A study of biomass production in relation to age in North Central New Mexico on Piñon Pine (Pinus edulis) stands.
Matthew Herrera, Kenneth Lopez, & Joaquin Gallegos, Environmental Science
Northern New Mexico College, Española, NM

Abstract
The results indicate specific regional growth pattern for Pinon Pine. The data about each forest stand.

Introduction
Pinon and Juniper wood lands are among some of the least studied forest types in North America. Due to the lack of research, during the mid-20th century these woodlands were deemed a nuisance and were subject to intense destruction. More than 3 million acres of piñon forests were converted to grasslands, generally under the auspices of "invading piñon" myth - a theory developed to support the creation of grasslands for the cattle industry at taxpayer expense (Destroying millions of acres of pine nut groves in the Great Basin, 2011). The destruction of these areas negatively affected species of wildlife and other vegetation's which whom relied on their presence for survival. One the major complications that arises when studying these species is determining age and biomass which in part makes it difficult in studying other parameters including: Height, DRC (Diameter at Root Collar), Crown Ratio, basal area, crown class, disease and pest outbreak. By gathering age on these stands will lead to better understand the complex growth physiology overall. This data on Piñon provides strong relationships between age total Height (R² = 0.53), DRC (R²<0.73), and Crown Ratio (R²<0.02) provide insightful data to ecologists, foresters, ranchers and other land managers on the crucial importance and the role they play on the ecosystem in the greater Southwest.

Results
A. Total Height
\[ y = 3.7752 \ln(x) - 1.338 \quad R^2 = 0.9386 \]
B. Diameter at Root Collar
\[ y = 0.552x^{0.894} \quad R^2 = 0.7129 \]
C. Crown Ratio
\[ y = 0.049x + 0.325 \quad R^2 = 0.4872 \]

Discussion
Piñon is a long-lived tree, maturing up to 250 years. Depending on the site, mature piñon trees range between 5 to 30 feet in height. Although large trees are common, especially in Northern New Mexico, piñons are generally small trees, usually less than 30 feet tall. In the graph on Total Height compared to age the graph has a rapid increase up to around 80 years old and then deliberately levels off (R²<0.53). The oldest tree core sampled in this research was 2450 years old and 25 feet in height. On the graph on DRC in comparison to age, it has a gradual consistent increase up to 125 years then increase slows (R²<0.73). DRC shows the strongest relationship with age out of all the variables within the study. What is noticed is that as the tree ages DRC contains a constant growth throughout the trees life. This indicates increases of biomass and carbon fixation. On the graph of crown ratio to age the crown ratio remains the same at approximately 80% throughout the trees life (R²<0.02). This data shows the weakest relationship and a vague funnel shape as a tree approaches 80%. Noisy data in the early seral stage indicates a funnel pattern and could be further supported by increased sampling of Piñon trees that are approaching 150 years old or a climax community. This is due to the lack of fire and thinning, increasing stand density and having little understory.

Conclusion & Implications
Piñon juniper stands are becoming overcrowded due to the suppression of fire. This increase has altered the physiology of piñon trees, forcing their crown ratio to remain the same throughout their life span. Understory growth has been greatly reduced due to the increase of canopy cover in these regions. Tree height increases rapidly until approximately 25 years of age and slowly increase to 125 years and plateaus soon after. Reasoning for this is that saplings grow rapidly in height to outcompete other surrounding vegetation to acquire more nutrients, sunlight, and water. To restore piñon juniper stands to their natural setting fire and thinning needs to be reintroduced to these areas. The removal of competition for limited resources will benefit the health of understory vegetation and piñon trees. While Total Height levels off significantly after 80 years, DCR continues to gradually increase showing continued biomass increase and carbon fixation. Increase in understory growth will help reduce runoff and sediment transport, increasing infiltration and soil moisture, moderating soil temperature, freeze-thaw and evaporation, redistributing nutrients, and mitigating grazing impacts in these areas.

Acknowledgments and References
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Materials and Methods
Research was conducted by randomly selecting a plot within five different piñon stands. An indicator tag was placed at the center of each plot for reference point. Coordinates were also acquired for each plot, along with the date and time of the study. Any tree that was within 23 feet from each reference point was flagged and analyzed for this experiment. Tree height, basal area, diameter of root collar, mistletoe sightings, canopy cover, crown ratio, crown base height, and a tree core samples were taken for each tree within the plots. The three factors that this study will be focusing on consist of basal area, crown base height, and crown closure though. Tree core samples were taken from living piñon and pine trees only. All other trees were excluded.

101 tree core samples were aged by using low magnifying microscopes to count tree rings. Each sample was counted and recorded on a data sheet with the age of each tree. Age data was compared to Total Height, DRC and Crown Ratio. Statistical analysis was performed and utilized a best fit protocol. Total Height utilized a Logarithmic Regression, DRC utilized an Exponential Regression, and Crown Ratio = Linear Regression.

Literature Cited


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Literature Cited

