FLAGSTAFF PULLIAM AIRPORT FUELS REDUCTION PROJECT

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Introduction

City of Flagstaff Goals and Prescriptions for Flagstaff Pulliam Airport Fuels Reduction Project

The City indentified five goals for the 134-acre fuels reduction project on city-owned land just north and east of Flagstaff Pulliam Airport:

- Reduce the risk of a stand-replacing fire
- Create conditions conducive to the re-introduction of low-intensity, surface fire
- Create a diverse forest structure that resembles the open structure that existed prior to the interruption of the historic fire regime
- Improve forest health by reducing stand densities
- Establish two squirrel winter core areas.

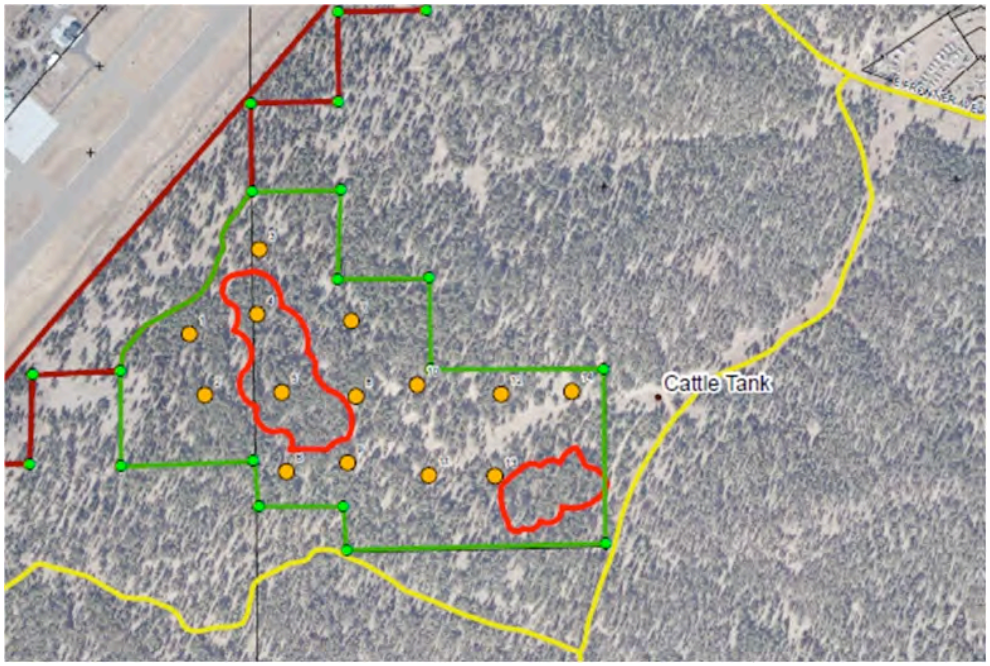
Several design features were incorporated into the project including a 24-inch diameter cap as the maximum diameter for harvested trees and retention of all squirrel nest trees as well as all yellow pine.

To achieve the stated goals, the City decided to implement a strict restoration prescription with variations. Included within their prescription were the following:

1. Develop pre-fire exclusion reference conditions by using pre-settlement evidences to determine the location of leave groups and tree densities. A replacement ratio of 1.5:1 retained trees will be used for each pre-settlement evidence found. Snags greater than 12 inches will be retained. Snag densities of no greater than 6 snags per acre are desired.
2. Conversely, areas without pre-settlement evidences will be used to re-establish former openings. All trees will generally be removed from these zones. Groups and clumps will vary in shape, size and number, and be irregular in shape. Basal areas will range from roughly 25 to 55 square feet per acre.
3. Leave all old, yellow ponderosa pine, regardless of size. Also leave all trees that are beginning to exhibit flat, platy, yellow bark if they are also dominants or co-dominants and have good tree form, health, and vigor.
4. Leave trees will exhibit good tree health, vigor, and form. Focus tree retention on leaving the healthiest trees with highest crown ratios. Leave trees will have minimal signs of mistletoe or bark beetle infestations.
5. Leave trees of all age classes will be considered to increase age class diversity. When possible, leave trees that are not in the most prevalent age classes, such as seedlings and saplings, if they exhibit good health, form, and vigor.

The high density of trees with their continuous, interlocking crowns promotes unhealthy forest conditions. If left untreated, this situation increases the potential for destructive crown fire as well as the likelihood of devastating insect and disease outbreaks. Yellow line = road, green line = project boundary, orange circles = monitoring plots, red-outlined areas= squirrel plots.

Map – 1: Area Map – Flagstaff Pulliam Airport Fuels Reduction Project, City of Flagstaff.



