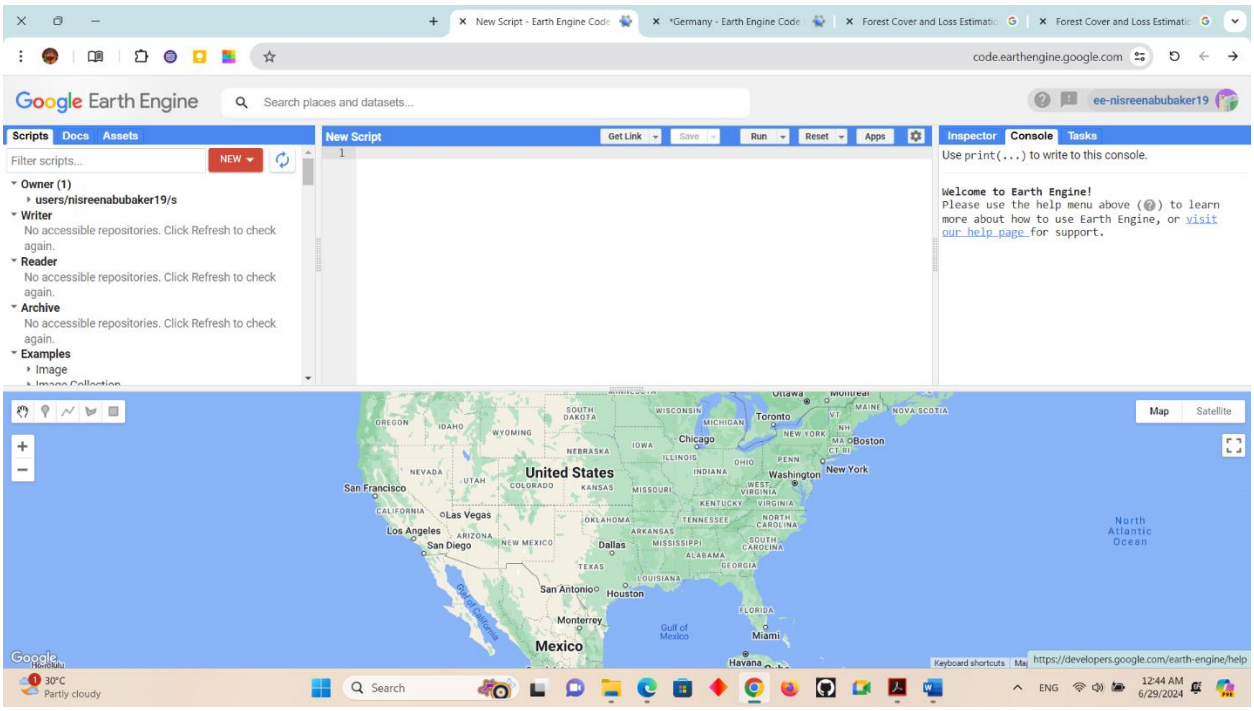
To **analyze forest cover loss in Germany over the past three years (2021-2023)** using **the Hansen Global Forest Change dataset** from Google Earth Engine (GEE), I'll need to use JavaScript within the GEE Code Editor. Below is a script that accomplishes this task:

```javascript
// Define the region of interest: Germany
var germany = ee.FeatureCollection('FAO/GAUL/2015/level0')
  .filter(ee.Filter.eq('ADM0_NAME', 'Germany'));

// Define the Hansen Global Forest Change dataset
var hansenDataset = ee.Image('UMD/hansen/global_forest_change_2023_v1_11');

// Select the 'lossyear' band which indicates the year of forest loss
var lossYear = hansenDataset.select('lossyear');

// Define the time range for forest loss: 2021-2023
var loss2021 = lossYear.eq(21);
var loss2022 = lossYear.eq(22);
var loss2023 = lossYear.eq(23);

// Combine the loss years into a single image
var loss2021_2023 = loss2021.or(loss2022).or(loss2023);

// Clip the loss image to Germany
var lossGermany = loss2021_2023.updateMask(loss2021_2023).clip(germany);

// Calculate the area of forest loss (in hectares)
var pixelArea = ee.Image.pixelArea().divide(10000); // Convert $m^2$ to hectares
```

```
var lossArea = pixelArea.updateMask(lossGermany).reduceRegion({
  reducer: ee.Reducer.sum(),
  geometry: germany,
  scale: 30,
  maxPixels: 1e10
});

// Print the area of forest loss to the console
print('Forest cover loss in Germany (2021-2023) in hectares:', lossArea.get('area'));

// Visualization parameters
var lossVisParams = {
  palette: ['red'],
  min: 0,
  max: 1,
  opacity: 0.7
};

// Add layers to the map
Map.centerObject(germany, 6);
Map.addLayer(lossGermany, lossVisParams, 'Forest Loss 2021-2023');
Map.addLayer(germany, {}, 'Germany Borders');
```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NEW
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Writer
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Examples
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Use print(...) to write to this console.
Welcome to Earth Engine!
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United States
Chicago
Toronto
Boston
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Washington
San Francisco
Las Vegas
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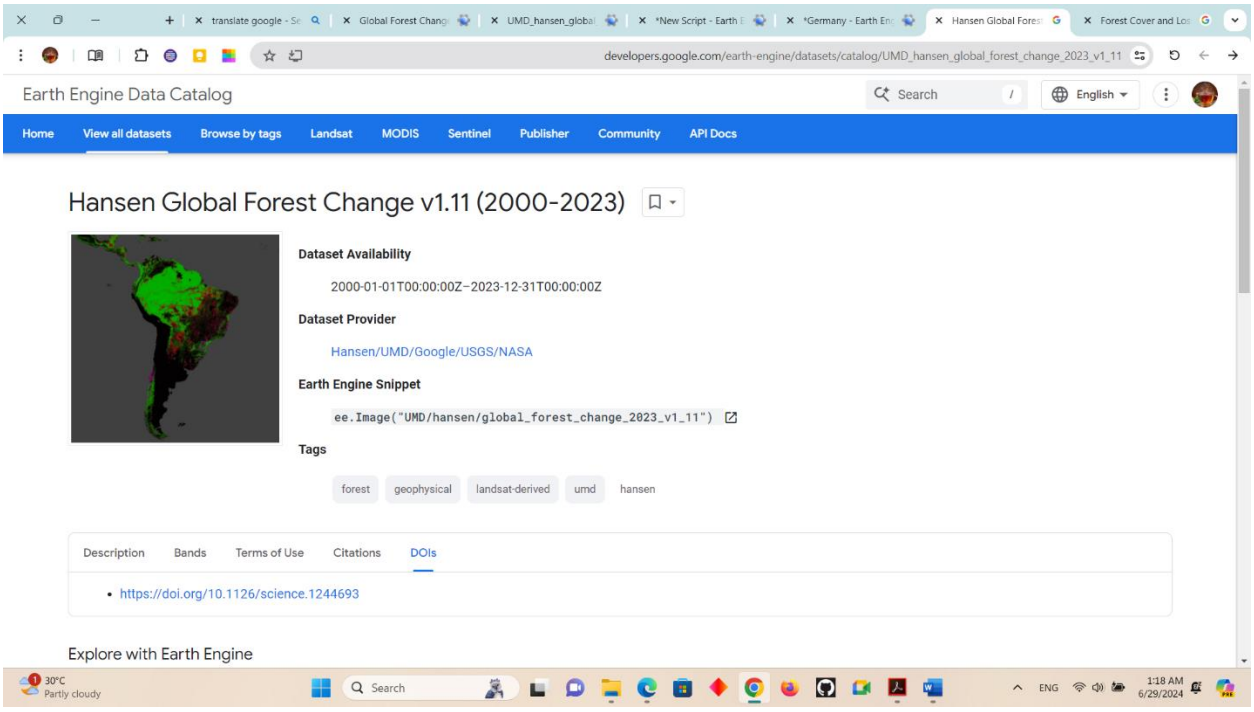
San Diego
Dallas
San Antonio
Houston
Monterrey
Mexico
Miami
Havana
North Atlantic Ocean
Gulf of Mexico
Map
Satellite
Search
30°C
Partly cloudy
ENG
12:44 AM
6/29/2024


