# Evaluating Tree Species for Carbon Sequestration at Madrona Marsh

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## Project Motivation & Goals

**Key Issue:**

Urbanization and industrialization are exponentially increasing $CO_2$ emissions, contributing to worsening climate change, according to the UN Environment Program. These issues demand nature based solutions that are sustainable.

**Solution:**

Trees absorb $CO_2$ and improve air quality through carbon sequestration.


*Fig 1. Map of the tree locations at Madrona Marsh, which is located within an urbanized area of Torrance, CA*

**Goal:**

To determine which tree species at Madrona Marsh (Fig. 1) in Torrance, CA are most effective at sequestering carbon and contributing to climate resilience in urban ecosystems.

- **Objective 1:** Investigate the carbon sequestration capacity of four tree species
- **Objective 2:** Examine how tree size and environmental factors, such as proximity to human activity (e.g., gas stations, car washes), influence carbon absorption
- **Objective 3:** Assess the role of these tree species in mitigating climate change

## Project Outcomes

**Tree Size & Sequestration:**

Larger trees sequester more carbon due to their greater biomass, with height and diameter being key factors. Our findings highlight eucalyptus trees as exceptional candidates for carbon storage.

**Highest Sequestration:**

Eucalyptus (E3C) stored 1569.76 kg of carbon, making it the most efficient species in this study.

**Lowest Sequestration:**

Oak trees stored the least carbon, with O1A at 10.62 kg and O3C at 10.66 kg, reflecting their slow growth rate.

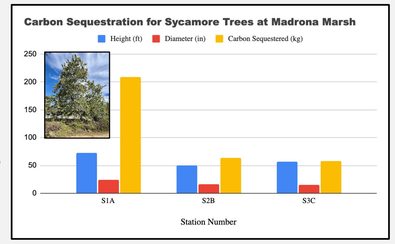
**Species Comparison:**

- **Eucalyptus:** Rapid-growing, highest sequestration, dense wood maximizes carbon storage efficiency.
- **Cottonwood:** Fast-growing, well-suited for urban carbon capture but stores less than eucalyptus.
- **Sycamore:** Moderate sequestration (S1A: 208.17 kg, S3C: 58.23 kg), indicating slower accumulation but long-term potential.
- **Oak:** Slowest-growing, lowest sequestration, but may contribute more over very long timescales.

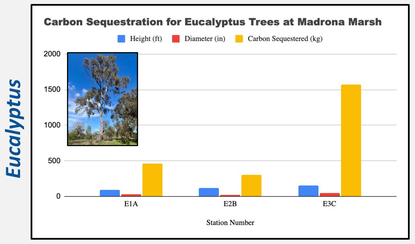
**Sequestration Trends:**

Eucalyptus (E3C) sequestered over three times more carbon than the next-highest species (Cottonwood C2B), highlighting its superior efficiency for short to medium-term carbon capture initiatives.

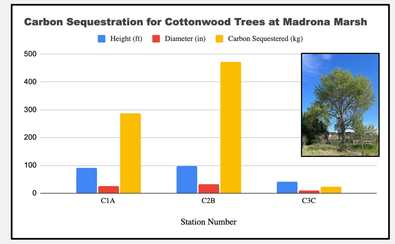
*Sycamore*



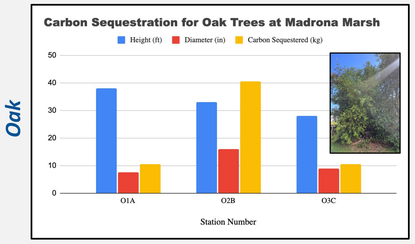

*Eucalyptus*




*Cottonwood*



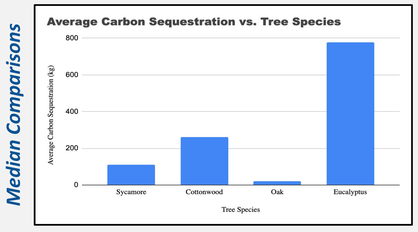

*Oak*




**Environmental Context and Observations**

**Preliminary observations suggest that trees located near gas stations and roads may have higher $CO_2$ exposure (Sites 2B and 3C), potentially increasing their sequestration rates.**

*Median Comparisons*




## Methods

- Project took place in **Torrance, CA** in **Los Angeles County** (Fig 2)
- Field work duration was from **October-December** (Fall/Winter)
- **3 sites** with one of each tree species: sycamore, oak, and cottonwood
- Eucalyptus trees were chosen from **scattered areas** in marsh (Fig. 1)
- Two key measurements were recorded for each selected tree
  - ❖ ***Tree Diameter at Breast Height*** *– Measured using a rope and a measuring tape*
  - ❖ ***Tree Height*** *– Measured using a clinometer (Fig. 3)*

**Carbon Sequestration Formulas**

*Above Ground Biomass (AGB) = ¼ x $D^2$ x H*
*Below Ground Biomass (TGB) = ⅛ × AGB*
*Total Biomass (TB) = AGB + BGB*
*Total Dry Weight (TDW) = TB × 0.725*
*Total Carbon (TC) = TDW × ½*
*$CO_2$ weight = TC × 3.67*


*Fig 2. Location of Torrance, CA*


*Clinometer*

*Fig 3. Using clinometer to measure height*

## Community Partnership

**About Madrona Marsh Nature Preserve:**

- Madrona Marsh is a seasonal wetland with vernal pools
- The 43 acres of land were once a former site of oil wells later transformed into a natural landscape
- One of the few natural areas in the South Bay region of LA County remaining

**About Miriam Taeubel (Community Partner):**

- Instructor II and Research Advisor at Madrona Marsh with a PHD in Environmental Science
- Participated in various professional research papers
- Helps students carry out their research in the field and analyze the data
- Began working together for my project in September of 2024


*Madrona Marsh*

*Miriam and I*

*Planting an Identification Flag*

## Conclusion and Next Steps

**Overall Takeaways:**

- **Tree selection for carbon sequestration**: Eucalyptus and cottonwood are the best choices for rapid carbon capture.
- **Long-term benefits**: Oaks sequester less carbon short-term but may store more over centuries.
- Planting trees with greater height and width is crucial for maximizing carbon storage.

**Future Plans:**

- I will be presenting my findings at the **Madrona Marsh Science Fair** on May 24, 2025
- My research will contribute to helping the marsh plant the particular trees to **efficiently combat increasing carbon** in the environment

## Acknowledgements and References

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*References:*

*Cities and climate change – UN Environment Program*