The Carbon Canopy

Where Trees Rewrite the Climate Story

GROUP

Bhuyka Nishchitha ID :1M1BGI050827

Yelugu Kavya ID : 1M1BGI050506

Project Background

"The Carbon Canopy Project is about more than planting trees — it's about measuring how forests actively rewrite our climate story. Using simulation models, we estimate CO_2 sequestration by different tree species and strategies, helping communities and policymakers understand the long-term impact of afforestation. Our canopy becomes the shield, and our data becomes the proof."

Problem Statement

- "Tree-planting projects lack accurate, long-term data on CO_2 sequestration and ecological impact, making it difficult to quantify their real contribution to carbon footprint reduction."
- Its difficult to measure long-term CO_2 capture and ecological benefits of tree-planting projects.

Our Solution

- Smart CO_2 Model – Python/R model to predict carbon capture over 10–20 years.
- Data-Driven Insights – Use growth, biomass & survival rates for accurate sequestration estimates.
- Community Involvement – Engage schools, citizens in planting drives.
- Low-Cost Strategy – Focus on native, fast-growing, and climate-resilient species.
- Awareness & Ownership – Give people measurable results of “their trees,” motivating participation.

Goals

- "To develop a cost-efficient, data-driven model that quantifies long-term CO_2 sequestration from afforestation, while promoting community participation and awareness to maximize ecological and social impact."

Interpretation

For a 1,000-tree teak cohort planted in Telangana, modeled using conservative, literature-aligned growth parameters, above-ground biomass accumulates rapidly during years 3–12 and approaches maturity by year 20. Using an IPCC wood carbon fraction of 0.47, the cohort's cumulative CO_2-equivalent sequestration reaches the order of several hundred to ~800+ tonnes CO_2 over 20 years (see exact annual numbers in cohort_results_teak.csv). Weekly observational samples (ages 1–20 yrs) were simulated with small measurement noise to provide a 3–4 week monitoring dataset suitable for validating growth-model fits and creating plots for presentations.

Tools

- Programming: Python, R
- Libraries/Packages: Pandas, NumPy, Matplotlib, ggplot2, SciPy
- Modeling: Growth curve modeling, regression, simulation techniques
- Geospatial Tools (if extended): GIS, QGIS, Cartopy
- Visualization: Dashboards (Plotly, Power BI, Tableau), charts/graphs
- Documentation & Reporting: MS Excel, Word, PPT

Content

- Cohort Simulation: For 1000 trees (Teak case), above-ground biomass reached ~600 tonnes over 20 years.
- CO_2 Sequestration: Equivalent to ~800 tonnes CO_2 captured in 20 years (per 1000 trees).
- Comparison Dataset: Different species show variable capture rates, guiding species selection.
- Outputs Delivered:
- CSV datasets (annual + weekly observations)
- Graphs of biomass & CO_2 growth
- Policy brief template + community awareness content
- Impact: Demonstrates measurable, long-term benefits of afforestation for Telangana.

Notes

The completed project outputs include CSV datasets, growth plots, and a one-page policy brief template. Our results show that afforestation with 1000 teak trees alone can capture around 800 tonnes of CO_2 in 20 years, with similar estimates available for other species. This makes the project not only cost-efficient but also community-engaging.

Key Features

- Carbon Sequestration Modeling – Predict CO_2 absorbed by different tree species over 10–20 years.
- Data-Driven Approach – Uses growth curves, biomass carbon content, and survival rates.
- Scenario Analysis – Simulate different planting scales, regions, and species mixes.
- Impact Visualization – Graphs/interactive dashboards to show carbon capture potential.
- Policy & Community Integration – Outputs designed to support planners, CSR projects, and schools.

Impact

- Quantifiable Climate Action – Provides measurable CO_2 sequestration data.
- Better Planning – Helps policymakers and NGOs design effective afforestation programs.
- Cost Efficiency – Optimizes choice of species and planting strategies for maximum impact.
- Community Engagement – Encourages citizen participation by showing personal impact (e.g., "your 10 trees = X tons CO_2 saved").
- Supports Sustainability Goals – Aligns with SDGs, CSR activities, and carbon credit programs.

Thank You