Aruba Report

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Introduction

This document provides a comprehensive guide to using and maintaining the **Mangrove Change Detection Application**. It is designed for non-R and non-statistical users and includes detailed instructions for running, customizing, and troubleshooting the app.

Part 1: User Guide

Getting Started

What Does This App Do?

The app: - Analyzes changes in mangrove vegetation using raster data. - Provides interactive visualizations, tables, and maps. - Forecasts future vegetation trends using advanced statistical models.

Step 1: Input Files

How to Load Raster Data

1. Gather your **TIF files** (raster data files).
2. Place all the files in one folder on your computer.
3. In the app:
    - Go to the **TIF Comparison** section.
    - Find the text box labeled **"Enter Directory Path for TIF Files"**.
    - Enter the full path to your folder. For example:

      `C:/Users/YourName/Documents/MangroveData`
4. Click the **Load TIF Files** button to load your data.

Step 2: Explore the App

Mangrove Analysis Section

1. **Set a Date Range**:
   - Use the slider to choose the time period for analysis.
   - Only data within the selected dates will be analyzed and displayed.
2. **Explore Trends**:
   - **Trend Analysis** tab: Shows a graph of vegetation counts over time.
   - **Forecasting** tab: Predicts future vegetation counts based on trends.
3. **Compare Data**:
   - **Yearly Comparison**: View vegetation changes year by year.
   - **Same Month Comparison**: Compare vegetation counts for the same month across different years.
4. **Seasonal Patterns**:
   - **Grouped Bar Plot**: Shows monthly vegetation counts grouped by year.
   - **Stacked Bar Plot**: Aggregates monthly counts across years.
5. **Downloadable Tables**:
   - Explore detailed data in the **Data Table** tab.
   - All results include vegetation counts, percentage changes, and affected hectares.

TIF Comparison Section

1. **View Raster Files**:
   - Navigate through raster files using the **Previous** and **Next** buttons.
   - Use the slider to jump to a specific file.
2. **Visualize Data**:
   - **Interactive Map**: Displays the raster data overlayed with the Aruba map.
   - **Difference Map**: Highlights areas where changes occurred between files.

Step 3: How Graphs and Tables Are Created

Vegetation Counts

1. The app reads your raster files and counts pixels where vegetation is detected.
   - Pixels with a value of `1` are considered vegetation.
   - The count of such pixels is used to calculate vegetation areas.
2. **Area in Hectares**:
   - Each vegetation pixel represents 0.09 hectares.
   - Total area (in hectares) is calculated as:

```
Hectares = Vegetation Count * 0.09
```

3. **Percentage Change**:
   - Vegetation changes between time points are calculated as:

     ```
     Percent Change = (Current Count - Previous Count) / Previous Count * 100
     ```

Step 4: Customizing the App

Changing File Paths

1. Update the **shapefile**:
   - Replace this line with your new shapefile path:

     ```
     ne_shp <- vect("Path/To/Your/Shapefile.shp")
     ```

2. Update the **raster data directory**:
   - Replace this path in the app:

     ```
     textInput("tifDirectory", "Enter Directory Path for TIF Files:", value = "Your/Directory/Path")
     ```

Part 2: Visualization Summary

GDP Analysis

Key Insights: - The GDP plot for Aruba shows significant **declines in 2008** (Global Financial Crisis) and **2020** (COVID-19 pandemic). - A strong recovery is observed post-2020.

Population Analysis

Key Insights: - Gradual increase in total population over the years. - Breakdown by age group: - Ages **0-14**: Declining trend. - Ages **15-64**: Remains the largest group. - Ages **65+**: Increasing proportion.

CO2 Emissions Analysis

Key Insights: - A sharp **decrease in 2010**. - Fluctuations observed post-2015. - **2020 drop** due to reduced transport activity during the pandemic.

Note:

The GDP, Population, and CO2 plots were finalized after the Mangrove section was completed, and the combined presentation was enhanced with the help of ChatGPT for polishing.

**Part3. Debugging the Application

3.1. Handling Missing Files If no TIF files are found: Ensure the directory path is correct. Check for valid .tif files in the specified folder. Use this line to debug: r Copy code files <- list.files(input$tifDirectory, pattern = ”

.tif“, full.names = TRUE) print(files) 3.2. Resolving CRS Issues If rasters are missing coordinate reference systems (CRS), assign a CRS manually: r Copy code if (is.na(crs(raster))) { crs(raster) <-”EPSG:4326” } 4. Updating Dependencies 4.1. R Packages Ensure all required packages are installed and updated: r Copy code install.packages(c(“shiny”, “terra”, “dplyr”, “ggplot2”, “lubridate”, “DT”, “leaflet”, “forecast”)) update.packages() 5. Common Errors and Solutions Error Cause Solution “No TIF files found!” Invalid directory or no .tif files Check directory path and file format. “CRS is missing” Rasters lack a coordinate reference Assign CRS using crs(raster) <- “EPSG:4326”. Blank graphs or tables Filters exclude all data Ensure valid date range and file names. App fails to start Missing or outdated packages Install and update required packages. 6. Testing the App 6.1. Before Deployment Verify all inputs (TIF files, shapefiles) are accessible. Test different date ranges and file navigation. 6.2. Regular Checks Ensure outputs (maps, tables, graphs) display expected results. Test for responsiveness when using large datasets.