Ecological Restoration Institute Involvement

At the request of Mark Shiery of the Flagstaff Fire Department, personnel from the Ecological Restoration Institute participated in the Flagstaff Airport Project (Map - 1). On October 20 and 21, 2009, Dave Brewer, Dennis Lund, Doc Smith, and Charlie Denton surveyed the project area to determine the pre-settlement tree diameter at breast height (dbh) for the area. Marking commenced on October 26 and was completed by November 13, 2009. Prior to our assessment, 14 plots were established.

Results of ERI Study

Site Conditions

Typically the sites in the project area occupied a slope of 0 to 15 percent with an average of roughly 1 or 2 percent. Aspects were variable, although generally neutral. The soils were mapped as moderately deep to deep over bedrock (20-60 inches). Soil classification to the subgroup level includes Mollic and

Typic Eutroboralfs with inclusions of Typic Argiborolls. Surface soil textures are typically sandy loam to loam with weak platy structure.

General Observations

1. There is very little existing vertical or horizontal diversity.
2. The evidence of the pre-settlement forest is well preserved making its identification easy (Appendix Photo-3).
3. There were very few shrubs (e.g., ceanothus) and no Gambel oak, New Mexican locust, or aspen.
4. There were numerous post-settlement trees greater than 24 inches dbh (Appendix Photo-4).
5. The understory is sparse, which is a consequence of the dense overstory (Appendix Photo-1).
6. The duff layer in the high-density stands (i.e., those with more than 100 to 150 trees per acre) is deep (estimated at more than 2 inches).
7. Existing stands have a large number of multiple-trunk trees that are the result of earlier damage by either porcupines or squirrels (i.e., eating or damaging the terminal bud).
8. There does not appear to be significant infestations of either dwarf mistletoe or bark beetles within the project area.

Pre-settlement Evidences and DBH Measurements

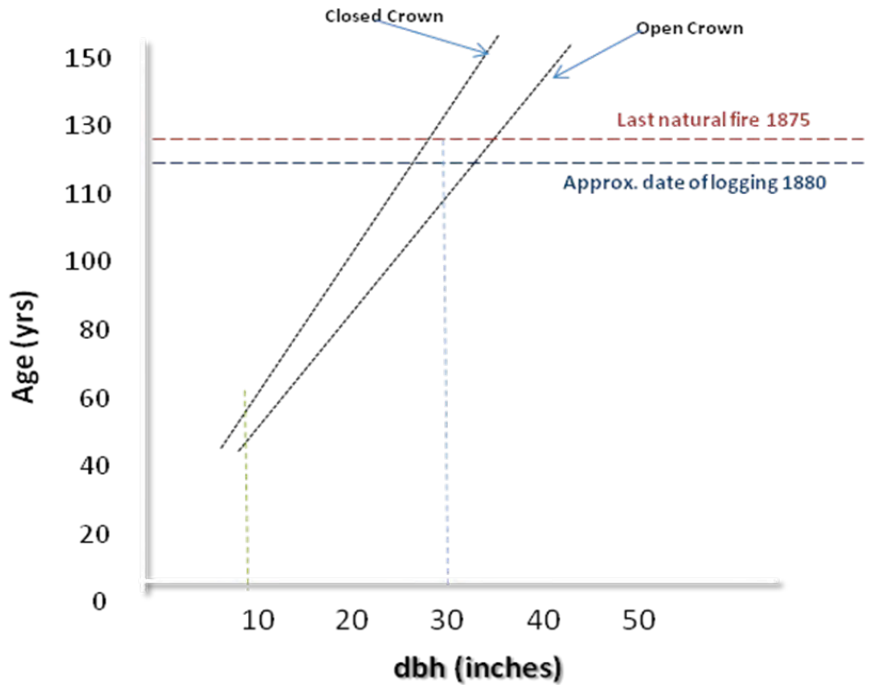
An inventory of conducted on the site found:

1. The existing average trees per acre (TPA) ranged from a low of 10 TPA to a high of 600 TPA with an average of 226 TPA.
2. The existing average basal area (BA) per acre was roughly 190 square feet per acre.
3. The existing average percent canopy cover was approximately 80 percent.
4. There were about 17 pre-settlement indicators per acre on average.

We estimated that the pre-settlement dbh ranged from 30 inches in more closed forest to 35 inches in open-grown situations (Figure 1). The two pre-settlement trees (germination dates around 1840) were actually found adjacent to the project area on Forest Service property. The fact that the City of Flagstaff parcel was clearcut in the late nineteenth or early twentieth century limited our ability to find any live pre-settlement trees. It appears that a large percentage of the existing trees on the site are the result of two regeneration pulses--one about 1900 and the other in the 1950s.

