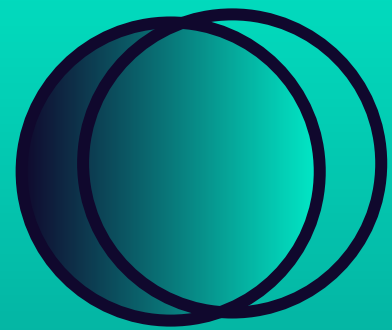




# Impact-Map: A gHM Visualization Tool

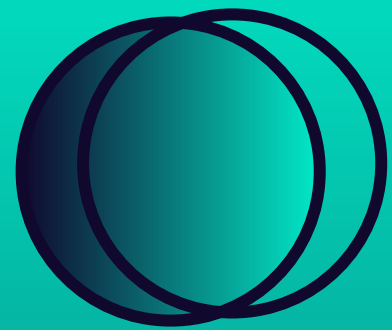
Inno Jed V. Lisboa



# Background

- Human activities have dramatically altered Earth's terrestrial landscapes
- Major changes: infrastructure, agriculture, and land use modifications
- Consequences: deforestation, habitat loss, reduced biodiversity
- Native species experiencing population declines
- Need for datasets quantifying human modification of landscapes





# Background

## GHM QUANTIFIES HUMAN MODIFICATION:

Quantifying human modification(H) of terrestrial landscapes by considering factors such as the proportion of a pixel occupied by stressors (F), the probability of stressors occurring at specific locations (p(Cs)), and the intensity of stressors (I)



Equation:  $H_s = F_s \cdot p(C_s) \cdot I_s$ .





1

# Problem Statement

- Global Human Modification (gHM) dataset quantifies human impact on Earth
- Valuable for researchers and conservationists
- Underutilized due to lack of user-friendly applications
- Technical barriers for researchers, policymakers, and public
- Requires coding skills and knowledge of Google Earth Engine or powerful GIS



# Objectives

- Create a usable web-app for analyzing and visualizing the gHM dataset
- Develop tools and features for visualization and analysis
- Serve gHM dataset and layers from a cloud server
- Use Google Earth Engine's cloud computing platform dynamically



# Scope and Limitation

## Scope

- Focus on datasets related to anthropogenic stressors in the Global Human Modification dataset
- Visualization and analysis limited to the Philippines

## Limitation

- Limited to the latest gHM dataset and its 300m x 300m resolution

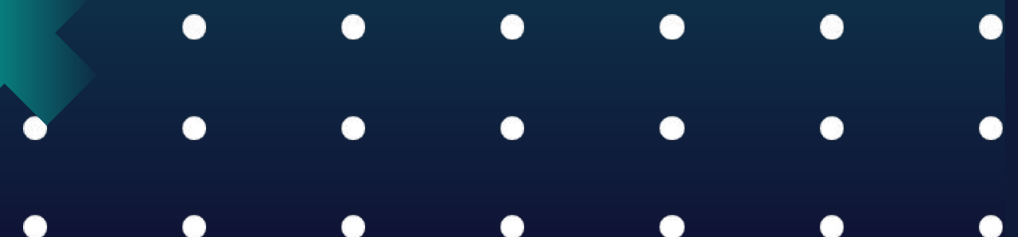




# RRRL

## Direct Threats Classification v2

- Definition: Immediate human actions causing harm to biodiversity.
- Examples: Unsustainable fishing, logging.
- Development: Combination of CMP and IUCN schemes.
- Characteristics: Simple, hierarchical, comprehensive, consistent, expandable, exclusive, scalable.



