Relative Growth Rate and Carbon Storage among Various Tree Species at Mae Sa Mai Restoring forest, Mae Rim District, Chiang Mai Province

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Abstract

The study and compare the growth rates of seedling and carbon storage of trees at Mae Sa Mai restoring forest, Mae Rim District, Chiang Mai Province was done by analyzing data on root collar diameter (RCD), height and diameter at breast height (DBH) with weather data using python programming to process data from the Terra satellite in the Google Earth Engine database.

The results found that different tree species have varying growth rates and carbon storage capacities depending on their physiology and weather condition especially rainfall factor. These can be categorized all tree species into 3 groups

- Fast-growing tree with highest carbon storage from the age of 5 years include *Erythrina Subumbrans*.
- Trees that reach peak carbon storage between 6-20 years include *Castanopsis calathiformis, Spondias axillaris, Alseodaphne andersonii,* and *Nyssa javanica*.
- Trees with the highest carbon storage when older than 20 years include *Alseodaphne andersonii, Ficus altissima,* and *Prunus cerasoides*.

Therefore, the appropriate sequencing of seedlings for planting is a factor to be consider for a fully functional ecosystem and efficient carbon dioxide sink.

Research Scope

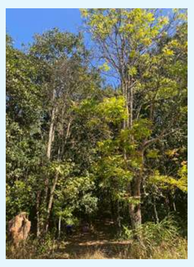
Research question : How do different types of perennial plants have different growth rates and carbon storage rates in each period?

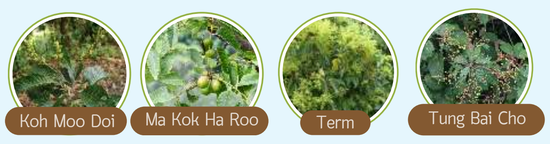
Hypothesis : Different types of perennial plants have different seedling growth rates and carbon sequestration rates.

Purposes of project : To study and compare the growth rate of seedlings and the carbon sequestration rate of each type of perennial plant

Methods

1. Select the study area ; Ban Mae Sa Mai restoring forest ;18.5127N, 98.5052E (seedlings have been planted since 1998)
2. Choose the species of trees which have a survival rate over 75% for the first three years. (12 species)
3. Measure all tree species for data of year 2023, including height, diameter at breast height (DBH), canopy width and length.

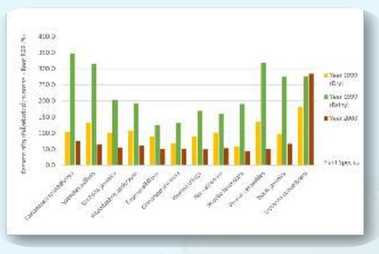


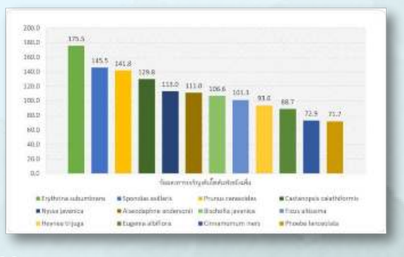


4. Analyze the relative growth rate of root collar diameter (RGR-RCD) from the database of FORRU observe in 1998-2000 andthe carbon storage rate of each tree species from the FORRU database in 2002-2020 and from the current collecting in 2023
5. Organized weather data with Python program through Terra satellite in Google Earth Engine database.
7. Compare seedling growth rates and carbon storage of each tree species
8. Discussion and conclusion.

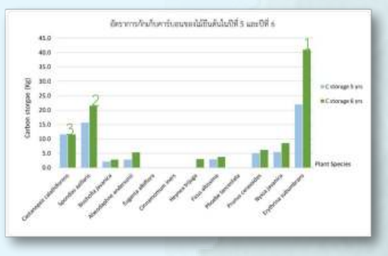
Result and Discussion

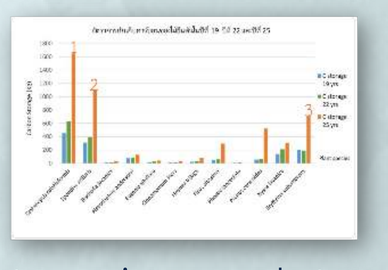
Relative growth rate of root collar diameter (RGR-RCD) each species of seedling has a different growth rate. *Erythrina Subumbrans* has the highest growth rate, then *Spondias axillaris, Prunus cerasoides, Castanopsis calathiformis,* and *Nyssa javanica*.





