THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

SERVIR

NASA

WORKSHOP: GOOGLE EARTH ENGINE AND COLLECT EARTH ONLINE FOR LAND USE AND COVER

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July 17, 2019

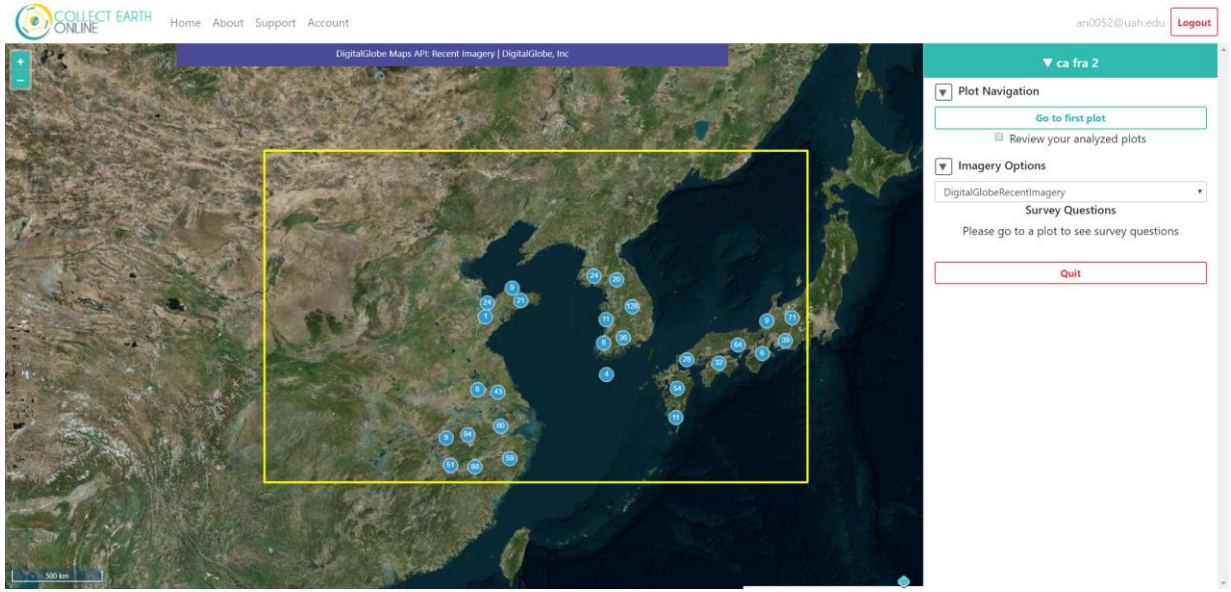
Collect Earth Online

COLLECT EARTH
ONLINE

Collect Earth Online

- Collect Earth Online (CEO): A visual image interpretation system for reference data collection
- Developed by SERVIR and FAO
- No installation needed
- Collaborative mapping

Fuente: Spatial Informatics Group



Collect Earth Online

COLLECT EARTH ONLINE

Exercises

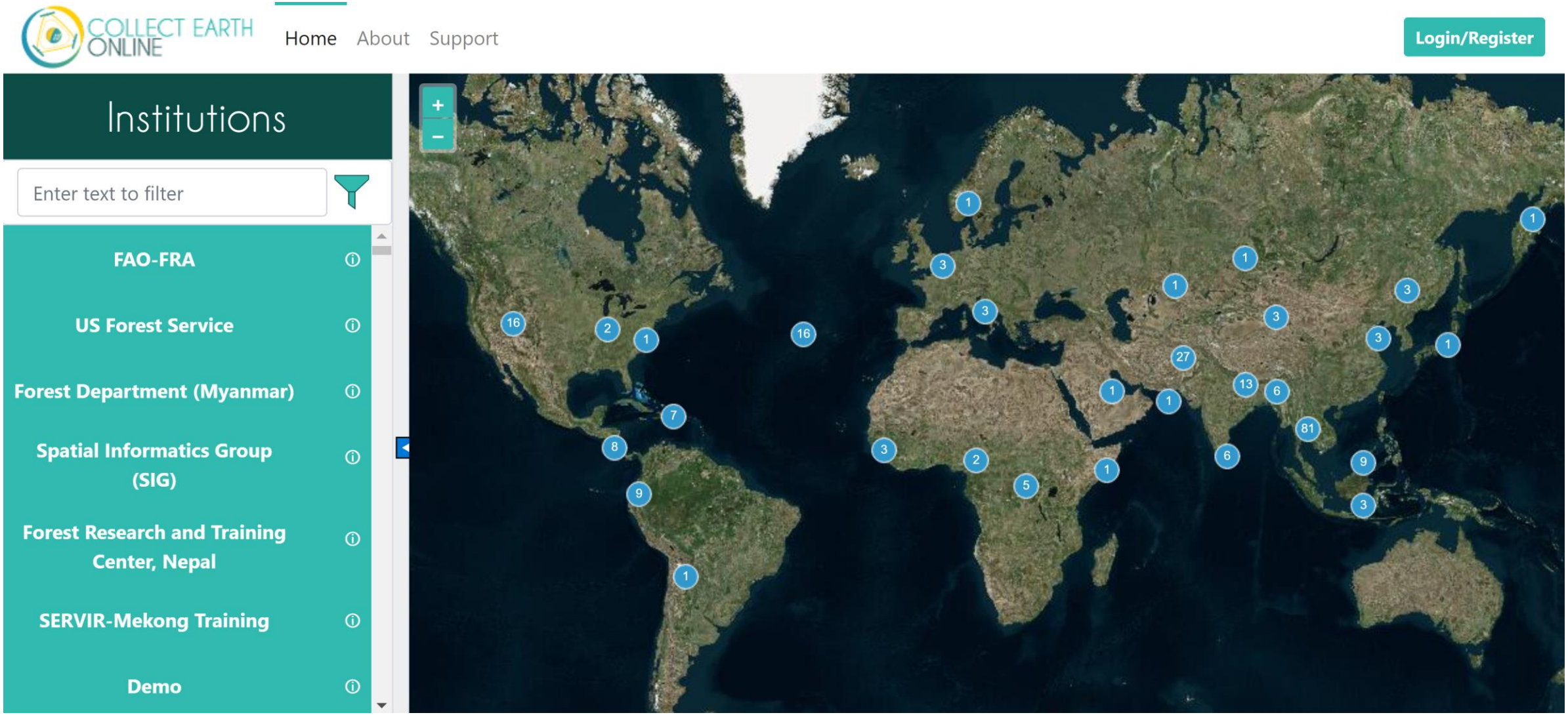
- How to créate a project
- Plot and sample design
- Survey design
- Plot navigation
- Imagery options
- How to export reference data

Useful links

- https://collect.earth/support
- https://collect.earth/downloads/CEO_Manual.pdf
- https://github.com/openforis/collect-earth-online/issues
- http://www.openforis.org/

Collect Earth Online

http://collect.earth



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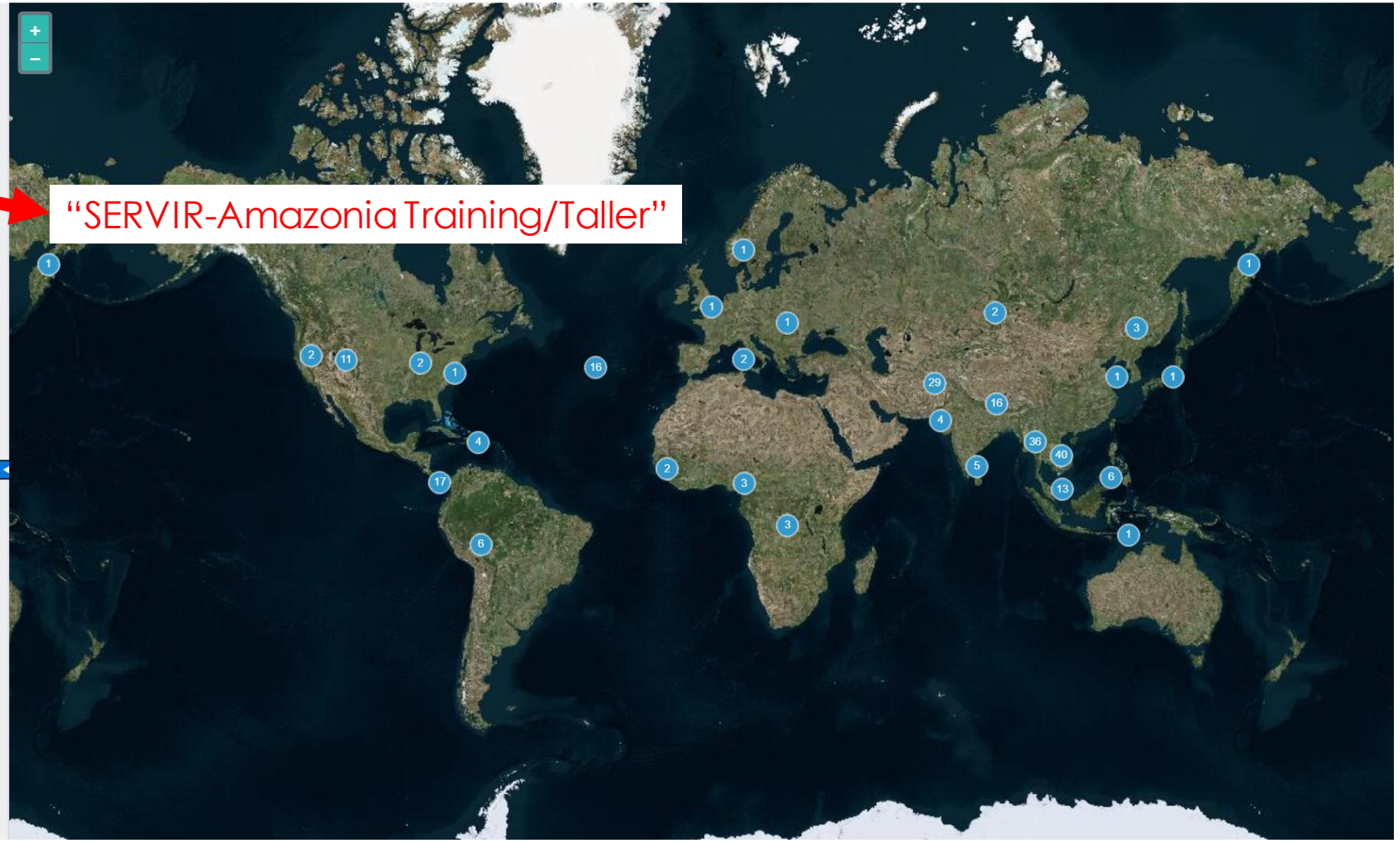
Institutions

Create New Institution

Enter text to filter

"SERVIR-Amazonia Training/Taller"

- FAO-FRA
- US Forest Service
- Forest Department (Myanmar)
- Spatial Informatics Group (SIG)
- Forest Research and Training Center, Nepal
- SERVIR-Mekong Training
- Demo
- Cambodia Change Detection
- Collaborative Forest Landscape Restoration Program (CFLRP)
- SERVIR-Mekong
- Afghanistan_NLCMS



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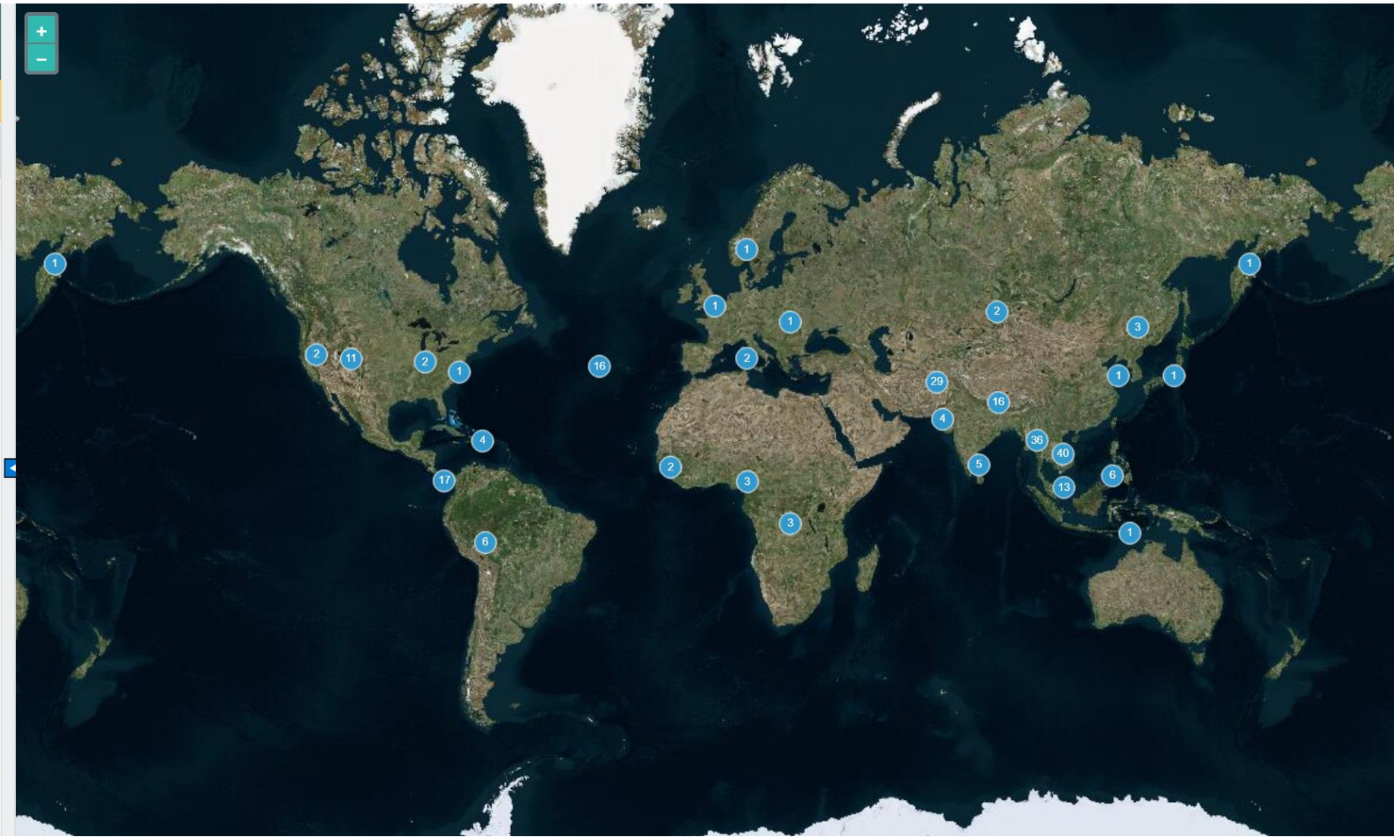
Institutions

