Comparison of Snag Dynamics in Four Forest Community Types of the Central Pine Barrens

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ABSTRACT

The Long Island Central Pine Barrens (CPB) contains a variety of threatened forest communities that require active management. To determine future management practices the Foundation for Ecological Research in the Northeast (FERN) has initiated a forest health-monitoring project to evaluate potential forest health indicators (e.g. amount of available habitat) in the CPB. Snags (standing dead trees) provide suitable habitat for a variety of forest wildlife. The goal of this research was to quantify the abundance of snags in four of the forest community types in the CPB, to determine which contains a greater amount of available habitat. Field data was collected at forty random plots (16 x 25meters, 400m^2), using the Monitoring Protocols for Central Pine Barrens Field Plots prepared by Michael S. Batcher. The field data collected at the forty plots was analyzed to estimate the abundance of snags in the targeted community types and establish the average diameter at breast height (dbh) of snags in each community type. Data analysis shows that the community type with the greatest incidence of snags/acre is coastal oak forest followed by oak-pine, pine-oak, and pitch pine, respectively. However more data is needed to increase the accuracy of the findings. The greatest average dbh exists in oak-pine forest, but when a standard deviation is applied to the data it shows there is no difference in the range of dbh's in each community type. This research is ongoing and when the data presented here are linked with future data, they can be used to determine the health of the forest.

INTRODUCTION

The Central Pine Barrens (CPB) make up approximately 41,683 hectares (ha) of Long Island, New York, (see Figure 1) and comprise a mosaic of threatened ecological communities (e.g. Forests, Woodlands, Shrublands, and globally rare Dwarf Pine Plains) [1]. These different community types are home to a variety of rare damselflies, butterflies, and moths as well as other invertebrates, birds, small mammals, bats, and herpetofauna [2]. The Foundation for Ecological Research in the Northeast (FERN) began a forest health-monitoring program in the CPB, in collaboration with the Pine Barrens Commission, the Upton Ecological and Research Reserve, The Nature Conservancy, the New York State Department of Environmental Conservation, and Brookhaven National Laboratory, to determine future conservation management goals and practices. To accomplish this, the initial research began assessing forest health indicators (e.g. amount of available habitat) to establish their thresholds (e.g. the optimal amount of available habitat per acre) [3].

Snags (standing dead trees) are an important component of forest ecosystems; they play an essential role in forests' food web and wildlife habitat. As a snag begins to decompose it is colonized by invertebrates that convert the snag into a food source for many wildlife species such as woodpeckers who have the unique ability to drill for food and excavate cavities. Cavities made, used, and eventually abandoned by woodpeckers become available habitat for secondary cavity nesters (e.g. birds, herpotafauna, small mammals, invertebrates), incorporating snags into the life cycles of a large diversity of wildlife (see Figure 2).

The goals of this research were to 1) Quantify the abundance of snags in four of the forest community types, coastal oak, oak-pine, pitch pine, and pine-oak, in the CPB then 2) Determine which community type contains a greater amount of available habitat, and 3) Establish the average diameter at breast height (dbh, approximately 4.5 feet above ground) of snags in each community type.

MATERIALS AND METHODS

All methods used to collect data came from the CPB forest health monitoring protocols by M. Batcher [3]. Field data was collected at forty random plots [16 by 25meter (m) 400m^2], located no closer than 50m to edges of human-dominated land use, other plots, and wetlands, and no closer than 25m to boundaries of other target community types (see Figure 3). This was to assure that plots were within specific community types and not in transitions between community types. The Nature Conservancy (TNC), generated the plot locations in Geographic Information System (GIS), in the target forest community types in the entire 41,683ha CPB.

Each plot was then located using orthophotographs and Global Positioning System (GPS) units to navigate to the Universal Transverse Mercator (UTM) coordinates generated in GIS.

Once the plot was located, the area was scouted to make sure there were no disturbed areas, roads, or other features that would make the location inappropriate. The

GPS location derived from the GIS was used for the first marker (M1). All other markers were placed relative to M1 (see Figure 4). Using two 50-m tapes, chain pins, sighting compasses and a rangefinder, the corners and boundaries of the 16 x 25m plot were laid out. To reduce heterogeneity within the plot, the long (25m) edge was laid out parallel to any discernible gradient, such as topography, human disturbance, such as a nearby road, or a nearby boundary to a different community type.