developers.google.com/earth-engine/datasets/catalog/UMD_hansen_global_forest_change_2023_v1_11
Earth Engine Data Catalog
Search
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Landsat
MODIS
Sentinel
Publisher
Community
API Docs
Hansen Global Forest Change v1.11 (2000-2023)
Dataset Availability
2000-01-01T00:00:00Z–2023-12-31T00:00:00Z
Dataset Provider
Hansen/UMD/Google/USGS/NASA
Earth Engine Snippet
ee.Image("UMD/hansen/global_forest_change_2023_v1_11")
Tags
forest
geophysical
landsat-derived
umd
hansen
Description
Bands
Terms of Use
Citations
DOIs
https://doi.org/10.1126/science.1244693
Explore with Earth Engine
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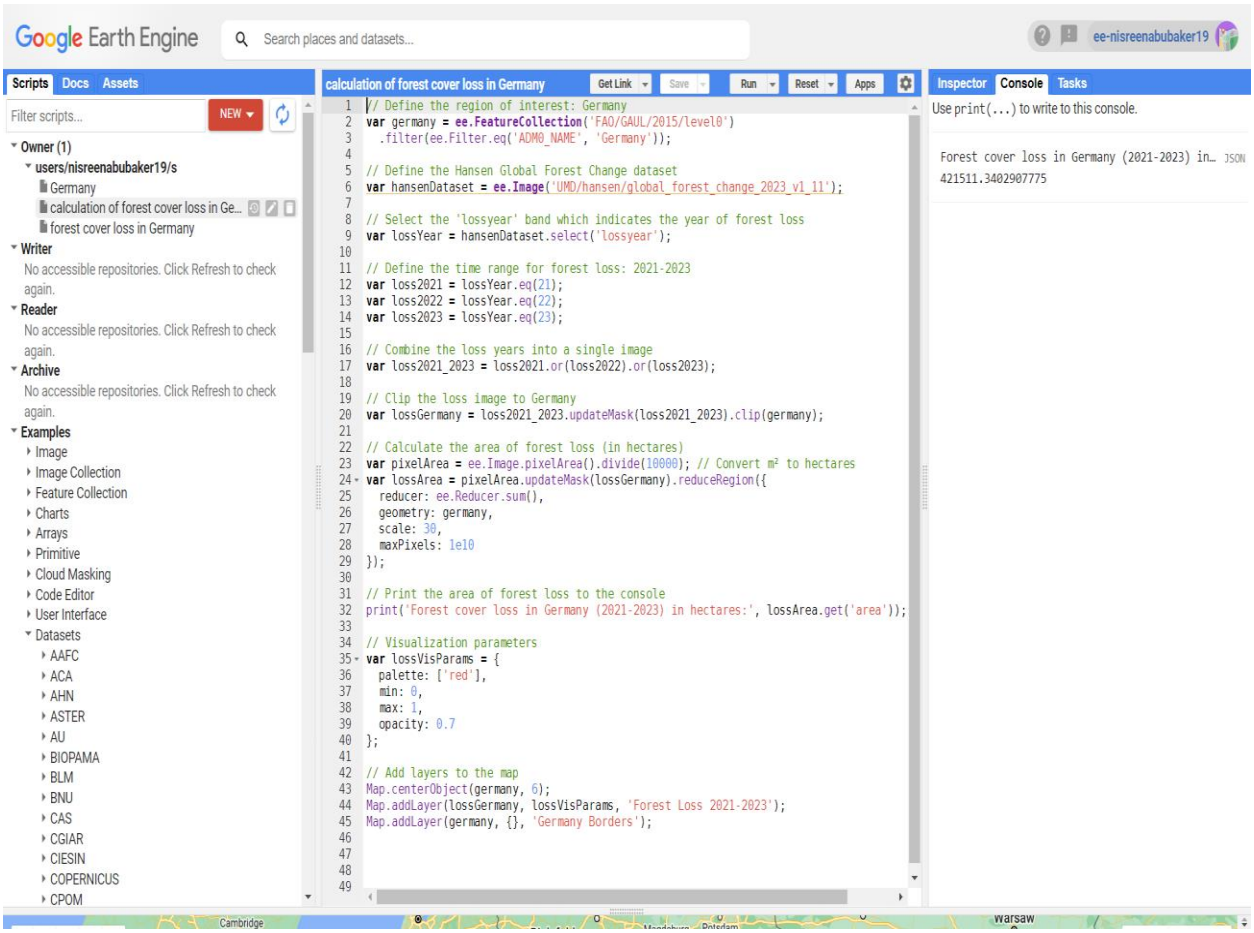
6/29/2024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Germany
calculation of forest cover loss in Ge...
forest cover loss in Germany
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Examples
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Image Collection
Feature Collection
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Arrays
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Cloud Masking
Code Editor
User Interface
Datasets
AAFC
ACA
AHN
ASTER
AU
BIOPAMA
BLM
BNU
CAS
CGIAR
CIESIN
COPERNICUS
CPOM
calculation of forest cover loss in Germany
Get Link
Save
Run
Reset
Apps
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// Clip the loss image to Germany
var lossGermany = loss2021_2023.updateMask(loss2021_2023).clip(germany);
// Calculate the area of forest loss (in hectares)
var pixelArea = ee.Image.pixelArea().divide(10000); // Convert m² to hectares
var lossArea = pixelArea.updateMask(lossGermany).reduceRegion({
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geometry: germany,
scale: 30,
maxPixels: 1e10
});
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// Visualization parameters
var lossVisParams = {
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// Add layers to the map
Map.centerObject(germany, 6);
Map.addLayer(lossGermany, lossVisParams, 'Forest Loss 2021-2023');
Map.addLayer(germany, {}, 'Germany Borders');
Inspector
Console
Tasks
Use print(...) to write to this console.
Forest cover loss in Germany (2021-2023) in… JSON
421511.3402907775
Cambridge
Warsaw