Create New Institution

servir-amazo

SERVIR-Amazonia Training/Taller



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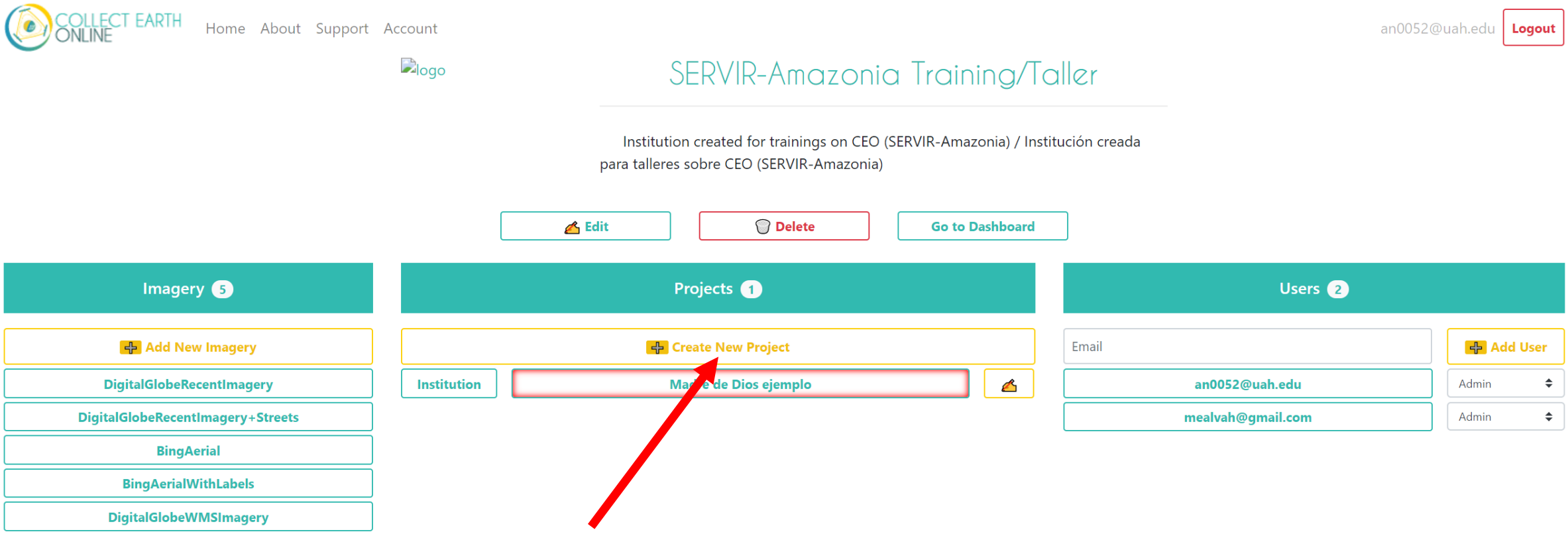
Creación de un proyecto



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Create Project

Use Project Template (Optional)

Template Filter (Name or ID)

Select Project

None

Project Info

Name

Description

Privacy Level

Public: *All* Users: *Logged In Users* Institution: *Group Members* Private: *Group Admins*

Project AOI

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Project AOI

Hold CTRL and click-and-drag a bounding box on the map

North

West East

South

Basemap Source

DigitalGlobeRecentImagery

Plot Design

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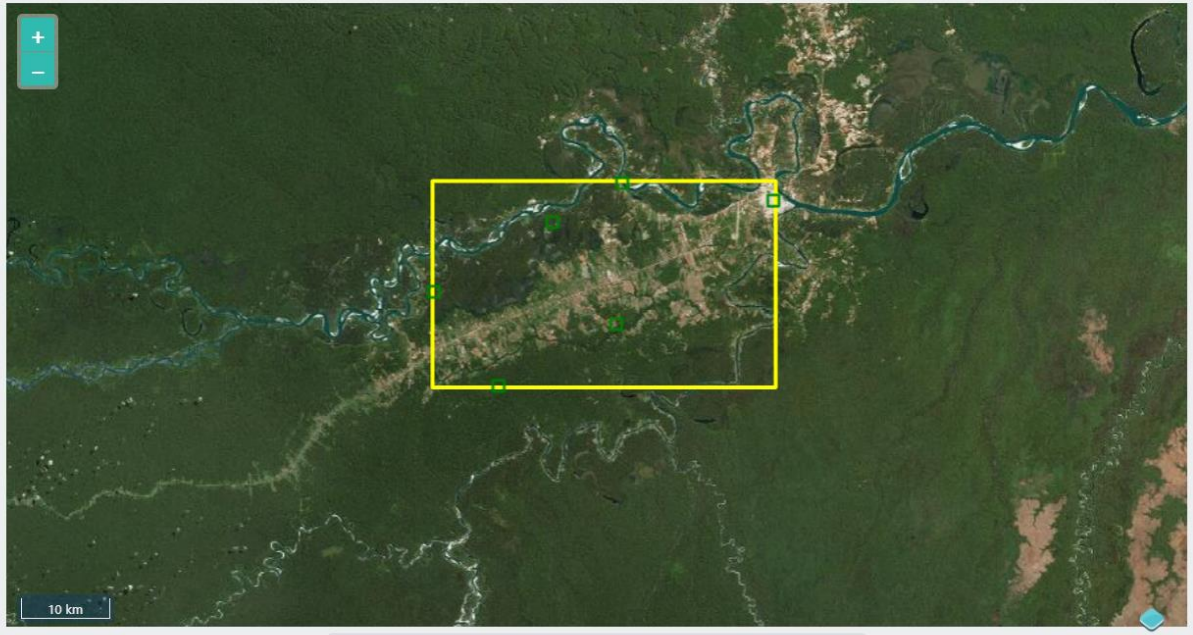
Project AOI



-12.5745912082845

-69.5420419202322 -69.1863591905305

-12.7837089735666

Basemap Source

DigitalGlobeRecentImagery

Plot Review

Spatial Distribution csv distribution

Collect Earth Online

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Plot Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Plot centers will be randomly distributed within the AOI.

Number of plots

Plot spacing (m)

Plot Shape

Circle Square

Diameter (m)

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be randomly distributed within the plot boundary.

Samples per plot

Sample resolution (m)

Survey Design

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	A	B	C
1	LONGITUDE	LATITUDE	PLOTID
2	-69.47329712	-12.78190041	1
3	-69.54019928	-12.68719959	2
4	-69.35099792	-12.71959972	3
5	-69.4178009	-12.61629963	4
6	-69.1882019	-12.59490013	5
7	-69.34559631	-12.5763998	6

PLOTID cannot start at 0

Plot Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP File: ceo_pts.csv

-Specify your own plot centers by uploading a CSV with these fields: LONGITUDE,LATITUDE,PLOTID.

Number of plots

Plot spacing (m)

Plot Shape

Circle Square

Diameter (m)

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be randomly distributed within the plot boundary.

Samples per plot

Sample resolution (m)

Survey Design

Collect Earth Online

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Plot Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP File: ceo_pts.csv

-Specify your own plot centers by uploading a CSV with these fields: LONGITUDE,LATITUDE,PLOTID.

Number of plots

Plot spacing (m)

Plot Shape

Circle Square

Width (m)

200

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be randomly distributed within the plot boundary.

Samples per plot

Sample resolution (m)

Survey Design

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Plot Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP File: ceo_pts.csv

-Specify your own plot centers by uploading a CSV with these fields: LONGITUDE,LATITUDE,PLOTID.

Number of plots

Plot spacing (m)

Plot Shape

Circle Square

Width (m)

200

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be randomly distributed within the plot boundary.

Samples per plot

Sample resolution (m)

Survey Design

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Plot Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP File: ceo_pts.csv

-Specify your own plot centers by uploading a CSV with these fields: LONGITUDE,LATITUDE,PLOTID.

Number of plots

Plot spacing (m)

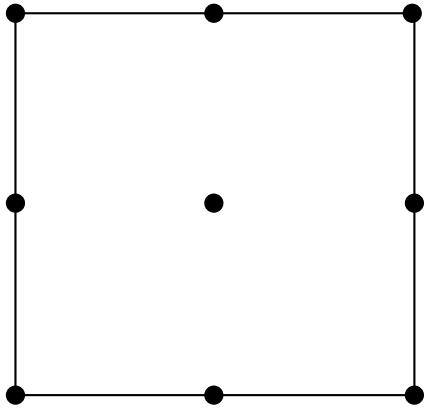
Plot Shape

Circle Square

Width (m)

200

40.000 m^2



Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be arranged on a grid within the plot boundary using the sample resolution selected below.

Samples per plot

Sample resolution (m)

100

Survey Design

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Width (m)

200

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be arranged on a grid within the plot boundary using the sample resolution selected below.

Samples per plot

Sample resolution (m)

100

Survey Design

Simple Advanced

Parent Question: None

Parent Answer: Any

New Question:

Add Survey Question

Project Management

Create Project

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Width (m)

200

Sample Design

Spatial Distribution

Random Gridded Upload CSV Upload SHP

-Sample points will be arranged on a grid within the plot boundary using the sample resolution selected below.

Samples per plot

Sample resolution (m)

100

Survey Design

Simple Advanced

Parent Question: None

Parent Answer: Any

New Question: Uso/Cobertura del Suelo?

Add Survey Question

Project Management

Create Project

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Survey Design

Simple Advanced

- Survey Card Number 1

X **Uso/Cobertura del Suelo**

Answers:

- X Agua
- X Bosque
- X Minería
- X Pastizal
- X Agricultura
- X Tala
- X Urbano/Artificial
- X Otro
- +

Parent Question: None

Parent Answer: Any

New Question:

Add Survey Question

Project Management

Create Project

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Survey Design

Simple Advanced

- Survey Card Number 1

X **Uso/Cobertura del Suelo**

Answers:

- X Agua
- X Bosque
- X Minería
- X Pastizal
- X Agricultura
- X Tala
- X Urbano/Artificial
- X Otro
- +

Parent Question: None

Parent Answer: Any

New Question:

Add Survey Question

Project Management

Create Project

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Review Project

Project Info

Name

Madre de Dios ejemplo

Description

Madre de Dios ejemplo

Privacy Level

Public: *All* Users: *Logged In Users* Institution: *Group Members* Private: *Group Admins*

Project AOI

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-12.5745912082845

-69.5420419202322 -69.1863591905305

-12.7837089735666

Basemap Source

DigitalGlobeRecentImagery

Plot Review

Spatial Distribution	csv distribution
Number of plots	6 plots
Plot shape	square
Plot size	200 m

Sample Design

Spatial Distribution	gridded distribution
Samples Per Plot	9 /plot
Sample Resolution	100 m

Survey Review

- Survey Card Number 1

Uso/Cobertura del Suelo?

- **Component Type:** button - text

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Samples Per Plot 9 /plot

Sample Resolution 100 m

Survey Review

- Survey Card Number 1

Uso/Cobertura del Suelo?

- **Component Type:** button - text

Answers:

- Agua
- Bosque
- Minería
- Pastizal
- Agricultura
- Tala
- Otro
- Urbano/Artificial

Rules:

No rules available for this survey

Project Management

Close Project | Update Project

Project Dashboard | Configure Geo-Dash

Download Plot Data | Download Sample Data

Project Stats

Collect Earth Online

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Samples Per Plot 9 /plot

Sample Resolution 100 m

Survey Review

- Survey Card Number 1

Uso/Cobertura del Suelo?

- **Component Type:** button - text

Answers:

- Agua
- Bosque
- Minería
- Pastizal
- Agricultura
- Tala
- Otro
- Urbano/Artificial

Rules:

No rules available for this survey

Project Management

Close Project | Update Project

Project Dashboard | Configure Geo-Dash

Download Plot Data | Download Sample Data

Project Stats

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Project Dashboard

Project AOI

Project Stats

Members	0	Contributors	1
Total Plots	6	Date Created	
Flagged Plots	0	Date Published	
Analyzed Plots	6	Date Closed	
Unanalyzed Plots	0	Date Archived	

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Samples Per Plot 9 /plot

Sample Resolution 100 m

Survey Review

- Survey Card Number 1

Uso/Cobertura del Suelo?

- **Component Type:** button - text

Answers:

- Agua
- Bosque
- Minería
- Pastizal
- Agricultura
- Tala
- Otro
- Urbano/Artificial

Rules:

No rules available for this survey

Project Management

Close Project | Update Project

Project Dashboard | Configure Geo-Dash

Download Plot Data | Download Sample Data

Project Stats

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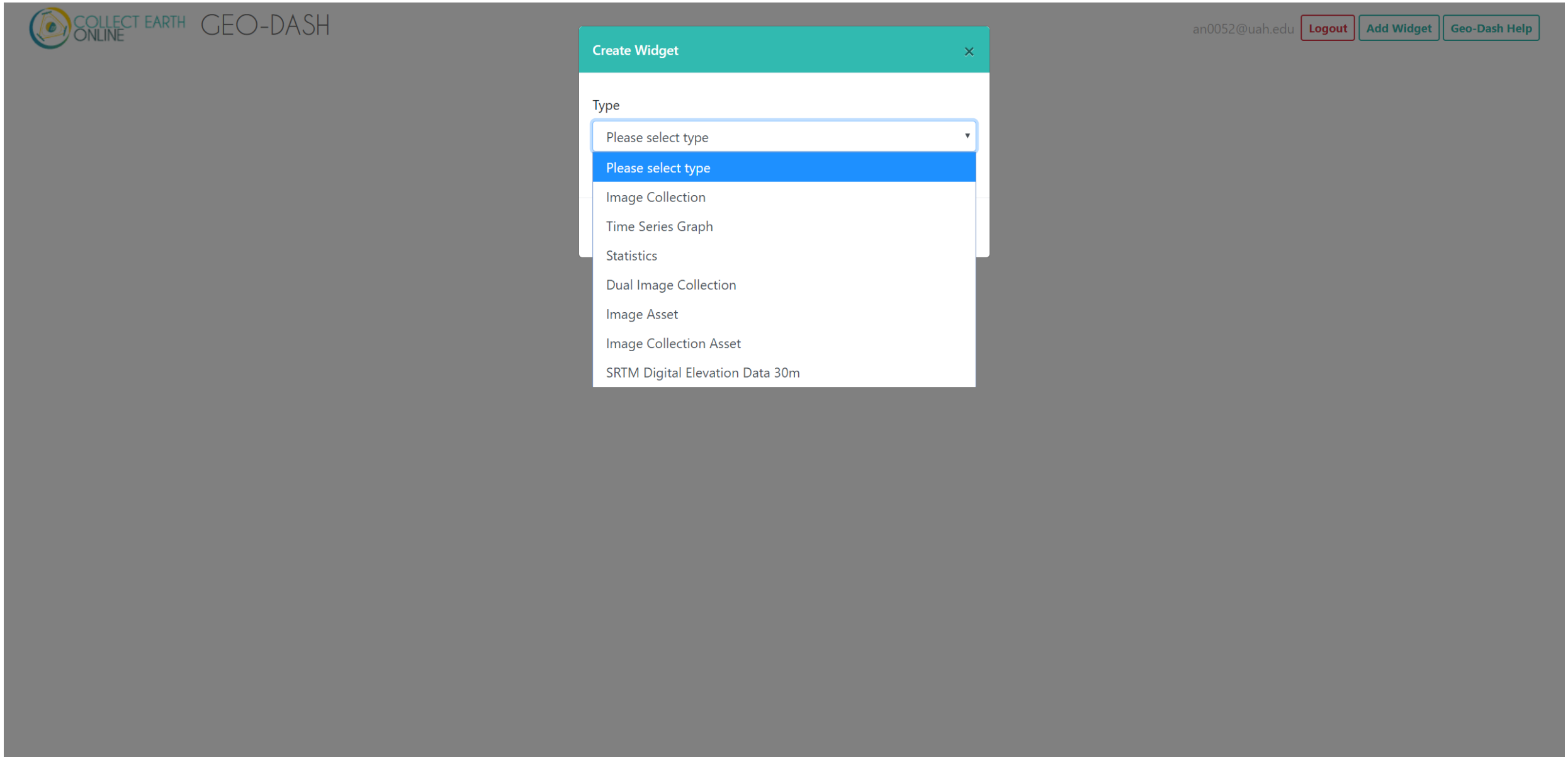