At the first marker (M1), the 50-meter tape was laid out toward M3 to establish the M1-M2-M3 16-meter side (see Figure 4). Then, the tape was wrapped around a chain pin and, to delineate one 25-meter side, laid out to M4. Using a second 50-meter tape the 25-meter side from M1 to M6 was delineated and at M6 the tape was wrapped around a chain pin and laid out to M4 to establish the M6-M5-M4 16-meter side.

When the plot boundaries were laid, out the actual length of each side was recorded along with the bearings. A 50-m tape was then laid from M2-M5 and the coordinates of the plot center were recorded. The plot was then permanently marked at each point (M1, M2, M3, M4, M5, M6, CM) with rebar and caps labeled with the plot number and point (e.g. 20M1, 20CM). A t-post was also used to mark M1 and a witness tree was selected outside the plot along the M1-M6 line, or the M1-M2-M3 line. The witness tree's species, dbh, distance and bearing from M1, CM, and M3 or M6 was recorded and an orange horizontal line was spray painted around the tree in addition to a vertical line facing the plot. This was all done to make finding the plot again in the future as easy as possible.

After everything discussed prior was completed, the dbh of all snags in the plot was recorded. All snags counted in this research were rooted in the ground within the plot and leaning at an angle of less than 65^0 from vertical (90^0), or 25^0 from horizontal and had a dbh greater than 10 cm. Snags were marked with chalk as they were measured to ensure that none were counted multiple times. When the dbh of all the snags in the plot was recorded all equipment was collected and the plot was complete.

All data was entered into a Microsoft Access database created by M. Batcher. The data was then transferred to a Microsoft Excel spreadsheet for analysis.

RESULTS

The number of snags in each community type was averaged and rounded to one decimal place (see Table 1). Those numbers were then extrapolated to represent the amount of snags/ha, presented in Figure 5, and extrapolated further to estimate the total number of snags in the entire area of each community type in the CPB (in Table 2, and Figure 6). Coastal oak forest contained the largest average number of snags per plot, number of snags per acre, and actual number of snags in the CPB (3.4/plot, 85/ha, and 638,010 total), followed by oak-pine forest (1.9/plot, 48/ha, and 504,384 total), pine-oak forest (0.8/plot, 20/ha, and 79,460 total), and pitch-pine forest (0.2/plot, 5/ha, and 32,850 total).

The average dbh per community type was calculated and rounded to one decimal place; a standard deviation was also calculated for the dbh's of each community type (see Table 3 and Figure 7). Oak-pine forest had the highest average dbh and standard deviation (13.6, ±4.161524), followed by coastal oak forest (12.7, ±3.536832), pitch pine forest (12.2, ±0), and pine-oak forest (11.9, ±1.563117).

DISCUSSION AND CONCLUSION

The community types examined in this research follow a pattern of succession that generally starts with pitch pine forest, which is then succeeded by pine-oak forest, oak-pine forest, and finally reaches coastal oak, the climax community. In their natural state, the CPB communities are dependent on wildfires to convert them from a later stage, such as coastal oak forest, to an earlier stage, such as pine-oak forest [2]. Based on the fact that pitch pine forest exists as a result of disturbance by wildfires, and coastal oak forest exists as the result of a lack of disturbance by wildfires, we would expect to see the greatest abundance of snags in coastal oak forest. Consequently, we would expect that amount to decline in oak-pine forest, pine-oak forest and pitch pine forest, respectively.

The data clearly show that the coastal oak forest community in the CPB contains the greatest abundance of available habitat in the form of snags. As expected that amount declines in oak-pine forest, pine-oak forest, and pitch pine forest. However, statistical analysis is needed to determine if we have sampled enough plots in each community type for the data to be statistically significant and if we haven't, further analysis is need to determine the number of additional plots that need to be sampled in each community type to make the data statistically significant. Average dbh's show that the oak-pine forest community contains the largest average dbh, although, as seen in Figure 7, when the standard deviation is applied to the data it shows there is no difference in the range of dbh's in the different community types. Pitch pine forest and pine-oak forest, again, lack a sufficient number of plots to represent them in this research; there was only one snag in the five pitch pine forest plots, so a standard deviation could not be applied.