calculation of forest cover loss in Germany

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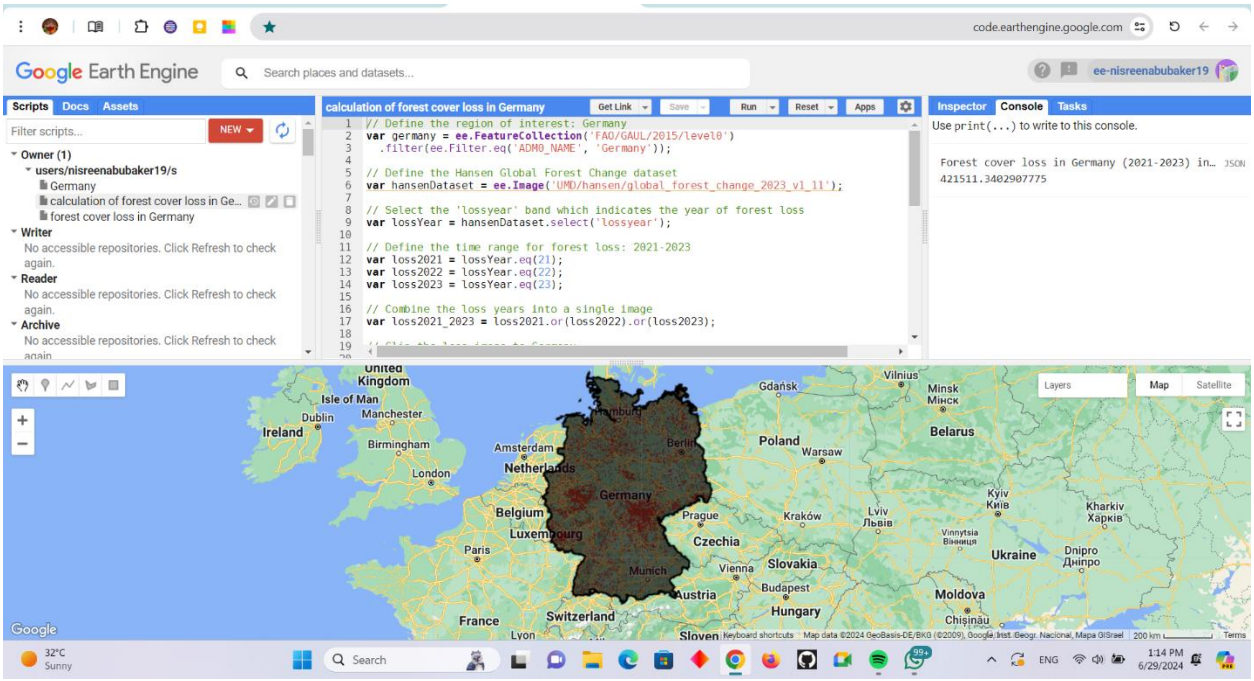
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Owner (1)
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Germany
calculation of forest cover loss in Ge...
forest cover loss in Germany
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Apps
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Inspector
