

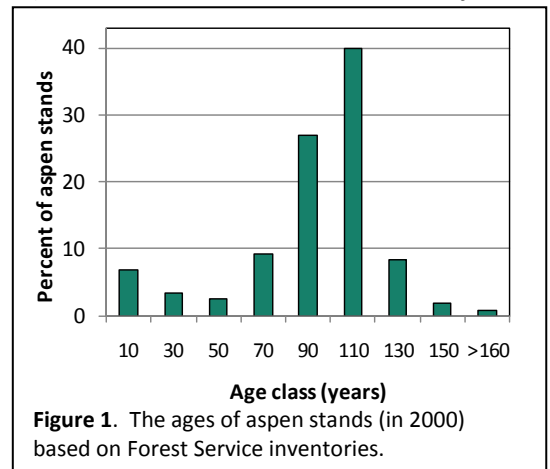
# How old are aspens on the Uncompahgre Plateau?

August 2011

One of the most treasured resources on the Uncompahgre Plateau in western Colorado is the expanse of quaking aspen (*Populus tremuloides*) forests. Aspen forests provide beauty, wildlife habitat, livestock forage, timber, and other values. It is tempting to assume that these forests always have been and always will remain as they are now, but we know that forests are never static. How dynamic have aspen forests been in the past? Has the Plateau always had aspen forests like those we see today, or were aspen more or less abundant in the past? What will the future of aspen be on the Plateau?

The current ages of the aspens provide insights into these questions. For example, if we have lots of young trees today, then we might expect good, healthy aspen forests in the future. If we have far fewer young trees than would have been typical in the 19<sup>th</sup> and 20<sup>th</sup> centuries, the Plateau will have less aspen “character” in the 21<sup>st</sup> century. Therefore, in the summer of 2010, a collaborative project involving the Uncompahgre Partnership, USDA Forest Service, and Colorado State University aimed to answer the question: How old are aspens on the Uncompahgre Plateau?

This question has two types of answers. One answer might be the ages of the stands of aspen we see on the Plateau today. We might consider the “birthday” of an aspen stand to be shortly after a fire killed most of the overstory trees in a forest, releasing a flush of new suckers that dominate the new stand for decades (or centuries) to come. Given the absence of major fires for more than a century, and the prevalence of selective forest harvesting rather than extensive clearcutting, most aspen stands today are 100 years or older. These are the ages typically reported in forest inventories (Figure 1), and the average age of aspen stands on the Uncompahgre Plateau is about 100 to 110 years; only 20% of the stands are younger than 70 years.



