



BioSphere



Project Biomapper

Sponsored by Dr. Christopher Doughty & Jenna M. Keany



Team BioSphere

Team Lead



Matthew
Nemmer

Recorder



Brandon
Warman

Release Manager



Teng
Ao

Architect



Dyanni
Bigham

Our Sponsors and Mentor



Dr. Christopher Doughty

Sponsor



Jenna M. Keany

Sponsor

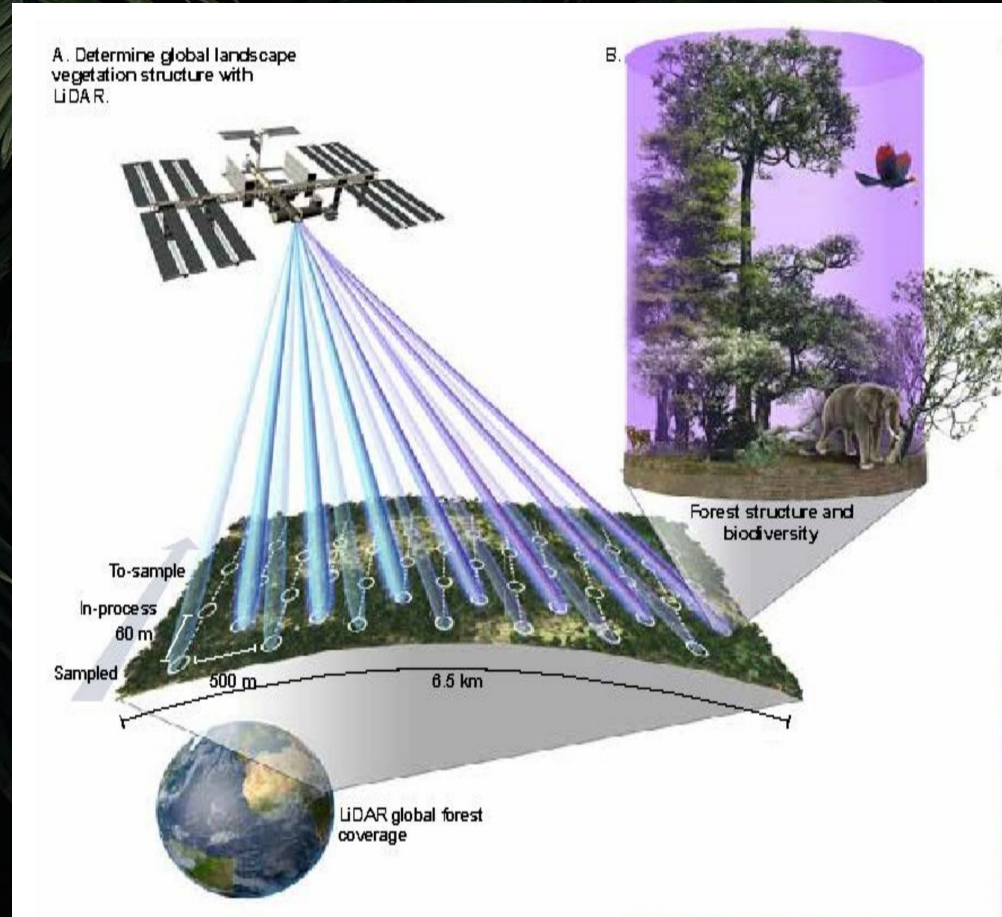


Melissa Rose

Mentor

Background

- Tropical forests are vital to the global ecosystem
 - Carbon storage
 - Species-rich
- Ecologists use lidar data to locate animals and draw conclusions about forests
- Policy makers use these conclusions to protect forests



Introduction

GEDI: Global Ecosystem Dynamics Investigation (Satellite lidar sensor)

- New (2018) lidar system with near-global coverage
- Measures the 3D structure of the Earth
 - Canopy height
 - Surface elevation
 - Canopy vertical structure
- GEDI data is complex, difficult to process, and hard to obtain



Problem Statement

- Ecologists and researchers struggle to obtain and view the GEDI data they need
- Our clients can process GEDI data for us
- Need for a tool to visualize the processed data
 - Google Earth Engine exists, but is inadequate

