CartograPlant: Integrating, visualizing, and analyzing genotype, phenotype, and environmental data for georeferenced plants

Jill Wegrzyn

Department of Ecology and Evolutionary Biology

University of Connecticut

Team!

- Irene Cobo-Simon – Postdoctoral Scholar
- Rish Ramnath - Lead Developer
- Vlad Savitsky– TPPS/TPPSc Developer
- Emily Grau – Lead Database Administrator of TreeGenes
- Gabe Barrett – Analytic workflow developer
- Sean Buehler – Tripal Developer
- Shay Muhonen – TreeGenes/CartograPlant Coordinator
- Meg Staton Lab (UTK) – TreeSnap! Noah Caldwell

Biocuration Team Lead (UConn): Meghan Myles

- Curation Team: Victoria Burton, Maddie Gadomski, Isabella Harding, Jeff Gamer, and Rachel Wolther

- Nic Herndon Lab (ECU)!

CartograPlant

Funded by USDA-NIFA #2018-09223
Funded by AG2PI

@JillWegrzyn
@TreeGenes

Today's Schedule (in EST!)

11:00-11:20 Introduction to CartograPlant - Dr. Jill Wegrzyn

11:20-11:40 Introduction to Data Submission with TPPS/TPPSc - Emily Grau

11:40-12:00 Introduction to Data Collection/Mobile Phenotyping with TreeSnap - Dr. Margaret Staton

12:00-12:15 Break

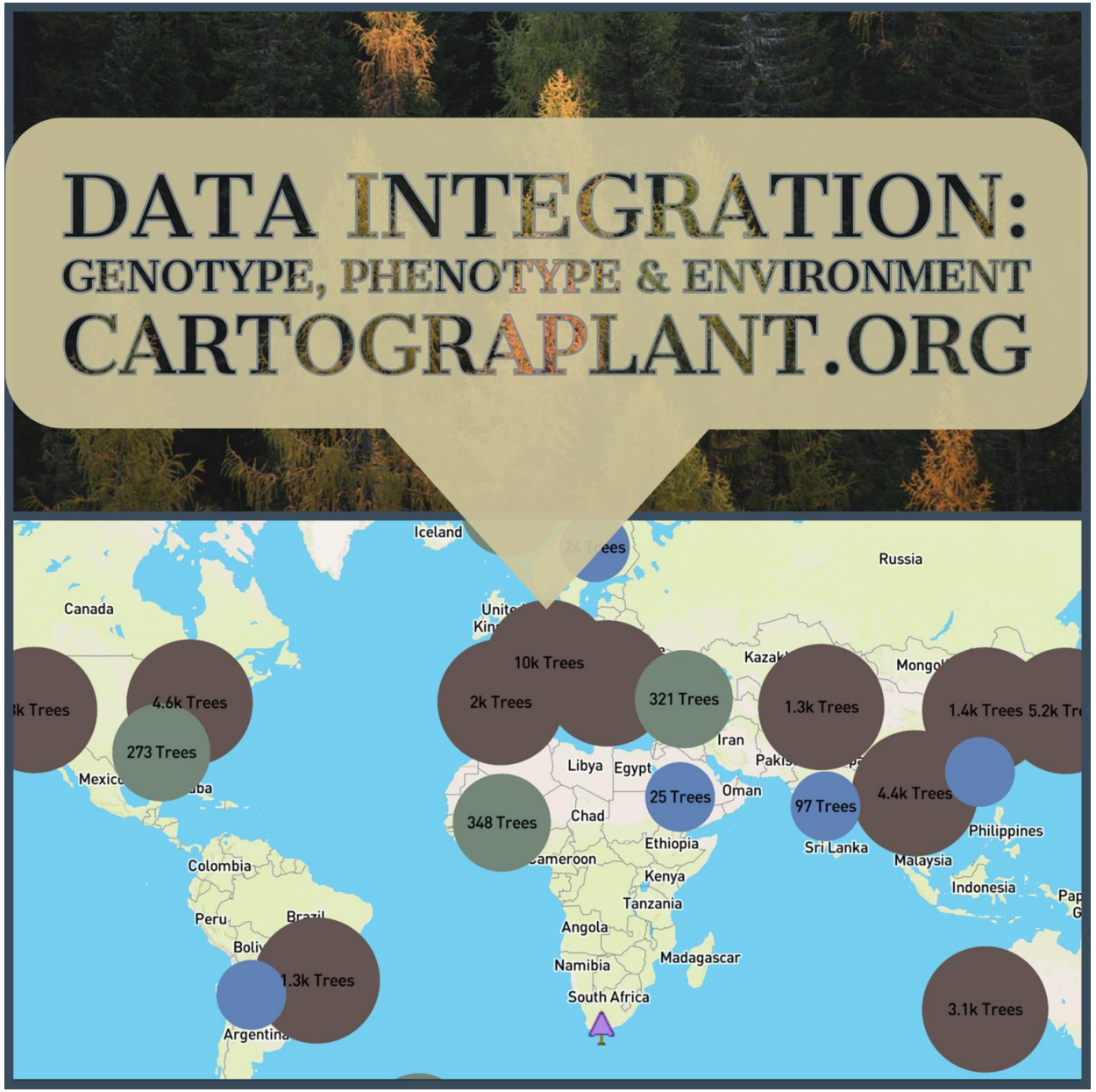
12:15-12:35 Behind the Scenes of CartograPlant - Environmental Layers and Data - Risharde Ramnath

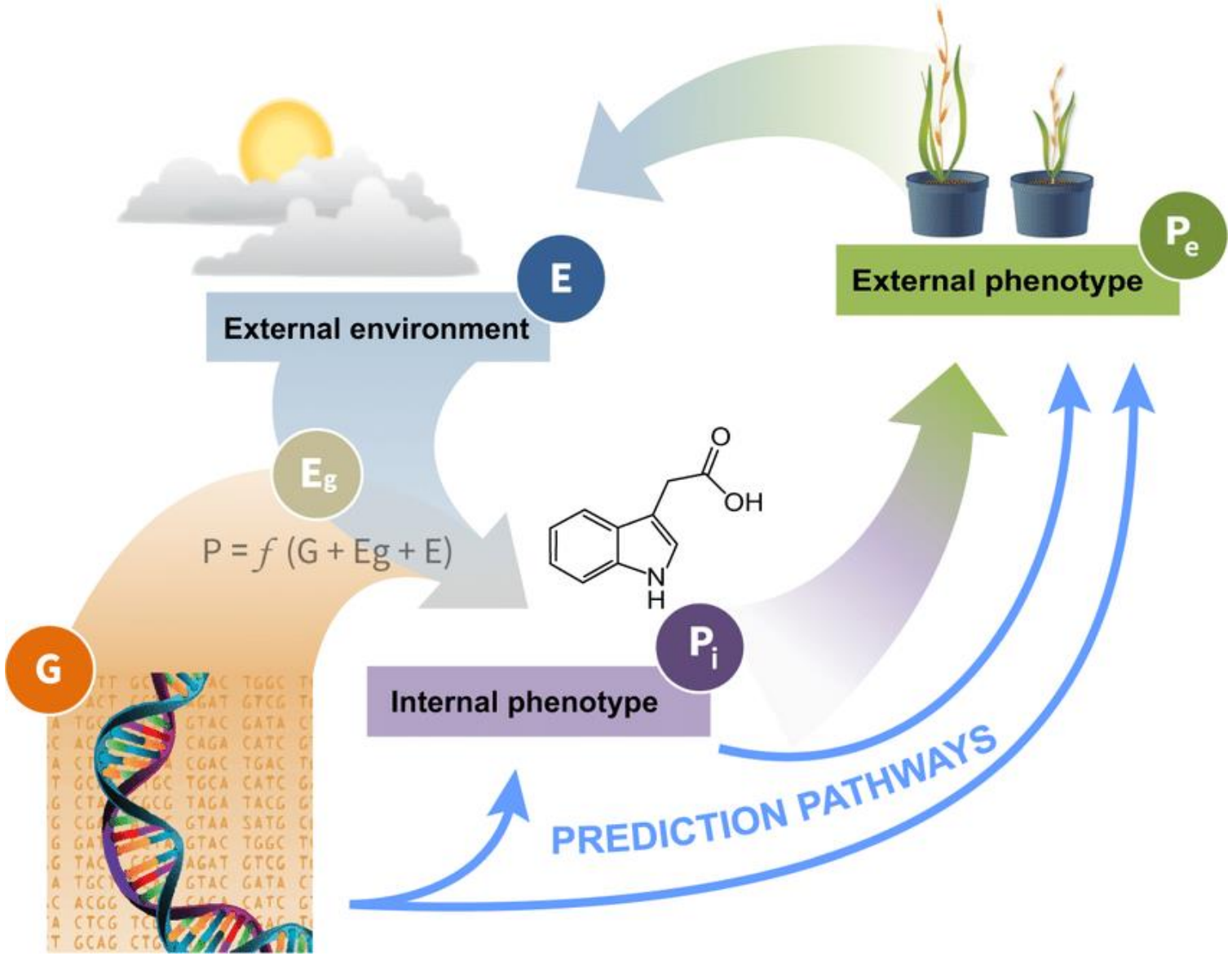
12:35-12:55 Analytics with CartograPlant (GWAS and GEA). Part 1 - Gabriel Barrett

12:55-1:15 Analytics with CartograPlant (GWAS and GEA). Part 2 – Dr. Irene Cobo-Simon

CartograPlant

Web-based and map-based platform to facilitate meta-analysis across scales (genes to environment)





Handakumbura et al. 2019

Who needs this data integration ?

Researchers that study georeferenced plant populations!

- Pests and Pathogens
- Breeding
- Assisted migration
- Invasive plants
- Climate adaptation
- Timber tracking

CartograPlant

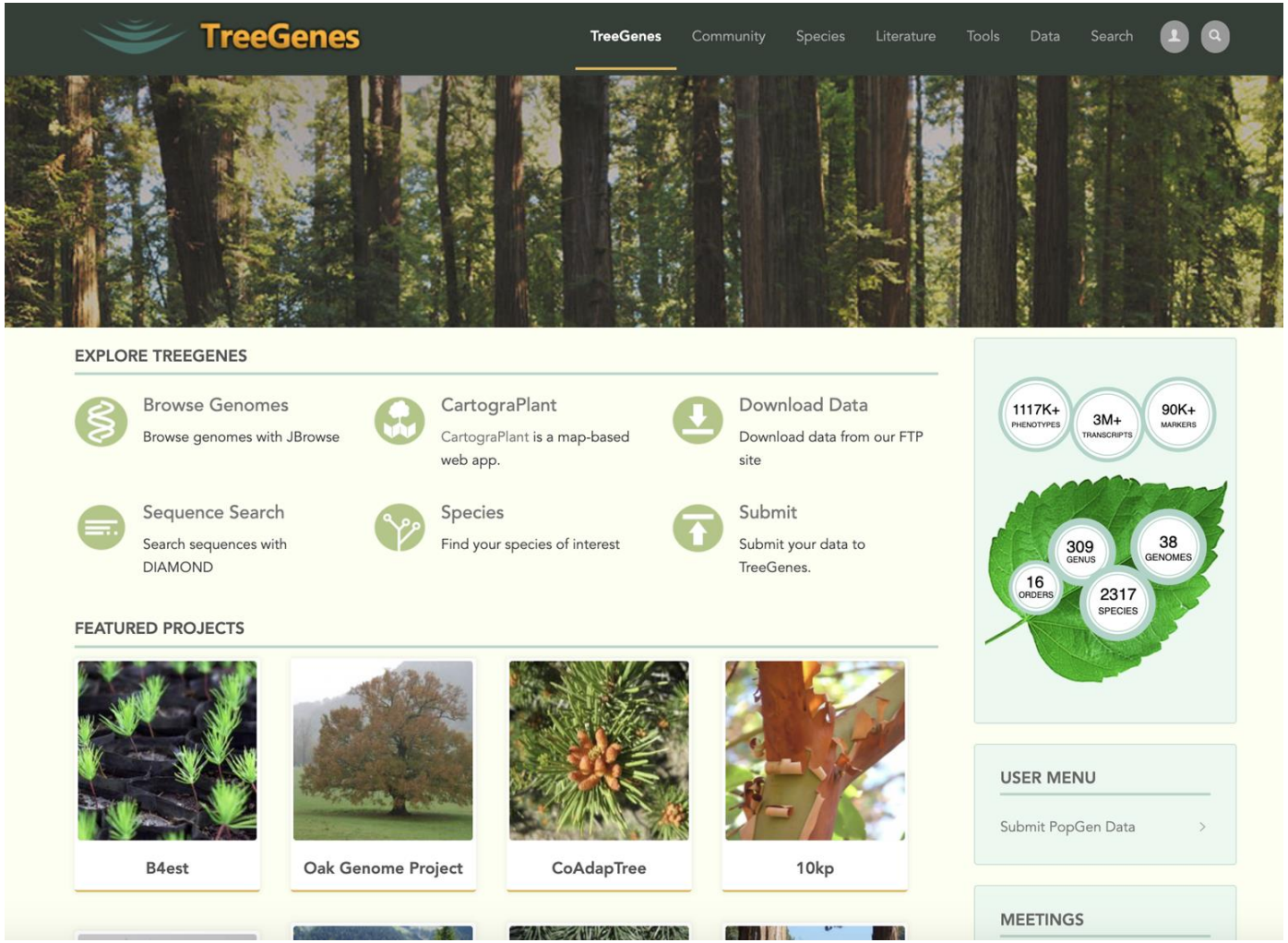
CartograTree -> CartograPlant

TreeGenes
treegenesdb.org

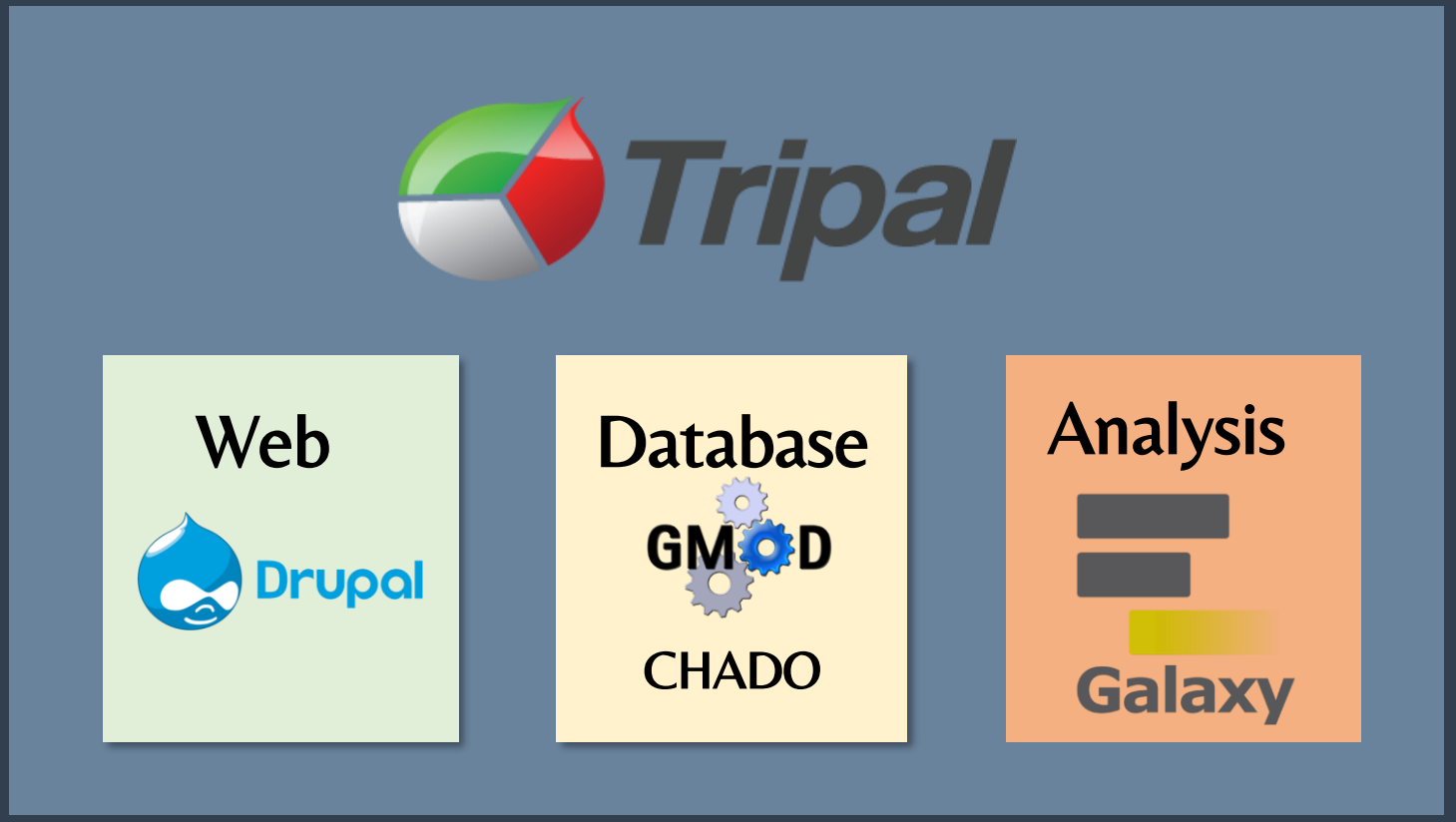
Integrated resource for forest tree genetics

2300 species genomes, genes, genetic maps, proteins, SNPs, traits

Tripal Database



Tripal is a software framework for biological databases



Tripal

Search

Features Citations Download & Install Support Blog API About Demo Site Home

User's Guide | **Developer's Handbook** | **Extension Modules** | **Tripal Community** | **Tripal @ gitHub.com** | **Tripal @ drupal.org**

Tripal is a toolkit for construction of online biological (genetics, genomics, breeding, etc), community database web portals, and is a member of the GMOD family of tools. Use Tripal out-of-the box to create a basic genomics site (with no programming) or customize using Tripal's Application Programming Interface (API). Tripal is free and open-source (GNU General Public License version 2), allows for extensive customization and is backed by a helpful user community. A strength of Tripal is our community of developers. Customization and extension of Tripal can be created and shared with other sites as modules allowing you to create your own tools and visualizations or leverage those developed by groups around the world. To see what features Tripal provides, see the Tripal User's Guide and the Developer's Guide! If you have any questions, thoughts, or concerns, we would love to hear from you on our GitHub Issue Queue!