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Use print(...) to write to this console.
Forest cover loss in Germany (2021-2023) in...
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Layers
Map
Satellite
Germany
Netherlands
Belgium
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Czechia
Poland
Belarus
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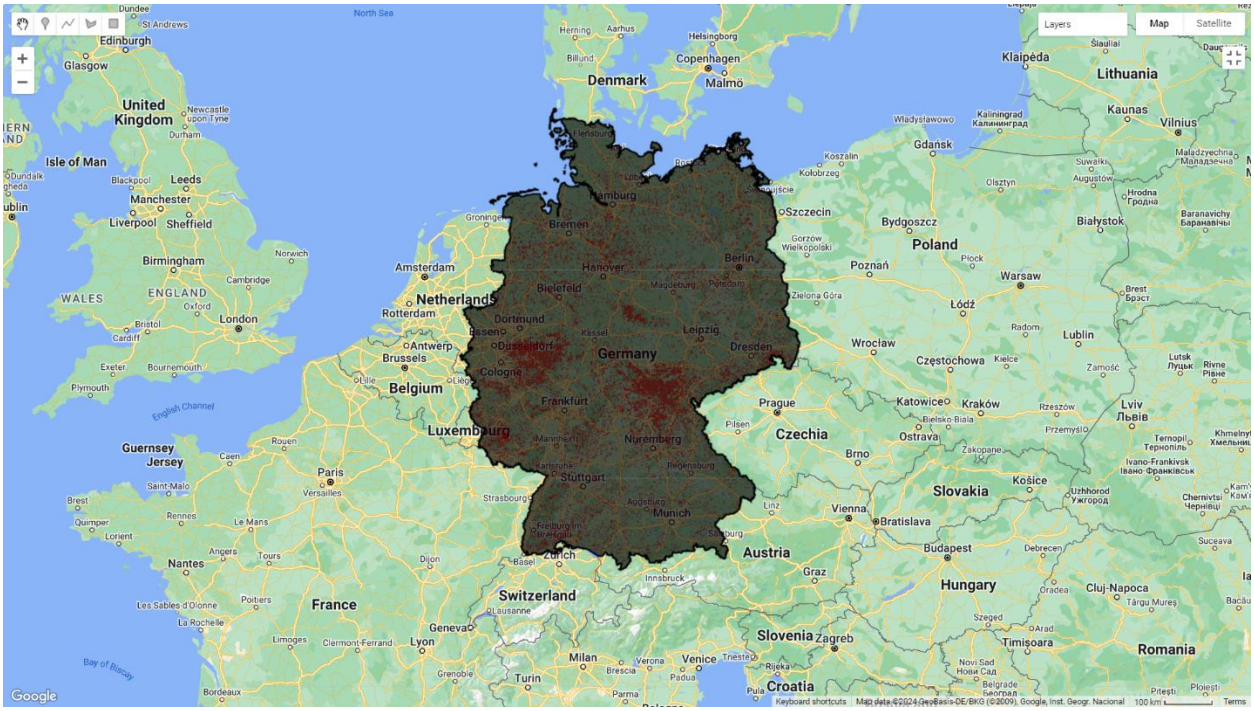
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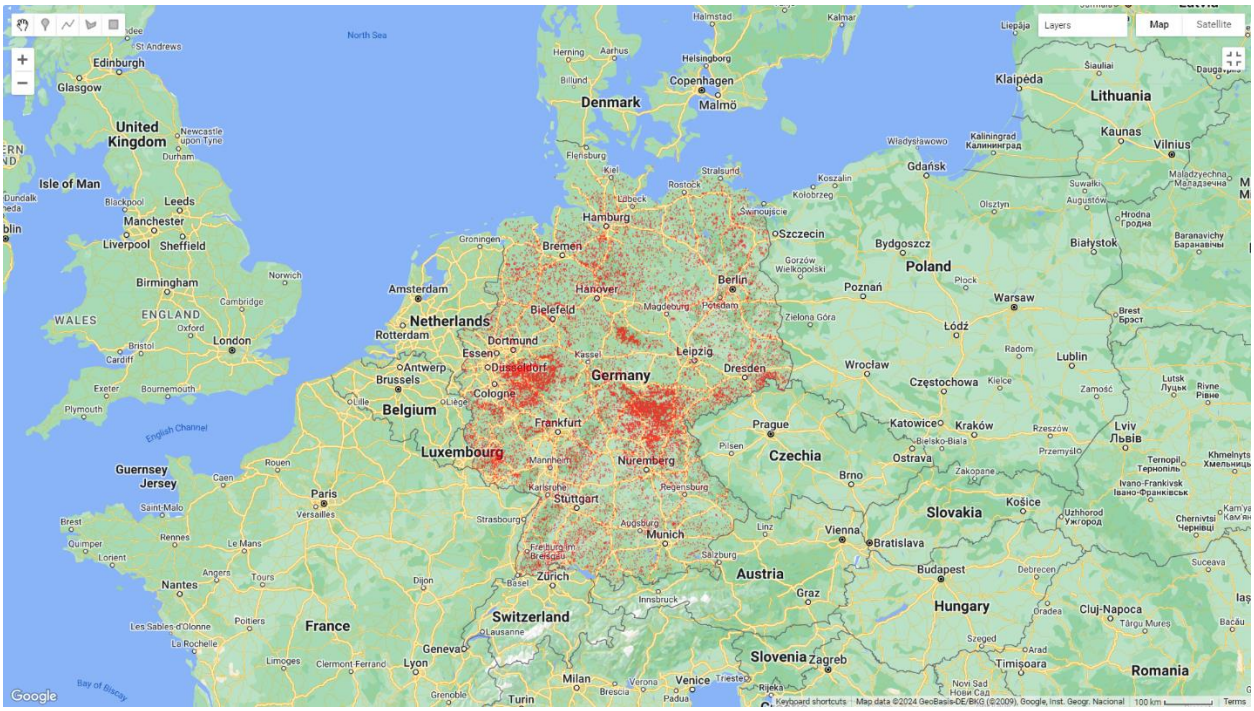
Ireland
Isle of Man
Google