USDA United States Department of Agriculture  
Forest Service

Grand Mesa Uncompahgre and Gunnison  
National Forests



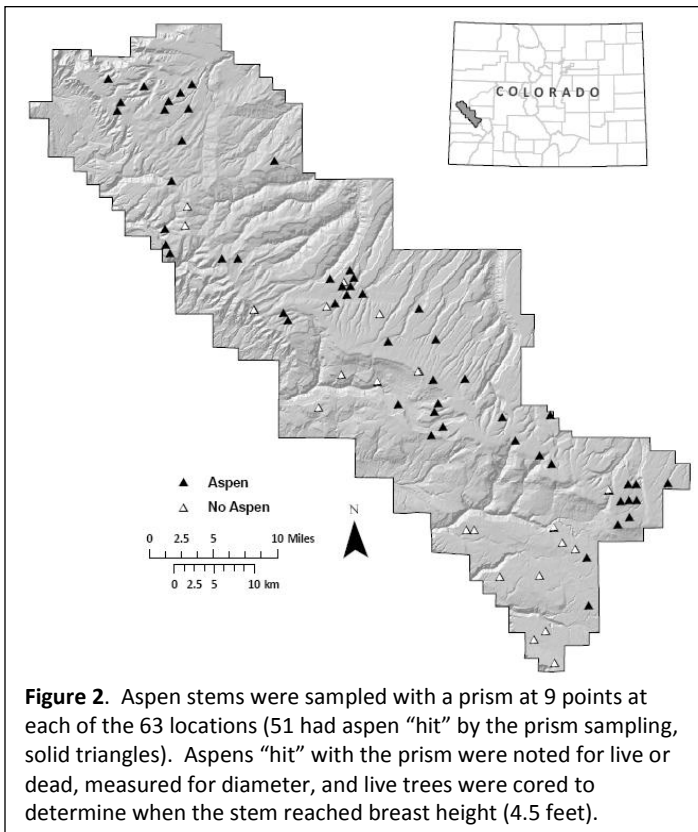
Colorado  
State  
University



COLORADO FOREST  
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However, most aspen stands, and mixed-species stands that contain aspen, have more than one age class of trees. The oldest, dominant trees support root systems that send up suckers over the decades, leading to a variety of ages for aspen trees within a stand. Given that more small trees can fit in a forest than large trees, these younger stems often out-number the old dominant trees in the overstory. Almost any combination of ages and numbers of aspen trees could be found in at least one stand somewhere on the Plateau.

Thus, the second type of answer to the question of “how old are aspens?” would apply to the ages of individual trees. Of all the aspen trees on the Plateau, how many are between 10 and 20 years old, and how many are 20 to 50 years old? If all aspen trees within a stand were the same age, the individual-tree answer would match the answer from the stand-age inventories. However, this is almost never the case; nearly all stands contain trees of multiple ages. Because standard forest inventories do not report the distribution of individual tree ages, this was the focus of the 2010 study.



**Methods:** We sampled 63 random locations across the portion of the Plateau where aspen occurs, and used 9 prism plots at each location to determine the number of aspen trees by size classes (Figure 2). Points were chosen at random so the insights developed from the sampling would fairly represent the overall status and history of aspen on the Plateau. The sizes and ages of individual trees from the prism samples were extrapolated to characterize stand structure and tree age distribution at the scale of an acre and across the entire Uncompahgre Plateau, using standard forestry cruising calculations. For example, if an 8” diameter tree was “hit” with a 20-BAF prism, this tree would have 50.3 square inches of basal area, and represent 57.3 trees/acre of this size. If a core taken from the 8” tree showed an age of 73 years, our accounting approach counted 57.3 trees/acre of this age. All tree ages reported here refer to when a stem reached breast height (4.5 feet), not when the sucker first emerged from the ground; suckers can remain small and suppressed for several years before reaching breast height and subsequently growing to tree size. (More detailed descriptions of the sampling and extrapolating approaches will be available in the journal publication

we’re developing.)

**Results:** Aspen is widespread and common on the Plateau, with an average of 90 trees occurring per acre, adding to 31.5 ft<sup>2</sup>/acre of basal area. The distribution of stems 10” in diameter and greater followed a classic “inverse J-shape” curve expected of a balanced size-distribution stand (Figure 3 C). Extending the trend to smaller trees would suggest the Plateau is missing more than two-thirds of the smaller aspen that would be needed to sustain current size patterns. Trees larger than 12” account for 7% of the aspen trees in 2010, but 25% of basal area.

The oldest tree encountered in the random sampling reached a height of 4.5 feet in 1738 (272 years ago), but very few were older than 200 years. Many aspen trees became established from the 1870s to the 1920s (Figure 4) following fires and other widespread disturbances during that period. The subsequent decades are represented more poorly in the current landscape; given normal rates of mortality as stands develop, the lower densities of these younger age classes will lead to substantially fewer trees in the middle-age classes in coming decades than in the forests in 2010.

Our results reflect changes in the aspen stands that resulted from normal rates of mortality associated with stand development as smaller trees are suppressed and die from competition with larger trees, as well as the recent sudden aspen decline (“SAD”). We did not delve into mortality drivers, but we noted that 3-8” diameter classes had a high proportion of standing dead trees (from stand development or from SAD?). Additional study would be needed to identify specific causes of mortality among aspen size classes.