Sites Using Tripal

Tripal sites are found worldwide.

News

Tripal v4 Compatibility

Aug 15, 2022

Tripal 4 will be keep up with Drupal releases!

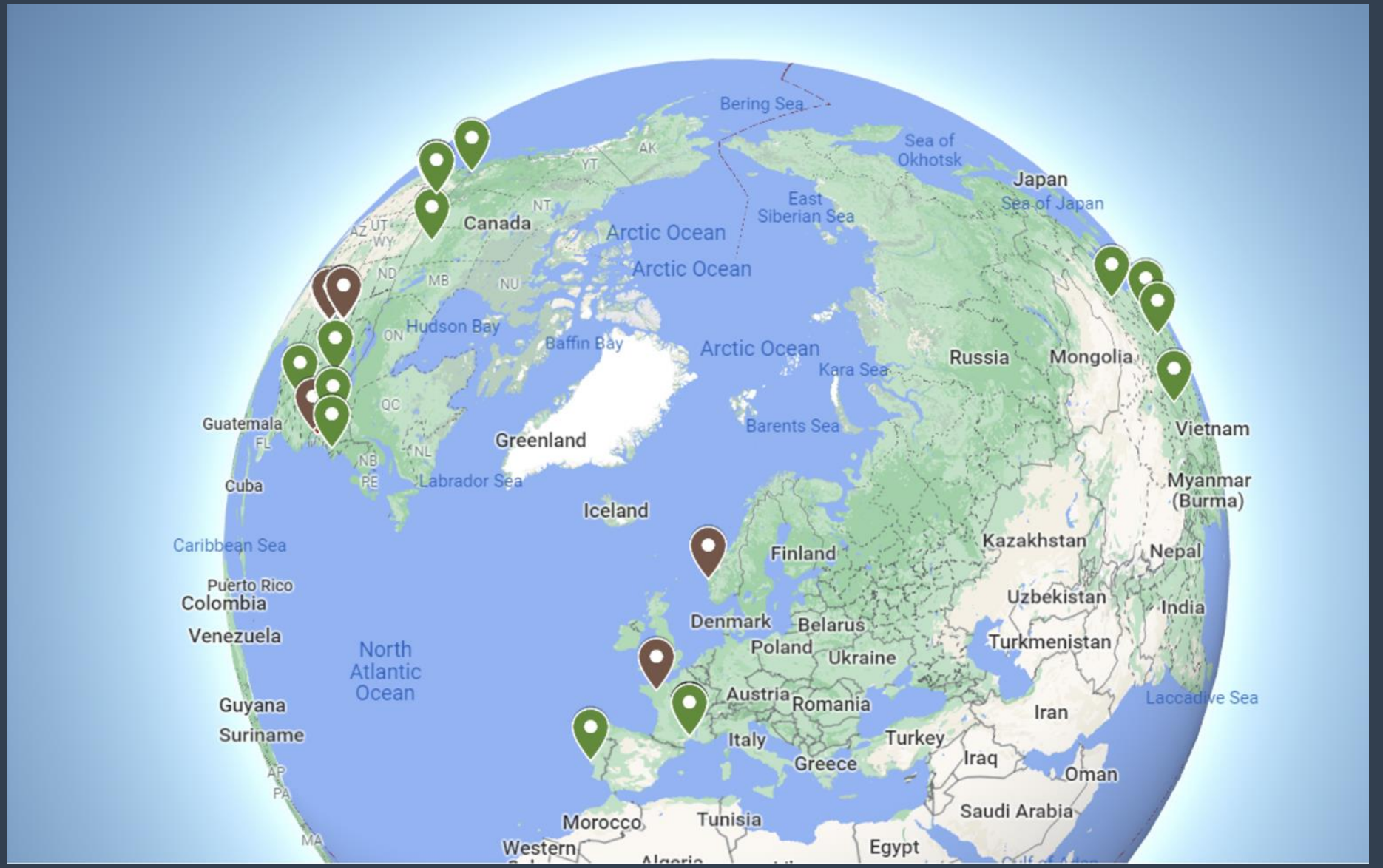
Technical Blog Posts

Introducing the Helium Data Exporter Tripal Module

An additional way to visualize pedigree and phenotypic data stored in a Tripal web portal.

DOI 10.5281/zenodo.6611672

The Helium Visualization Framework is a visualization tool for large-scale plant pedigree data with the option to overlay categorical data. We developed the Helium Data Exporter module to transform germplasm and raw


Bering Sea
Sea of Okhotsk
Japan
Sea of Japan
East Siberian Sea
Canada
Arctic Ocean
Arctic Ocean
Arctic Ocean
Hudson Bay
Baffin Bay
Kara Sea
Russia
Mongolia
Barents Sea
Greenland
Vietnam
Guatemala
Labrador Sea
Myanmar (Burma)
Cuba
Iceland
Caribbean Sea
Finland
Kazakhstan
Nepal
Puerto Rico
Colombia
Uzbekistan
India
Denmark
Belarus
Venezuela
Poland
Ukraine
Turkmenistan
North Atlantic Ocean
Austria
Romania
Laccadive Sea
Guyana
Iran
Suriname
Italy
Turkey
Greece
Iraq
Oman
Saudi Arabia
Morocco
Tunisia
Egypt
Western
YT
AK
NT
AZ
UT
WY
ND
MB
NU
ON
QC
FL
NB
NL
PE
AP
PA
MA

Active Tripal Websites

KnowPulse

Legume Information System

Citrus Genome Database

CottonGen

Mimubase

Musa Germplasm Informat

DivSeek Canada

PeanutBase

Planosphere

Genome Database for Rosaceae

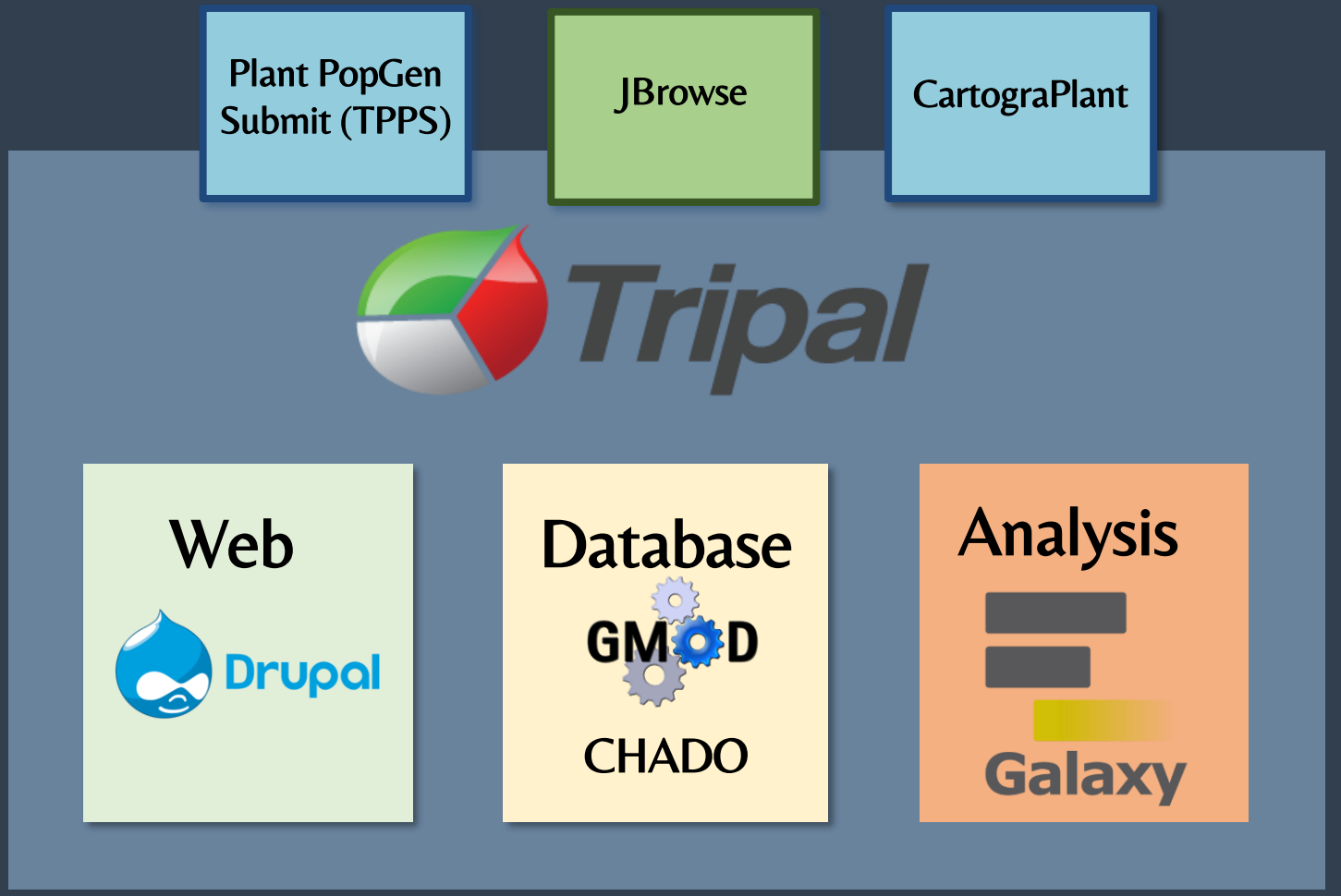
Genome Database for Vaccinium

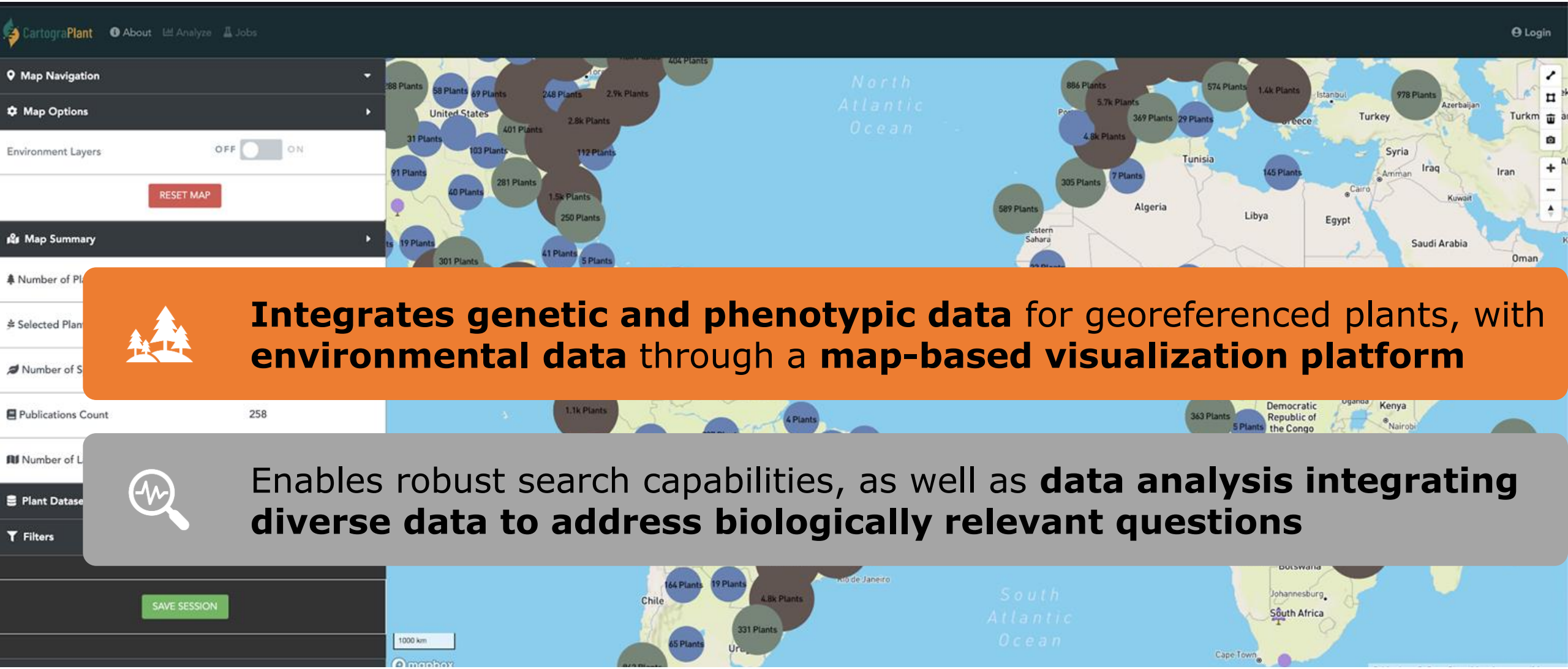
Hardwood Genomics Project

Plant Fungal Pathogen Genomics Project

Rice Genome Hub

TreeGenes:
Tripal is a software framework for biological databases





Integrates genetic and phenotypic data for georeferenced plants, with **environmental data** through a **map-based visualization platform**

Enables robust search capabilities, as well as **data analysis integrating diverse data to address biologically relevant questions**

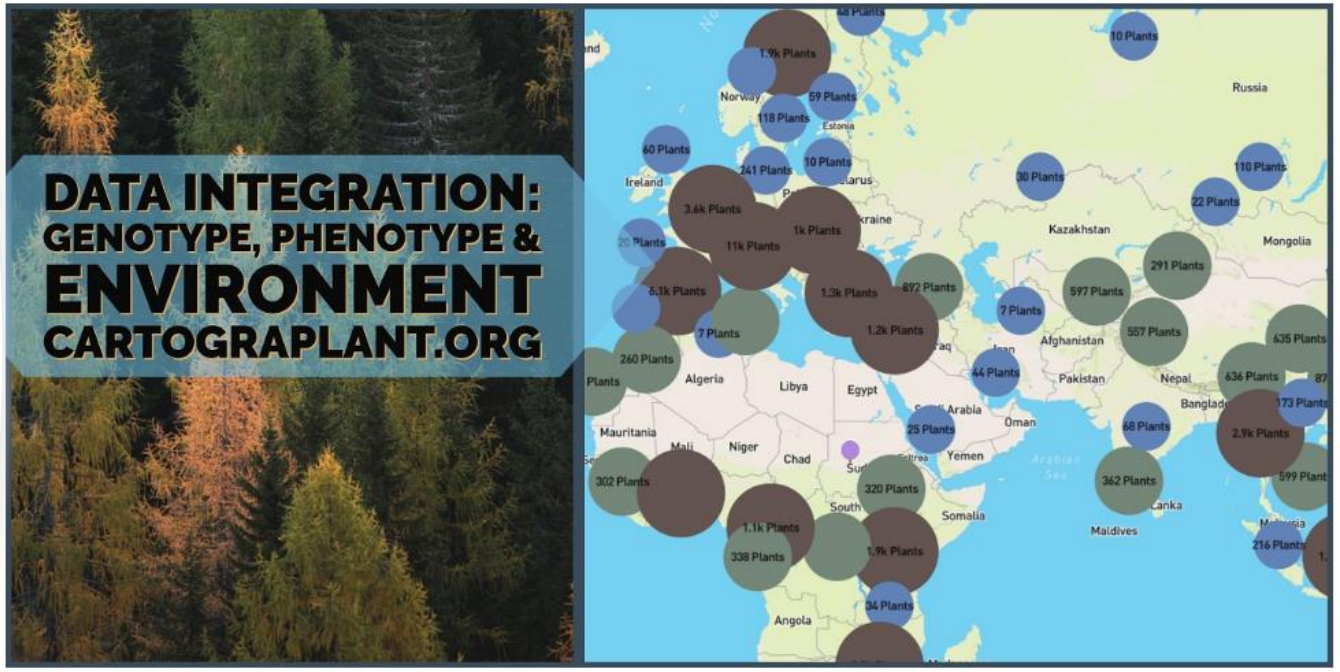
Global and Regional Layers Integrated

- Metrics are pre-loaded for georeferenced coordinates of plants
- Available for all locations on the map
- Maps are converted and hosted through Geoserver and base layers with Mapbox

CartograPlant.Org

CartograPlant

Integration of genomic, phenomic, and environmental data for georeferenced plants