Layers
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Glasgow
Isle of Man
Leeds
Manchester
Liverpool
Sheffield
Birmingham
WALES
ENGLAND
London
Bristol
Cardiff
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Bremen
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Netherlands
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Slovakia
Prague
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Poland
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Gdańsk
Szczecin
Bydgoszcz
Białystok
Wrocław
Katowice
Kraków
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Budapest
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Slovenia
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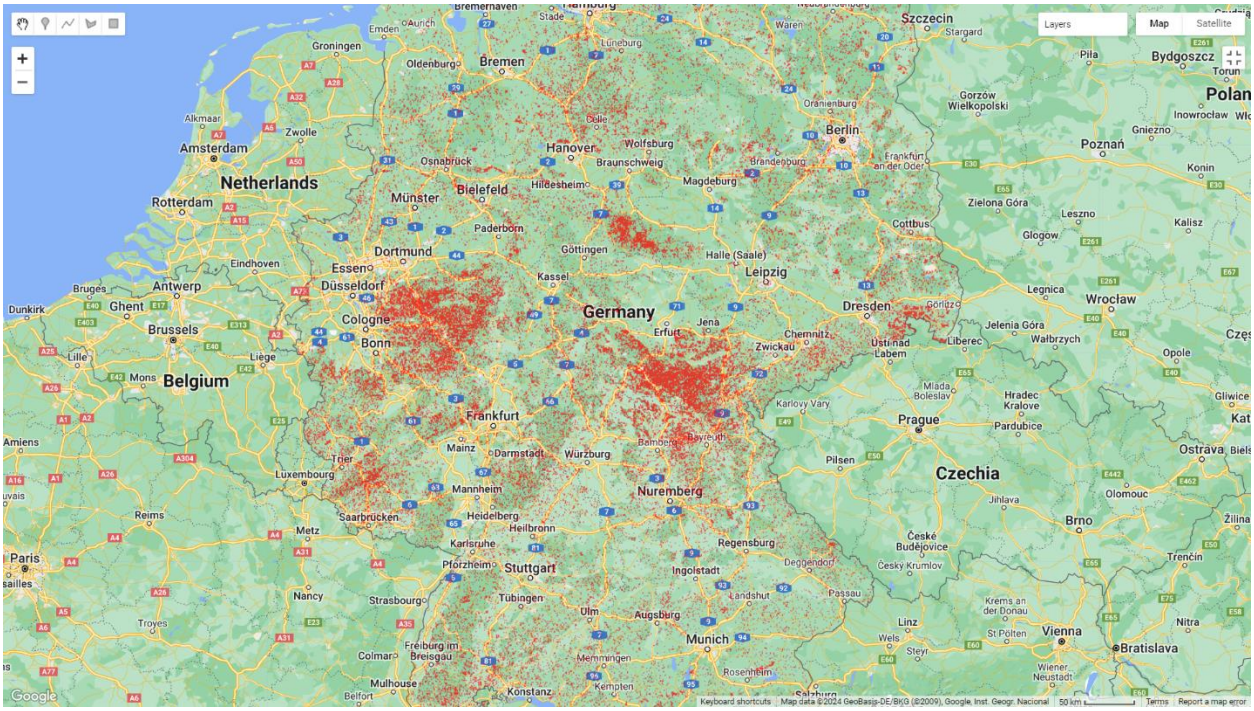
France
Paris
Lyon
Milan
Venice
Guernsey
Jersey
Google


Layers
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Satellite
Netherlands
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Brussels
Ghent
Bruges
Dunkirk
Lille
Liege
Mons
Germany
Cologne
Bonn
Düsseldorf
Dortmund
Essen
Bielefeld
Münster
Osnabrück
Hanover
Wolfsburg
Braunschweig
Berlin
Magdeburg
Leipzig
Halle (Saale)
Dresden
Frankfurt
Mainz
Darmstadt
Würzburg
Nuremberg
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Luxembourg
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Saarbrücken
Metz
Nancy
Strasbourg
Tübingen
Freiburg im Breisgau
Colmar
Mulhouse
Konstanz
Paris
Reims
Amiens
Troyes
Google

Explanation of the Script:

1. Define the Region of Interest (ROI):

   - The script filters the FAO GAUL dataset to extract the boundaries of Germany.

2. Load the Hansen Global Forest Change Dataset:

   - The script loads the Hansen dataset, specifically version 1.11 (2000-2023).

3. Select the 'lossyear' Band:

   - The 'lossyear' band indicates the year when forest loss occurred.

4. Define the Time Range for Analysis:

   - The script sets the years 2021, 2022, and 2023 for forest loss analysis.

5. Combine the Loss Years into a Single Image:

   - The script combines the forest loss data for the years 2021, 2022, and 2023 into one image.

6. Clip the Loss Image to Germany:

   - The script clips the forest loss image to the boundaries of Germany.

7. Calculate the Area of Forest Loss:

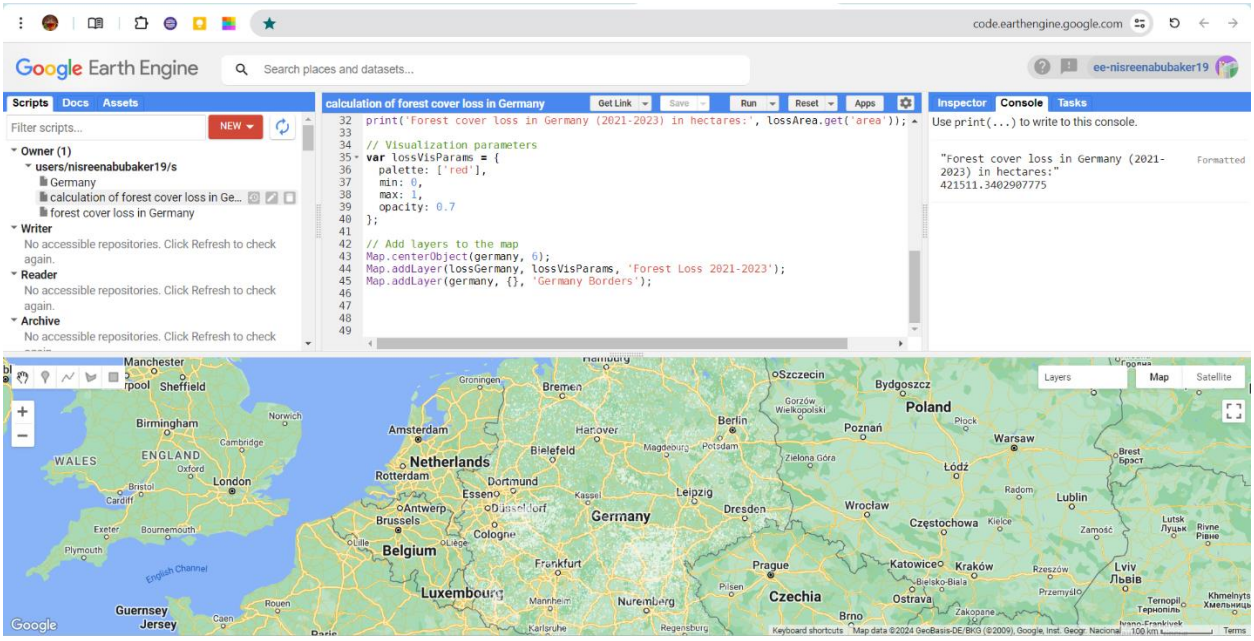
   - The script calculates the area of forest loss in hectares using the pixel area and sums the total area of loss within Germany.