### Aspen size patterns

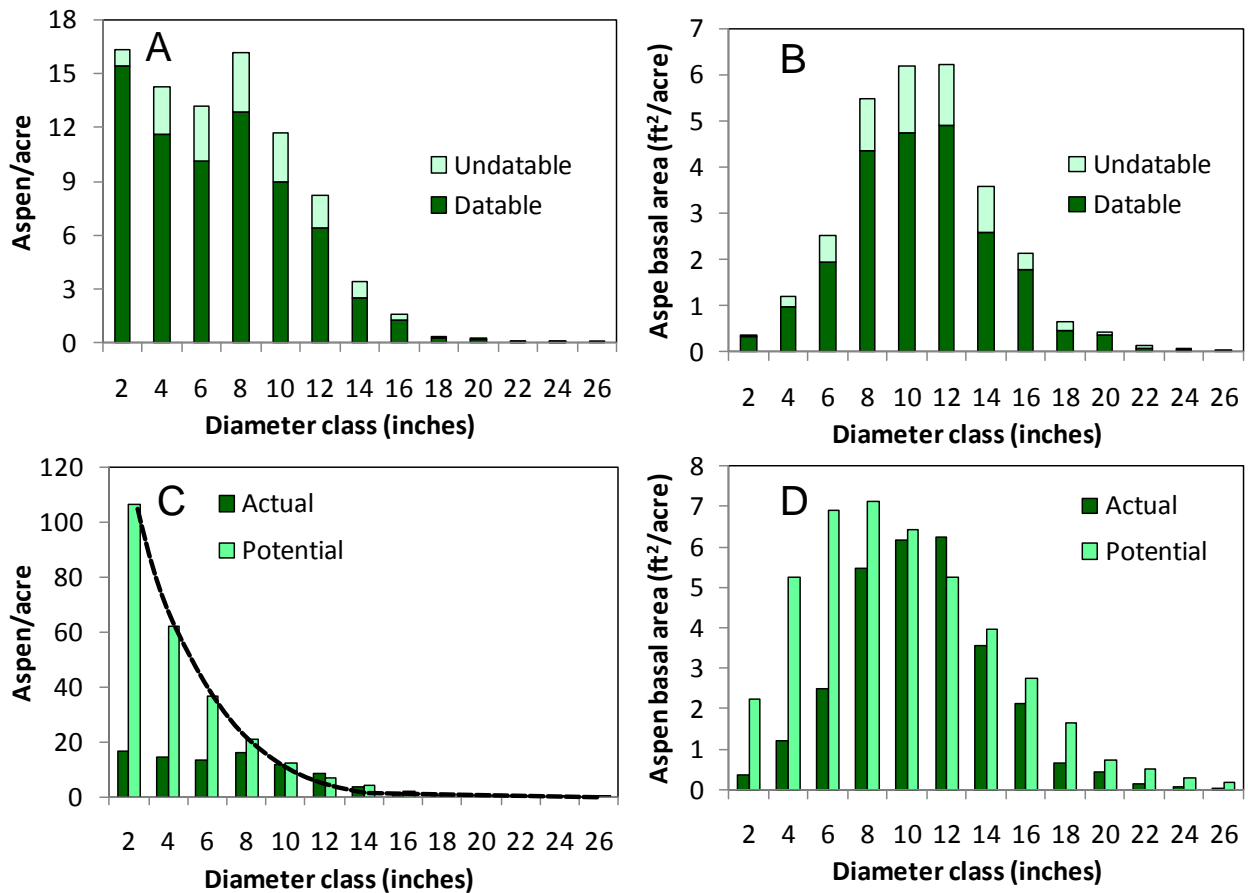


Figure 3. Aspen basal area in 2010 averaged 31.5 ft<sup>2</sup>/acre across the Uncompahgre Plateau. Some trees had heartrot, preventing determination of stem age ("Undatable stems"); the proportion of datable trees declined from about 90% for smaller size classes to about 60% for the largest classes. Trees less than 8" in diameter comprised about 2/3 of all trees (A), but basal area was dominated by trees >10" (B). The number of trees >10" fit an exponential pattern ( $r^2 = 0.98$ ), indicating a consistent pattern of growth of trees into each size class, and death of larger trees. If this trend is extended to smaller diameters (C), the Plateau has only 15% to 30% of the small trees needed to "refill" the size distribution of larger stems. The "missing" smaller diameter trees add up to a current deficit of about 1/3 in the aspen basal area on the Plateau (D).