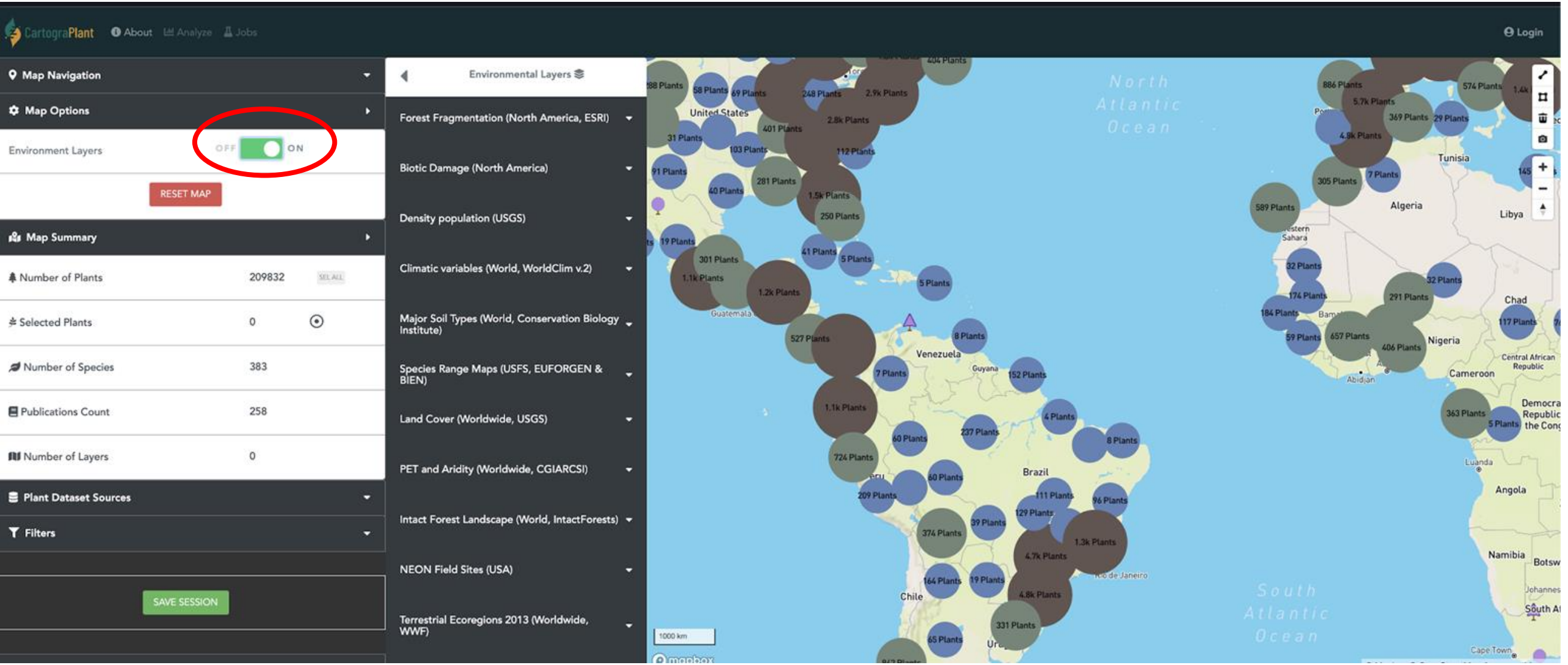


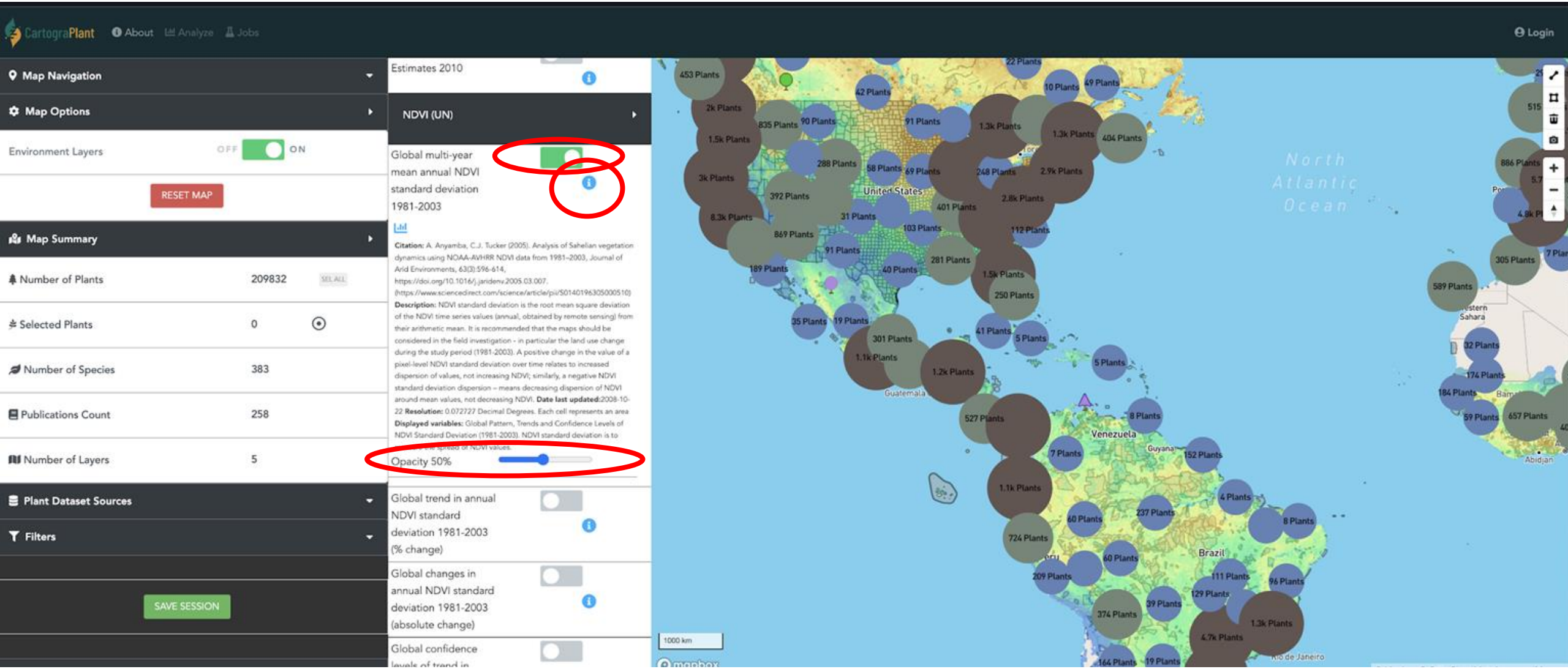
g-lived and sessile plant species serve as ideal models to assess population structure and adaptation to the environment. Despite the availability of comprehensive data, the researchers who study them are challenged to integrate data describing genotype, phenotype, and the environment. Towards this goal, the web application CartograTree (now known as CartograPlant), was designed and implemented as an open repository and open-source analytic web-based framework for all three.

Get Started
Browse or search CartograPlant here

Submit
Submit data for analysis

User Guide
Detailed documentation, tutorials and resources


CartograPlant
About
Analyze
Jobs
Login
Map Navigation
Map Options
Environment Layers
OFF
ON
RESET MAP
Map Summary
Number of Plants
209832
Selected Plants
0
Number of Species
383
Publications Count
258
Number of Layers
0
Plant Dataset Sources
Filters
SAVE SESSION
Environmental Layers
Forest Fragmentation (North America, ESRI)
Biotic Damage (North America)
Density population (USGS)
Climatic variables (World, WorldClim v.2)
Major Soil Types (World, Conservation Biology Institute)
Species Range Maps (USFS, EUFORGEN & BIEN)
Land Cover (Worldwide, USGS)
PET and Aridity (Worldwide, CGIARCSI)
Intact Forest Landscape (World, IntactForests)
NEON Field Sites (USA)
Terrestrial Ecoregions 2013 (Worldwide, WWF)
North Atlantic Ocean
South Atlantic Ocean
United States
Venezuela
Guyana
Brazil
Chile
Guatemala
Tunisia
Algeria
Libya
Western Sahara
Nigeria
Chad
Cameroon
Central African Republic
Angola
Namibia
Luanda
Abidjan
Cape Town
1000 km
mapbox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209832
SEL ALL
Selected Plants
0
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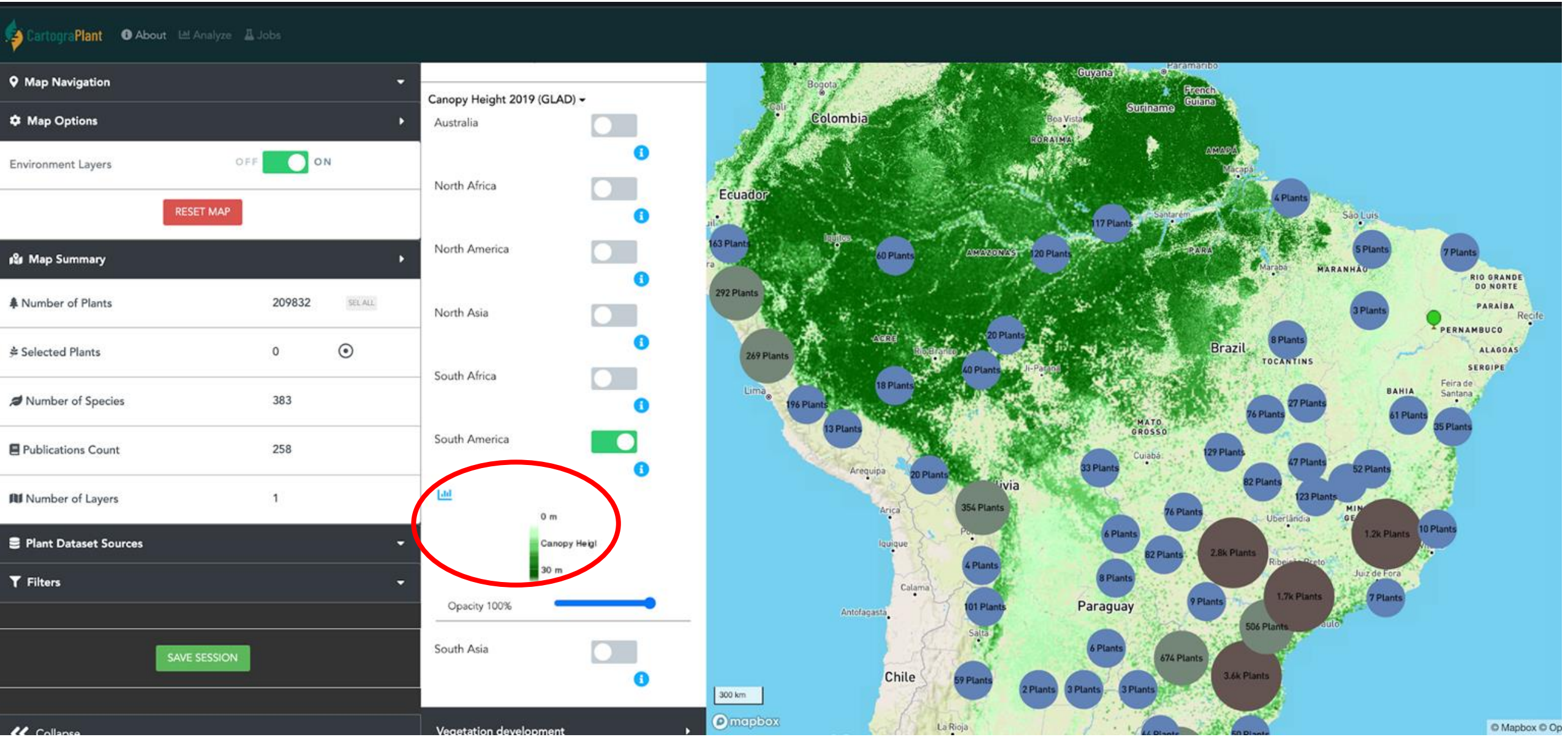
258
Number of Layers
5
Plant Dataset Sources
Filters
SAVE SESSION
Estimates 2010
NDVI (UN)
Global multi-year mean annual NDVI standard deviation 1981-2003
Citation: A. Anyamba, C.J. Tucker (2005). Analysis of Sahelian vegetation dynamics using NOAA-AVHRR NDVI data from 1981–2003, Journal of Arid Environments, 63(3):596-614, https://doi.org/10.1016/j.jaridenv.2005.03.007. (https://www.sciencedirect.com/science/article/pii/S0140196305000510)
Description: NDVI standard deviation is the root mean square deviation of the NDVI time series values (annual, obtained by remote sensing) from their arithmetic mean. It is recommended that the maps should be considered in the field investigation - in particular the land use change during the study period (1981-2003). A positive change in the value of a pixel-level NDVI standard deviation over time relates to increased dispersion of values, not increasing NDVI; similarly, a negative NDVI standard deviation dispersion – means decreasing dispersion of NDVI around mean values, not decreasing NDVI. Date last updated:2008-10-22 Resolution: 0.072727 Decimal Degrees. Each cell represents an area
Displayed variables: Global Pattern, Trends and Confidence Levels of NDVI Standard Deviation (1981-2003). NDVI standard deviation is to
Opacity 50%
Global trend in annual NDVI standard deviation 1981-2003 (% change)
Global changes in annual NDVI standard deviation 1981-2003 (absolute change)
Global confidence
North Atlantic Ocean
United States
Guatemala
Venezuela
Guyana
Brazil
Western Sahara
Abidjan
Rio de Janeiro
1000 km
mapbox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0
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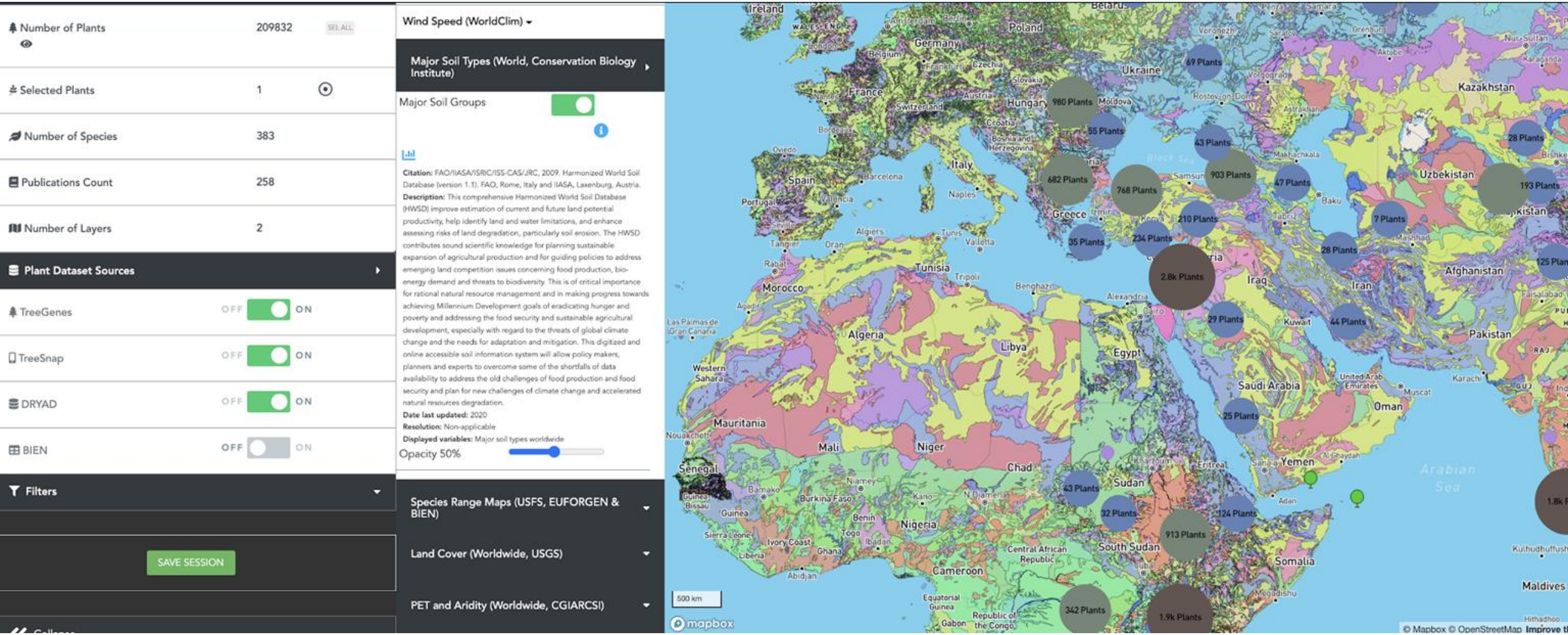
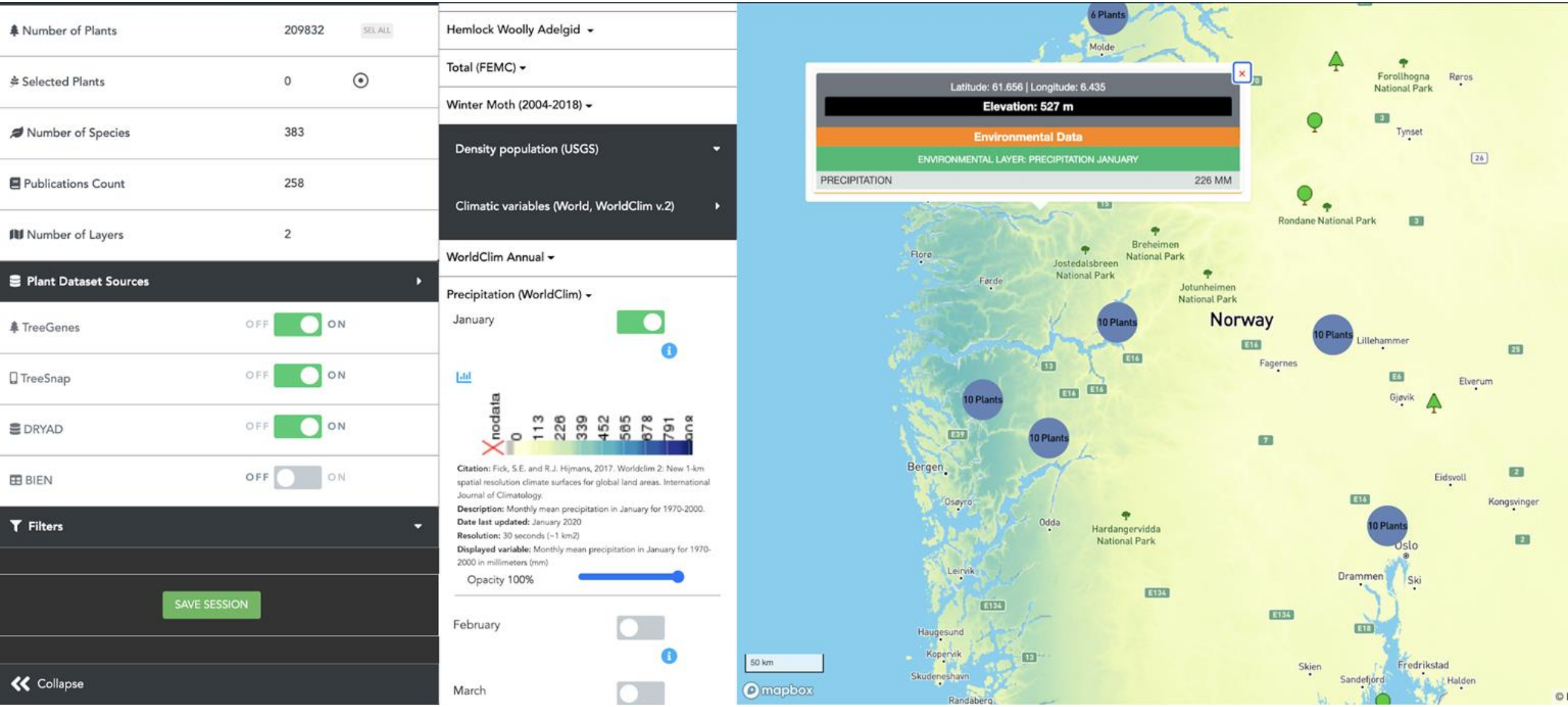
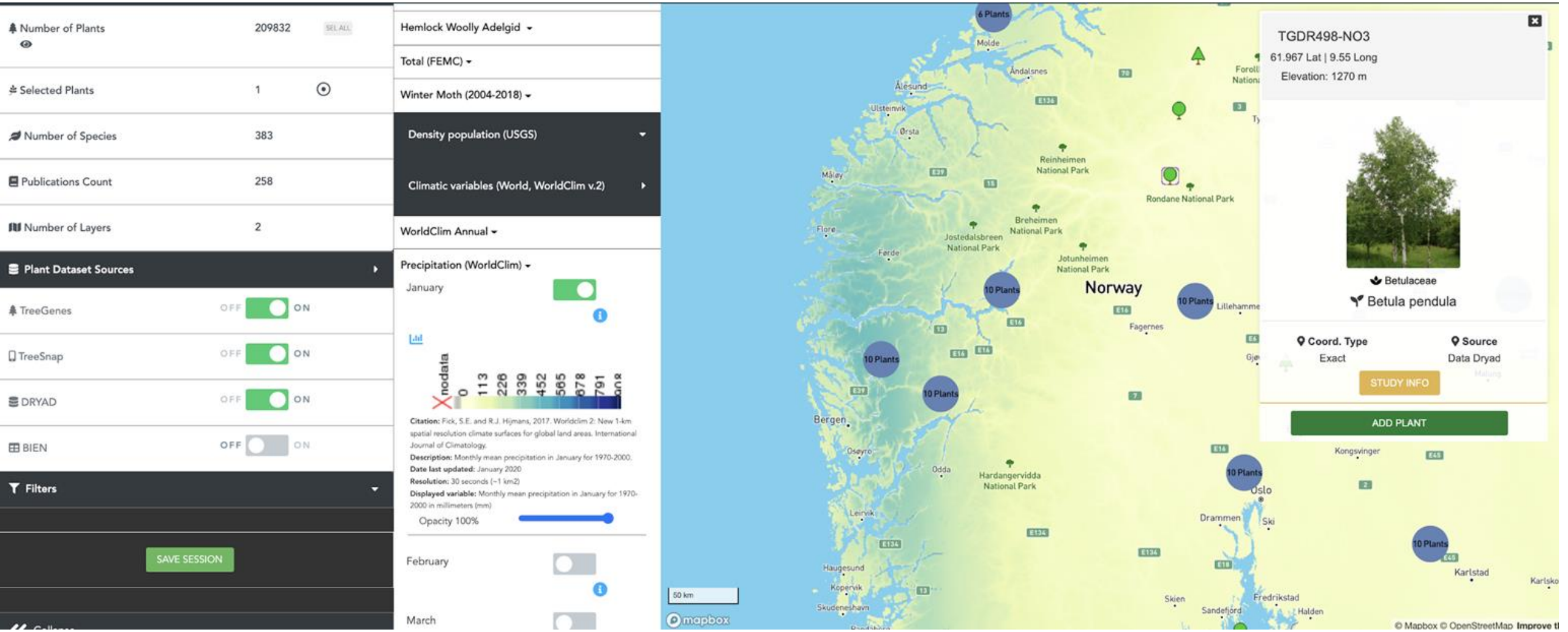
258
Number of Layers
1
Plant Dataset Sources
Filters
SAVE SESSION
Collapse
Canopy Height 2019 (GLAD)
Australia
North Africa
North America
North Asia
South Africa
South America
0 m
Canopy Heigl
30 m
Opacity 100%
South Asia
Vegetation development
Colombia
Ecuador
Peru
Brazil
Paraguay
Chile
Bolivia
Guyana
Suriname
French Guiana
Lima
Bogota
Arequipa
Cuiabá
Santarém
Macapá
Maraba
São Luis
Recife
Feira de Santana
Uberlândia
Juiz de Fora
La Rioja
Salta
Antofagasta
Calama
Iquique
Arica
RORAIMA
AMAPA
PARA
AMAZONAS
ACRE
MARANHÃO
TOCANTINS
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
BAHIA
MATO GROSSO
RIO GRANDE DO NORTE
4 Plants
117 Plants
163 Plants
60 Plants
120 Plants
5 Plants
7 Plants
292 Plants
3 Plants
20 Plants
269 Plants
8 Plants
40 Plants
18 Plants
196 Plants
13 Plants
76 Plants
27 Plants
61 Plants
35 Plants
129 Plants
33 Plants
47 Plants
52 Plants
82 Plants
123 Plants
20 Plants
354 Plants
76 Plants
6 Plants
1.2k Plants
10 Plants
82 Plants
2.8k Plants
4 Plants
8 Plants
9 Plants
1.7k Plants
7 Plants
101 Plants
506 Plants
6 Plants
674 Plants
3.6k Plants
59 Plants
2 Plants
3 Plants
3 Plants
300 km
mapbox
© Mapbox © Op