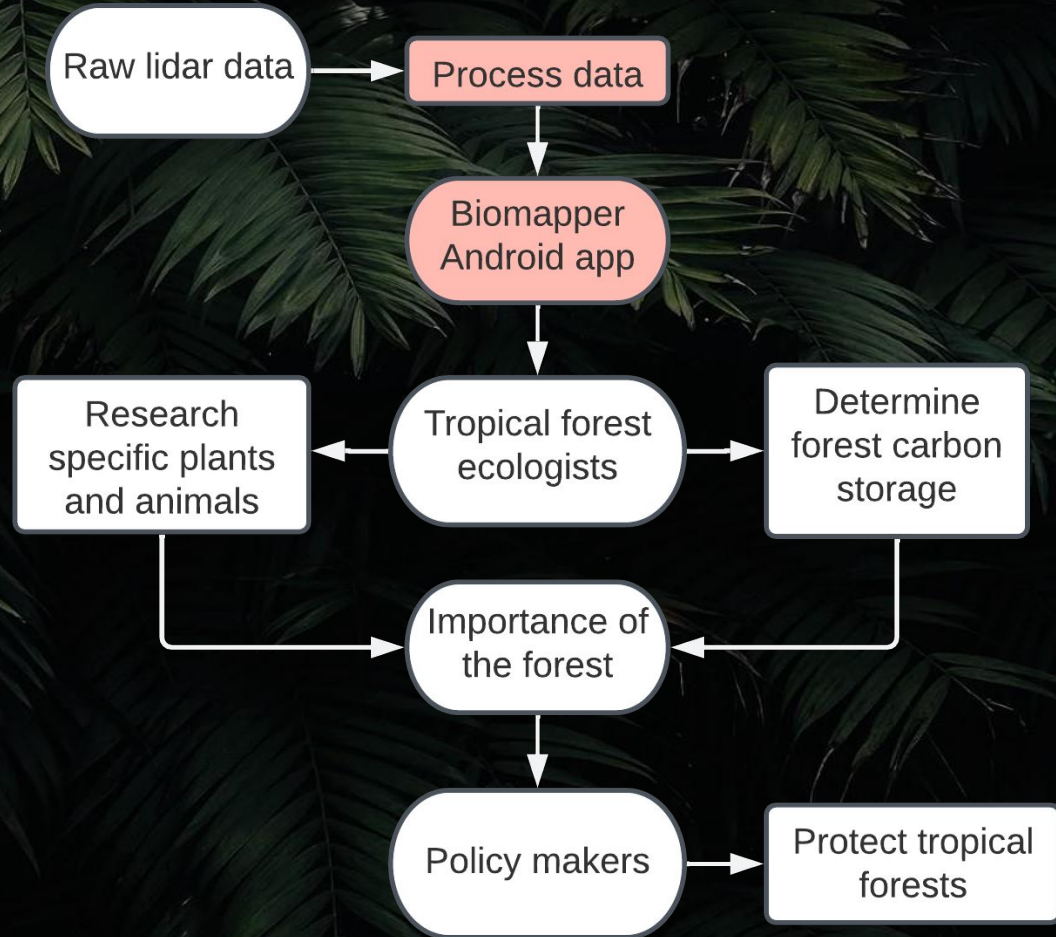
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Solution Overview

Android application - Biomapper

- Provides ecologists with an easy-to-use tool
- Includes a map for visualizing lidar data
- Gives ecologists access to data wherever they go



Domain-Level Requirements

Display a map that can be navigated

- Scroll and zoom color-coded maps
- Can select one of three data types

Tools for locating areas of interest

- Ability to filter data
- Get data value for a selected point

Offline functionality

- User can specify the region of interest and data types to download

The app will support French and English

- User can switch between them

Default center location

- Either the region of interest or the device location

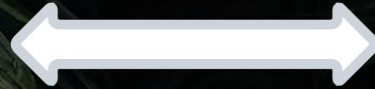


Implementation Overview

Mobile App



Map Data
Retrieval



Web Server



Implementation Overview

Android app responsibilities

- Displaying the data on a map
- Downloading for offline use
- Getting data value for a selected point (when offline)
- Including French and English translations



Server responsibilities

- Storing map data
- API for filtering map data
- API for getting data value for a selected point



Android App Demo

App Introduction

- When the app is first opened, the map is shown
- The user can navigate to the main menu and sub-menus

Android App Demo

Use case #1 - Finding a region of interest (ROI)

- You are a tropical forest ecologist looking for a specific species of bird
- You know the bird lives in trees of medium height (about 25 meters tall)

Android App Demo

Use case #2 - Downloading a ROI

- You have found a region of interest
- Now you want to download that area for a specific set of data types