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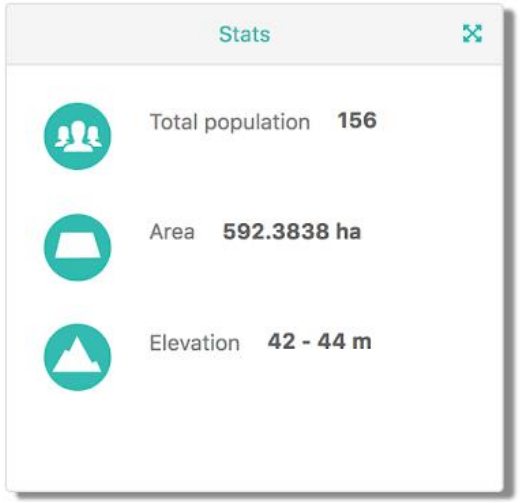
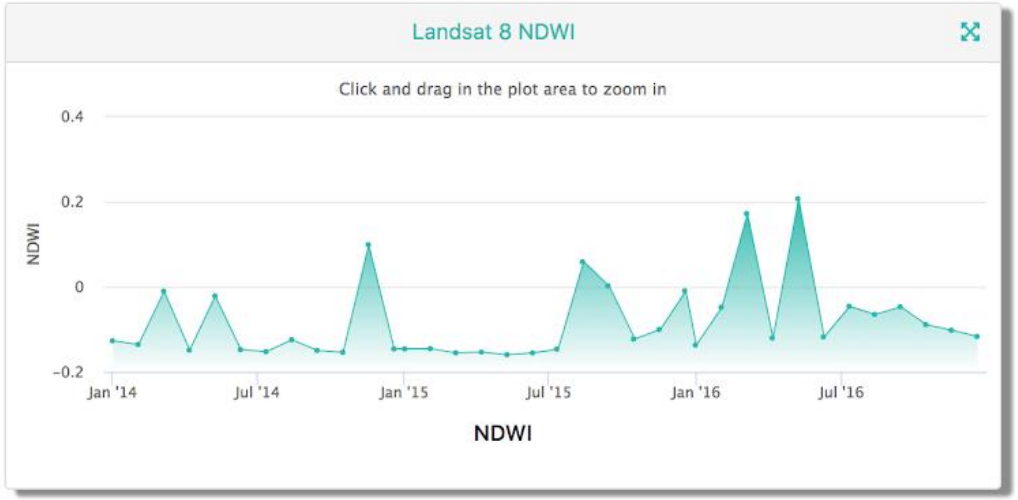
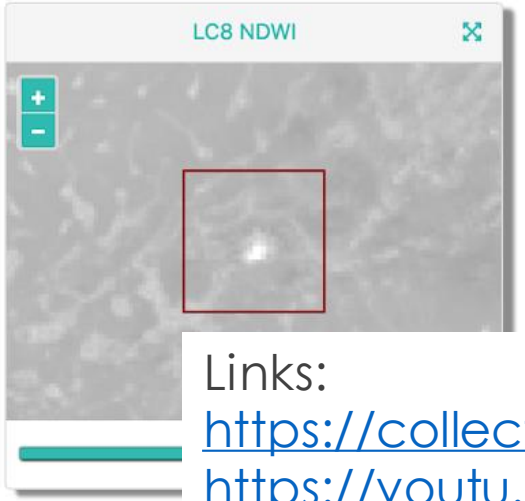
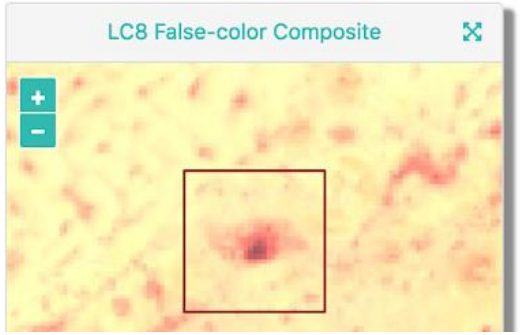
COLLECT EARTH ONLINE GEO-DASH

admin@openforis.org Logout





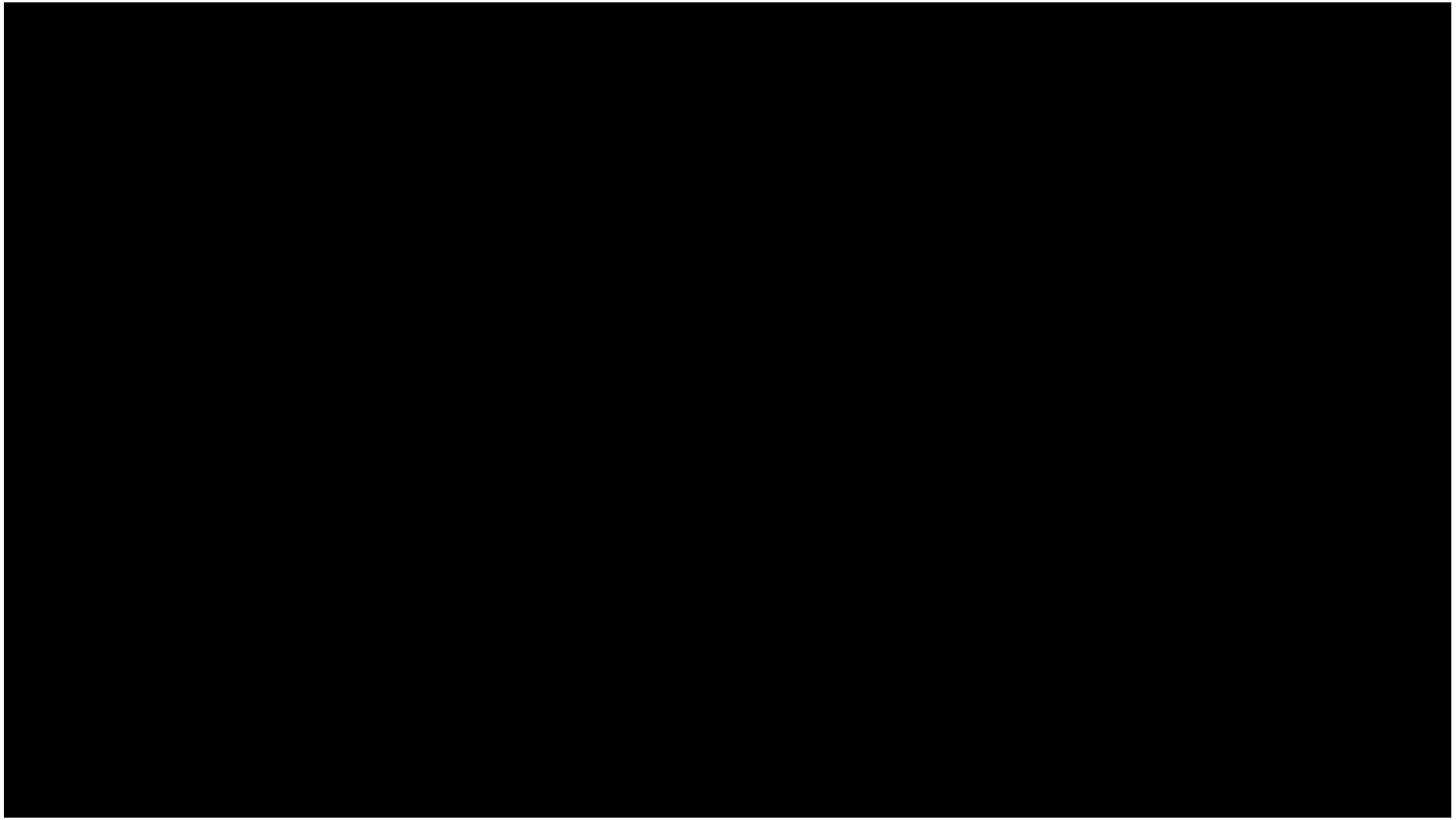




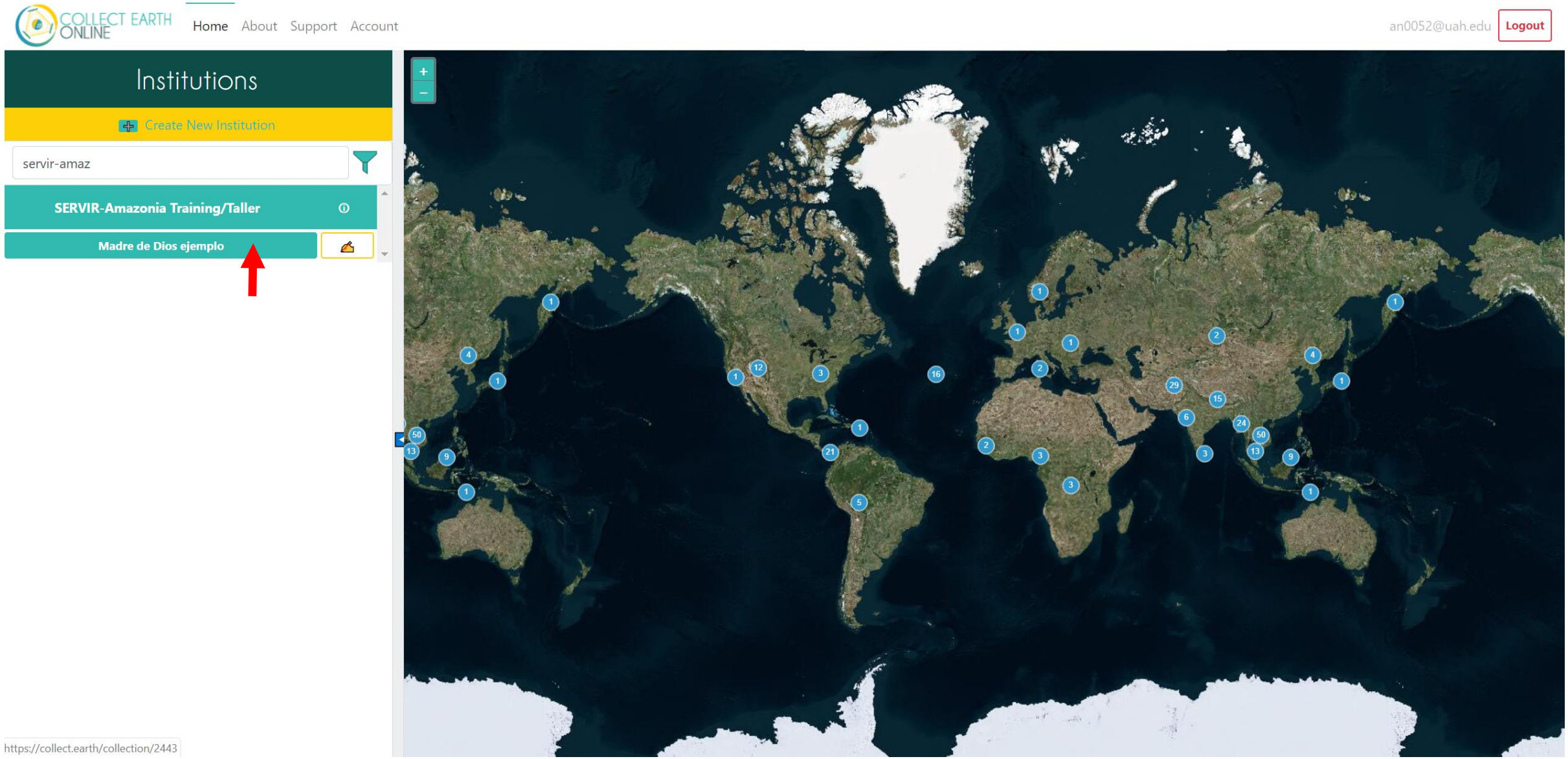
Links:
https://collect.earth/geo-dash/geodash-help
https://youtu.be/7elvltgDbXw
https://youtu.be/7elvltgDbXw

Collect Earth Online

How to create a Project (https://youtu.be/ecXmOx_kCPU)



Collect Earth Online



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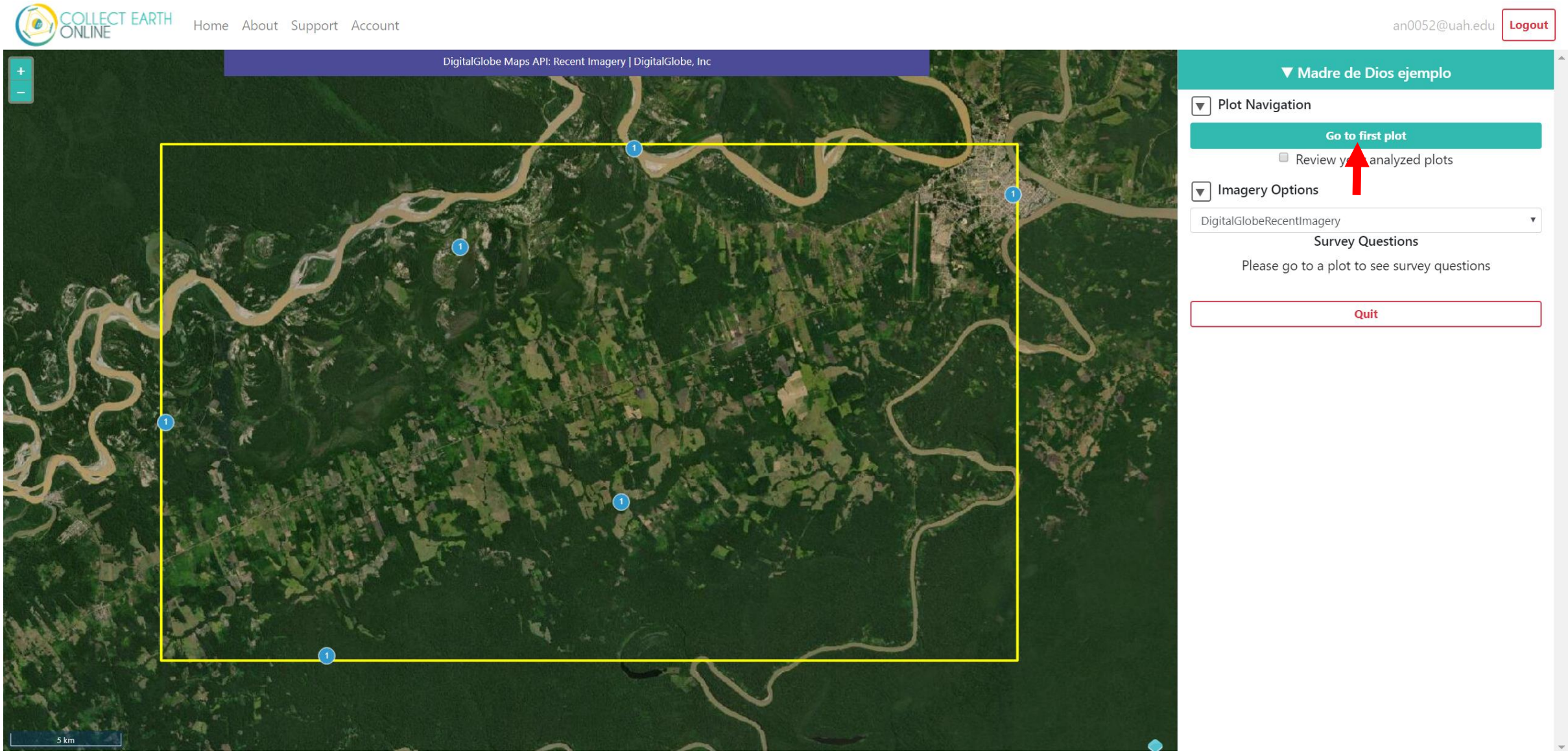

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▼ Madre de Dios ejemplo

▼ Plot Navigation - ID: 1

1 Go to plot

Review your analyzed plots

Re-Zoom Geodash

Download Plot KML

▼ Imagery Options

DigitalGlobeRecentImagery

Unanswered Color Black White

Survey Questions

< 1 >

\- Uso/Cobertura del Suelo?