Number of Plants 209832 SEL ALL
Selected Plants 1
Number of Species 383
Publications Count 258
Number of Layers 2
Plant Dataset Sources
TreeGenes OFF ON
TreeSnap OFF ON
DRYAD OFF ON
BIEN OFF ON
Filters
SAVE SESSION
Wind Speed (WorldClim)
Major Soil Types (World, Conservation Biology Institute)
Major Soil Groups
Citation: FAO/IIASA/ISRIC/ISS-CAS/JRC, 2009. Harmonized World Soil Database (version 1.1). FAO, Rome, Italy and IIASA, Laxenburg, Austria.
Description: This comprehensive Harmonized World Soil Database (HWSD) improve estimation of current and future land potential productivity, help identify land and water limitations, and enhance assessing risks of land degradation, particularly soil erosion. The HWSD contributes sound scientific knowledge for planning sustainable expansion of agricultural production and for guiding policies to address emerging land competition issues concerning food production, bio-energy demand and threats to biodiversity. This is of critical importance for rational natural resource management and in making progress towards achieving Millennium Development goals of eradicating hunger and poverty and addressing the food security and sustainable agricultural development, especially with regard to the threats of global climate change and the needs for adaptation and mitigation. This digitized and online accessible soil information system will allow policy makers, planners and experts to overcome some of the shortfalls of data availability to address the old challenges of food production and food security and plan for new challenges of climate change and accelerated natural resources degradation.
Date last updated: 2020
Resolution: Non-applicable
Displayed variables: Major soil types worldwide
Opacity 50%
Species Range Maps (USFS, EUFORGEN & BIEN)
Land Cover (Worldwide, USGS)
PET and Aridity (Worldwide, CGIARCSI)
69 Plants
980 Plants
55 Plants
43 Plants
682 Plants
768 Plants
903 Plants
47 Plants
28 Plants
193 Plants
210 Plants
7 Plants
35 Plants
234 Plants
2.8k Plants
28 Plants
29 Plants
44 Plants
25 Plants
43 Plants
32 Plants
124 Plants
913 Plants
342 Plants
1.9k Plants
500 km
mapbox
© Mapbox © OpenStreetMap Improve t


Number of Plants 209832 SEL ALL
Selected Plants 0
Number of Species 383
Publications Count 258
Number of Layers 2
Plant Dataset Sources
TreeGenes OFF ON
TreeSnap OFF ON
DRYAD OFF ON
BIEN OFF ON
Filters
SAVE SESSION
Collapse
Hemlock Woolly Adelgid
Total (FEMC)
Winter Moth (2004-2018)
Density population (USGS)
Climatic variables (World, WorldClim v.2)
WorldClim Annual
Precipitation (WorldClim)
January
nodata 0 113 226 339 452 565 678 791
Citation: Fick, S.E. and R.J. Hijmans, 2017. Worldclim 2: New 1-km spatial resolution climate surfaces for global land areas. International Journal of Climatology.
Description: Monthly mean precipitation in January for 1970-2000.
Date last updated: January 2020
Resolution: 30 seconds (~1 km2)
Displayed variable: Monthly mean precipitation in January for 1970-2000 in millimeters (mm)
Opacity 100%
February
March
Latitude: 61.656 | Longitude: 6.435
Elevation: 527 m
Environmental Data
ENVIRONMENTAL LAYER: PRECIPITATION JANUARY
PRECIPITATION 226 MM
6 Plants
Molde
Forollhogna National Park
Røros
Tynset
Rondane National Park
Breheimen National Park
Jostedalsbreen National Park
Jotunheimen National Park
Norway
Lillehammer
Fagernes
Elverum
Gjøvik
Florø
Førde
Bergen
Osøyro
Odda
Hardangervidda National Park
Leirvik
Haugesund
Kopervik
Skudeneshavn
Randaberg
Eidsvoll
Kongsvinger
Oslo
Drammen
Ski
Skien
Fredrikstad
Sandefjord
Halden
50 km
mapbox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Plant Dataset Sources
TreeGenes
OFF
ON
TreeSnap
OFF
ON
DRYAD
OFF
ON
BIEN
OFF
ON
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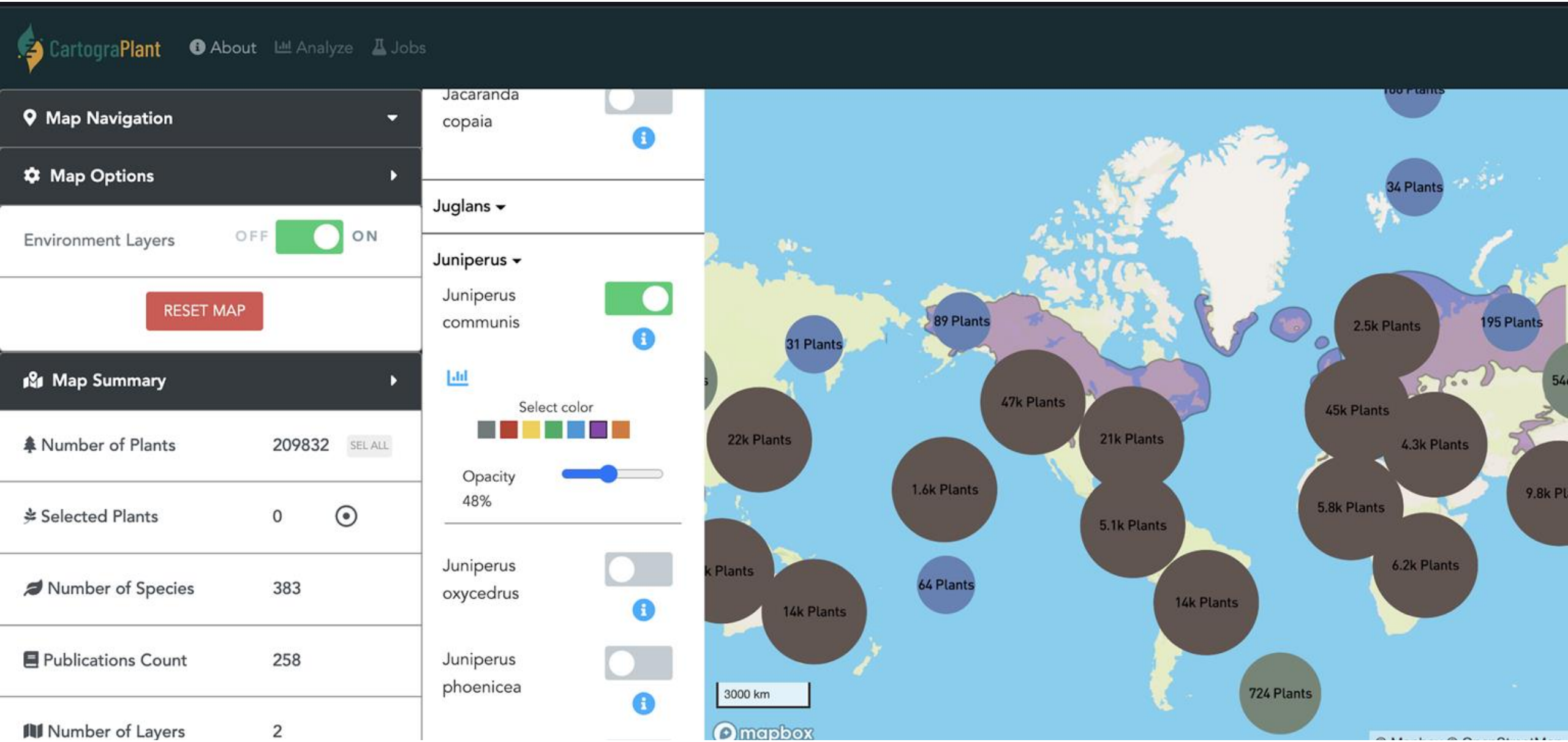
SAVE SESSION
Hemlock Woolly Adelgid
Total (FEMC)
Winter Moth (2004-2018)
Density population (USGS)
Climatic variables (World, WorldClim v.2)
WorldClim Annual
Precipitation (WorldClim)
January
nodata
0
113
226
339
452
565
678
791
Citation: Fick, S.E. and R.J. Hijmans, 2017. Worldclim 2: New 1-km spatial resolution climate surfaces for global land areas. International Journal of Climatology.
Description: Monthly mean precipitation in January for 1970-2000.
Date last updated: January 2020
Resolution: 30 seconds (~1 km2)
Displayed variable: Monthly mean precipitation in January for 1970-2000 in millimeters (mm)
Opacity 100%
February
March
6 Plants
Molde
Åndalsnes
Ålesund
Ulsteinvik
Ørsta
Måløy
Reinheimen National Park
Rondane National Park
Breheimen National Park
Jostedalsbreen National Park
Jotunheimen National Park
Flore
Førde
10 Plants
Norway
Lillehamme
Fagernes
Bergen
Oseyro
Odda
Hardangervidda National Park
Leirvik
Haugesund
Kopervik
Skudeneshavn
Oslo
Drammen
Ski
Kongsvinger
Karlstad
Skien
Fredrikstad
Sandefjord
Halden
50 km
mapbox
© Mapbox © OpenStreetMap Improve t
TGDR498-NO3
61.967 Lat | 9.55 Long
Elevation: 1270 m
Betulaceae
Betula pendula
Coord. Type
Exact
Source
Data Dryad
STUDY INFO
ADD PLANT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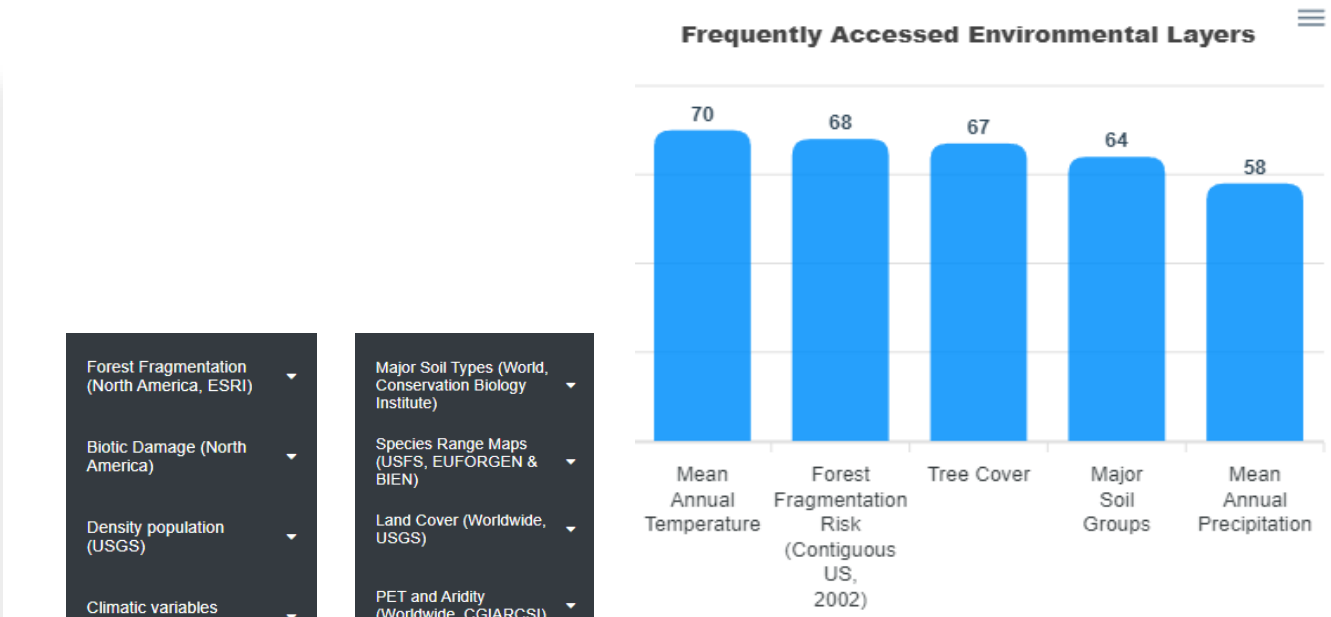
2
Jacaranda copaia
Juglans
Juniperus
Juniperus communis
Select color
Opacity
48%
Juniperus oxycedrus
Juniperus phoenicea
34 Plants
89 Plants
31 Plants
2.5k Plants
195 Plants
47k Plants
45k Plants
22k Plants
21k Plants
4.3k Plants
1.6k Plants
5.8k Plants
5.1k Plants
6.2k Plants
64 Plants
14k Plants
14k Plants
724 Plants
3000 km
mapbox

CartograPlant Layers Statistics



- Forest Fragmentation (North America, ESRI)
- Biotic Damage (North America)
- Density population (USGS)
- Climatic variables (World, WorldClim v.2)
- Intact Forest Landscape (World, IntactForests)
- NEON Field Sites (USA)
- Terrestrial Ecoregions 2013 (Worldwide, WWF)
- Climatic variables (World, ClimateWNA)
- Major Soil Types (World, Conservation Biology Institute)
- Species Range Maps (USFS, EUFORGEN & BIEN)
- Land Cover (Worldwide, USGS)
- PET and Aridity (Worldwide, CGIARCSI)
- Seed Zones (Eastern North America)
- Canopy height (Worldwide)
- Vegetation development
- National Forests (North America, USFS)

OVER 900 Layers and counting!