This research is the first step in an ongoing project to monitor the health of the CPB. The baseline data presented in this paper gives a general idea of the abundance and average densities of snags in the CPB, and when it is linked with data from future sampling it can be used as an indicator to help establish the health of the forest. When the data is complete research needs to be conducted on the cavity dependent species of the CPB to determine the optimal number of snags/ha for each of those species dependent on snags to sustain a healthy population. Then, by overlapping the optimal number of snag/ha each species needs and comparing that to what's available to them in the different community types the diversity of wildlife populations in those community types can be estimated and that information can be used to aid in the development of future environmental management plans for the CPB. To enhance future data it is suggested that modifications be made to future sampling protocols to include the condition of the snags as in [4,5,6], the number of foraging/nesting cavities as in [6], what species of animal, if any, is using the snag and for what purpose as in [6].

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Community Type	Average Number of Snags	Number of Plots Sampled
Oak-Pine	1.9	17
Coastal Oak	3.4	14
Pitch Pine	0.2	5
Pine-Oak	0.8	4

Table 1: A comparison of the average number of snags in each community type and the number of plots sampled in each community type.

Community Type	Number of Hectares in the CPB	Total Number of Snags
Oak-Pine	10,508	504,384
Coastal Oak	7,506	638,010
Pitch Pine	6,570	32,850
Pine-Oak	3,973	79,460

Table 2: Total estimated number of snags in the entire area of each community type.

Community Type	Average Snag dbh	Standard Deviation
Oak-Pine	13.6	±4.161524
Coastal Oak	12.7	±3.536832
Pitch Pine	12.2	±0
Pine-Oak	11.9	±1.563117

Table 3: Average snag dbh per community type with their relative standard deviation.

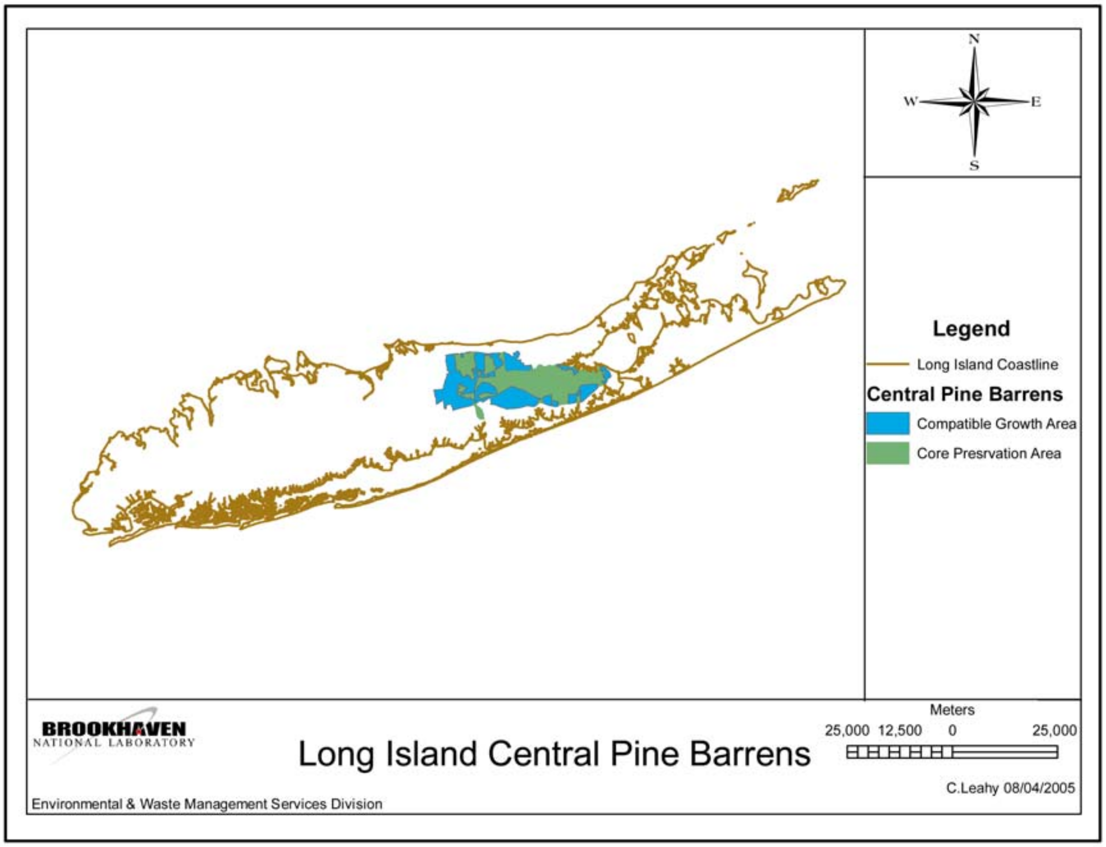

Figure 1: A map of the CPB separated into the 21,448 ha compatible growth area and the 20,235 ha core preservation area.