Agua	Agricultura
Bosque	Tala
Minería	Otro
Pastizal	Urbano/Artificial

Save

Flag Plot Clear All

Quit

Collect Earth Online

Plot navigation/data collection (https://youtu.be/t2D5WgWKhPg)

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Samples Per Plot 9 /plot

Sample Resolution 100 m

Survey Review

Survey Card Number 1

Uso/Cobertura del Suelo?

- **Component Type:** button - text

Answers:

- Agua
- Bosque
- Minería
- Pastizal
- Agricultura
- Tala
- Otro
- Urbano/Artificial

Rules:

No rules available for this survey

Project Management

Close Project | Update Project

Project Dashboard | Configure Geo-Dash

Download Plot Data | Download Sample Data

Project Stats

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	PLOT_ID	SAMPLE_I	LON	LAT	FLAGGED	ANALYSES	USER_ID	COLLECTIC	ANALYSIS_	IMAGERY_	IMAGERYY	STACKING	PL_PLOTI	USO/COBERTURA DEL SUELO?												
2	1.35E+08	4.8E+08	-69.4742	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
3	1.35E+08	4.8E+08	-69.4742	-12.7819	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
4	1.35E+08	4.8E+08	-69.4742	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
5	1.35E+08	4.8E+08	-69.4733	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
6	1.35E+08	4.8E+08	-69.4733	-12.7819	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
7	1.35E+08	4.8E+08	-69.4733	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
8	1.35E+08	4.8E+08	-69.4724	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
9	1.35E+08	4.8E+08	-69.4724	-12.7819	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
10	1.35E+08	4.8E+08	-69.4724	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque												
11	1.35E+08	4.8E+08	-69.5411	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Tala												
12	1.35E+08	4.8E+08	-69.5411	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Tala												
13	1.35E+08	4.8E+08	-69.5411	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque												
14	1.35E+08	4.8E+08	-69.5402	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque												
15	1.35E+08	4.8E+08	-69.5402	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Agricultura												
16	1.35E+08	4.8E+08	-69.5402	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Agricultura												
17	1.35E+08	4.8E+08	-69.5393	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque												
18	1.35E+08	4.8E+08	-69.5393	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlol	2016	Accuracy_	2	Otro												
19	1.35E+08	4.8E+08	-69.5393	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque												
20	1.35E+08	4.8E+08	-69.3519	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlobeRecentImagery			3	Bosque												
21	1.35E+08	4.8E+08	-69.3519	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal												
22	1.35E+08	4.8E+08	-69.3519	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal												
23	1.35E+08	4.8E+08	-69.351	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Otro												
24	1.35E+08	4.8E+08	-69.351	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal												
25	1.35E+08	4.8E+08	-69.351	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal												
26	1.35E+08	4.8E+08	-69.3501	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlobeRecentImagery			3	Bosque												
27	1.35E+08	4.8E+08	-69.3501	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Otro												
28	1.35E+08	4.8E+08	-69.3501	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal												
29	1.35E+08	4.8E+08	-69.4187	-12.6172	FALSE	1	an0052@u	52:06.0	105	DigitalGlol	2016	Accuracy_	4	Miner?a												
30	1.35E+08	4.8E+08	-69.4187	-12.6163	FALSE	1	an0052@u	52:06.0	105	DigitalGlol	2016	Accuracy_	4	Miner?a												

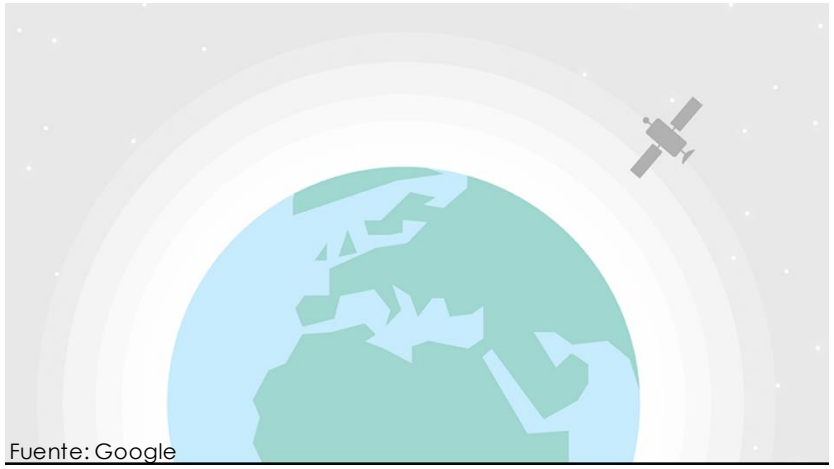
ceo-madre-de-dios-ejemplo-sampl

Google Earth Engine

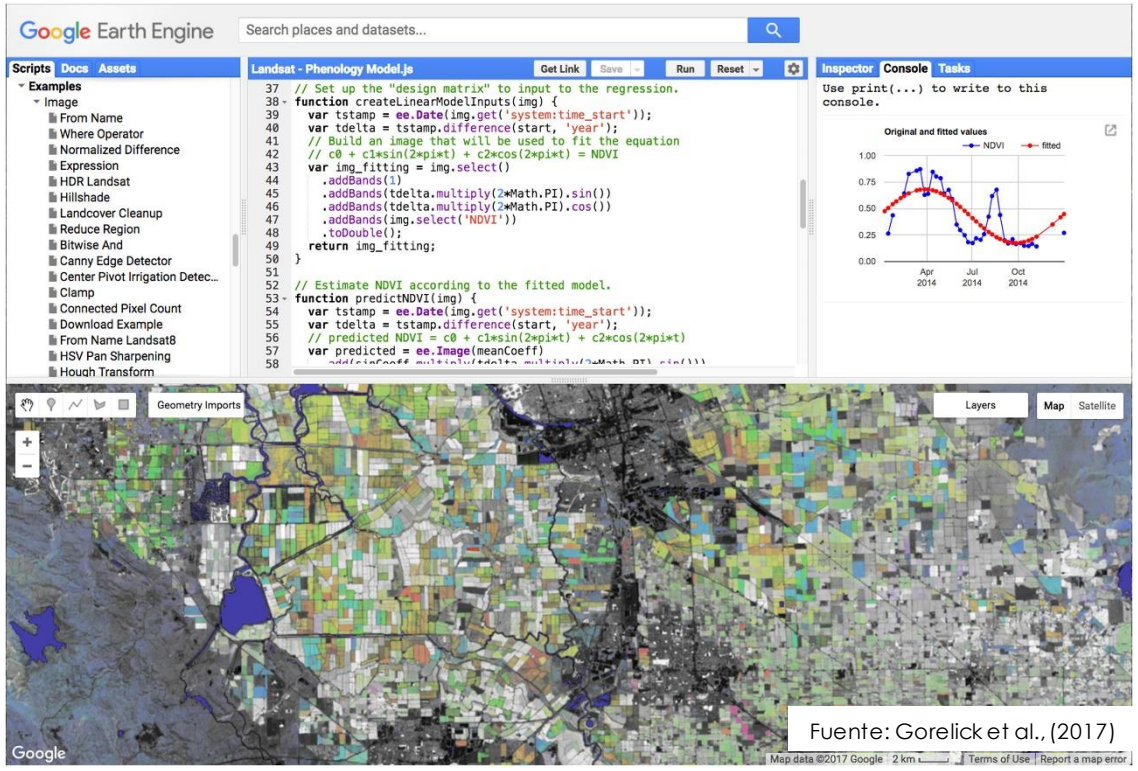
Google Earth Engine

Google Earth Engine

- Google Earth Engine (GEE): planetary scale cloud platform
- For access, processing and analysis of multitemporal satellite data from different sources
- Entire Landsat archive is already there!
- JavaScript or Python API
- Easy-to-share scripts
- Own data upload



Fuente: Google



Fuente: Gorelick et al., (2017)

Google Earth Engine

Exercises

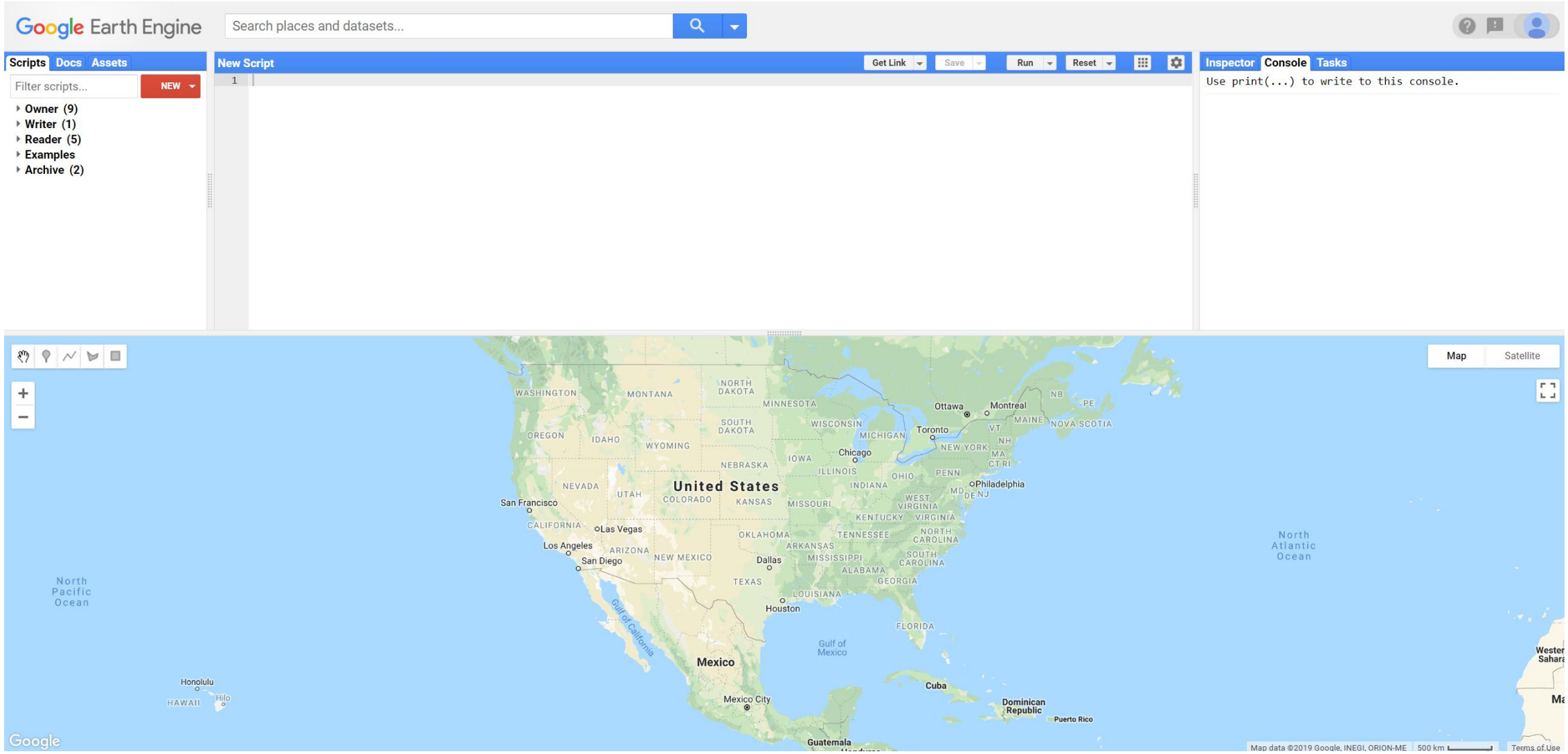
- CEO reference data as an asset
- How to filter satellite data
- How to define your study area / geometries
- How to plot time series and histograms for LULC
- How to use packages
- How to create time series animation
- Compariosn between optical and radar time series
- How to export results

Useful Links

- https://earthengine.google.com/faq/
- https://developers.google.com/earth-engine/

Google Earth Engine

http://code.earthengine.google.com



Google Earth Engine

- To execute the Scipt, you can either select the *Run* button at the top, or use the keystroke combination *CTRL + Enter*
- To comment lines use as first characters //. You can mark several lines and use the keystroke combination *CTRL + /* to comment/uncomment the block. Alternatively, you can use /* as the first line of the block and */ as the last line of the block to comment/uncomment the block

Google Earth Engine

Scripts: https://code.earthengine.google.com/?accept_repo=users/an0052/servir-amazonia