CartograPlant

Where do the plants come from?

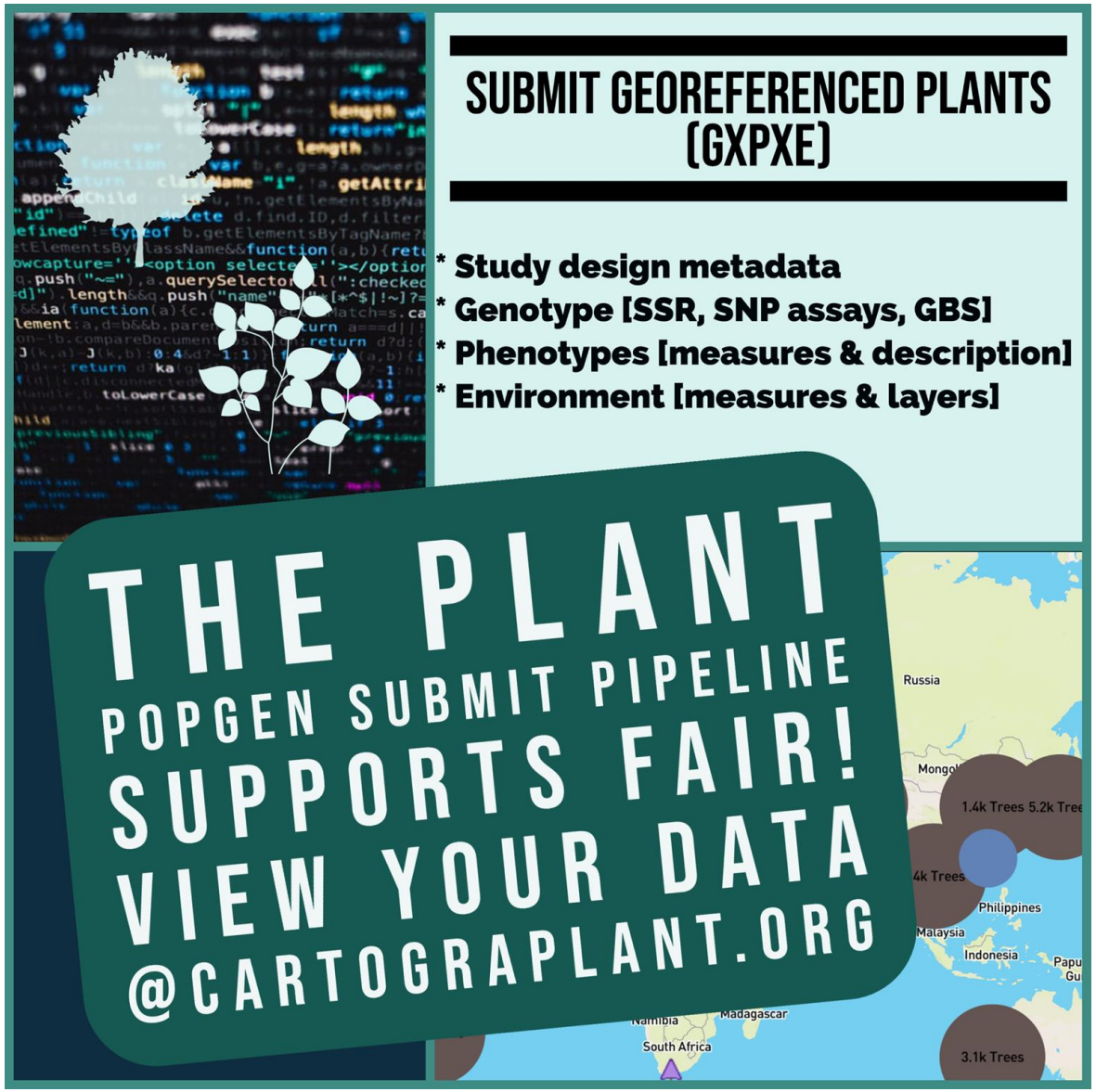
Multiple Sources!

Provide a mechanism for georeferenced plant data to be imported from:

- Directly from scientists!
- Mobile applications (citizen science and research based)
- Public Repositories (curation)

Study Types

- Landscape Genomics
- Population Structure
- Association Mapping
- Diversity Estimates



DRYAD

Search

Explore Data | About | Help

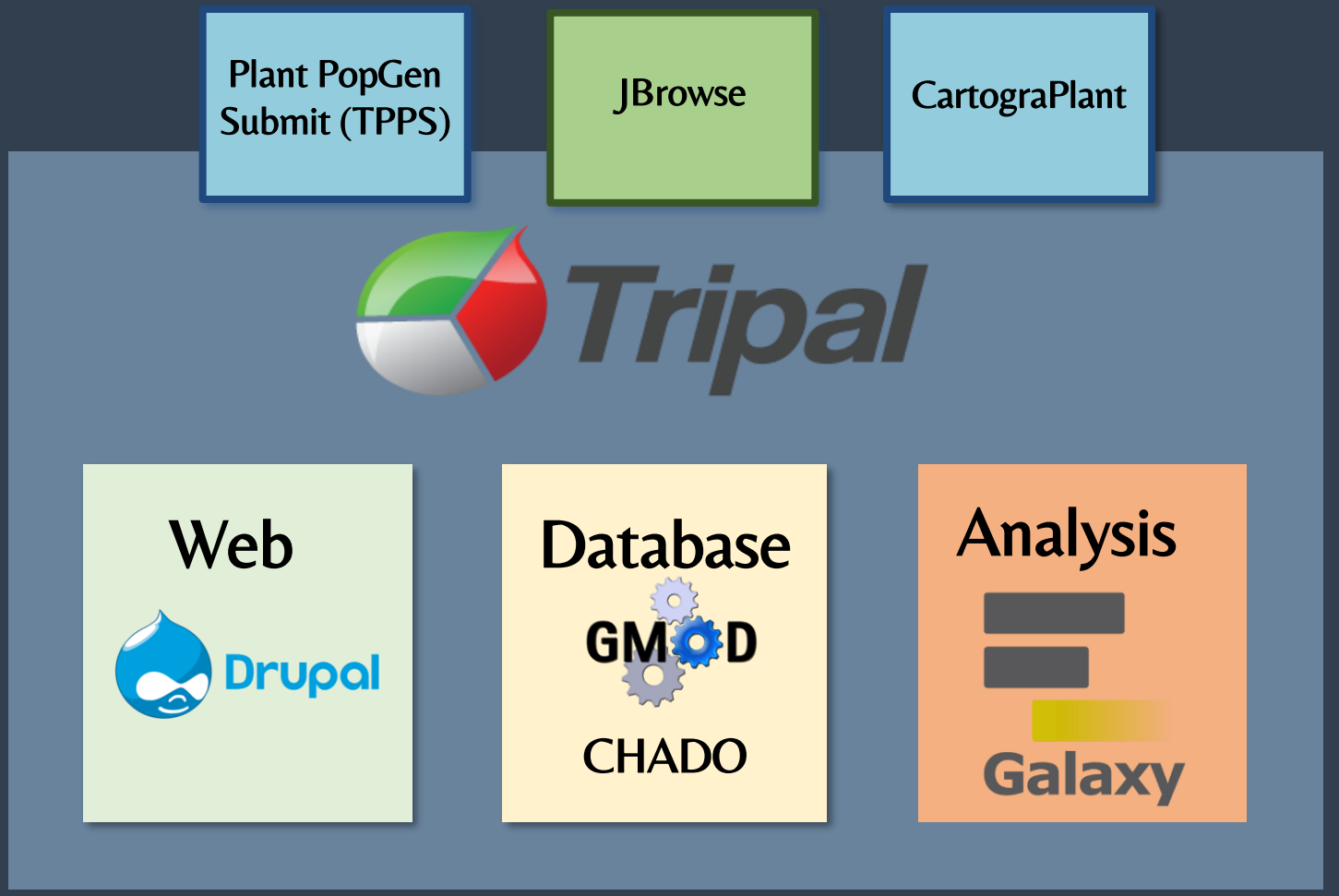
for your research data

Dryad (Curation Based)

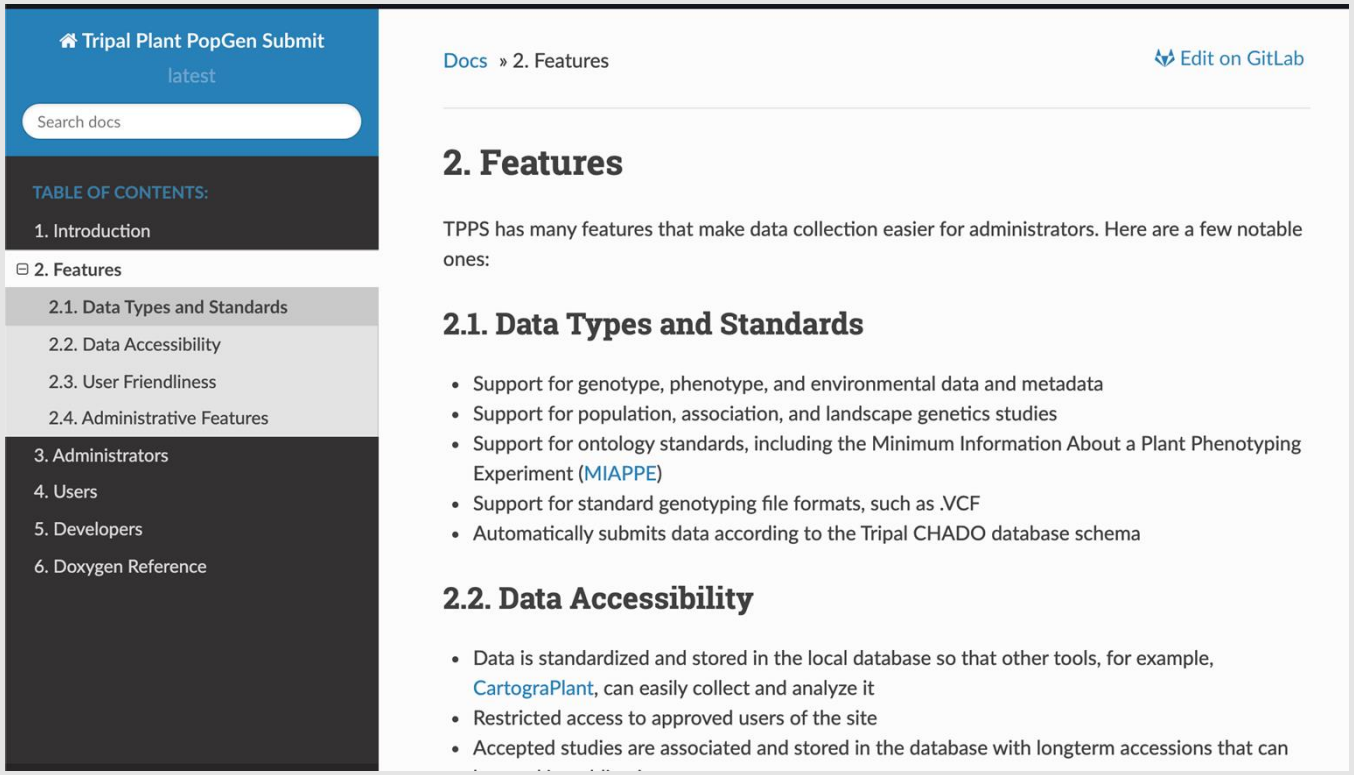
Dryad is a community-owned resource
Learn more about our organizational memberships

Submit Now

TreeGenes:
Tripal is a software framework for biological databases



TPPS Data Import



- Tripal Plant PopGen Submit Pipeline
  - Public version
  - Curation team version
- Ontologies (controlled vocabularies)
  - Generates standardizes storage to improve queries and provide a framework for meta-analysis across studies
- Experimental Design
- Raw Data
- Works with existing primary databases
- Generates DOI
- Metadata + Data

FAIR DATA

FINDABLE

Data has rich metadata and unique identifier

ACCESSIBLE

Data can be easily downloaded or used by using standard protocols

INTEROPERABLE

Metadata use an accessible and standard language

REUSABLE

Data is well-described and provides clear usage of licences


Findable
Persistent Identifiers (PIDs)
Rich metadata
Indexed data repositories
PIDs in metadata
Accessible
Standard communications protocol
Open, free protocol
Authentication, where necessary
Metadata is always available
Interoperable
Vocabularies
Vocabularies are FAIR
Linked metadata
Reusable
Metadata have multiple attributes
Usage license
Provenance
Community standards

Data and metadata collection in TPPS

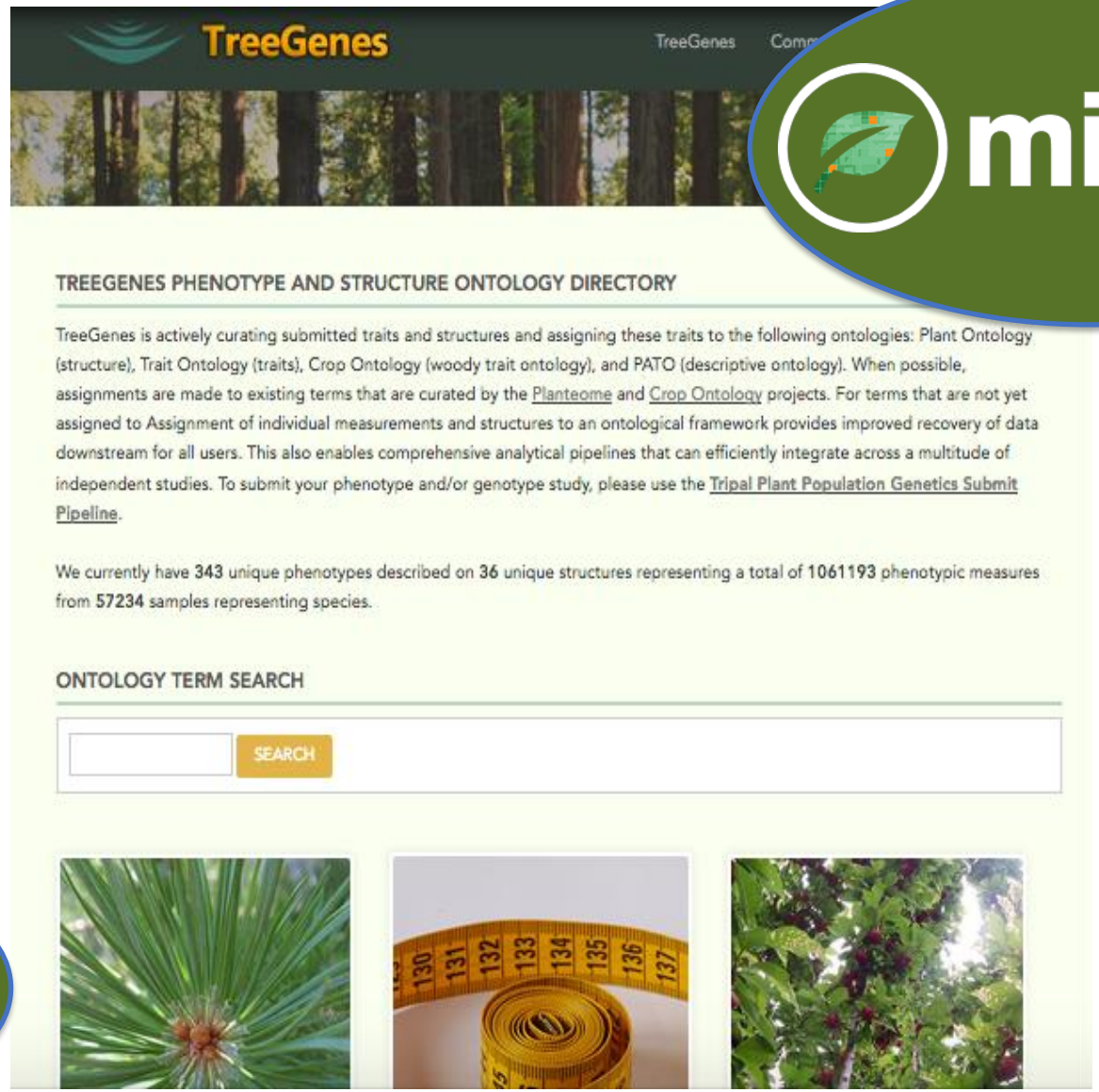
Study Design (GxPxE)
- Landscape
- Common Garden
- Plot

Genotype Design
- Assay
- Exome Capture
- GBS/RAD-Seq
- Transcriptome
- WGS

Phenotype
- Structure
- Units
- Index

Analysis
- Method
- Structure
- Kinship
- Associations

DOI



miappe

Biocuration Team Magic!