2

# RRRL

## Application on Google Earth Engine

Theobald et al. (2020):

- Quantifying human modification using pixel-based calculations.
- Temporal Change Formula:  $H_{ad} = (H_u - H_t) / (u - t)$ .
- The contemporary estimate highlights that 14.5% of lands globally have been completely modified by human activities, underscoring the magnitude of anthropogenic changes on terrestrial ecosystems







# Methods

## A. APIs and Technologies

- Google Earth Engine API: Utilized for GEE processes and app publishing.
- Leaflet: JavaScript library for custom map tools and overlays.
- Google Cloud Platform: Hosts map tiles for 1990-2017 gHM.
- Render: Cloud deployment platform for Impact-Map.
- JavaScript and HTML: Adds interactivity and structure to the web app.
- GeoJSONs: Administrative boundaries from Philippine Statistics Authority.
- Chart.js: JavaScript library for interactive charts and graphs.
- QGIS: Creates XYZ tiles for maps.





# Methods

## B. Features

- Single Page Web App (SPA): No page navigation needed.

### Average gHM Generation:

- Drawing Tool: Draw polygons for gHM calculation.
- Search Functionality: Find provinces, cities, regions.
- CSV Export: Upload CSV for specific areas.

### gHM Distribution Generation:

- Drawing Tool: Draw polygons for distribution calculation.
- Search Functionality: Find provinces, cities, regions.
- CSV Export: Upload CSV for specific areas.
- Layer Viewing: Visualize gHM dataset for 1990-2017 in the Philippines.
- Graphs: Line graph for average gHM, pie chart for distribution.
- Side Panel: Color reference and additional gHM information.