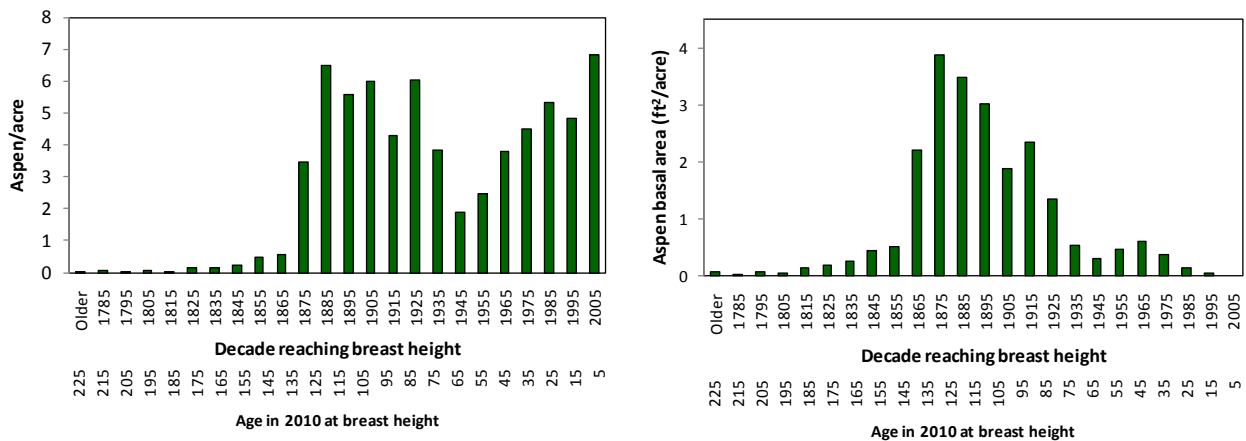
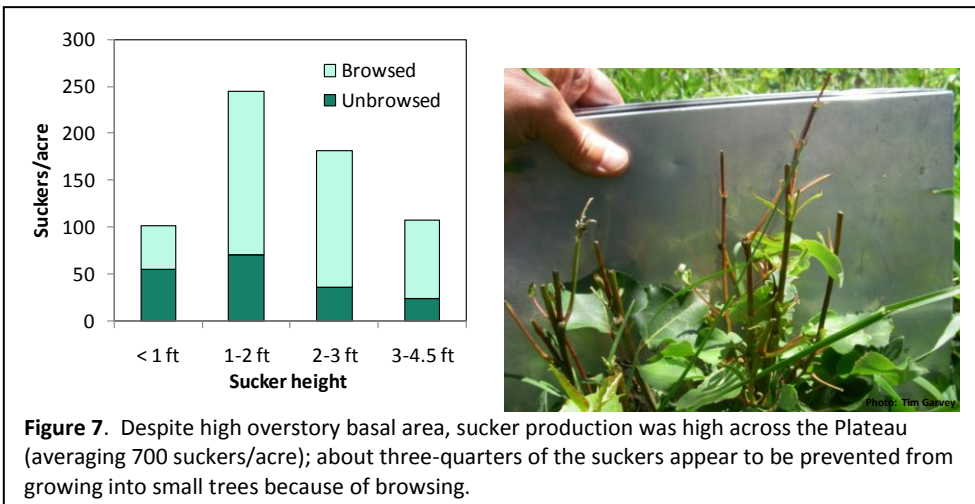
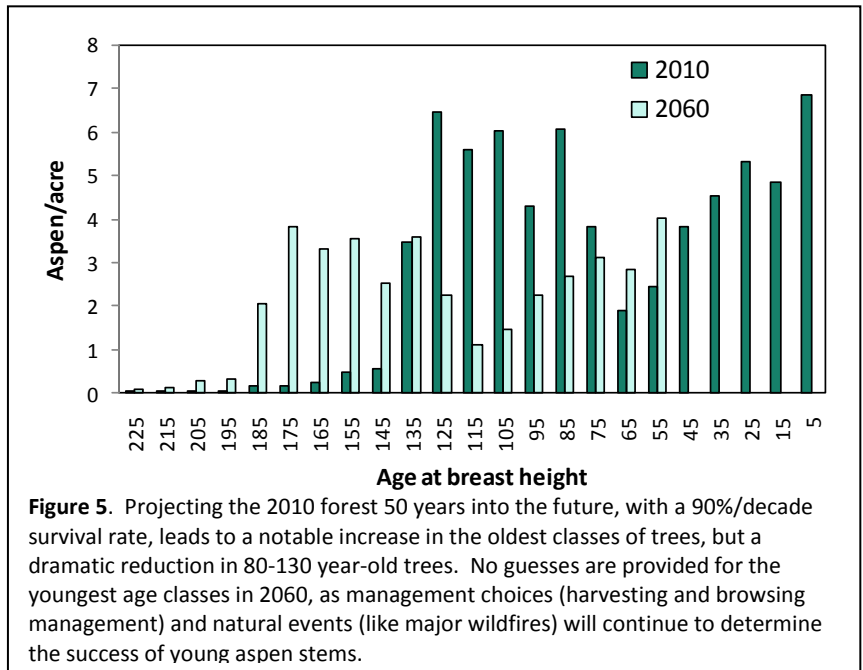