A1 | 2. This table shows the origin of each phenotype file, and where each file is re-used

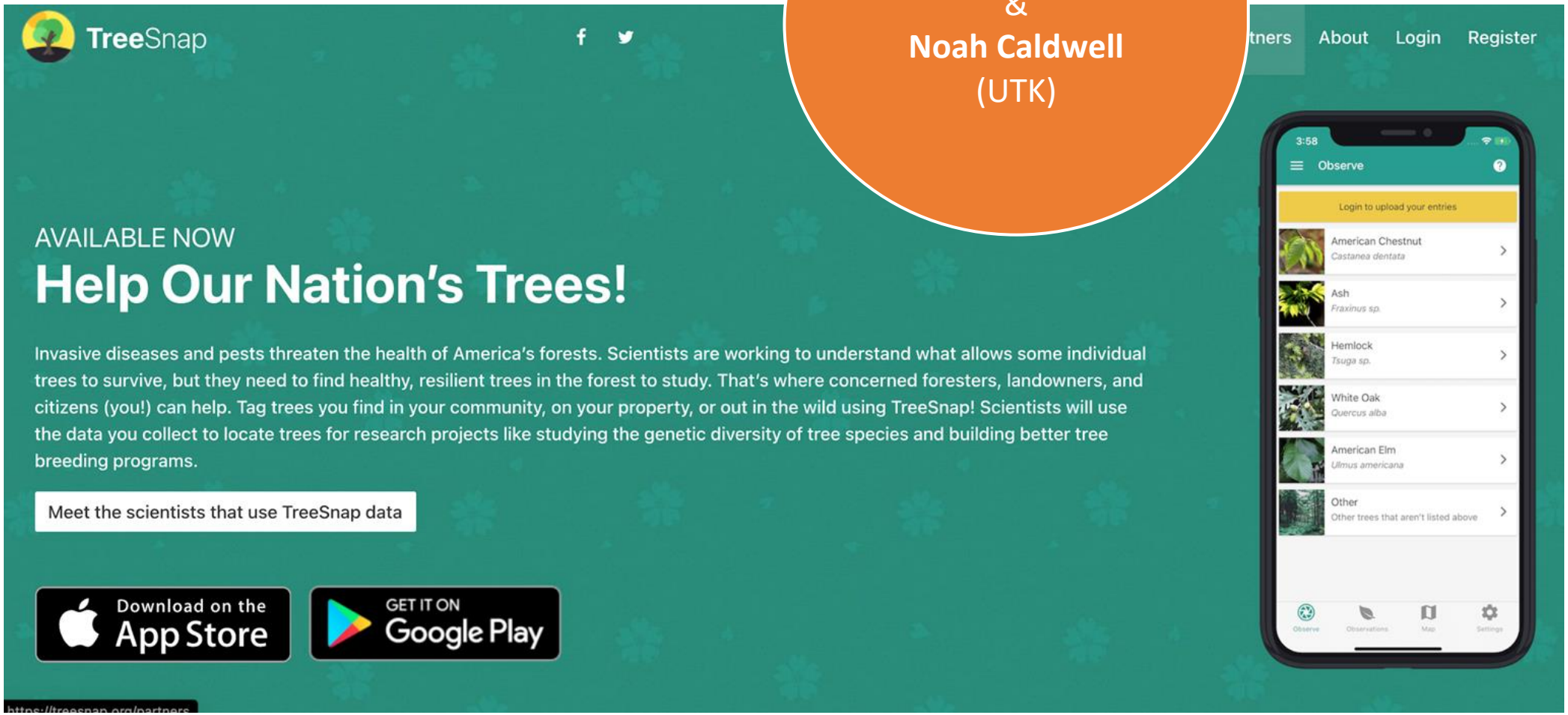
	A	B	C	D	E	F	G	H	I
1	2. This table shows the origin of each phenotype file, and where each file is re-used								
2	**Pheno File**	**TGDR 665**	**TGDR 655**	**TGDR 682**	**TGDR 674**	**TGDR 675**	**TGDR 683**	**TGDR 725**	**TGDR 727**
3	**655 file**	0	1	2	2	0	0	2	0
4	**675 file**	0	0	0	0	1	0	0	0
5	**683 file**	0	0	0	0	0	1	0	0
6	**727 file**	0	0	0	0	0	0	0	1
7									
8	0 = file not used 1 = original Pheno 2 = reuses a Pheno								
9									
10									
11	3. This table shows the origin of each genotype file, and where each file is re-used								
12	**SNP File**	**TGDR 665**	**TGDR 655**	**TGDR 682**	**TGDR 674**	**TGDR 675**	**TGDR 683**	**TGDR 725**	**TGDR 727**
13	**665 csv**	1	2	0	0	0	0	0	0
14	**682 csv**	0	0	1	0	0	0	0	0
15	**674 vcf**	0	0	0	1	2	0	0	0
16	**683 csv**	0	0	0	0	0	1	0	0
17	**725 vcf**	0	0	0	0	0	0	1	0
18	**727 vcf**	0	0	0	0	0	0	0	1
19									

File Types Present | Re-use File Overlap | Tree_ID Overlap

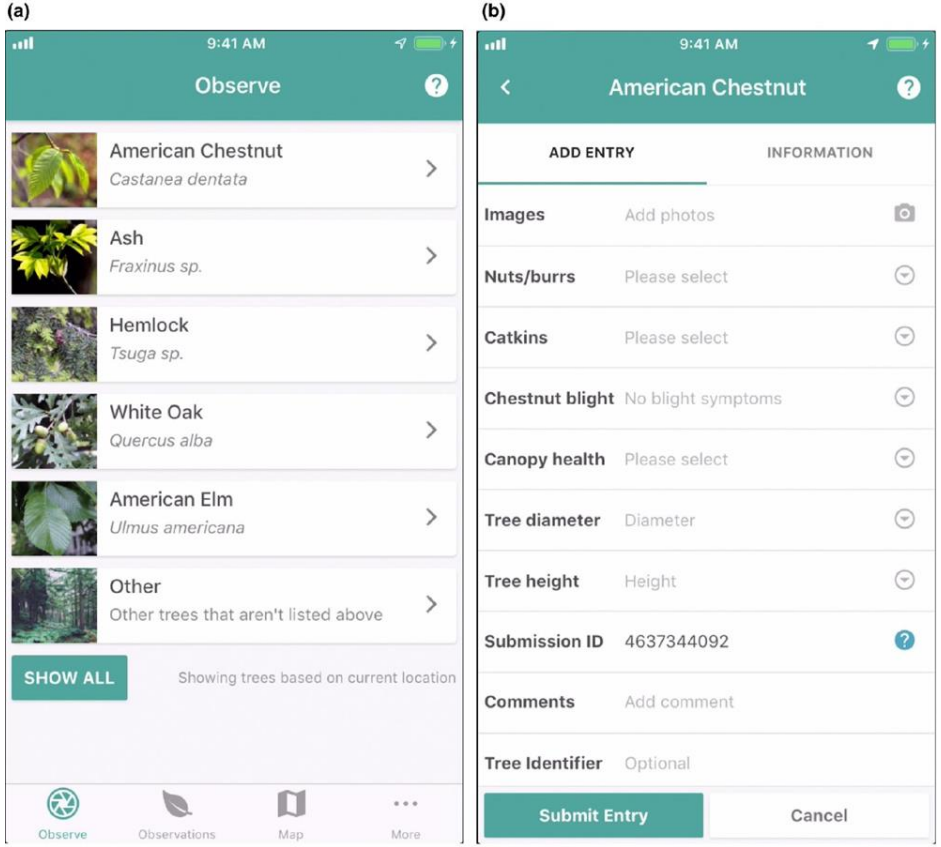
Proper metadata collection – flanking sequences, positions, genome versions allows re-mapping to the new genomes

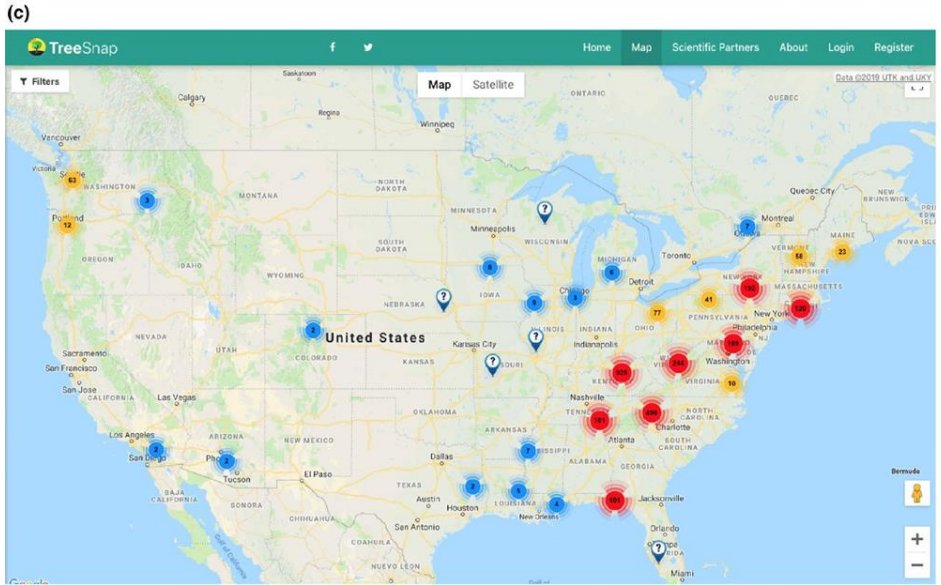
Mobile Applications

Dr. Meg Staton
(UTK)
&
Noah Caldwell
(UTK)



Template and custom views (target species)





Received: 1 February 2019 | Revised: 10 April 2019 | Accepted: 16 April 2019
DOI: 10.1002/ppp3.41

Plants People Planet PPP

BRIEF REPORT

TreeSnap: A citizen science app connecting tree enthusiasts and forest scientists

Ellen Crocker[1,2] | Bradford Condon[3] | Abdullah Almsaeed[3] | Benjamin Jarret[4] | C. Dana Nelson[2,5] | Albert G. Abbott[2] | Doreen Main[6] | Margaret Staton[3]

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[2]Forest Health Research and Education Center, University of Kentucky, Lexington, Kentucky, USA
[3]Department of Entomology and Plant Pathology, University of Tennessee, Institute of Agriculture, Knoxville, Tennessee, USA
[4]The American Chestnut Foundation, Asheville, North Carolina, USA
[5]USDA Forest Service, Southern Research Station, Lexington, Kentucky, USA
[6]Department of Horticulture, Washington State University, Pullman, Washington, USA

Correspondence
Margaret Staton, Department of Entomology and Plant Pathology, University of Tennessee, Institute of Agriculture, Knoxville, Tennessee, USA.
Email: e.crocker@uky.edu

Funding information
National Science Foundation, Grant/Award Number: 1444573; U.S. Forest Service; University of Kentucky; University of Connecticut; Washington State University; Oregon State University

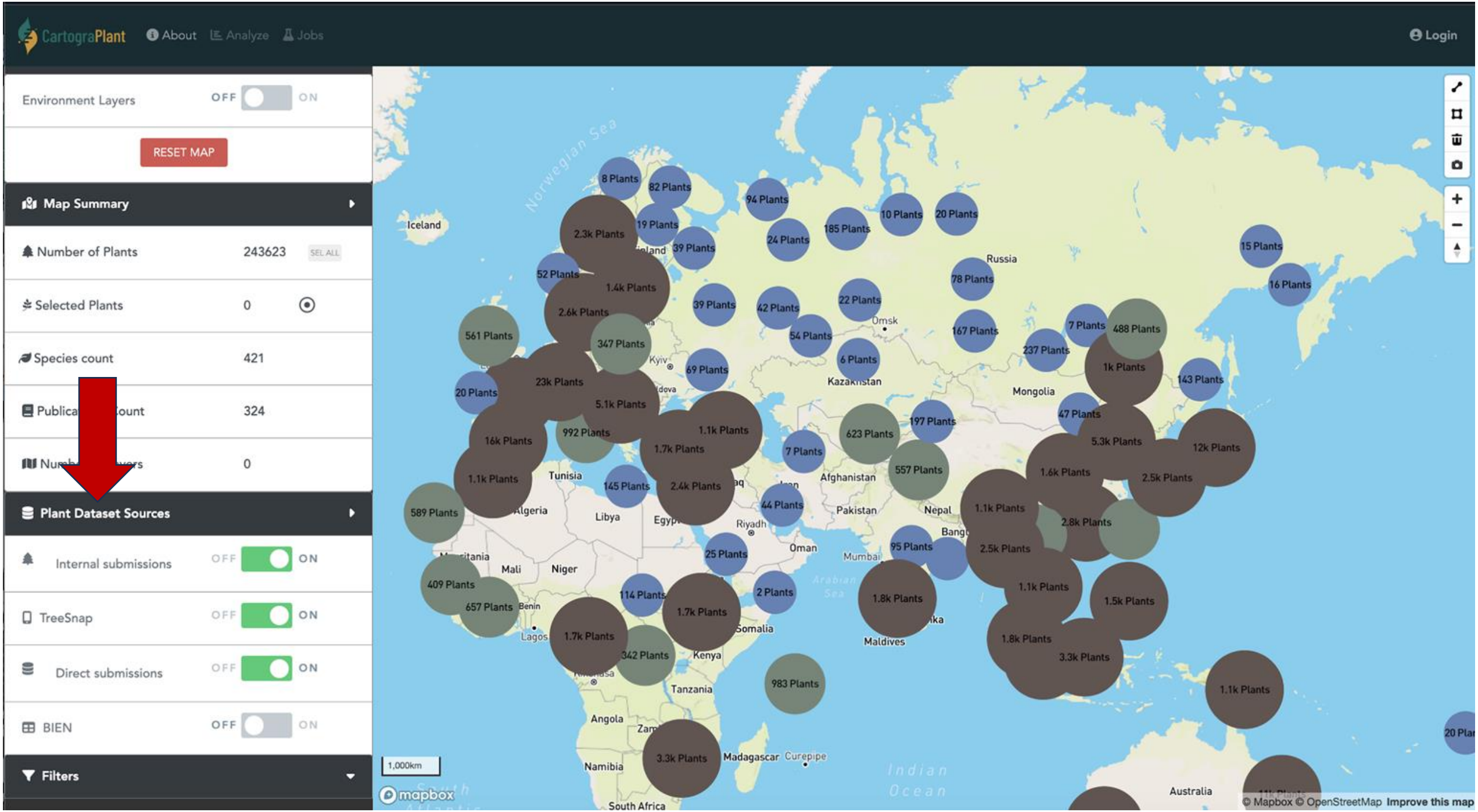
Societal Impact Statement
The scientists that study and work to improve forest health need information on where pests and diseases are spreading, as well as where healthy, resilient trees remain. TreeSnap is a citizen science project and mobile app created to meet this need by enabling citizens to easily submit global positioning system (GPS) locations, photos, and observational information about trees of interest to scientists. The app was designed and built to ensure that the data being collected directly helps scientists engaged in a number of forest health research activities, including studying the genetic diversity of tree species, breeding trees, and monitoring tree health.

KEYWORDS
citizen science, forest health, chestnut, treesnap, mobile app, restoration breeding

1 | INTRODUCTION

Citizen science engages non-professional scientists in scientific research (Bonney et al., 2009; Conrad & Hilchey, 2011; Dickinson et al., 2012; Dickinson, Zuckerberg, & Bonter, 2010; McKinley et al., 2017). For researchers, citizen science offers exciting opportunities to expand the range and scope of data collected and involve a broader and more diverse group of observers and data contributors (Pocock, Tweddle, Savage, Robinson, & Roy, 2017). By incorporating a large number of interested people working in parallel, citizen science has the potential to accelerate the pace or expand the scope of research projects. In today's world of constrained research funding, communicating the value of scientific research to the public is increasingly important yet avenues for sharing scientific research with general audiences are few and researchers typically have little institutional support for education and outreach activities, despite outreach

Ellen Crocker, Bradford and Abdullah Almsaeed Condon contributed equally to this work.


CartograPlant
About
Analyze
Jobs
Login
Environment Layers
OFF
ON
RESET MAP
Map Summary
Number of Plants
243623
SEL ALL
Selected Plants
0
Species count
421
Publica ount
324
Numb ers
0
Plant Dataset Sources
Internal submissions
OFF
ON
TreeSnap
OFF
ON
Direct submissions
OFF
ON
BIEN
OFF
ON
Filters
Norwegian Sea
Iceland
Russia
Omsk
Kyiv
Kazakhstan
Mongolia
Afghanistan
Pakistan
Nepal
Tunisia
Algeria
Libya
Egypt
Riyadh
Oman
Mali
Niger
Benin
Lagos
Somalia
Kenya
Tanzania
Angola
Namibia
Madagascar
Curepipe
South Africa
Maldives
Mumbai
Arabian Sea
Indian Ocean
Australia
8 Plants
82 Plants
94 Plants
10 Plants
20 Plants
19 Plants
2.3k Plants
39 Plants
24 Plants
185 Plants
15 Plants
16 Plants
52 Plants
1.4k Plants
2.6k Plants
78 Plants
39 Plants
42 Plants
22 Plants
561 Plants
347 Plants
54 Plants
167 Plants
7 Plants
488 Plants
237 Plants
1k Plants
143 Plants
69 Plants
6 Plants
20 Plants
23k Plants
5.1k Plants
47 Plants
16k Plants
992 Plants
1.1k Plants
1.7k Plants
623 Plants
197 Plants
5.3k Plants
12k Plants
7 Plants
557 Plants
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2.5k Plants
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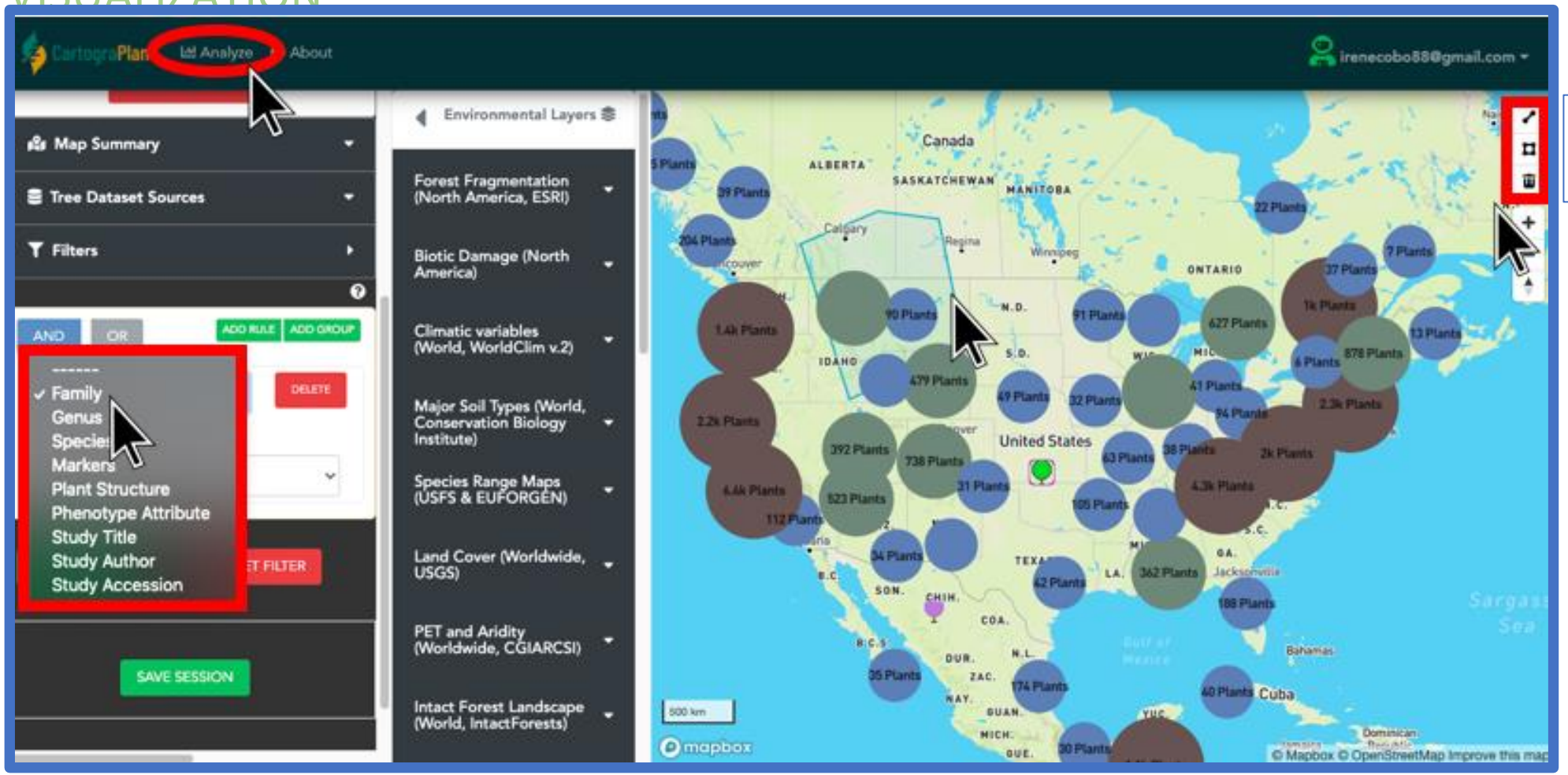
145 Plants
2.4k Plants
589 Plants
44 Plants
1.1k Plants
2.8k Plants
95 Plants
2.5k Plants
25 Plants
409 Plants
657 Plants
114 Plants
2 Plants
1.8k Plants
1.1k Plants
1.5k Plants
1.7k Plants
1.8k Plants
342 Plants
3.3k Plants
983 Plants
1.1k Plants
3.3k Plants
1,000km
mapbox
© Mapbox © OpenStreetMap Improve this map