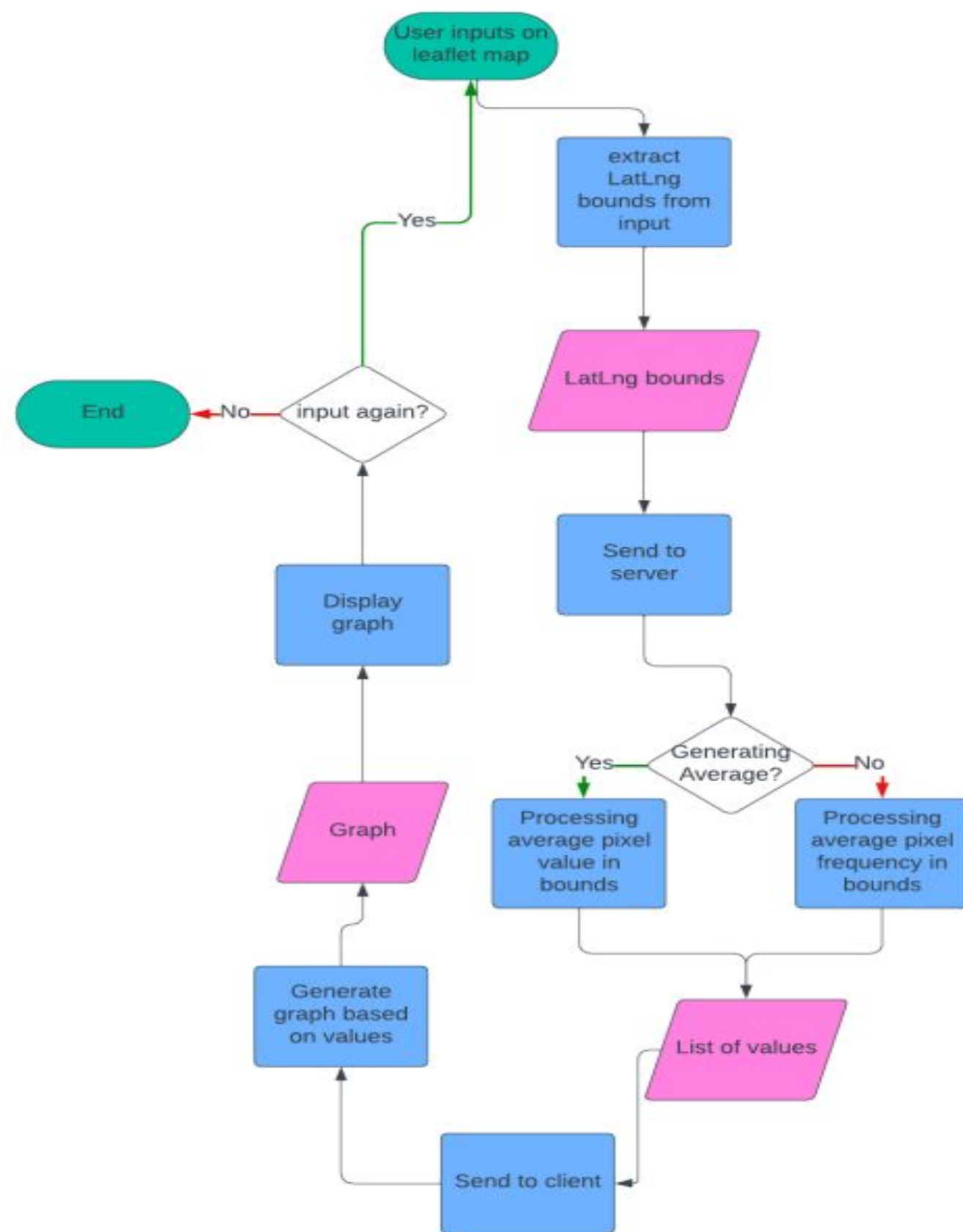
# Methods

## C. Evaluation

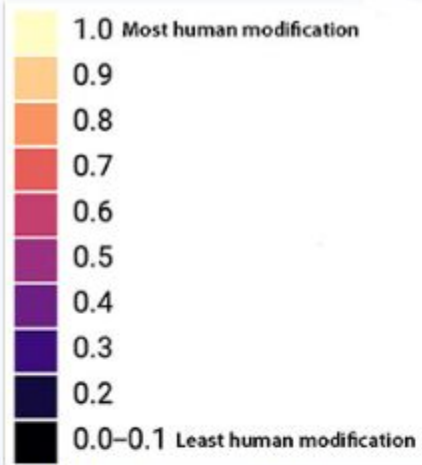
- Purposive Sampling (30 participants)
  - Target students majoring in Forestry, Ecology, and wildlife
  - Researchers in the field of nature and conservation
- SUS testing