The rapid diameter growth we observed, which in some cases was as much as 6-8 inches per decade, is supported by data from nearby Taylor Woods. When the BA in Taylor Woods was reduced to 20-30 square feet per acre, the diameter growth produced trees greater than 20 inches dbh. In contrast, the control area still had average dbh of 2-3 inches with BAs ranging from 140 to 160 square feet per acre. Although the exact conditions of the stands at the airport after cutting is not known, it was open enough to produce large, mature blackjacks in 100 years or less (and in most cases with dbh greater than 24 inches).

Figure – 1: Diameter-Age Relationships for the Airport Treatment - City of Flagstaff Fuels Reduction



General Conclusion

The disruption of the fire regime roughly 140 years ago (1870s) has contributed to the large increase in the density of trees found in the project area. This will continue to influence unhealthy conditions in this forest and contribute to the high probability of wind-driven crown fire.

Specific Conclusions in Terms of City-identified Goals

Reduce the risk of stand-replacing fire

Once the project area is harvested, the hazard of a wind-driven wildfire will be reduced, although to what level remains open to some speculation. While the prescription called for a 1.5:1 replacement ratio

(strict restoration), the City also decided to place a 24-inch maximum size for harvested trees (i.e., diameter cap), retain all yellow pines, and retain all squirrel nest trees. These features may prevent the City from achieving the overall goal. According to the pre-settlement evidences, we should have been marking about 25 leave trees per acre and we anticipate it was more on the order of 35-50 leave trees per acre. These higher densities might create pockets that could be a source of fire brands and cause spotting and fire control problems within and possibly outside the project area. This can also be said for the two squirrel winter core areas where densities and basal areas were kept at fairly high levels. Off-setting this potential problem is the re-establishment of the interspaces that should limit the spread of any fire and provide sites where ground crews can aggressively fight any fire.

Create conditions that are conducive to the re-introduction of low-severity, surface fire

The restoration of the former openings will allow the reintroduction of low-severity, surface fire. From our observations, once these openings are established there should be a dramatic increase in bunchgrasses that ultimately will allow low-severity, surface fire and provide greater overall diversity in the forest.

Create a diverse forest structure that resembles the open nature that existed prior to the interruption of the historic fire regime

With generally only two age classes present in the project area, creating a diverse forest structure where the groups are uneven-age (three age classes minimum) with significant vertical diversity at the group level will only occur after several pulses of regeneration. In some cases the 24-inch diameter cap caused us to use those larger ones as replacement trees. This meant that we left the younger age classes for removal to keep as close to the range of natural variability as possible. Limiting harvests by placements of diameter caps will tend to form even-age stands, which is contrary to the evolutionary history of ponderosa pine. However, even with diameter caps in place, we anticipate that an uneven-age stand structure will eventually occur.

Improve forest health by reducing stand densities

Harvesting excess trees will allow the leave trees to use the site more effectively due to increased water and nutrients uptake, thus increasing their ability to withstand prolonged periods of drought and insect. Moreover, the potential for transmission of insect and disease pathogens will be reduced by breaking up the continuous, interlocking canopy cover.

Establish two squirrel winter core areas

The City, in cooperation with the Arizona Game and Fish Department, took the lead on marking these two areas. Given the higher density of trees in these areas, and the greater fire hazard this presents, if either one experiences a crown fire there could be significant spotting. Since the other portions of the project have been treated this should not be problem unless the spotting goes outside the treatment area.

Appendix: Photos

Photo 1: This picture shows how few understory plants exist near the airport due to the high density and shady canopy of post-settlement trees. Also note the small, tight clump of pre-settlement trees (inside blue oval).

Photo 2: The lack of pre-settlement evidences means this particular site was at one time an interspace between the trees. Historically, it would have been covered with bunchgrasses, like Arizona fescue, that would have promoted low-severity, ground fires which would have consumed regenerating pine trees. Today there is an almost continuous interlocking crown of trees, no grasses, and an increased threat of catastrophic wildfire and/or damage from insects and diseases.

Photo 3: Former pre-settlement group with lower densities of post-settlement trees and resulting higher diversity levels in the understory. Arizona fescue, mountain muhly, black dropseed, and squirreltail are the dominant grasses.

Photo 4: Arrow marks a post-settlement ponderosa pine with a dbh in excess of 24 inches. Although some people consider this tree "old," it has none of the old-age characteristics of a ponderosa pine--yellowing of the bark on all four panels for the entire length of the tree, large lower branches that are often dead, and a flattened top. This tree is a mature blackjack.