- Script1
- Script2

Google Earth Engine

- CEO reference data as an Asset in GEE

PLOT_ID	SAMPLE_I	LON	LAT	FLAGGED	ANALYSES	USER_ID	COLLECTIC	ANALYSIS_	IMAGERY_	IMAGERYY	STACKING	PL_PLOTID	USO/COBERTURA DEL SUELO?
1.35E+08	4.8E+08	-69.4742	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4742	-12.7819	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4742	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4733	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4733	-12.7819	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4733	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.4724	-12.7828	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
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1.35E+08	4.8E+08	-69.4724	-12.781	FALSE	1	an0052@u	49:22.1	104.8	DigitalGlol	2016	Accuracy_	1	Bosque
1.35E+08	4.8E+08	-69.5411	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Tala
1.35E+08	4.8E+08	-69.5411	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Tala
1.35E+08	4.8E+08	-69.5411	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque
1.35E+08	4.8E+08	-69.5402	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque
1.35E+08	4.8E+08	-69.5402	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Agricultura
1.35E+08	4.8E+08	-69.5402	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Agricultura
1.35E+08	4.8E+08	-69.5393	-12.6881	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque
1.35E+08	4.8E+08	-69.5393	-12.6872	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlol	2016	Accuracy_	2	Otro
1.35E+08	4.8E+08	-69.5393	-12.6863	FALSE	1	an0052@u	50:15.4	135.6	DigitalGlobeRecentImagery			2	Bosque
1.35E+08	4.8E+08	-69.3519	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlobeRecentImagery			3	Bosque
1.35E+08	4.8E+08	-69.3519	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal
1.35E+08	4.8E+08	-69.3519	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal
1.35E+08	4.8E+08	-69.351	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Otro
1.35E+08	4.8E+08	-69.351	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal
1.35E+08	4.8E+08	-69.351	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal
1.35E+08	4.8E+08	-69.3501	-12.7205	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlobeRecentImagery			3	Bosque
1.35E+08	4.8E+08	-69.3501	-12.7196	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Otro
1.35E+08	4.8E+08	-69.3501	-12.7187	FALSE	1	an0052@u	51:43.3	170.2	DigitalGlol	2016	Accuracy_	3	Pastizal
1.35E+08	4.8E+08	-69.4187	-12.6172	FALSE	1	an0052@u	52:06.0	105	DigitalGlol	2016	Accuracy_	4	Miner?a
1.35E+08	4.8E+08	-69.4187	-12.6163	FALSE	1	an0052@u	52:06.0	105	DigitalGlol	2016	Accuracy_	4	Miner?a

ceo-madre-de-dios-ejemplo-sampl

1 – Water
2 – Forest
3 – Logging
4 – Agriculture
5 – Pasture
6 – Mining
7 – Urban

LON	LAT	LULC
-69.4742	-12.7828	2
-69.4742	-12.7819	2
-69.4742	-12.781	2
-69.4733	-12.7828	2
-69.4733	-12.7819	2
-69.4733	-12.781	2
-69.4724	-12.7828	2
-69.4724	-12.7819	2
-69.4724	-12.781	2
-69.5411	-12.6881	3
-69.5411	-12.6872	3
-69.5411	-12.6863	2
-69.5402	-12.6881	2
-69.5402	-12.6872	4
-69.5402	-12.6863	4
-69.5393	-12.6881	2
-69.5393	-12.6872	8
-69.5393	-12.6863	2
-69.3519	-12.7205	2
-69.3519	-12.7196	5
-69.3519	-12.7187	5
-69.351	-12.7205	8
-69.351	-12.7196	5
-69.351	-12.7187	5
-69.3501	-12.7205	2
-69.3501	-12.7196	8
-69.3501	-12.7187	5
-69.4187	-12.6172	6
-69.4187	-12.6163	6

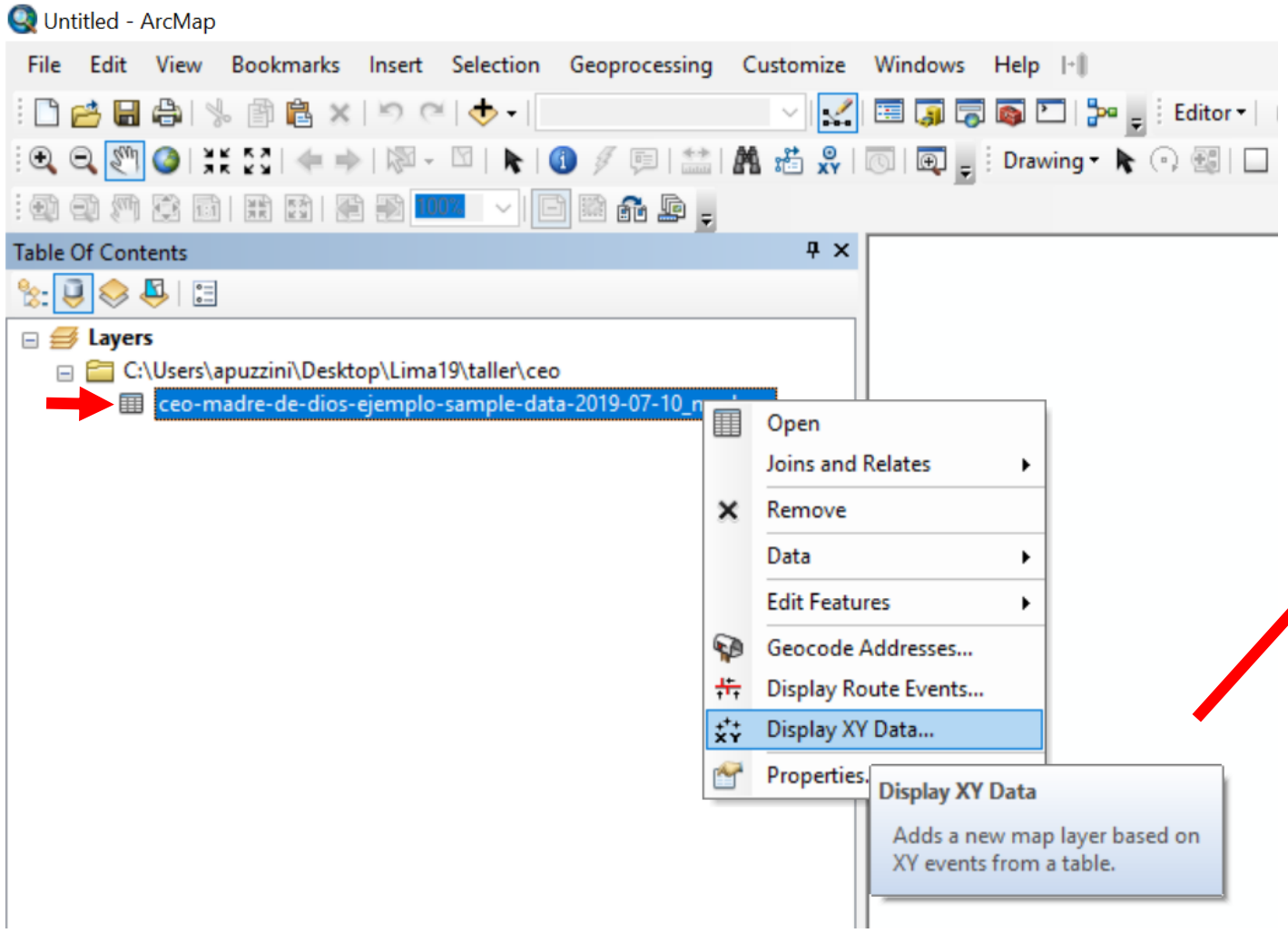
ceo-madre-de-dios-e

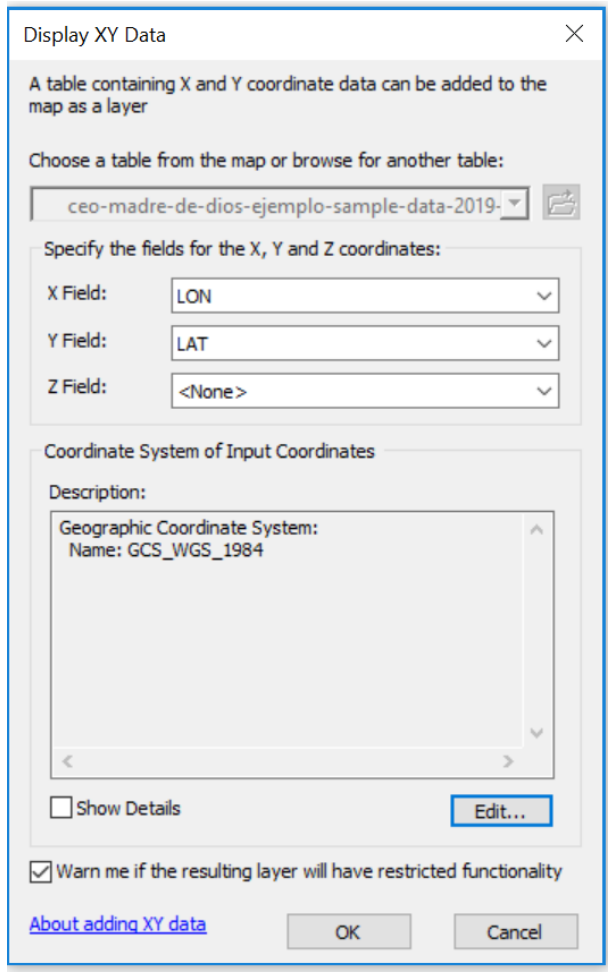
Delete unecessary columns and add unique numbers for each class

Google Earth Engine

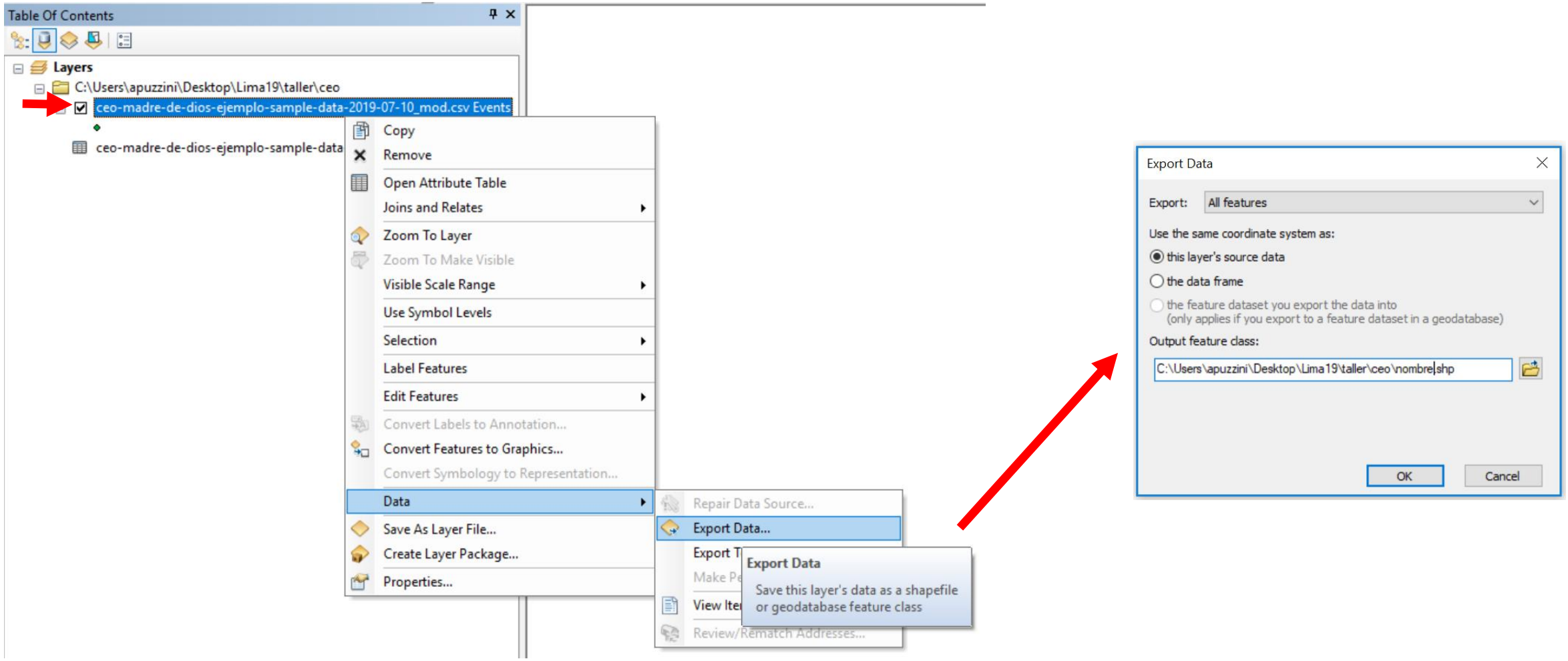
Google Earth Engine

In ArcGIS (o QGIS), open the csv table, right click on the table and select "Display XY Data":
X Field is the longitude, Y Field is the latitude (check your table), and the Coordinate Sytem is "GCS_WGS_1984"





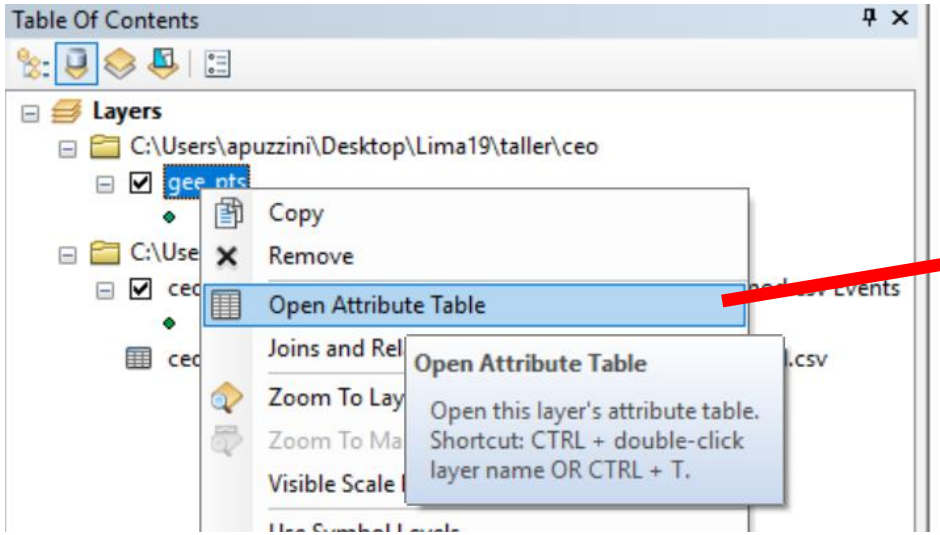
Google Earth Engine

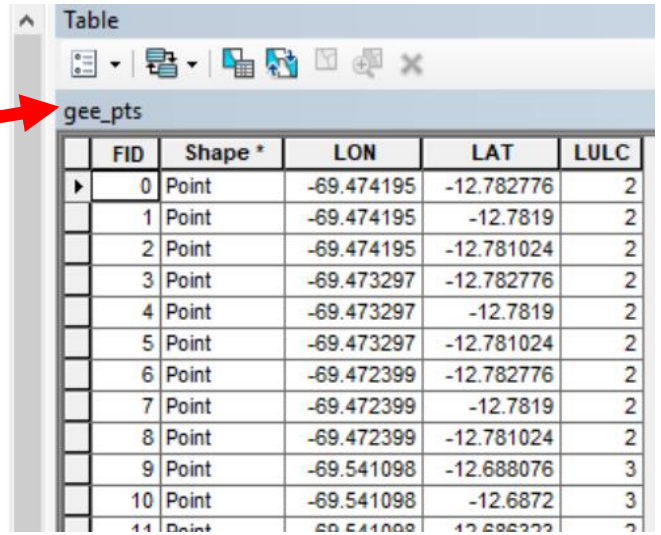


Right click on "…csv Events" and select "Data > Export Data", choose a name for the shapefile, "OK"

Google Earth Engine

Right click on the shapefile and select "Open Attribute Table":