3





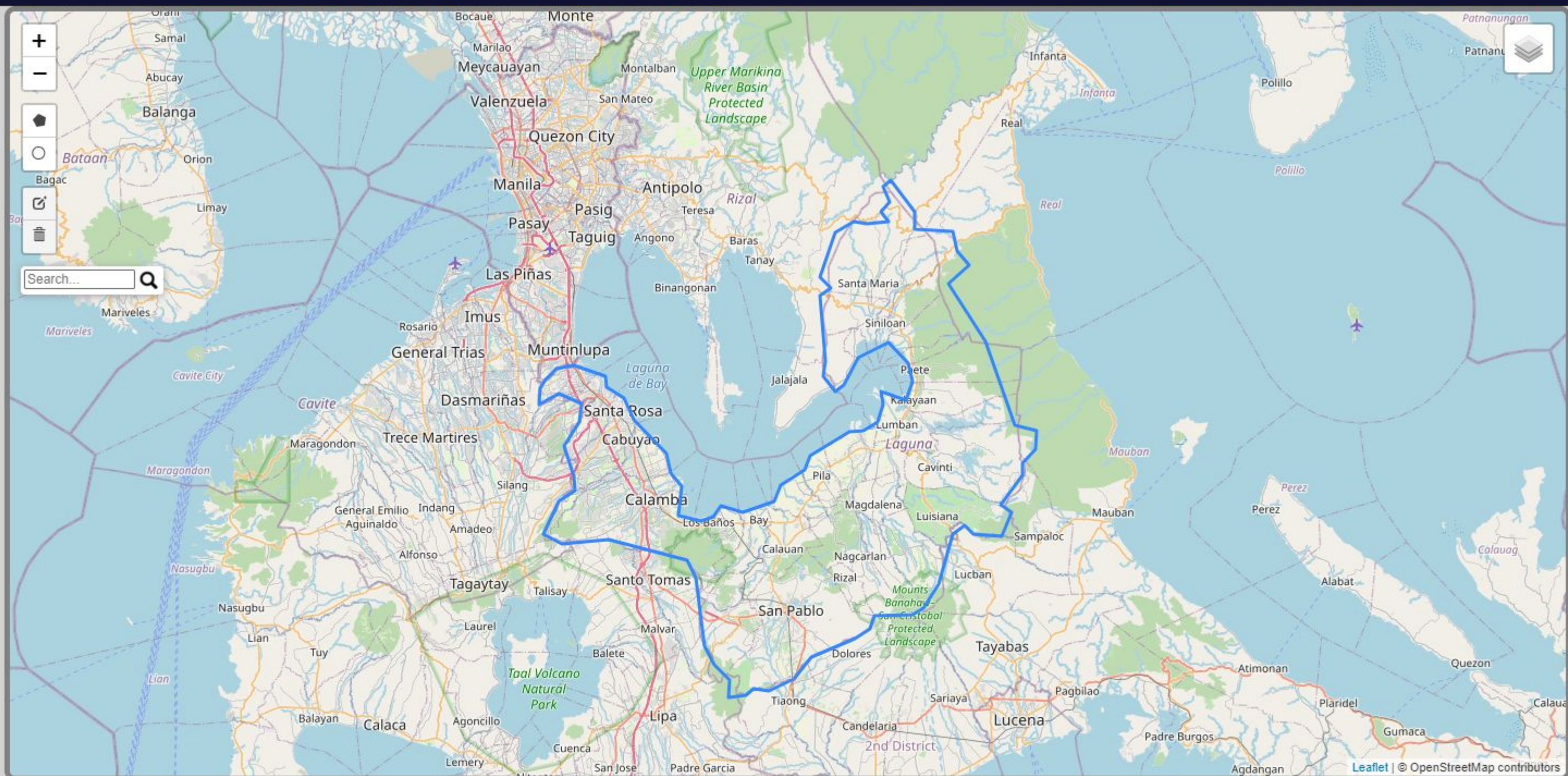


Global human modification across terrestrial lands. Black represents areas with no mapped modification ( $HM = 0$ ), dark blue in low modification ( $0.00 < HM \leq 0.10$ ), purple in moderate modification ( $0.10 < HM \leq 0.40$ ), and yellow in high modification ( $0.40 < HM \leq 1.00$ ). Note that low modified lands are areas with low mapped human influence and is not necessarily equivalent to the extent of native vegetation

Answer Survey

Scientific References

Learn More About gHM

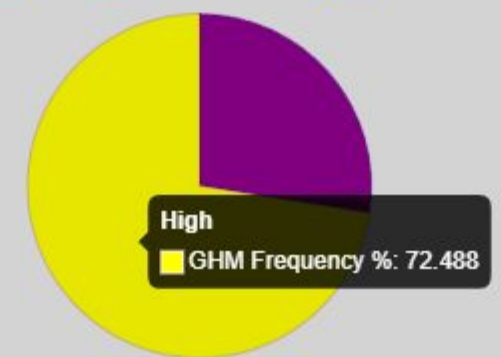


GHM\_1990

- ☐ Generate gHM for a city
- ☒ Generate gHM for a province
- ☐ Generate gHM for a Region (may take a while)

Choose File No fil...hosen

Low Moderate High



Submit CSV

Activate Windows  
Go to Settings to activate Windows.



1.0 Most human modification

0.9

0.8

0.7

0.6

0.5

0.4

0.3

0.2

0.0-0.1 Least human modification

Global human modification across terrestrial lands. Black represents areas with no mapped modification (HM = 0), dark blue in low modification ( $0.00 < HM \leq 0.10$ ), purple in moderate modification ( $0.10 < HM \leq 0.40$ ), and yellow in high modification ( $0.40 < HM \leq 1.00$ ). Note that low modified lands are areas with low mapped human influence and is not necessarily equivalent to the extent of native vegetation