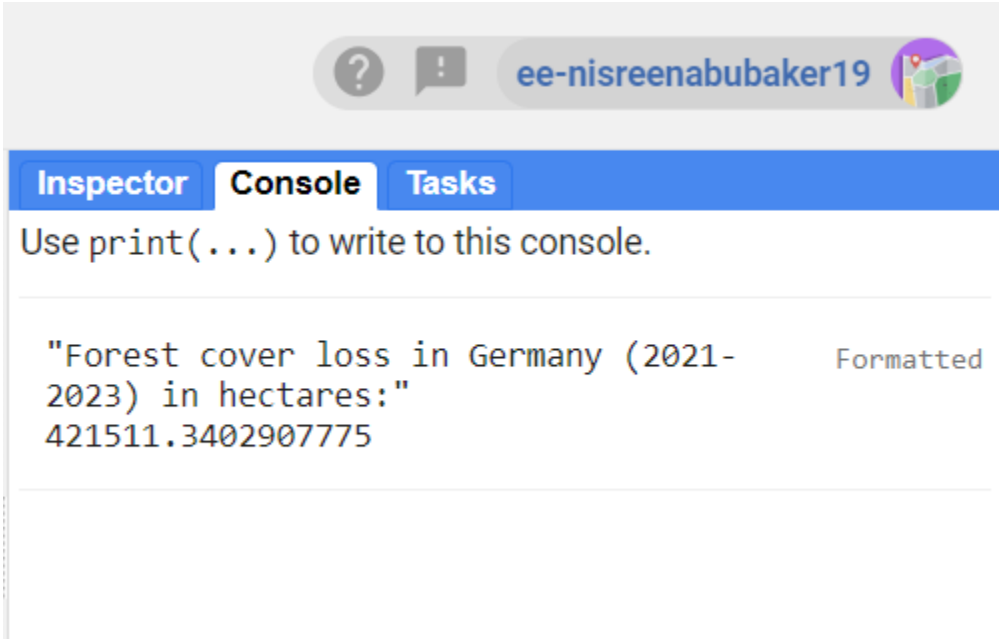
8. Print the Results:

   - The total area of forest loss in Germany from 2021 to 2023 is printed to the console.

9. Visualization:

- The script sets up visualization parameters and adds the layers to the map, centering the map on Germany.





Forest cover loss in Germany (2021-2023) in hectares:
421511.340291

To create and export a raster map of forest cover loss in Germany from 2021 to 2023 using Google Earth Engine (GEE), I need to modify the script slightly to include the export functionality. The script will now create a raster map and export it as a GeoTIFF file. Here is the updated script:

```javascript
// Define the region of interest: Germany
var germany = ee.FeatureCollection('FAO/GAUL/2015/level0')
  .filter(ee.Filter.eq('ADM0_NAME', 'Germany'));

// Define the Hansen Global Forest Change dataset
var hansenDataset = ee.Image('UMD/hansen/global_forest_change_2023_v1_11');

// Select the 'lossyear' band which indicates the year of forest loss
var lossYear = hansenDataset.select('lossyear');

// Define the time range for forest loss: 2021-2023
var loss2021 = lossYear.eq(21);
var loss2022 = lossYear.eq(22);
var loss2023 = lossYear.eq(23);

// Combine the loss years into a single image
var loss2021_2023 = loss2021.or(loss2022).or(loss2023);

// Clip the loss image to Germany
var lossGermany = loss2021_2023.updateMask(loss2021_2023).clip(germany);

// Calculate the area of forest loss (in hectares)
```

```
var pixelArea = ee.Image.pixelArea().divide(10000); // Convert m² to hectares
var lossArea = pixelArea.updateMask(lossGermany).reduceRegion({
  reducer: ee.Reducer.sum(),
  geometry: germany,
  scale: 30,
  maxPixels: 1e10
});

// Print the area of forest loss to the console
print('Forest cover loss in Germany (2021-2023) in hectares:', lossArea.get('area'));

// Visualization parameters
var lossVisParams = {
  palette: ['red'],
  min: 0,
  max: 1,
  opacity: 0.7
};

// Add layers to the map
Map.centerObject(germany, 6);
Map.addLayer(lossGermany, lossVisParams, 'Forest Loss 2021-2023');
Map.addLayer(germany, {}, 'Germany Borders');

// Export the raster map as a GeoTIFF
Export.image.toDrive({
  image: lossGermany,
  description: 'Germany_Forest_Loss_2021_2023',
  scale: 30,
```

```
  region: germany.geometry(),
  fileFormat: 'GeoTIFF',
  maxPixels: 1e10
});
```

Explanation of the Export Functionality:

1. Export the Raster Map:
   - The `Export.image.toDrive` function is used to export the raster map of forest loss as a GeoTIFF file.
   - The parameters include:
     - `image`: The image to export (forest loss in Germany).
     - `description`: A descriptive name for the exported file.
     - `scale`: The resolution in meters per pixel (30 meters).
     - `region`: The region of interest (geometry of Germany).
     - `fileFormat`: The file format for the exported image (GeoTIFF).
     - `maxPixels`: The maximum number of pixels to export (set to a large value to handle the full image).