INTERFACE AND DATA VISUALIZATION

https://cartograplant.org/



Polygon drawing on the map

DATA SELECTION FOR ANALYSIS

CartograPlant About Analyze Jobs Login

Plant Dataset Sources

Internal submissions OFF ON

TreeSnap OFF ON

Direct submissions OFF ON

BIEN OFF ON

Filters

AND OR ADD RULE ADD GROUP

Study Title DELETE

equal

Estimating heritability of diseas…

APPLY FILTER RESET FILTER

SAVE SESSION

Collapse

TGDR046-KM37

43.227 Lat | -88.69 Lon

Elevation: 260 m

Juglandaceae

Juglans cinerea

Coord. Type Approximate

Source TreeGenes

STUDY INFO

ADD SELECTED PLANTS (28)

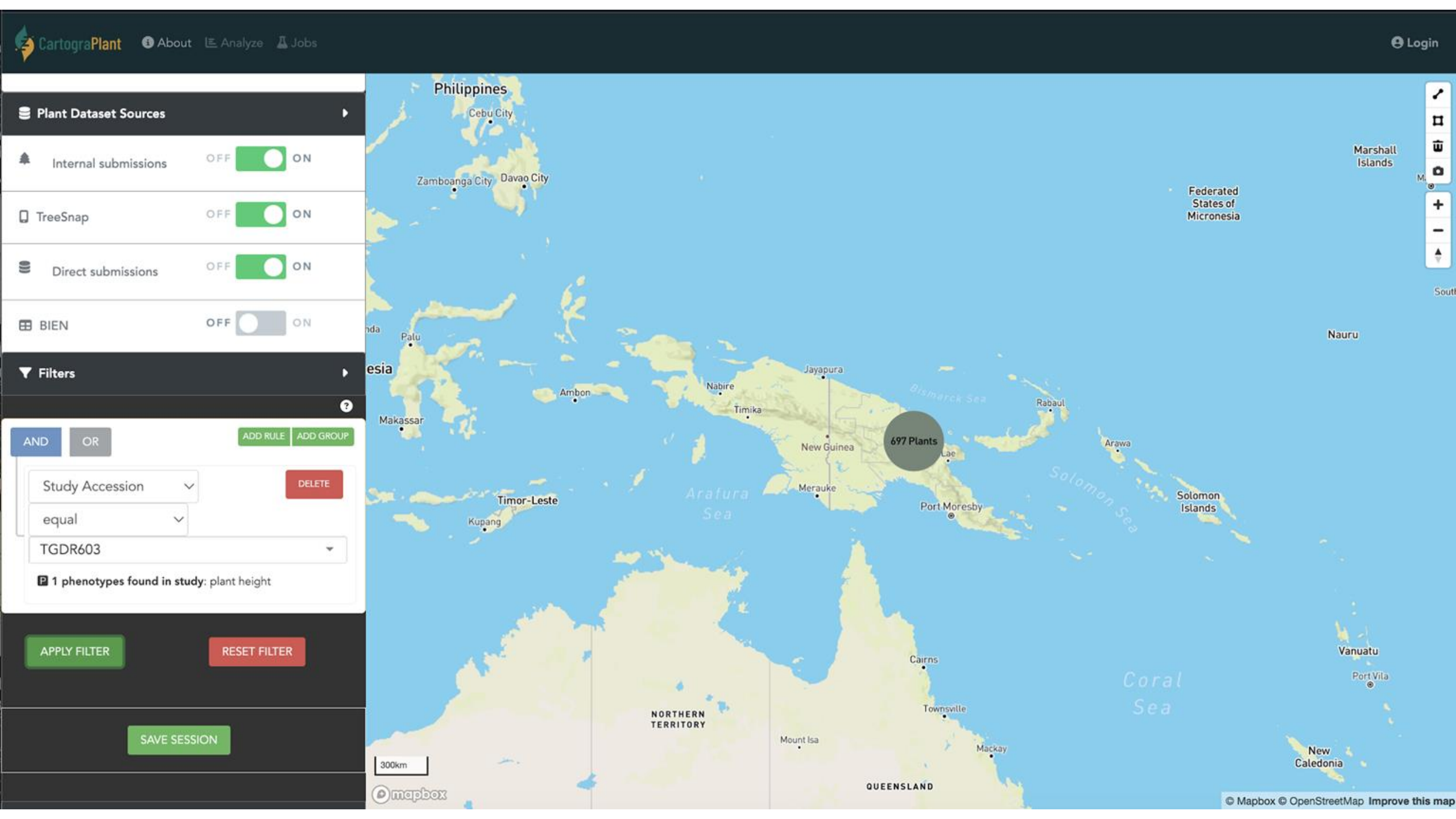
KM37 ADD PLANT

KM36 ADD PLANT

Reeseville Clyman County Rd J State Hwy 26 County Rd ME County Rd EM Lebanon County Rd E Mud Lake Wildlife Area County Rd Q Richwood Old Lebanon County Rd G County Rd K Hubbleton State Hwy 19 Watertown West St S 12th St RYV County Rd SC Pipersville Ixonia Ebenezer Grellton 2km

mapbox

© Mapbox © OpenStreetMap Improve this map


CartograPlant
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Direct submissions
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TGDR603
1 phenotypes found in study: plant height
APPLY FILTER
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Philippines
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Zamboanga City
Davao City
Palu
Makassar
Ambon
Nabire
Jayapura
Timika
New Guinea
697 Plants
Lae
Merauke
Timor-Leste
Kupang
Arafura Sea
Bismarck Sea
Rabaul
Arawa
Port Moresby
Solomon Islands
Solomon Sea
Federated States of Micronesia
Marshall Islands
Nauru
Vanuatu
Port Vila
Coral Sea
Cairns
Townsville
Mackay
Mount Isa
NORTHERN TERRITORY
QUEENSLAND
New Caledonia
300km
mapbox
© Mapbox © OpenStreetMap Improve this map

TGDR603-NUM_HAH_0025_2

BIOME No biome number could be retrieved.

Study Associated

Speciation in a keystone plant genus is driven by elevation: a case study in New Guinean Ficus

Segar, S. T. 2016 View Additional Details

Ficus hahliana, Ficus arfakensis

Study File Downloads

Tree Accession

Genotype SSRs/cpSSRs Ficus hahliana

Genotype SSRs/cpSSRs Ficus arfakensis

Ficus hahliana Phenotype File

Study Type

Genotype x Phenotype

Markers

microsatellite

Markers Count

36

Phenotype Measures

2360

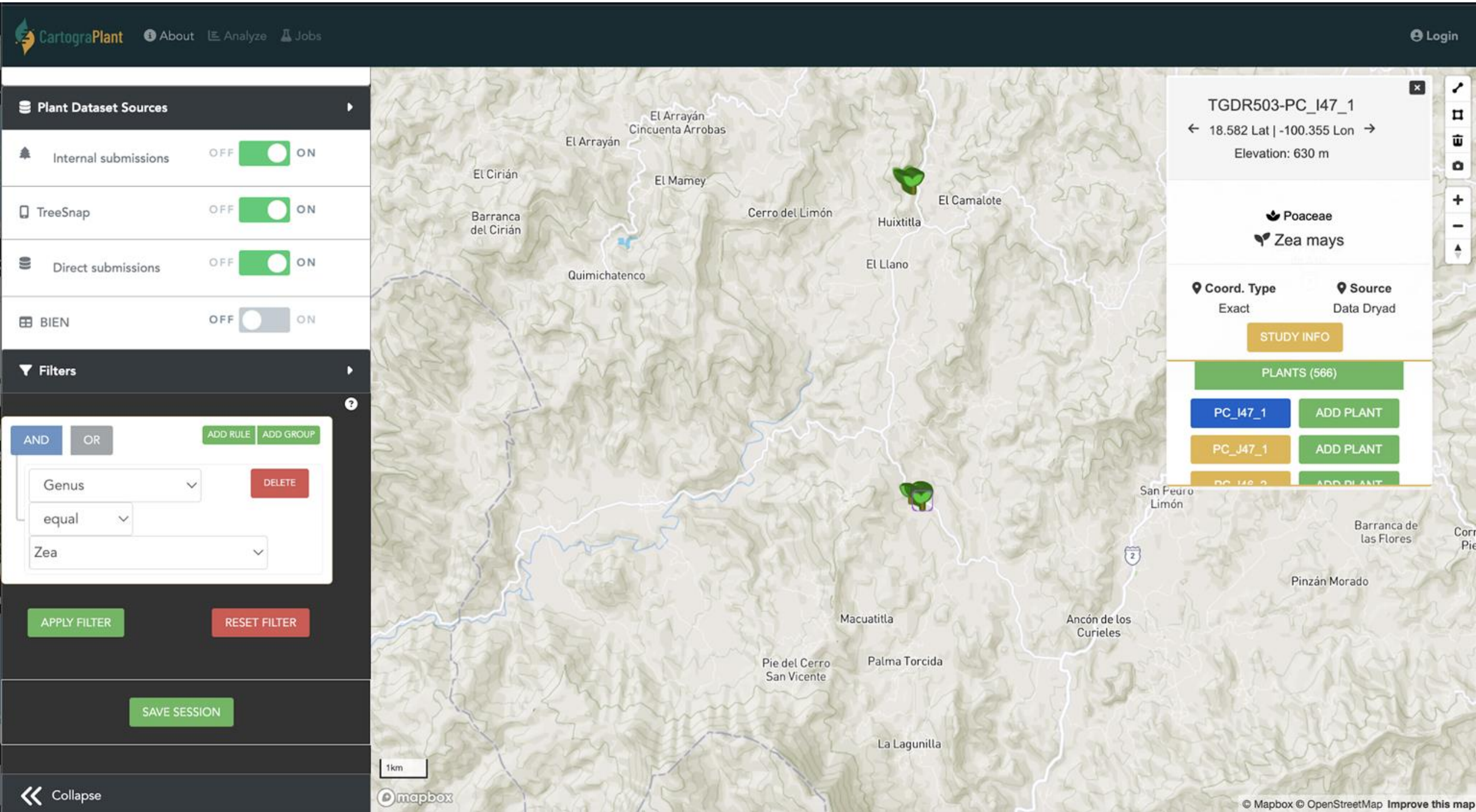
Plant specific details for TGDR603-NUM_HAH_0025_2

Unique Phenotypes

4

Plant Phenotypic Data

Plant ID	Name	Value	Units	Structure	Observation
TGDR603-NUM_HAH_0025_2	Tree Sex	Male	Boolean	whole plant	phenotypic sex
TGDR603-NUM_HAH_0025_2	Height (cm)	1.355	centimeter	whole plant	height
TGDR603-NUM_HAH_0025_2	Width (cm)	1.66	centimeter	whole plant	width
TGDR603-NUM_HAH_0025_2	Volume (cm3)	0.97751650300000004	cubic centimeter	whole plant	volume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El Arrayán
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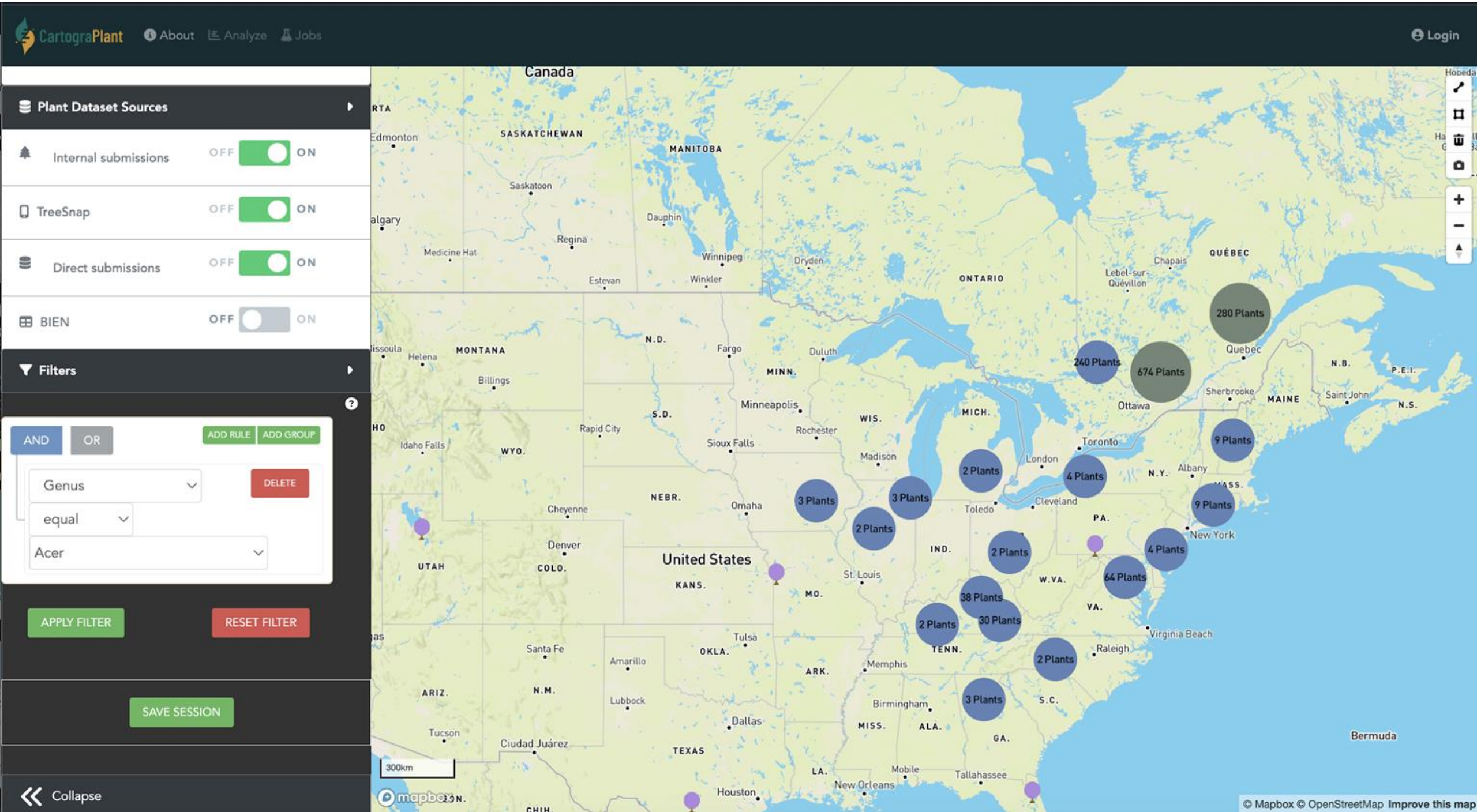
El Arrayán
El Cirián
El Mamey
Barranca
del Cirián
Cerro del Limón
Huixtitla
El Camalote
El Llano
Quimichatenco
San Pedro
Limón
Barranca de
las Flores
Pinzán Morado
Macuatitla
Ancón de los
Curieles
Pie del Cerro
San Vicente
Palma Torcida
La Lagunilla
1km
mapbox
TGDR503-PC_I47_1
18.582 Lat | -100.355 Lon
Elevation: 630 m
Poaceae
Zea mays
Coord. Type
Exact
Source
Data Dryad
STUDY INFO
PLANTS (566)
PC_I47_1
ADD PLANT
PC_J47_1
ADD PLANT
© Mapbox © OpenStreetMap Improve this map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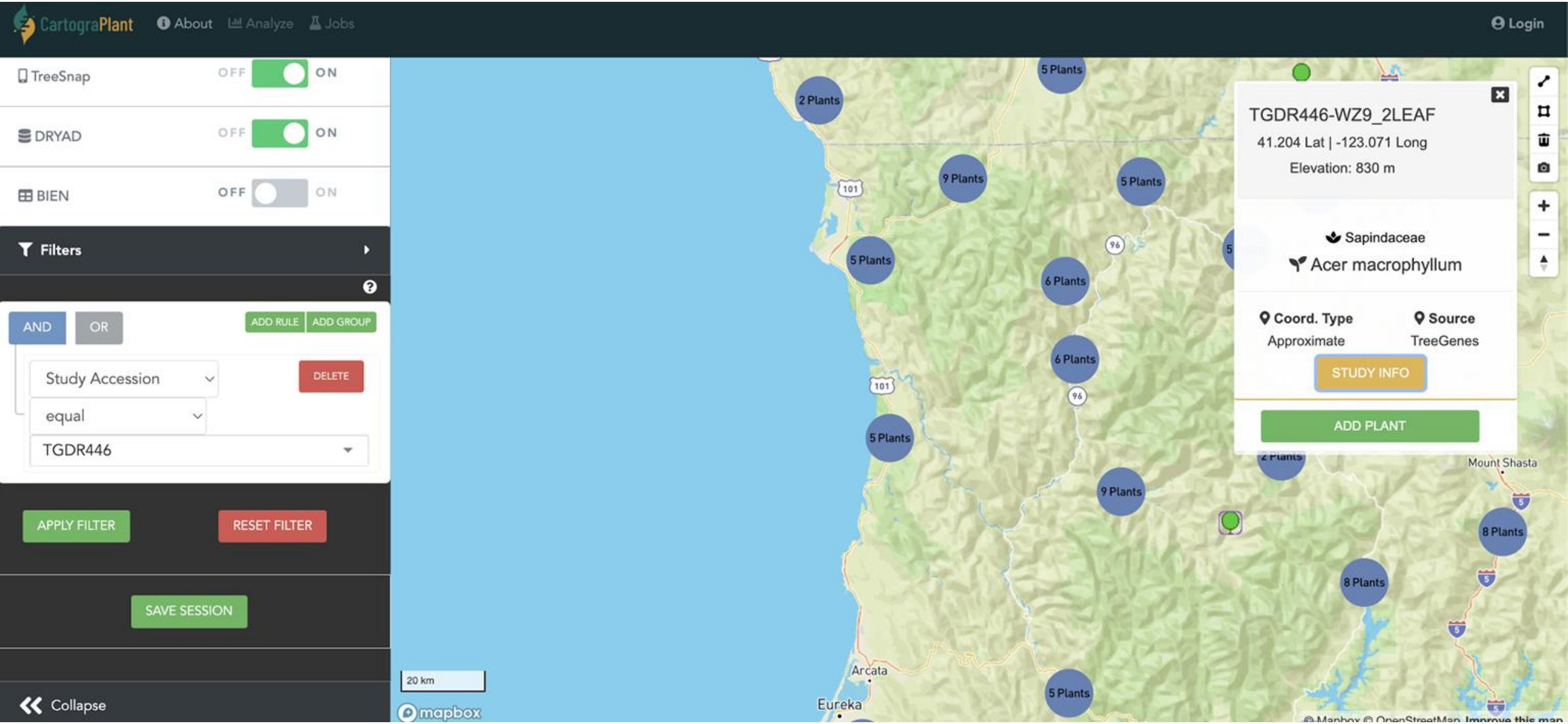
Bermuda
Edmonton
Saskatoon
Regina
Winnipeg
Dauphin
Dryden
Winkler
Estevan
Medicine Hat
Helena
Billings
Fargo
Duluth
Minneapolis
Rapid City
Sioux Falls
Rochester
Madison
Omaha
Cheyenne
Denver
Idaho Falls
Toronto
London
Cleveland
Toledo
Albany
New York
Ottawa
Quebec
Sherbrooke
Saint John
Chapais
Lebel-sur-Quévillon
St. Louis
Memphis
Raleigh
Virginia Beach
Santa Fe
Amarillo
Lubbock
Dallas
Tulsa
Tucson
Ciudad Juárez
Houston
New Orleans
Mobile
Tallahassee
Birmingham
SASKATCHEWAN
MANITOBA
ONTARIO
QUÉBEC
MONTANA
N.D.
MINN.
S.D.
WYO.
NEBR.
UTAH
COLO.
KANS.
MO.
IND.
MICH.
WIS.
N.Y.
PA.
W.VA.
VA.
TENN.
ARK.
MISS.
ALA.
GA.
S.C.
OKLA.
TEXAS
ARIZ.
N.M.
LA.
MAINE
MASS.
N.B.
P.E.I.
N.S.
280 Plants
240 Plants
674 Plants
9 Plants
2 Plants
4 Plants
3 Plants
3 Plants
2 Plants
9 Plants
2 Plants
4 Plants
64 Plants
38 Plants
30 Plants
2 Plants
2 Plants
3 Plants
300km
© Mapbox © OpenStreetMap Improve this map