Figure 2: A flying squirrel using a cavity in a 12.2 dbh oak snag for habitat.

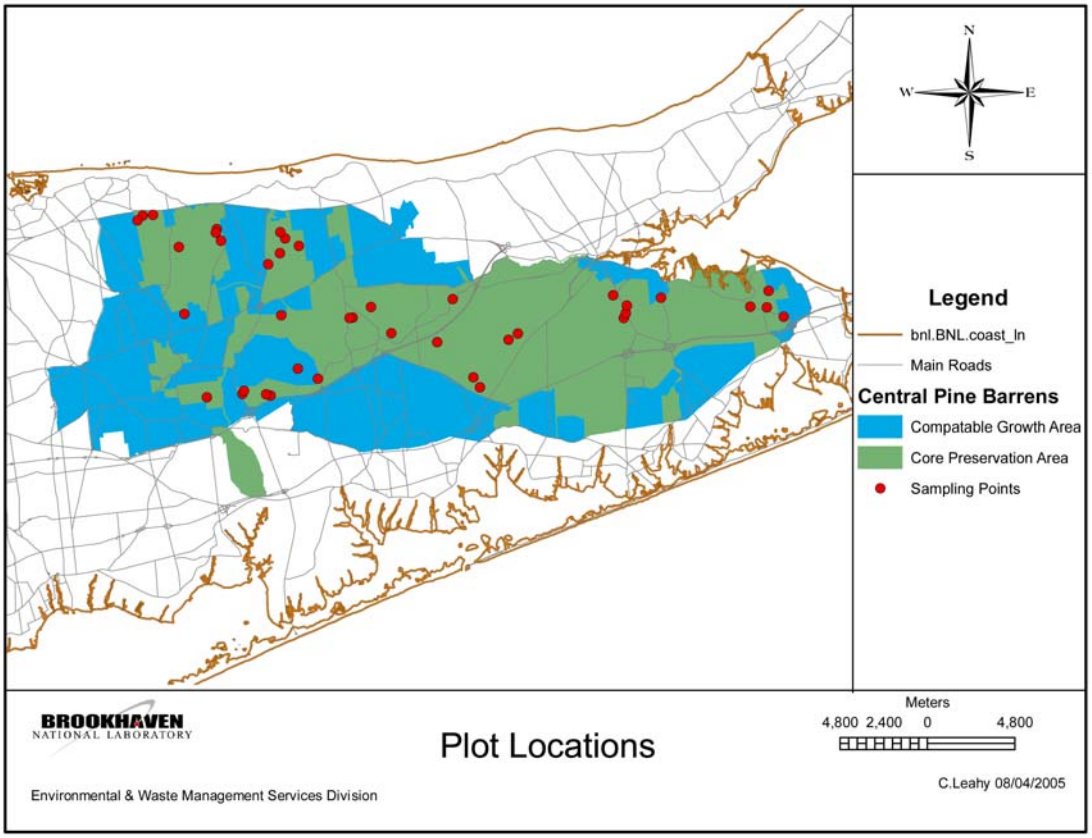

Figure 3: A map of the locations of the forty randomly located plots within the CPB.