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Learn More About gHM

+

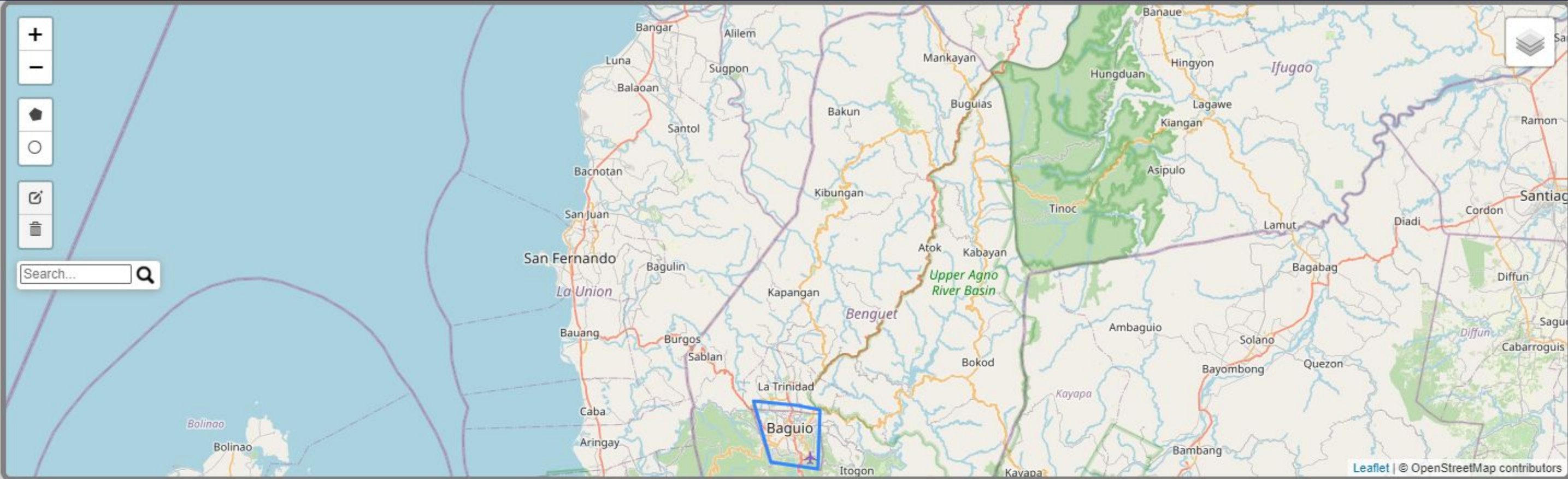
-

🏠

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🗑️

Search...