FID	Shape *	LON	LAT	LULC
0	Point	-69.474195	-12.782776	2
1	Point	-69.474195	-12.7819	2
2	Point	-69.474195	-12.781024	2
3	Point	-69.473297	-12.782776	2
4	Point	-69.473297	-12.7819	2
5	Point	-69.473297	-12.781024	2
6	Point	-69.472399	-12.782776	2
7	Point	-69.472399	-12.7819	2
8	Point	-69.472399	-12.781024	2
9	Point	-69.541098	-12.688076	3
10	Point	-69.541098	-12.6872	3

Google Earth Engine

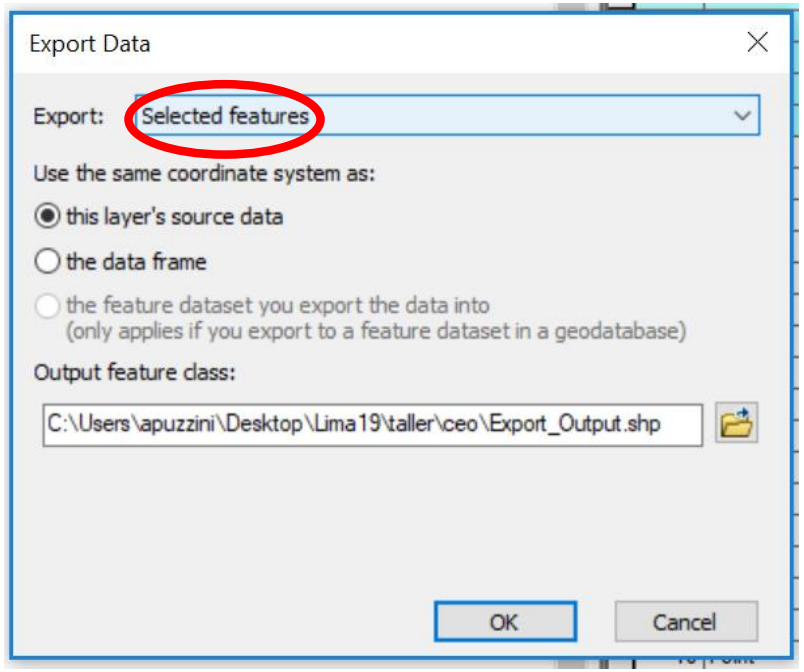
Google Earth Engine

Double click on "LULC" column to organize it in numerical order:

FID	Shape *	LON	LAT	LULC
45	Point	-69.346495	-12.577277	1
46	Point	-69.346495	-12.5764	1
47	Point	-69.346495	-12.575523	1
48	Point	-69.345596	-12.577277	1
49	Point	-69.345596	-12.5764	1
50	Point	-69.345596	-12.575523	1
51	Point	-69.344698	-12.577277	1
52	Point	-69.344698	-12.5764	1
53	Point	-69.344698	-12.575523	1
0	Point	-69.474195	-12.782776	2
1	Point	-69.474195	-12.7819	2
2	Point	-69.474195	-12.781024	2
3	Point	-69.473297	-12.782776	2
4	Point	-69.473297	-12.7819	2
5	Point	-69.473297	-12.781024	2
6	Point	-69.472399	-12.782776	2
7	Point	-69.472399	-12.7819	2
8	Point	-69.472399	-12.781024	2
11	Point	-69.541098	-12.686323	2
12	Point	-69.540199	-12.688076	2
15	Point	-69.539301	-12.688076	2
17	Point	-69.539301	-12.686323	2
18	Point	-69.351896	-12.720476	2
24	Point	-69.3501	-12.720476	2
9	Point	-69.541098	-12.688076	3
10	Point	-69.541098	-12.6872	3
13	Point	-69.540199	-12.6872	4
14	Point	-69.540199	-12.686323	4
19	Point	-69.351896	-12.7196	5
20	Point	-69.351896	-12.718723	5
22	Point	-69.350998	-12.7196	5
23	Point	-69.350998	-12.718723	5
26	Point	-69.3501	-12.718723	5
27	Point	-69.418699	-12.617176	6
28	Point	-69.418699	-12.6163	6
29	Point	-69.418699	-12.615423	6
30	Point	-69.417801	-12.617176	6
31	Point	-69.417801	-12.6163	6
32	Point	-69.417801	-12.615423	6

Select each class rows and export them as unique shapefile (Data>Export Data):

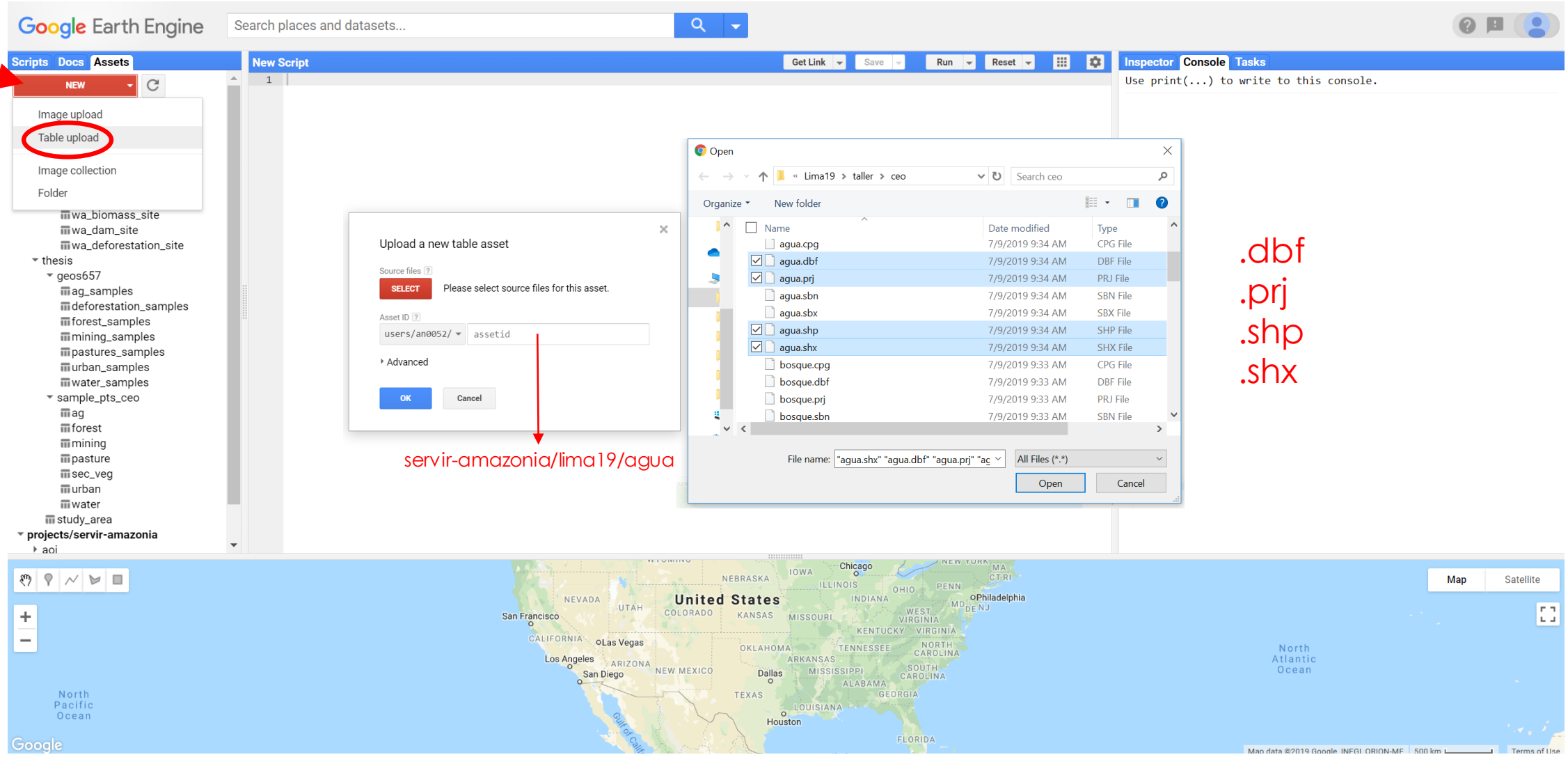
FID	Shape *	LON	LAT	LULC
45	Point	-69.346495	-12.577277	1
46	Point	-69.346495	-12.5764	1
47	Point	-69.346495	-12.575523	1
48	Point	-69.345596	-12.577277	1
49	Point	-69.345596	-12.5764	1
50	Point	-69.345596	-12.575523	1
51	Point	-69.344698	-12.577277	1
52	Point	-69.344698	-12.5764	1
53	Point	-69.344698	-12.575523	1
0	Point	-69.474195	-12.782776	2
1	Point	-69.474195	-12.7819	2
2	Point	-69.474195	-12.781024	2
3	Point	-69.473297	-12.782776	2
4	Point	-69.473297	-12.7819	2
5	Point	-69.473297	-12.781024	2
6	Point	-69.472399	-12.782776	2
7	Point	-69.472399	-12.7819	2
8	Point	-69.472399	-12.781024	2
11	Point	-69.541098	-12.686323	2
12	Point	-69.540199	-12.688076	2
15	Point	-69.539301	-12.688076	2
17	Point	-69.539301	-12.686323	2



The same for each class(1 to 7)

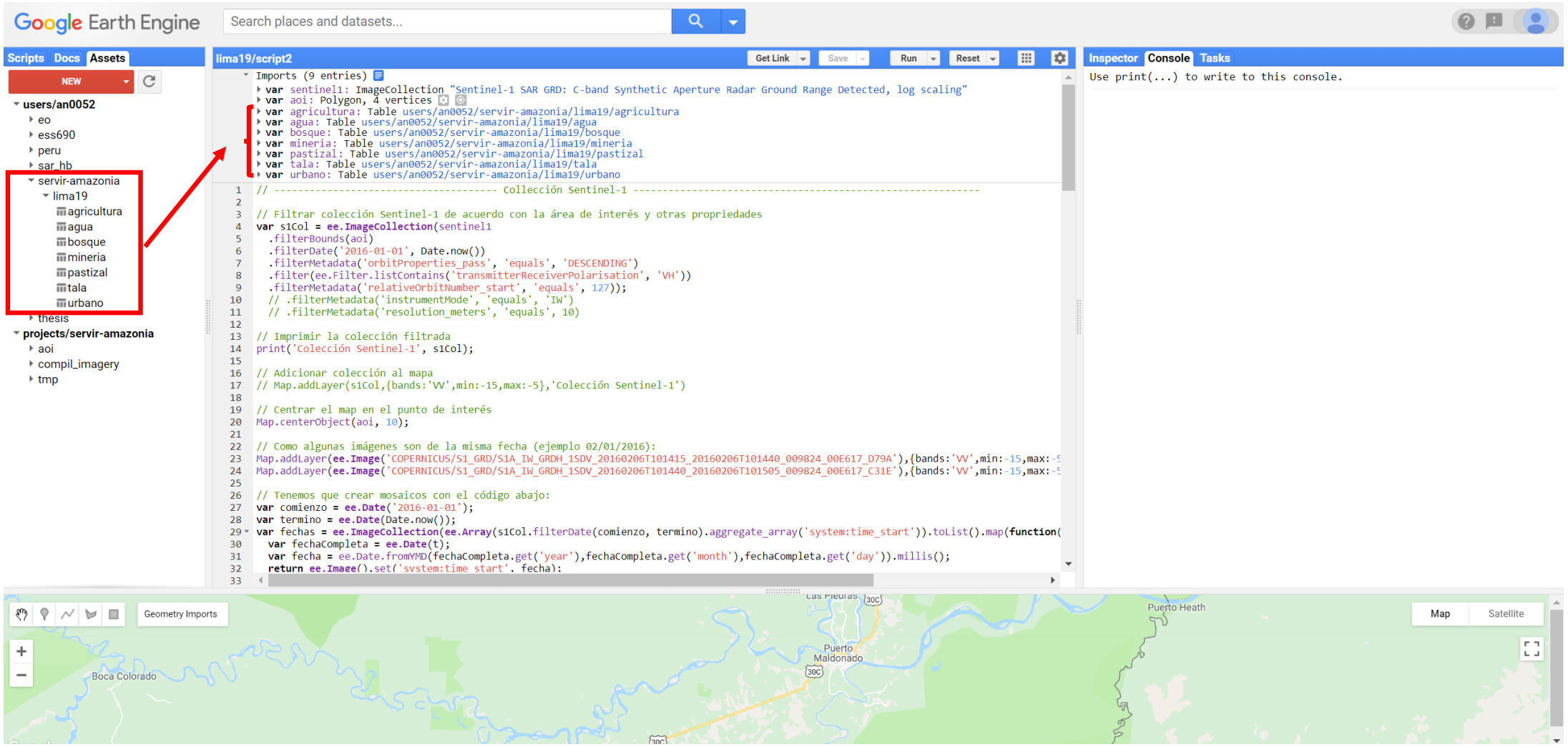
Google Earth Engine

- CEO reference data as an Asset in GEE



Google Earth Engine

- CEO reference data as an Asset in GEE



Synthetic Aperture Radar (SAR)

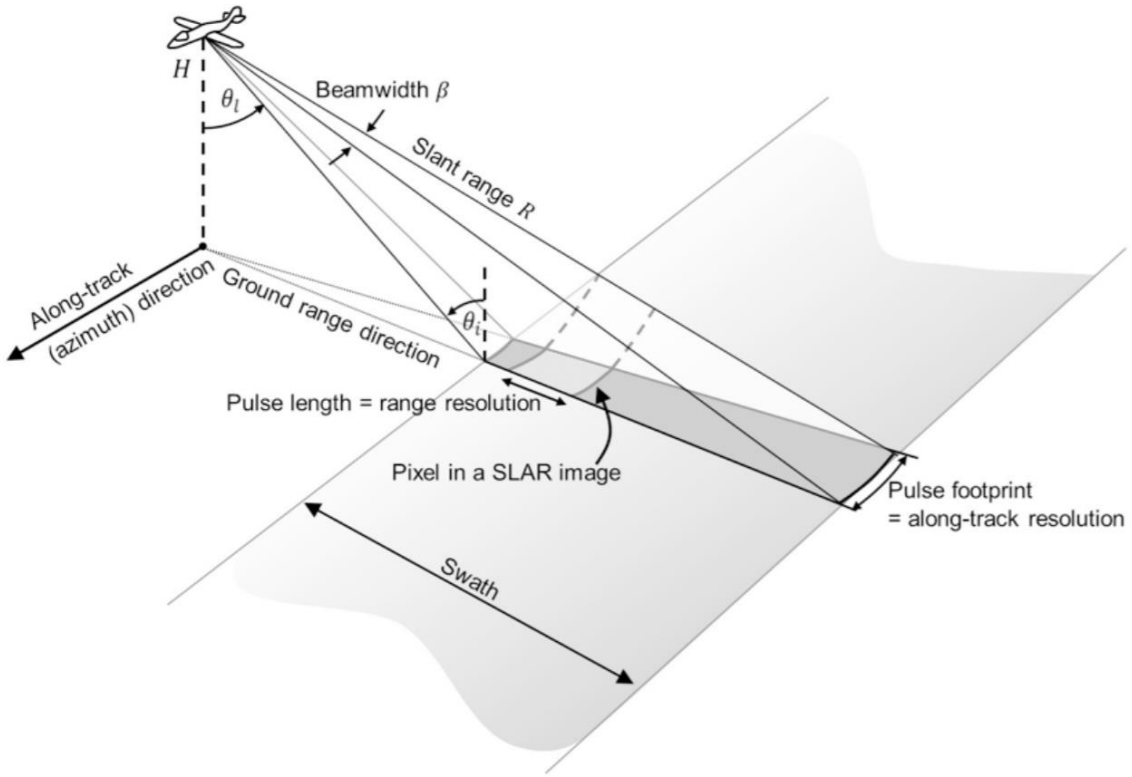


Figure 2.1 *Observation geometry of a SLAR imager. The radar flies along a straight line at altitude H and observes Earth at an oblique look angle θ_l. Instead of the look angle, sometimes the incidence angle θ_i = (90° – θ_l) is annotated. The size of the illuminated footprint is defined by the antenna beamwidth β and the distance between satellite and ground R. Note that the radar beam is wide in range direction but narrow in azimuth. The generation of an image is facilitated by the forward motion of the airborne platform.*