Figure 4. The pattern of tree establishment (decade when trees reached breast height) was very irregular. The fire year of 1842 did not create an apparent cohort that survived to 2010 whereas the fires of 1863 and 1879 launched a series of 5 or 6 decades of very high establishment (number of stems on left; basal area of these stems on right).

**Future Aspen Forests.** The historical age structure can provide some insights into the future aspen forests of the Plateau (Figure 5). A long-term rate of aspen survival might be 90% surviving each decade; If we currently have an average of 6 trees/acre that date to the 1880s, another 50 years of mortality may lead to three survivors/acre of this cohort by 2060. Of course major droughts, fires or other events could kill these veteran trees faster than expected. The young cohort that dates from the 1980s (about 5 trees/acre on average) would decline to about 2 trees in 50 years. Thus, the overall story would be that in 2060 the Plateau may have only 1/3 as many middle-aged aspen trees (80-120 years) as we have now, along with substantially more old trees.



How many young trees (under 50 years) will be here in 2060? The data presented above characterized stems taller than breast height; small suckers that are currently <4.5 feet tall will be an important source of taller trees in the future. We measured the number of small suckers in 18.4-foot radius plots at each corner of the prism-sampling triangles. Ninety-eight percent of the corners with aspen trees also had aspen suckers (average of

700 suckers/acre). Interestingly, the number of aspen suckers did not relate at all to the basal area of conifers; plots with 0 to 120 ft<sup>2</sup> of conifer basal area tended to show the same high level of aspen suckers. However, recent browsing pressure appears high enough to prevent most of these from growing into tree-size-class stems (Figure 7).

**Conclusions:** So, how old are the aspens on the Uncompahgre Plateau? About 25% of the trees are under 35 years, half are younger than 80 years, and 25% are older than 115 years. Just 1% of the aspen are older than 165 years. If the trends of the past half-century continue into the future, then the forests in 2060 will be different from the forests of today in some important ways. We'll have more old trees (over 120 years old in 2060—the trees that are 70-120 years old today) but substantially fewer middle-age trees (80-120 years old in 2060—the trees that are 30-70 years old today). It's hard to say how many young trees (less than 50 years old) we'll have. We could have great numbers of them, given the abundance of suckers on the Plateau today. However, if browsing continues to suppress the growth of these suckers, then young aspen trees could be scarcer in the future. Large fires, severe droughts, or other manifestations of climate change could alter these current trajectories of aspen forest development. Management choices also will influence these trends in important ways. This information on the current age structure and our projections of potential future aspen forest development can aid in evaluating the likely outcomes of specific management decisions.