☒ Generate gHM for a city

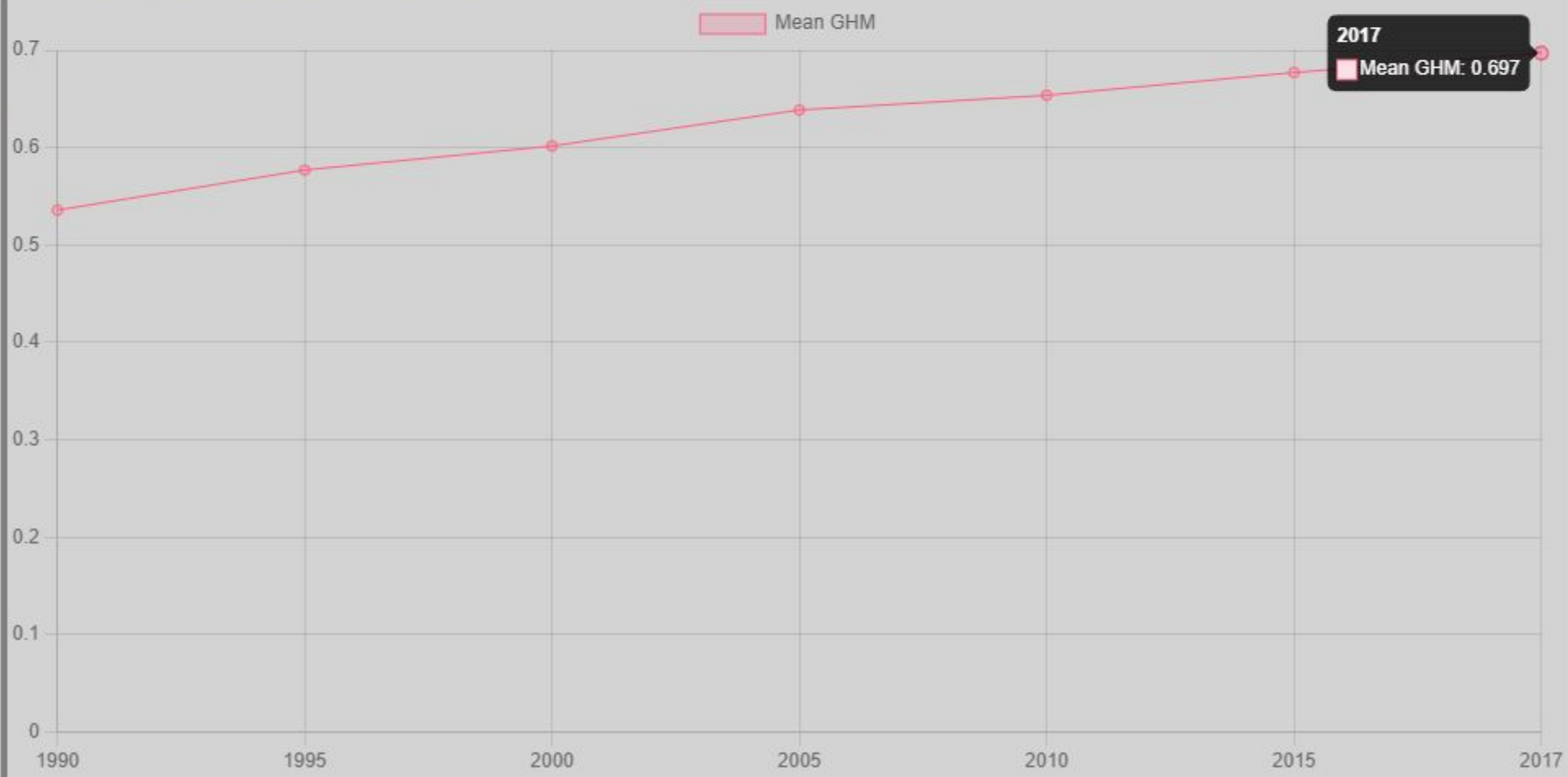
☐ Generate gHM for a province

☐ Generate gHM for a Region (may take a while)

Choose File

No file chosen

Mean GHM



Year	Mean GHM
1990	0.53
1995	0.57
2000	0.60
2005	0.63
2010	0.65
2015	0.67
2017	0.697

2017

Mean GHM: 0.697

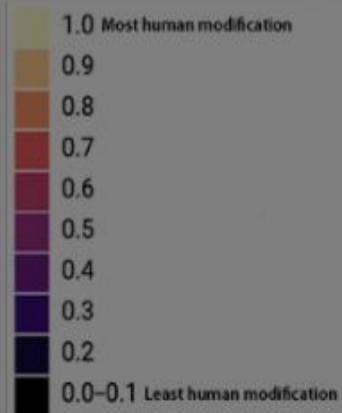
Submit CSV

Go Back

Activate Windows

Go to Settings to activate Windows.