Running the Script:

1. Open the Google Earth Engine Code Editor:
   - Go to the [Google Earth Engine Code Editor](https://code.earthengine.google.com/).

2. Copy and Paste the Script:
   - Copy the entire script above and paste it into a new script in the Code Editor.

3. Run the Script:

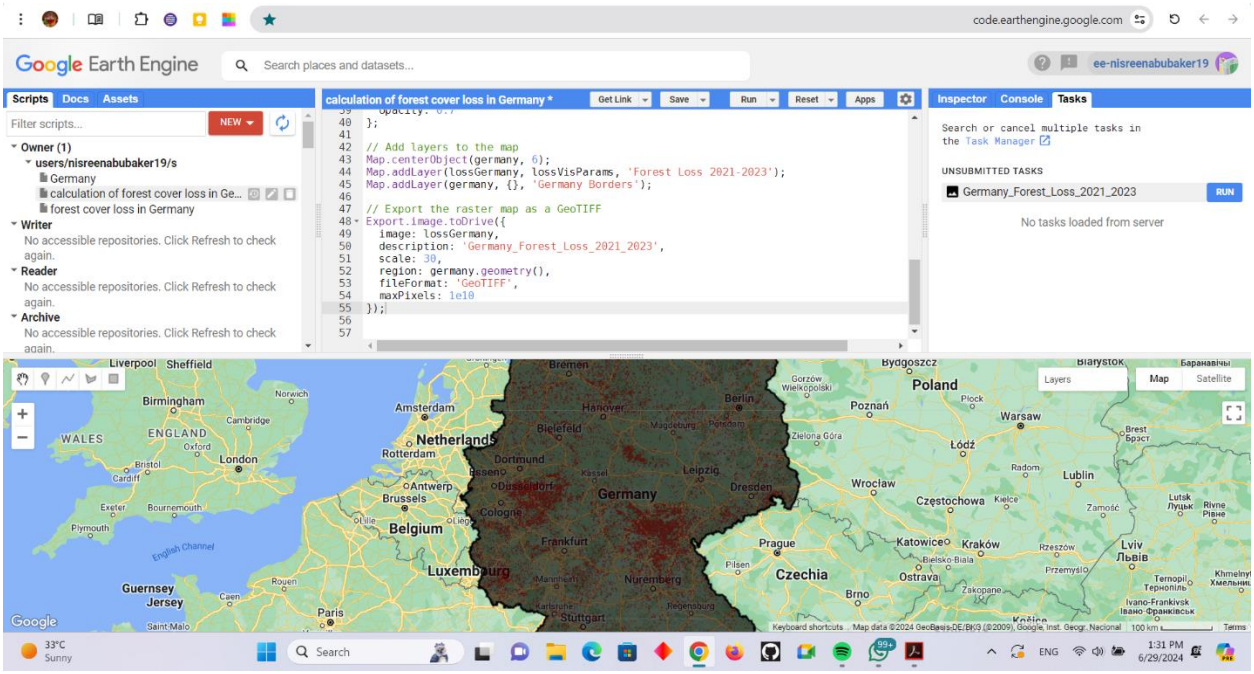
- Click the "Run" button to execute the script.

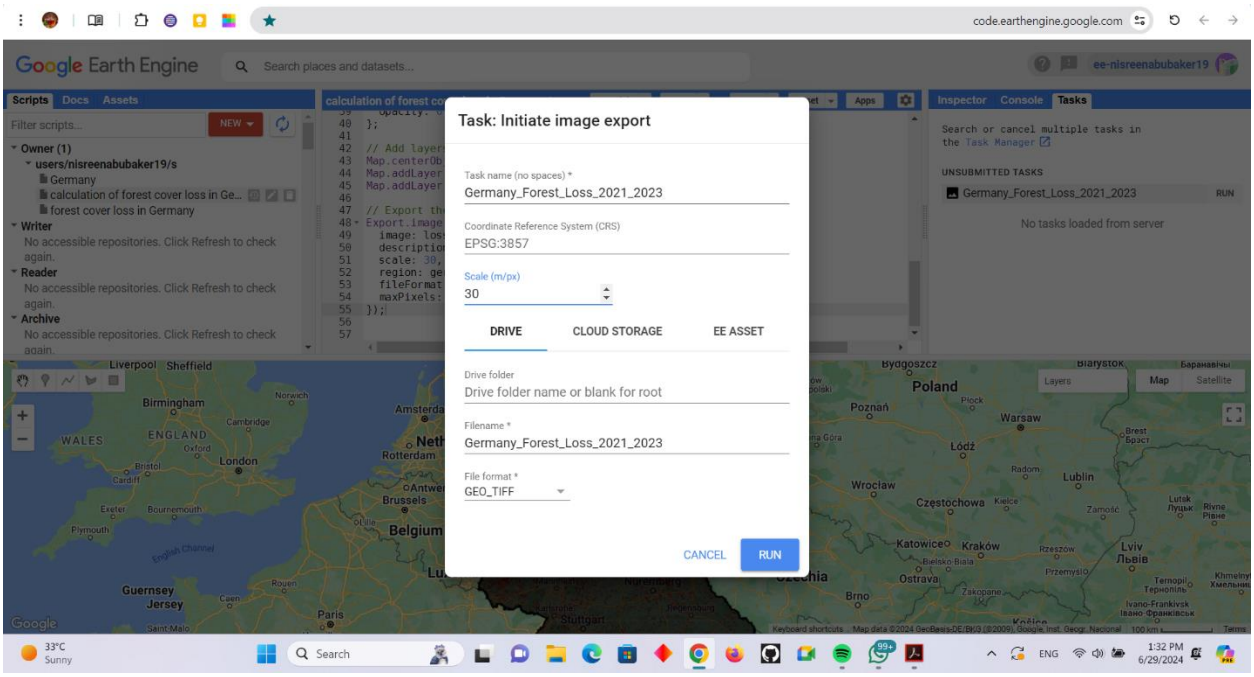
4. Export the Image:

- After the script runs, you will see an "Exports" tab on the right-hand side.