CartograPlant
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TGDR446
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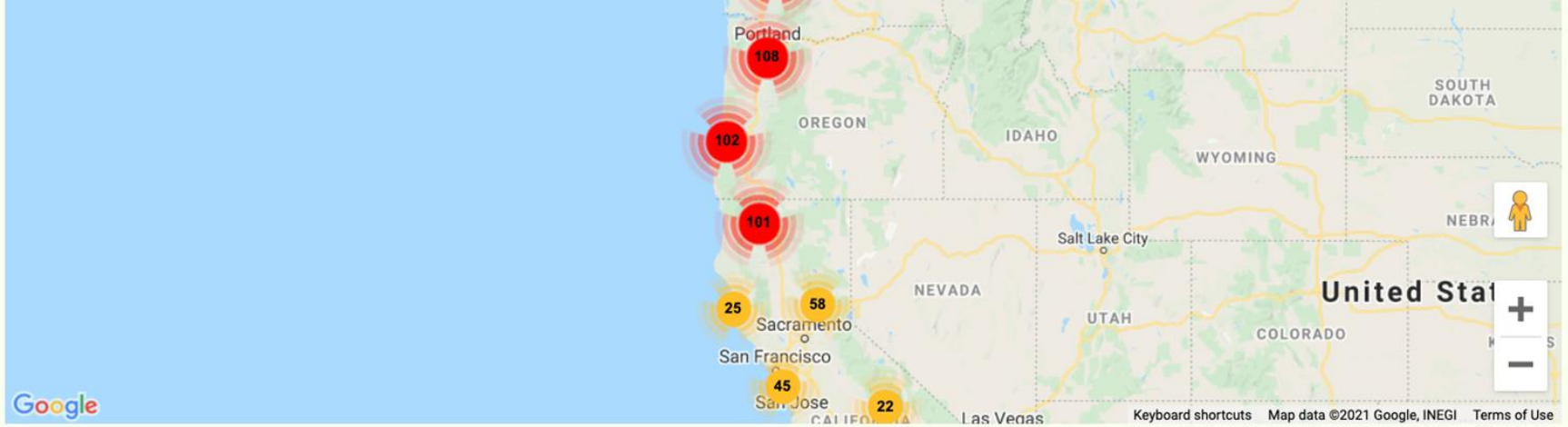
SAVE SESSION
Collapse
2 Plants
5 Plants
9 Plants
5 Plants
101
5 Plants
6 Plants
96
6 Plants
101
96
5 Plants
9 Plants
8 Plants
8 Plants
5 Plants
TGDR446-WZ9_2LEAF
41.204 Lat | -123.071 Long
Elevation: 830 m
Sapindaceae
Acer macrophyllum
Coord. Type
Approximate
Source
TreeGenes
STUDY INFO
ADD PLANT
Mount Shasta
Arcata
Eureka
20 km
mapbox

TreeGenes View



RANGE-WIDE ASSESSMENT OF A SNP PANEL FOR INDIVIDUALIZATION AND GEOLOCALIZATION OF BIGLEAF MAPLE (ACER MACROPHYLLUM PURSH)

Cronn, Richard, Kristen N. Finch, Laura L. Hauck, Meaghan Parker-Forney, Brook G. Milligan, Jenélle Dowling, Adventure Scientists

Published 2021, in Forensic Science International: Animals and Environments

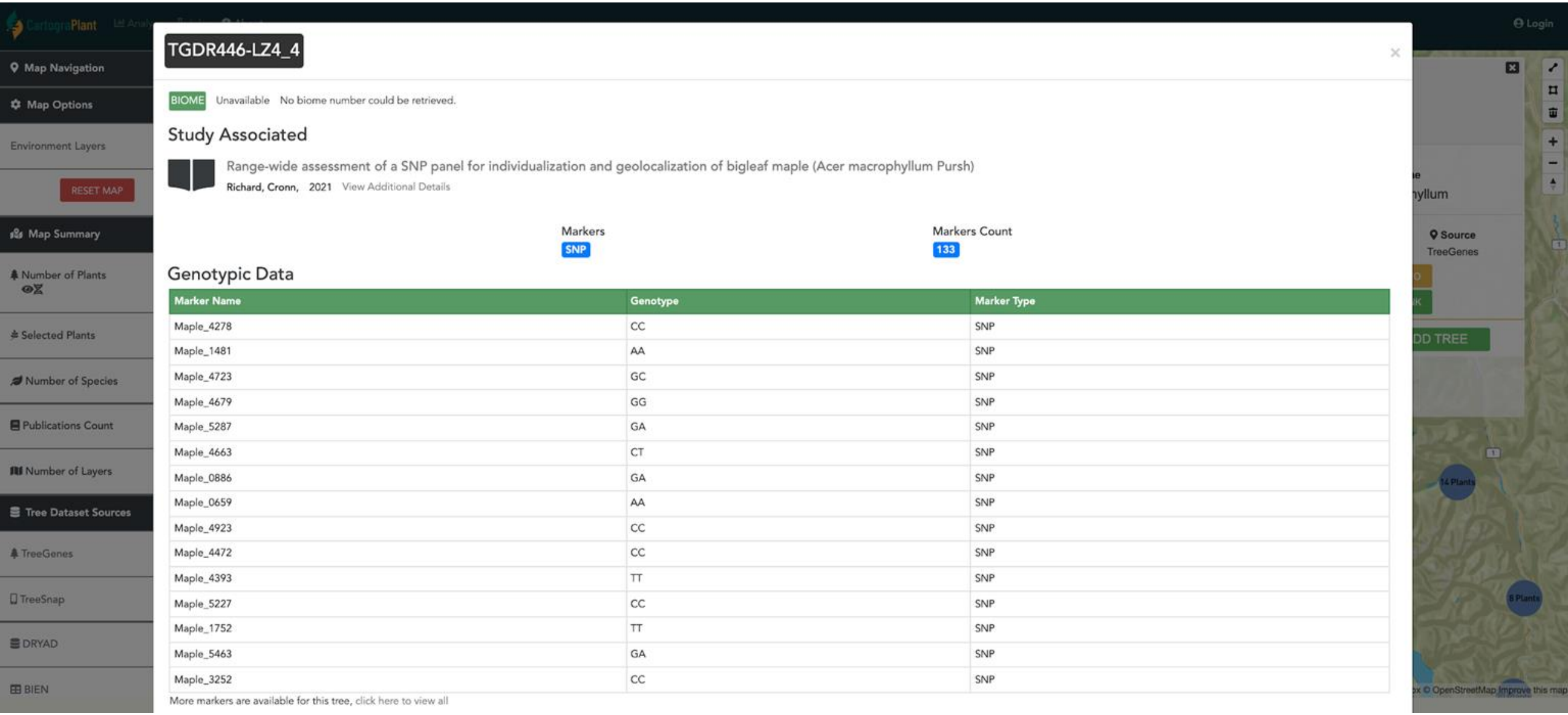
Click to show abstract

View in CartograPlant

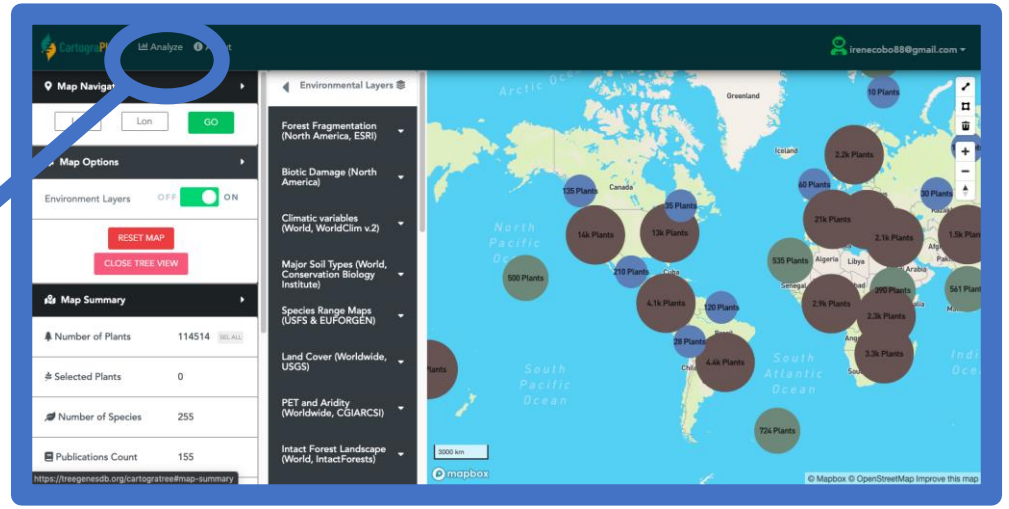
Download compressed raw files

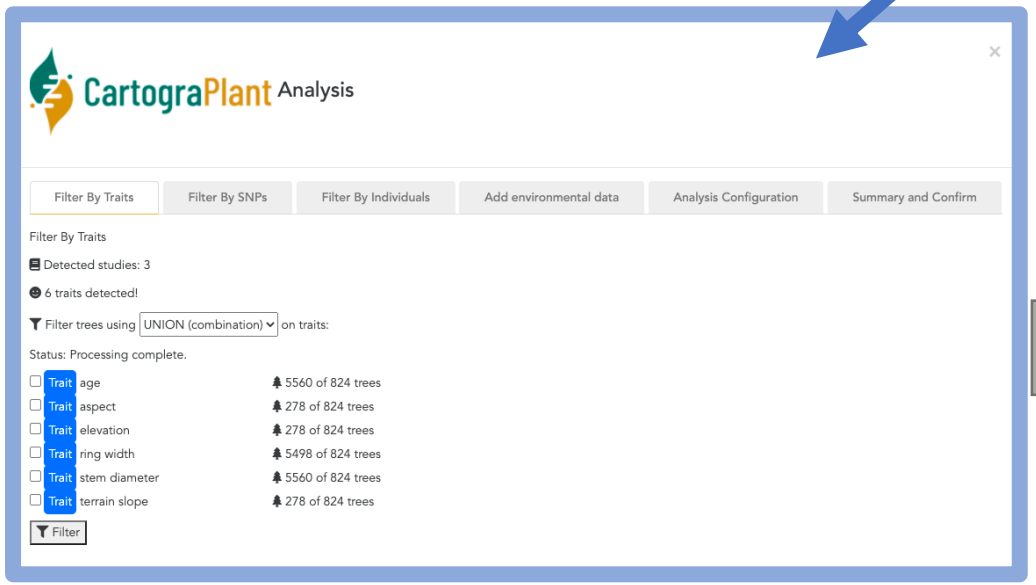
Species | Study Details | Plants | Genotypes

Accession	TGDR446
Title	Range-wide assessment of a SNP panel for individualization and geolocalization of bigleaf maple (Acer macrophyllum Pursh)
Authors	Cronn, Richard, Kristen N. Finch, Laura L. Hauck, Meaghan Parker-Forney, Brook G. Milligan, Jenélle Dowling, Adventure Scientists
Species	Acer macrophyllum
Data Type	Genotype
Study Type	Natural Population (Landscape)
File Downloads	TGDR446_Plant_Accession_Acer_macrophyllum.csv TGDR446_Genotype_SNPs_Assay_Acer_macrophyllum.csv
Population Size	1158


CartograPlant
Login
Map Navigation
Map Options
Environment Layers
RESET MAP
Map Summary
Number of Plants
Selected Plants
Number of Species
Publications Count
Number of Layers
Tree Dataset Sources
TreeGenes
TreeSnap
DRYAD
BIEN
TGDR446-LZ4_4
BIOME Unavailable No biome number could be retrieved.
Study Associated
Range-wide assessment of a SNP panel for individualization and geolocalization of bigleaf maple (Acer macrophyllum Pursh)
Richard, Cronn, 2021 View Additional Details
Markers
SNP
Markers Count
133
Genotypic Data
Marker Name
Genotype
Marker Type
Maple_4278 CC SNP
Maple_1481 AA SNP
Maple_4723 GC SNP
Maple_4679 GG SNP
Maple_5287 GA SNP
Maple_4663 CT SNP
Maple_0886 GA SNP
Maple_0659 AA SNP
Maple_4923 CC SNP
Maple_4472 CC SNP
Maple_4393 TT SNP
Maple_5227 CC SNP
Maple_1752 TT SNP
Maple_5463 GA SNP
Maple_3252 CC SNP
More markers are available for this tree, click here to view all
Source
TreeGenes
14 Plants
8 Plants

Analytics in CartograPlant





Summary

- Integrate relevant environmental layers from curated public sources
- Provide a mechanism for georeferenced plant data to be imported (FAIR)
- HPC supported workflows that are user-accessible and reproducible
- Future
  - More regional and higher resolution layers
    - Population structure
  - Improved/Additional Analytics
  - Respond to community needs!

Today's Schedule (in EST!)

11:00-11:20 Introduction to CartograPlant - Dr. Jill Wegrzyn

11:20-11:40 Introduction to Data Submission with TPPS/TPPSc - Emily Grau

11:40-12:00 Introduction to Data Collection/Mobile Phenotyping with TreeSnap - Dr. Margaret Staton

12:00-12:15 Break

12:15-12:35 Behind the Scenes of CartograPlant - Environmental Layers and Data - Risharde Ramnath

12:35-12:55 Analytics with CartograPlant (GWAS and GEA). Part 1 - Gabriel Barrett

12:55-1:15 Analytics with CartograPlant (GWAS and GEA). Part 2 – Dr. Irene Cobo-Simon