Android App Demo

Use case #3 - Switching language

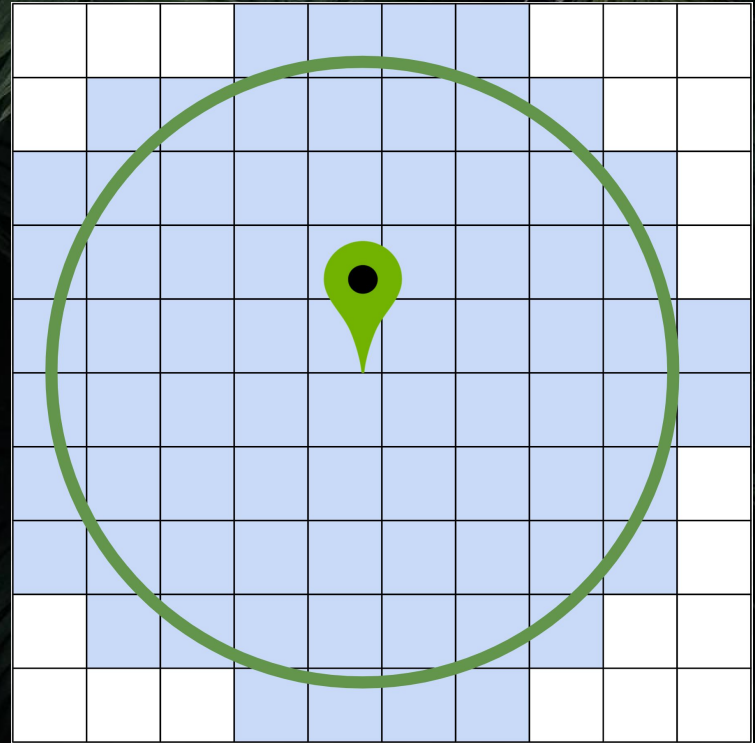
- Device is in your native language (English)
- You want to temporarily let another ecologists see the app, but they prefer a different language (French)

Challenges and Resolutions

- Determining which map tiles to download

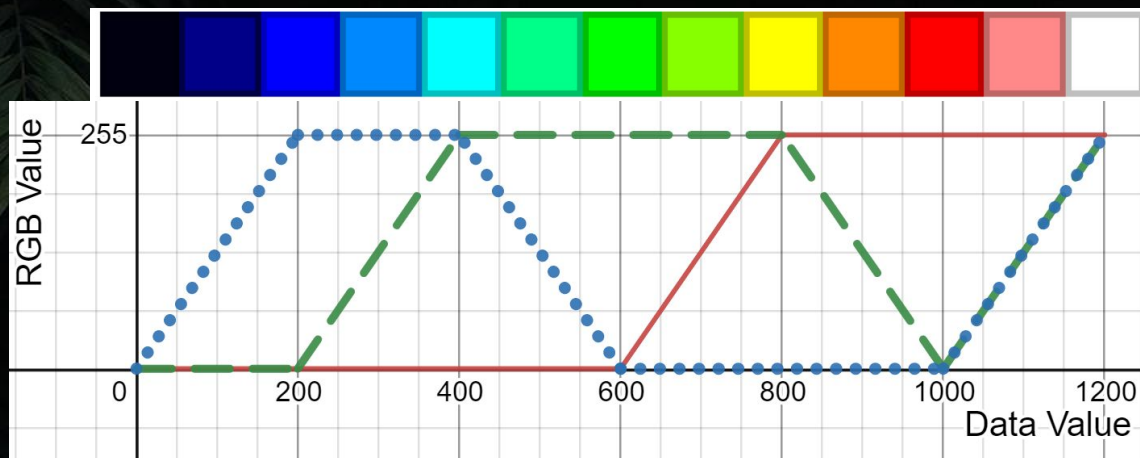
Solution

- User clicks a center point and inputs a radius
- Calculate which map tiles cover any part of this circular area and download them



Challenges and Resolutions

- Tiling datasets is a multi-step process
 - Looking for a quick and easy process
- Accuracy of RGB values to data
 - alternative solution is not cost effective