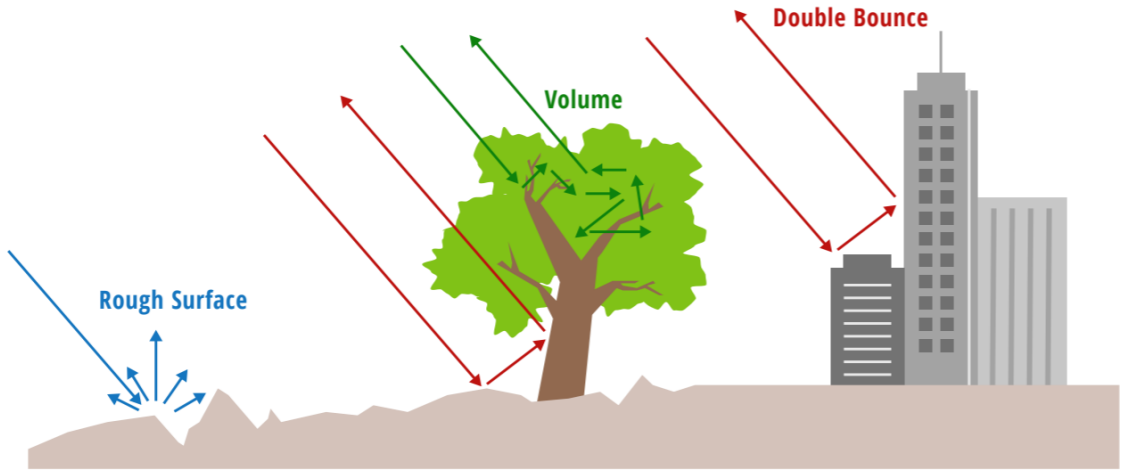
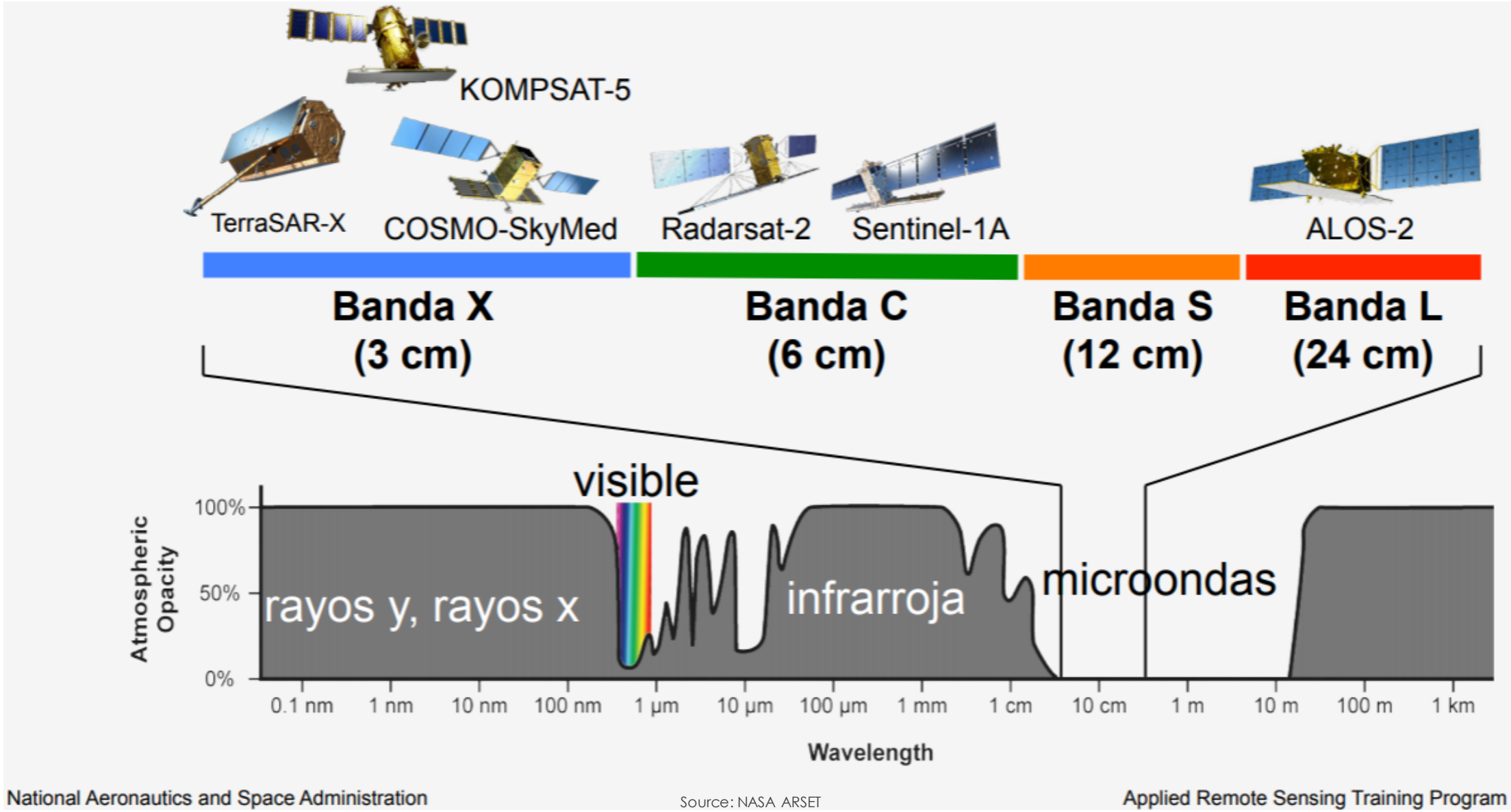


Figure 2.9 *Schematic sketch of the three main scattering types considered for SAR data.*

Source: SAR Handbook: Comprehensive Methodologies for Forest Monitoring and Biomass Estimation. (2019) Eds. Flores, A., Herndon, K., Thapa, R., Cherrington, E. NASA. https://doi.org/10.25966/nr2c-s697

Synthetic Aperture Radar (SAR)



National Aeronautics and Space Administration

Source: NASA ARSET

Applied Remote Sensing Training Program

Synthetic Aperture Radar (SAR)

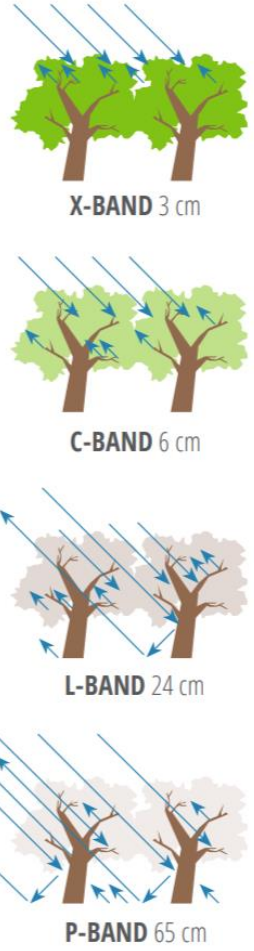


Figure 5.10 *Sensitivity of SAR measurements to forest structure and penetration into the canopy at different wavelengths used for airborne or spaceborne remote sensing observations of the land surface.*

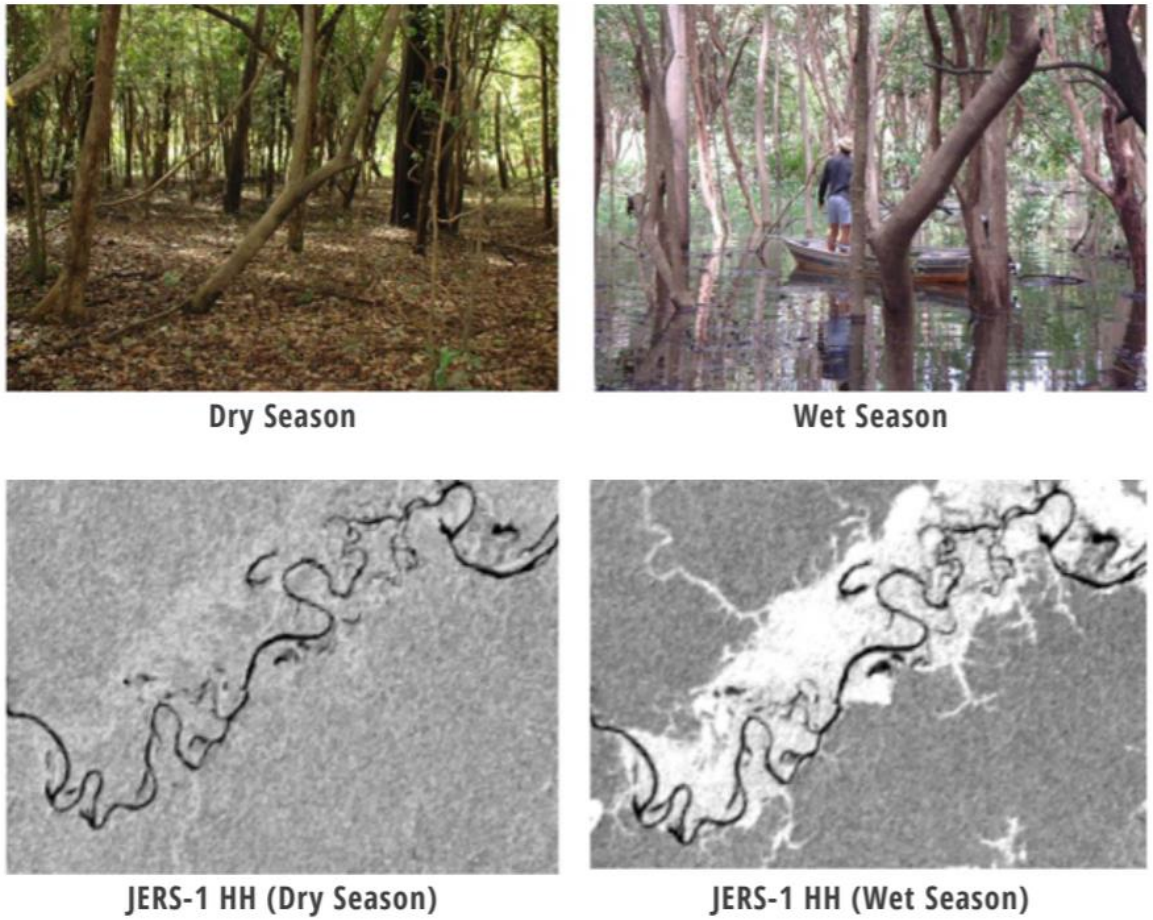
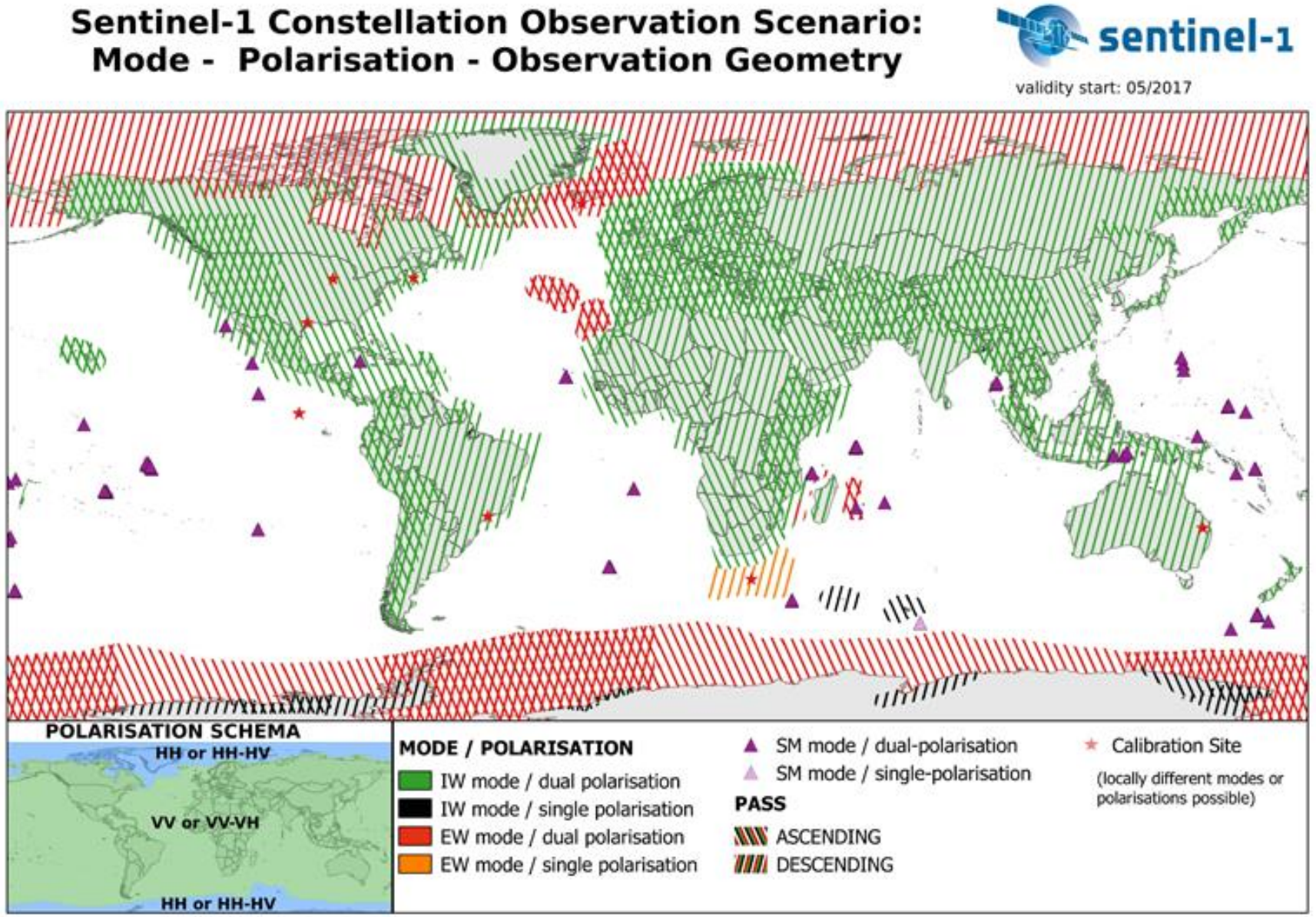