Global human modification across terrestrial lands. Black represents areas with no mapped modification ( $HM = 0$ ), dark blue in low modification ( $0.00 < HM \leq 0.10$ ), purple in moderate modification ( $0.10 < HM \leq 0.40$ ), and yellow in high modification ( $0.40 < HM \leq 1.00$ ). Note that low modified lands are areas with low mapped human influence and is not necessarily equivalent to the extent of native vegetation

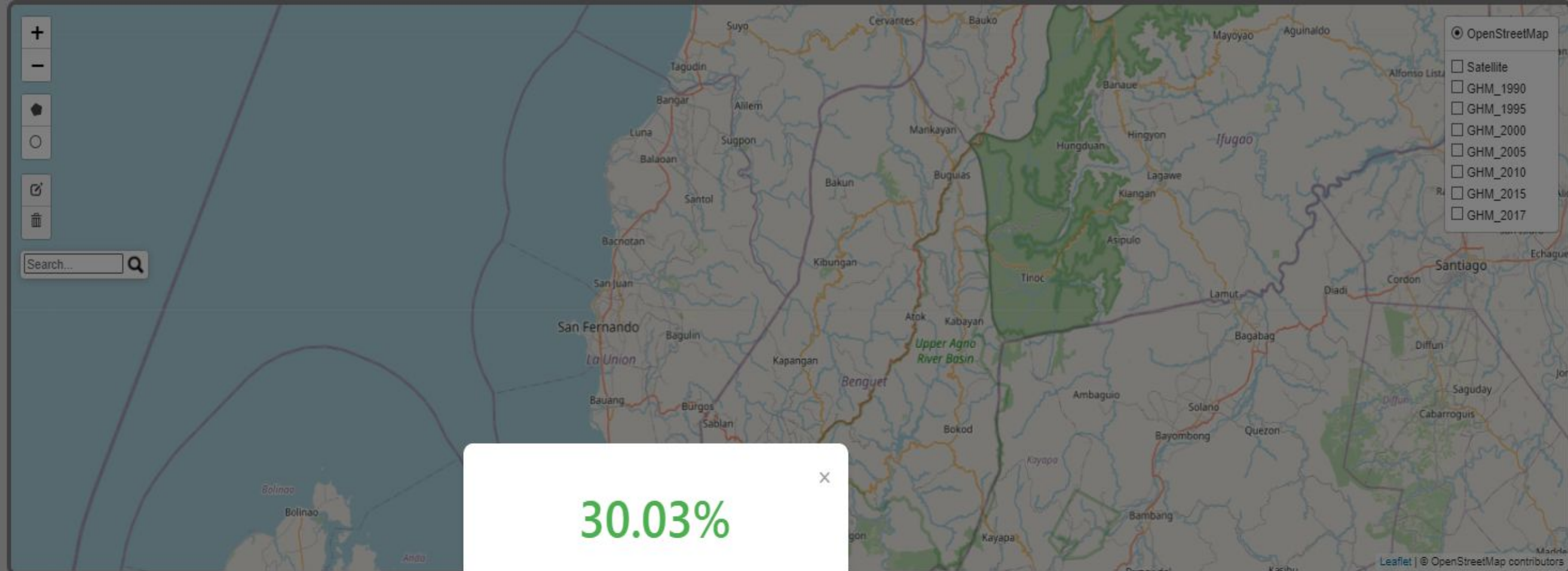
Answer Survey

Scientific References

Learn More About gHM

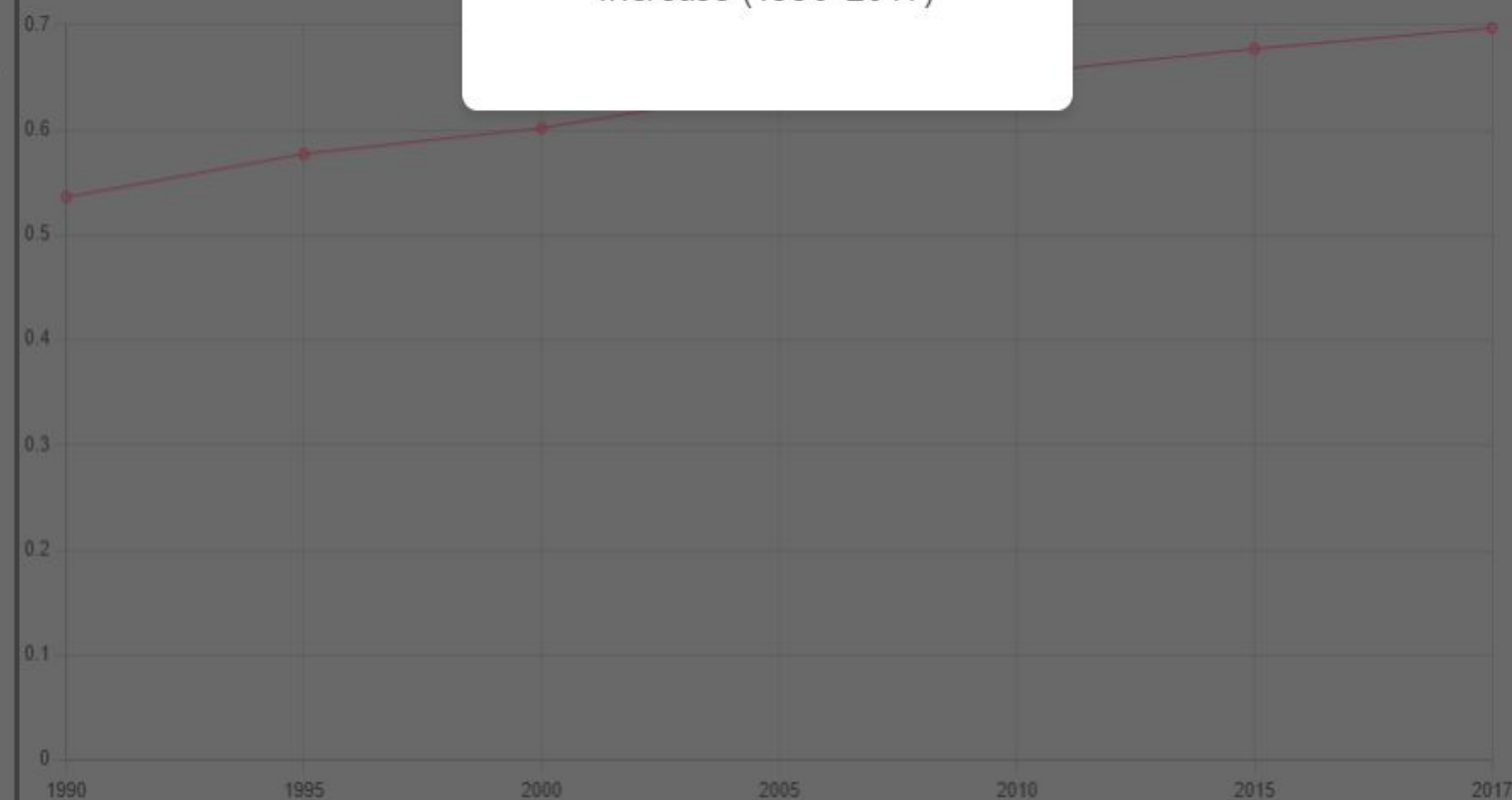
- ☒ Generate gHM for a city
- ☐ Generate gHM for a province
- ☐ Generate gHM for a Region (may take a while)

Choose File No file chosen



30.03%

Increase (1990-2017)



Submit CSV

Go Back

Activate Windows

Go to Settings to activate Windows.

# 4

## Results and Discussion

- Developed Impact-Map web app.
- Used HTML, JavaScript, and libraries like Leaflet for drawing tools and GeoJSON integration.
- Server-side architecture based on Express framework and Google Earth Engine (GEE) API.
- Custom search function with GeoJSONs from Google Cloud bucket.
- Dynamic map tiles for Global Human Modification (gHM) dataset.
- CSV import feature for LatLng bounds.
- Deployed on Render for scalability and achieved an SUS score of 82.75.







5

# Conclusion

- Successful development of Impact-Map for gHM layers in The Philippines
- Achieved excellent SUS score of 82.75

## Recommendations for future versions:

- Expand geographic focus
- Implement individual detailed stressor analysis with graphical representation



**Thank you!**