Testing Plan

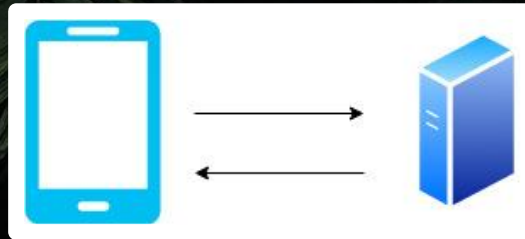
Unit Testing

- Jasmine and JS-ImageDiff tool
- JUnit



Integration Testing

- Tested HTTP requests sent from app to server

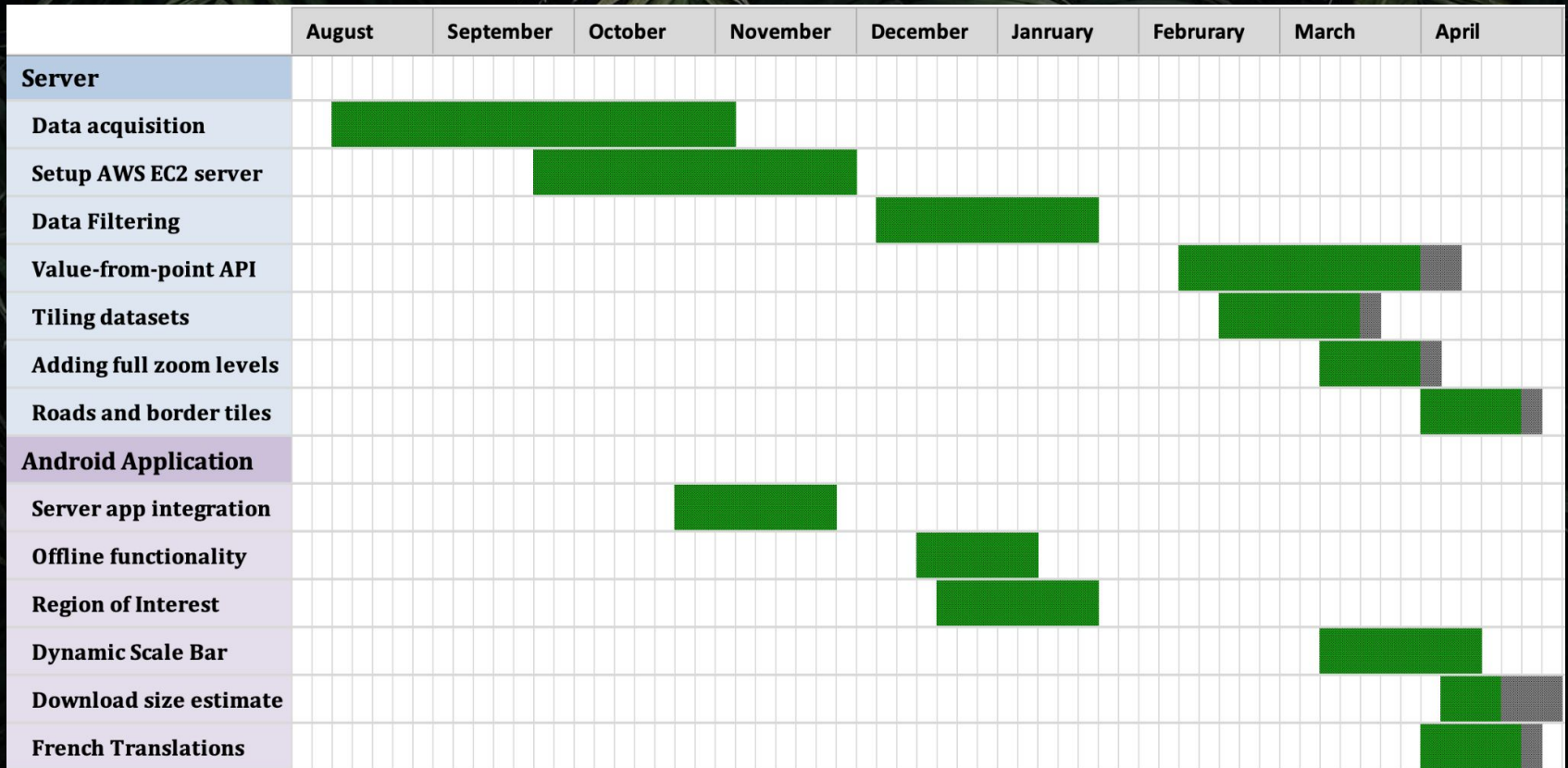


Usability Testing

- Client's research team
- Questions based on simplicity, ease of navigation, usefulness

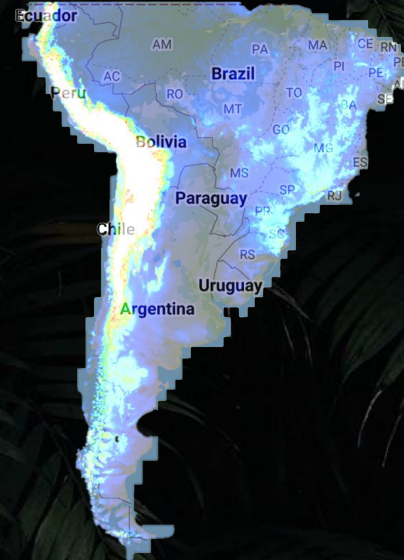


Schedule



Future Work

- iOS application
- AWS EC2 Server upgrade
- Expand coverage for South America.



Instance	vCPU*	Mem (GiB)	Network Performance
t2.micro	1	1	Low to Moderate
t2.small	1	2 +1	Low to Moderate
t2.medium	2 +1	4 +2	Low to Moderate

Conclusion

- Problem: Ecologists and researchers struggle viewing lidar data from GEDI
- Solution: Mobile application with offline functionality and data visualization,
- Plan: Finish remaining element and usability testing





Thank you for your time

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We are open to answering questions