Figure 5.15 *Changes of SAR backscatter in wetland forests acquired during the dry and wet seasons showing large backscatter difference due to inundation and an increase in the surface-volume scattering interaction in HH polarization.*

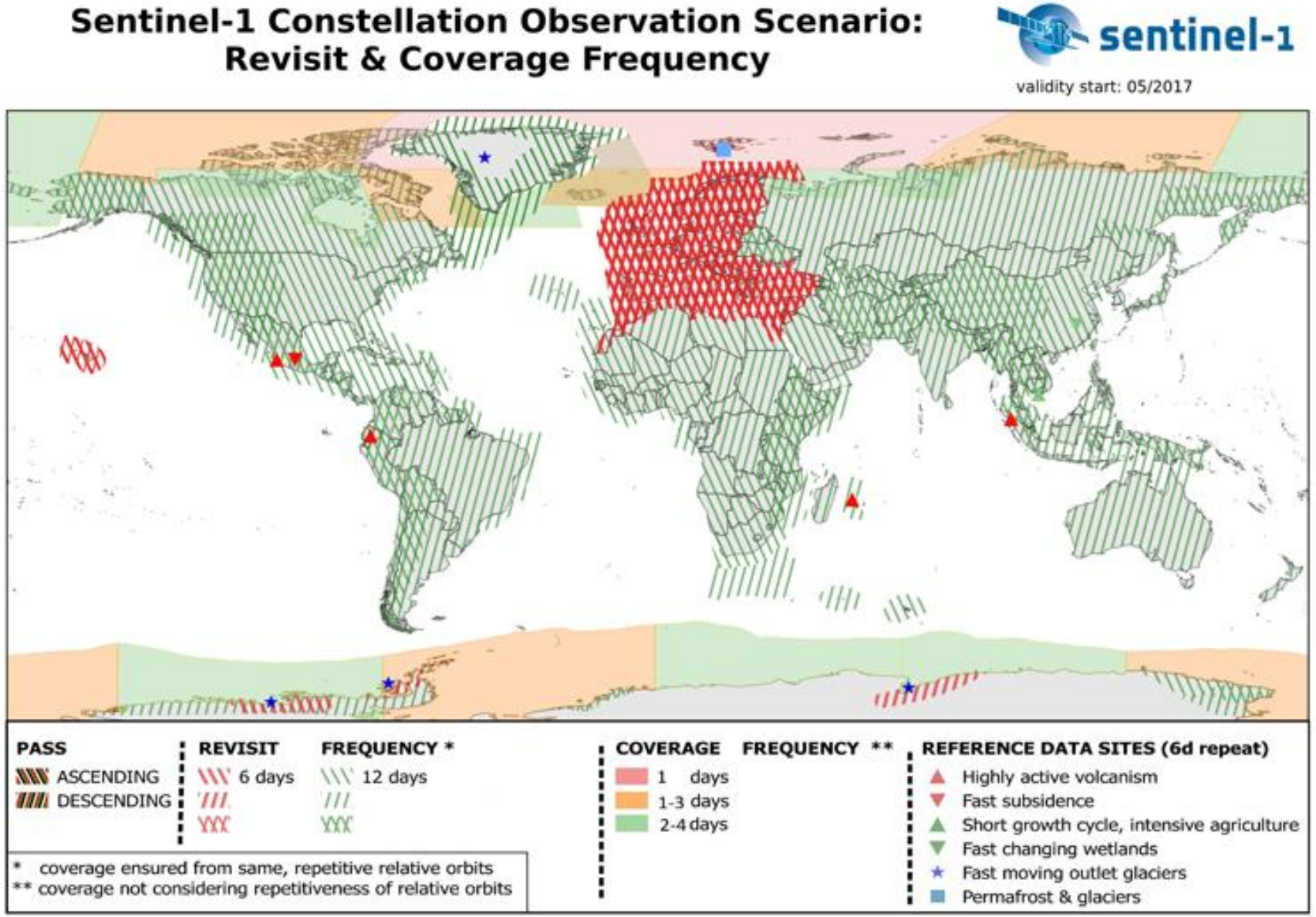
Source: SAR Handbook: Comprehensive Methodologies for Forest Monitoring and Biomass Estimation. (2019) Eds. Flores, A., Herndon, K., Thapa, R., Cherrington, E. NASA. https://doi.org/10.25966/nr2c-s697

Synthetic Aperture Radar (SAR)



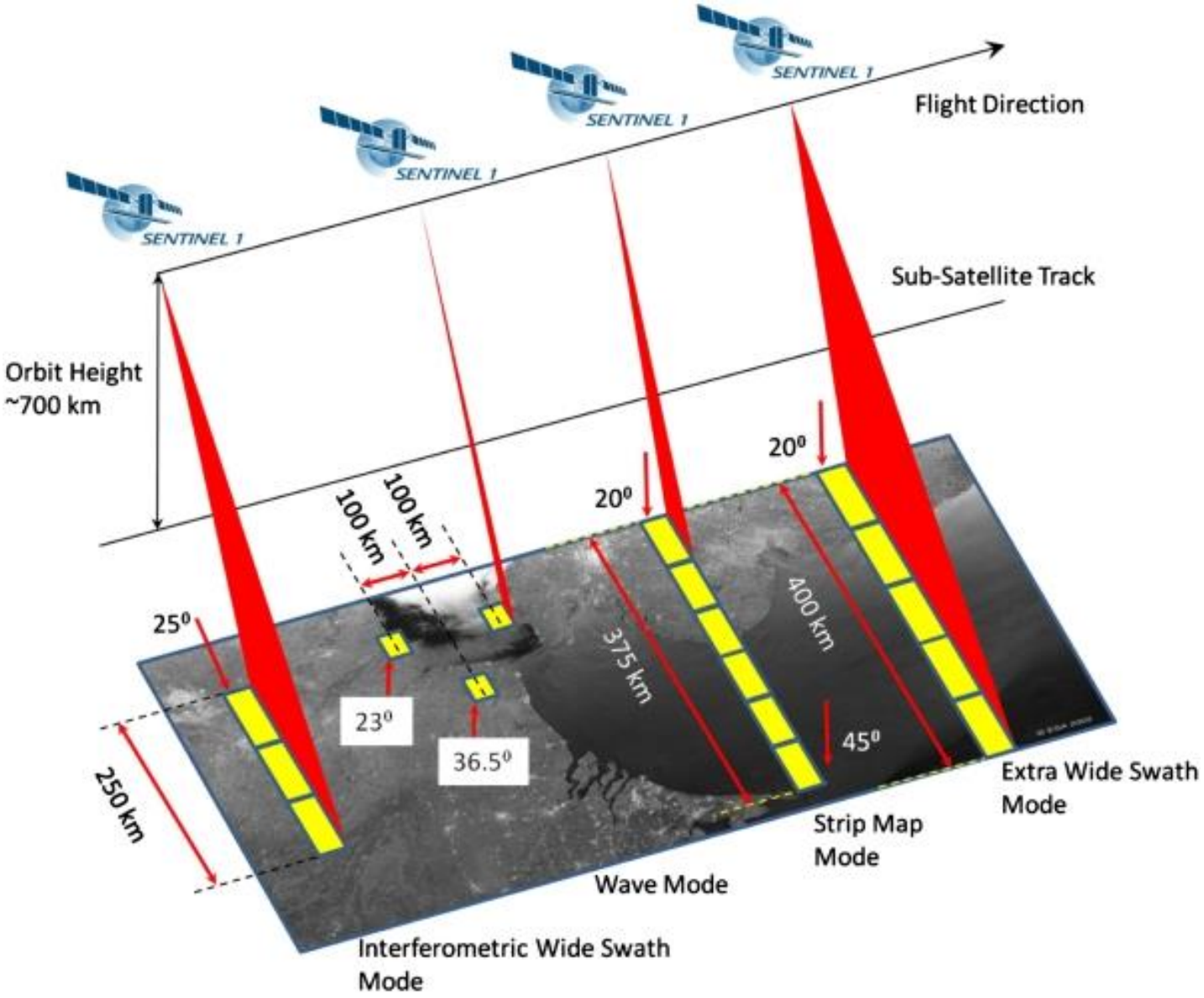
Source: ASF. https://www.asf.alaska.edu/sentinel/data/observation-plans/

Synthetic Aperture Radar (SAR)



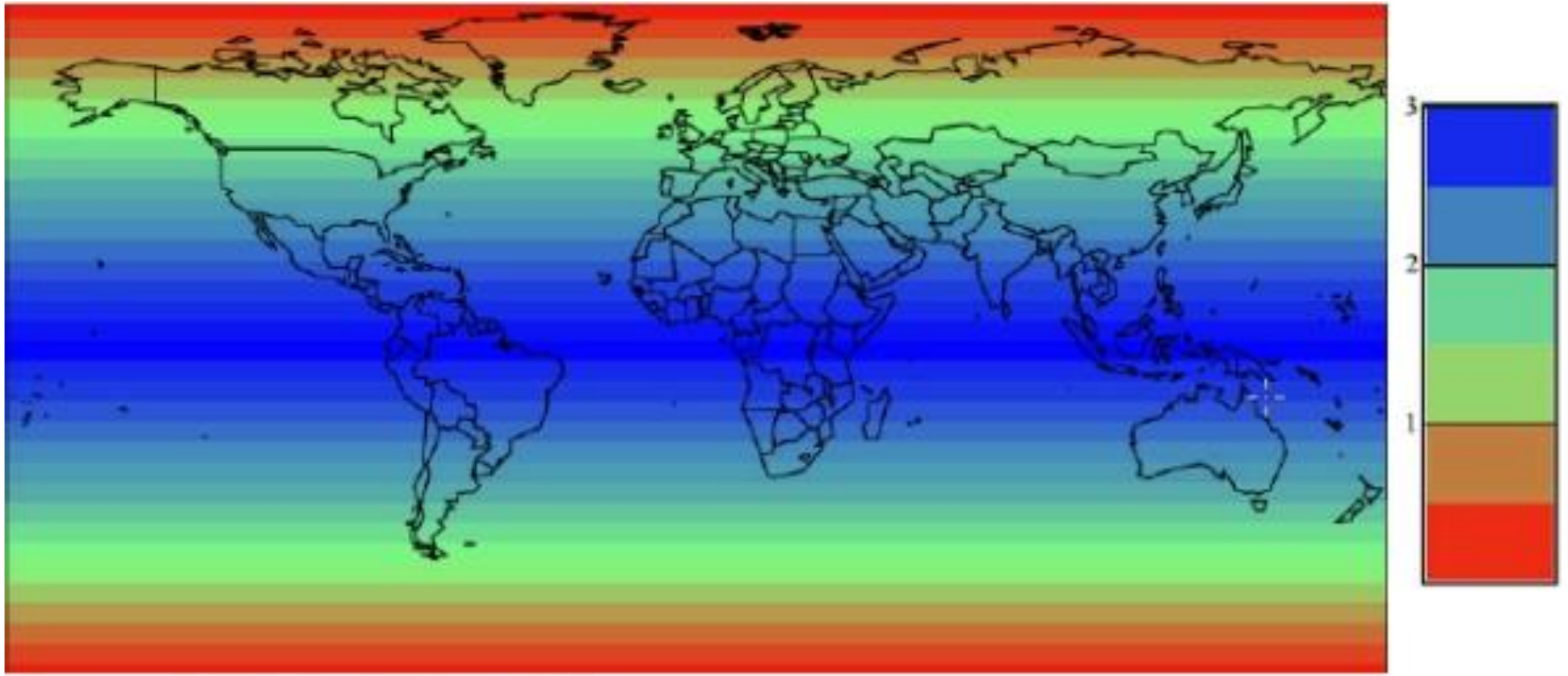
Source: ASF. https://www.asf.alaska.edu/sentinel/data/observation-plans/

Synthetic Aperture Radar (SAR)



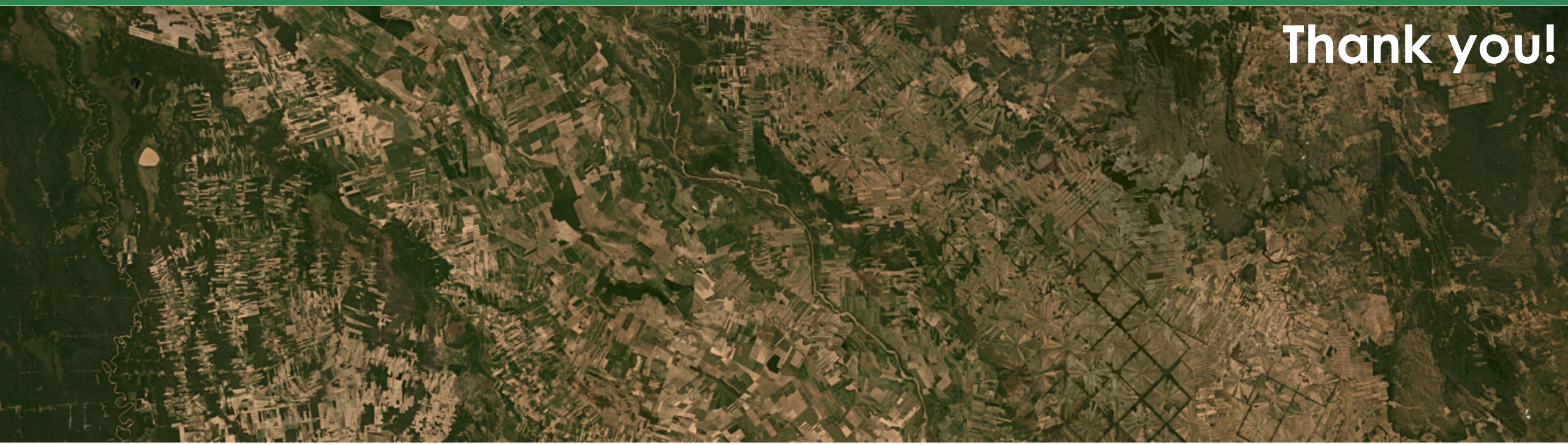
Source: ESA. https://sentinel.esa.int/web/sentinel/user-guides/sentinel-1-sar/acquisition-modes

Synthetic Aperture Radar (SAR)



- ✓ Two satellites in a 12 day orbit
- ✓ Repeat frequency: 6 days (important for coherence)
- ✓ Revisit frequency: (asc/desc & overlap): 3 days at the equator, <1 day at high latitudes (Europe ~ 2 days)

Source: ESA. https://sentinel.esa.int/web/sentinel/user-guides/sentinel-1-sar/revisit-and-coverage. Also check: https://sentinel.esa.int/web/sentinel/missions/sentinel-1/satellite-description/geographical-coverage



Questions?

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