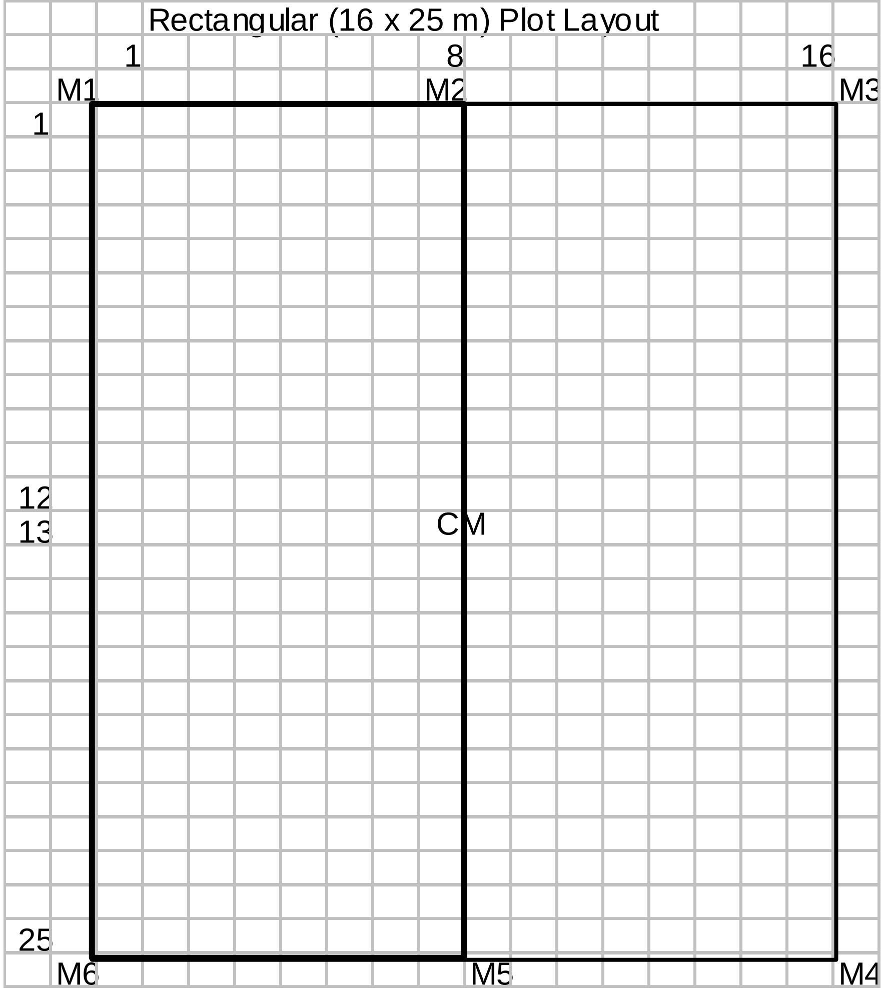

Figure 4: Example of plot layout adapted from [3]

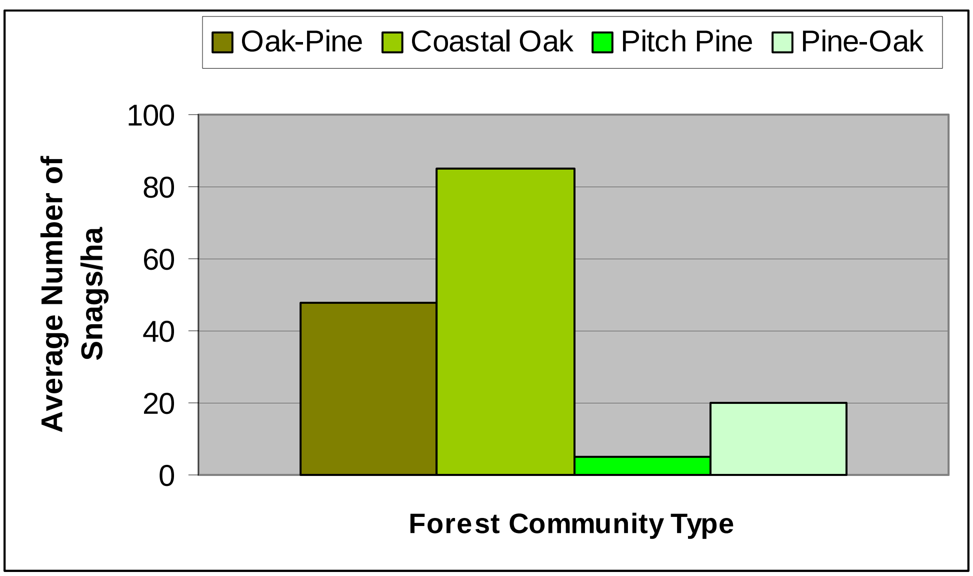

Figure 5: The average number of snags/ha calculated for each community type.