- Click the "Run" button next to the export task to start exporting the GeoTIFF file to your Google Drive.

Once the export is complete, I can download the GeoTIFF file from my Google Drive and use it for further analysis or visualization in GIS software.

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Germany
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forest cover loss in Germany
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Archive
No accessible repositories. Click Refresh to check again.
Inspector
Console
Tasks
Search or cancel multiple tasks in the Task Manager
UNSUBMITTED TASKS
Germany_Forest_Loss_2021_2023
RUN
No tasks loaded from server
Task: Initiate image export
Task name (no spaces) *
Germany_Forest_Loss_2021_2023
Coordinate Reference System (CRS)
EPSG:3857
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DRIVE
CLOUD STORAGE
EE ASSET
Drive folder
Drive folder name or blank for root
Filename *
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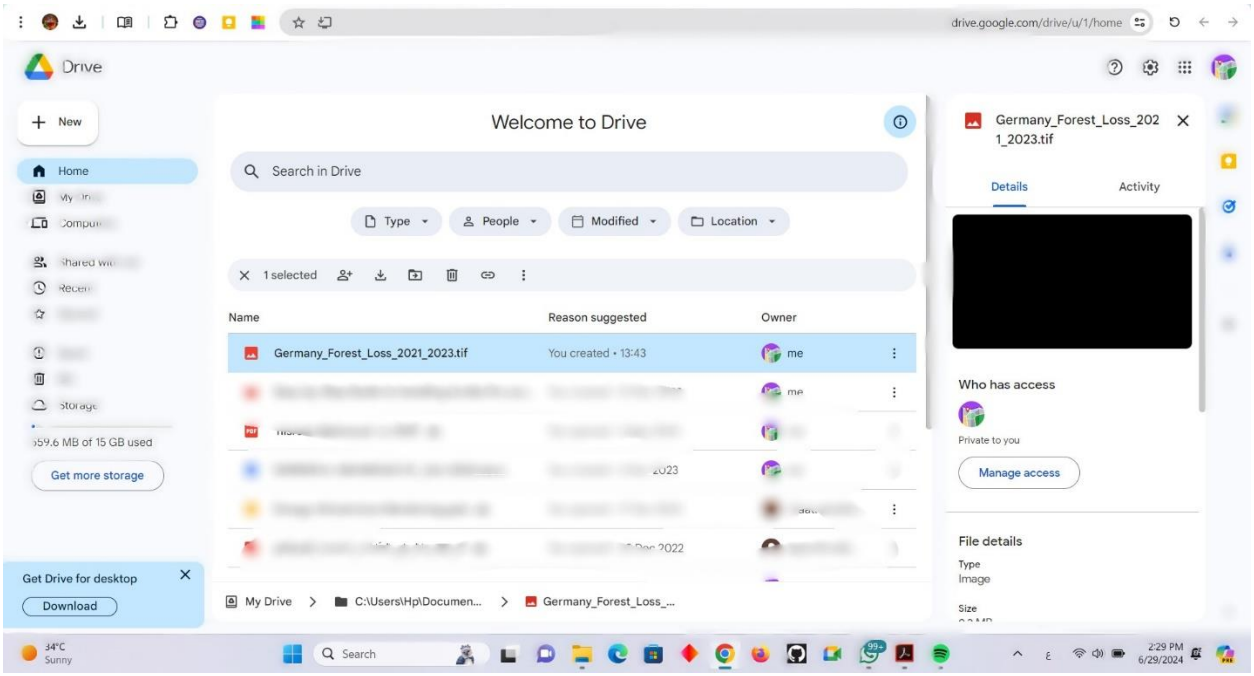
Drive
New
Home
Shared with me
Recent
Starred
Trash
Storage
59.6 MB of 15 GB used
Get more storage
Get Drive for desktop
Download
Welcome to Drive
Search in Drive
Type
People
Modified
Location
1 selected
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Reason suggested
Owner
Germany_Forest_Loss_2021_2023.tif
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My Drive
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Germany_Forest_Loss_2021_2023.tif
Details
Activity
Who has access
Private to you
Manage access
File details
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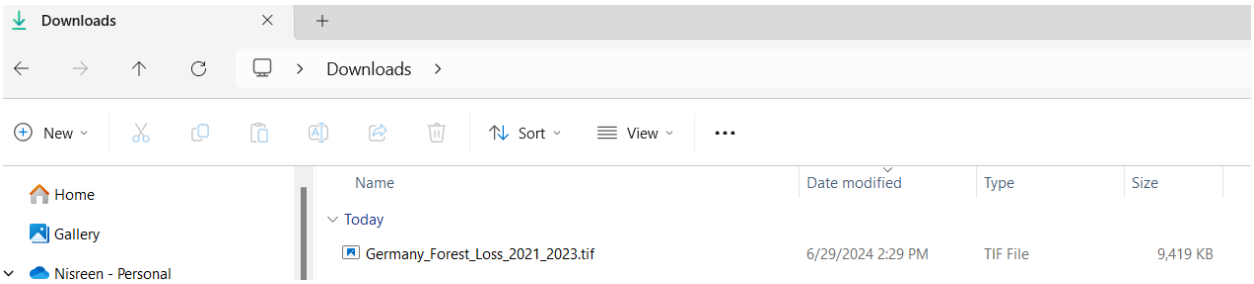
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