Carbon Storage each species has different carbon storage amounts over the years. During the 5-6 year period, *Erythrina subumbrans* is the highest rate of carbon storage. While by the 19th year, climax species like *Castanopsis calathiformis* and *Spondias axillaris* became the highest rates instead. This is because both of these species have fully grown with tall trunks and forming dense canopy cover, leading to limited light reaching the forest floor. This may limit the growth of light-demanding other tree species like *Erythrina*.

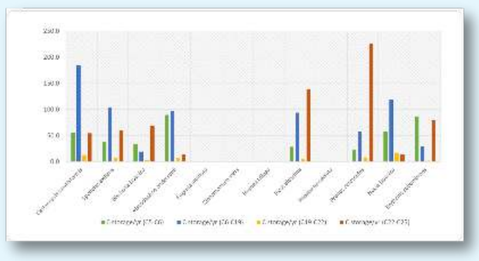


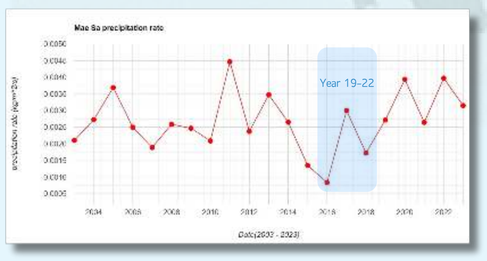


From comparing the annual carbon storage increases between each year and the previous year. We can divided trees into 3 groups as follows:

- Fast-growing tree with highest carbon storage from the age of 5 years include Erythrina Subumbrans.
- Trees that reach peak carbon storage between 6-20 years include Castanopsis calathiformis, Spondias axillaris, Alseodaphne andersonii, and Alseodaphne andersonii.
- Trees with the highest carbon storage when older than 20 years include Alseodaphne andersonii, Ficus altissima, and Prunus cerasoides.

Furthermore, unsuitable weather may also result in a decrease of carbon storage which can be seen from the relation between an average carbon storage per year of tree species at 19-22 years and the reduced rainfall during the same period. These factor may effect to low carbon storage continuously several years in some tree species as *Alseodaphne andersonii*, and *Nyssa javanica*.





Conclusion

From the results it has been concluded that each tree species has different growth rate and carbon storage, depending on the plant physiology and weather conditions. Furthermore being careful about planting exotic species into the area is also important, as *Castanopsis calathiformis*, a species brought from other areas, which has tall trunk and thick canopy and no consumer of the seeds and seedlings. Then it spreads and become a dominant species in the area, which affects the reduction in the overall number and the growing ability of local species eventually.

Scientific name of tree

- Koh Moo Doi - *Castanopsis calathiformis* (Skan) Rehder & E.H. Wilson
- Ma Kok Ha Roo - *Spondias axillaris* Roxb.
- Term - *Bischofia javanica* Blume
- Tung Bai Cho - *Alseodaphne andersonii* (King ex Hook.f.) Kosterm.
- Ma Ha - *Eugenia albiflora* Duth. ex Kurz.
- Ta Sue Tung - Heynea trijuga Roxb. ex Sims
- Aob Shei - *Cinnamomum iners* (Reinw. ex Nees & T.Nees) Blume
- Krang - *Ficus altissima* Blume
- Lae Book - *Phoebe lanceolate* (Wall. ex Nees) Nees
- *Nang Praya Sue Klong* - *Prunus cerasoides* Buch.-Ham. ex D.Don
- Kang Kak - *Nyssa javanica* (Blume) Wangerin
- Thong Lang Pa - *Erythrina Subumbrans* (Hassk.) Merr.

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