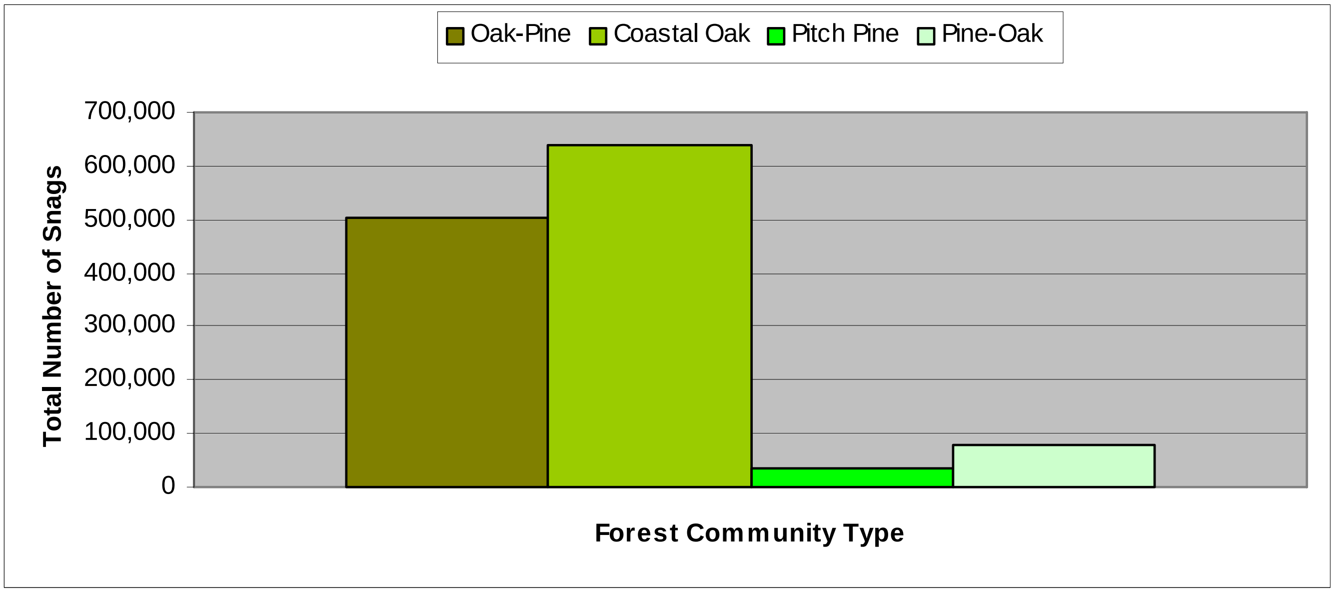

Figure 6: The total number of snags in each community type.

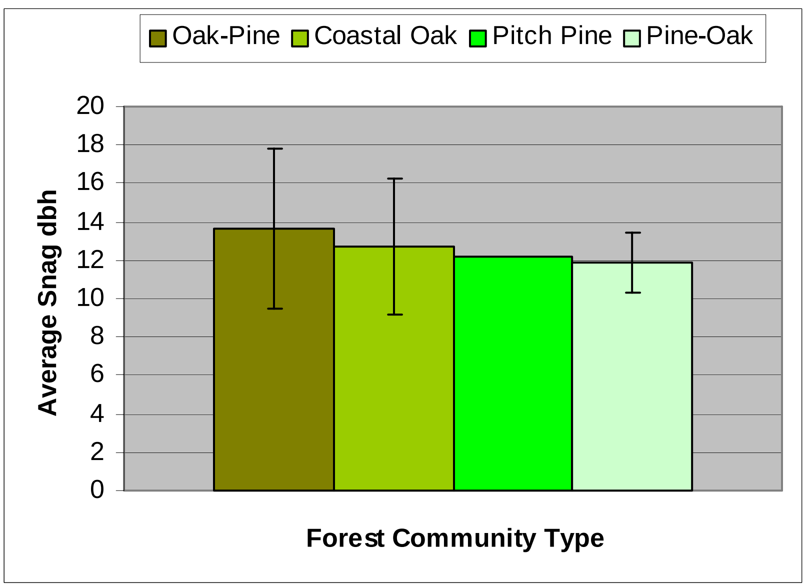

Figure 7: Average dbh of snags measured in each community type with their relative standard deviation.