

Greater Flagstaff Forests Partnership

Mountaineer II Partner Mark

Qualitative Assessment



Anne Mottek Lucas
Mottek Consulting
PO Box 22511 • Flagstaff, AZ 86002

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Executive Summary

- ❖ For the Mountaineer_II Partner Mark, the Greater Flagstaff Forests Partnership (GFFP) collaboratively developed a prescription with the US Forest Service (USFS) and implemented a mark that reflects a clumpy, groupy forest structure with openings, containing horizontal & vertical heterogeneity. The mark included processes that describe and document all steps sufficiently so that it can be demonstrated and discussed with all Partners, the USFS, and other interested parties.
- ❖ In addition to restoring natural ecosystem composition, structure, and function while reducing forest fuel levels, an underlying goal of the Mountaineer_II Partner Mark was to improve processes from the first Partner Mark, Mountaineer_I. More specifically, improvements were made in the prescription's development, translating the prescription to the actual mark and management of the marking process.
- ❖ During the "Mountaineer_II" Partner Mark project, GFFP adapted a process that used fewer and more experienced markers familiar with the prescription, as well as recording and documenting the mark as a qualitative assessment. Thus, the Partnership will use the insights gathered through this assessment to further improve each rendition of the process from prescription through implementation.
- ❖ This project had multiple steps that included: 1) developing a prescription, 2) developing marking guidelines, 3) marking the site, and 4) modifying the USDA Forest Service Southwestern Region Fuels Sampling Protocol (USFS Region 3 Common Stand Exam Field Guide; Version 1.7).
- ❖ The prescription's silvicultural treatment was Uneven-aged Management – Group Selection. This prescription included a diameter cap that stipulates trees 24 inches diameter at breast height (DBH) and greater will be retained.
- ❖ The prescription of the Mountaineer_II Partner Mark site was compared to the adjacent stand, known as Mountaineer Schoolhouse FY09 (SH) unit.

Lessons Learned

- ❖ For the next Partnership Mark project, GFFP recommends describing the silvicultural treatment as "Uneven-aged Management - Group Retention." The current prescription describes the silviculture treatment as "Group Selection." "Selection" is a term that denotes choosing trees to remove to create openings, whereas "retention" signifies trees that remain.

- ❖ An important revelation in comparing prescriptions arose when P Ringle (USFS Silviculturist) was asked to comment on the variations between the Mountaineire II Partner Mark and the School House (SH) Unit's prescriptions. As Ringle suspected, some still view the Forest Service's primary consideration as foreseeing a "timber production mode." She explained, in attempting to counter this inference, further reference and details are included in the SH prescription that reflect multiple use concepts, such as managing for wildlife.
- ❖ While it is understandable the USFS wants to retain the most vigorous and healthy trees for optimal growth production, GFFP argues leaving some less desirable trees, exhibiting lower crown ratios, forks, and twisted branches, for example. The Partnership views these attributes as valuable to both wildlife and aesthetics, ultimately retaining variability within the forest.
- ❖ Although the prescription denotes a maximum basal area (BA) of 120 ft²/ac in groups, GFFP markers noted a few groups may contain BA greater than 120 ft²/ac. GFFP defends this position in attributing the higher BA to groups of yellow pines that are inherently more resistant to fire. GFFP further justifies this judgment by encouraging the USFS to increase maximum BA to 160 ft²/ac, allowing this in only 10% of the stand (or some variation thereof e.g. 160 ft²/ac in 10% and 120 ft²/ac in 10%), versus a maximum BA of 120 ft²/ac in 20% of the unit.
- ❖ GFFP chose to retain adjacent large trees in groups, sometimes sandwiched together or only one foot apart. To offset the increases in BA in groups as well as allowing close spacing of trees within the groups, the Partnership suggests increasing efforts in clearing duff within the groups. These recommendations are also prescribed in raking around old growth before controlled burns that not only mitigate tree mortality, but also discourage uncharacteristic fire behavior.
- ❖ Prior to developing the prescription, visiting the site to assess special considerations and specific needs for the unit was a crucial step.
- ❖ Universally defining the terms "groups," "clumps," "interspaces" and "openings" across agencies would encourage the use of these terms in prescriptions that could then be translated to on-the-ground marking.
- ❖ Training markers by the silviculturist who wrote the prescription is a critical step in assuring success of the mark. This will assure markers fully grasp the intent of the silvicultural treatment as well as a holistic perspective of the desired future conditions on the unit.

- ❖ Although a silviculturist initially guided markers, 43 trees above the diameter limit were missed. In the future, markers should run a diameter tape to be sure large trees are not missed as well as a walk and check the unit once marking is complete.
- ❖ To make the marking process more efficient, once a group is identified and marked, immediately mark within the group before moving on to the next group.
- ❖ In considering a leave tree mark, in general, if the silvicultural treatment is uneven-aged, it is not necessary to mark trees less than 5 inches DBH. With other types of contracts that include stewardship or thin from below, trees that fall in these classes should be marked as leave trees.
- ❖ In areas such as the Mountaineer_II Partner Mark site, abutting a neighborhood as well as having an exceptionally high amount of recreational activity, extra care needs to be taken to adequately and clearly describe within the prescription recreational considerations, such as trees by the trail etc., so that misinterpretations by the markers are minimized.
- ❖ With so many residents' inquiries, conveying their concern about the mark, believing a leave tree mark was a "cut tree mark," it was evident that land management agencies responsible for treating the unit should place signage in the area.
- ❖ To avoid operational damage to trees that are adjoining with the split occurring at DBH or above, or for trees that are sandwiched together (< 1 ft. apart), these trees should either both be marked to leave or both marked to cut. Markers missed a good amount of split trees and should look for these characteristics when marking.
- ❖ The USFS Common Stand Exam Field Guide Region 3, Version 1.7 Monitoring Protocol that the Partnership originally revised was last updated in 2005. For the next round of protocol revisions, the Partnership should incorporate relevant changes/additions from the 2009 version as well as adaptations derived from collecting data in the field.
- ❖ To parallel USFS fire modeling, previous GFFP monitoring studies have incorporated NEXUS software. New fire modeling software, Fuel Management Analyst (FMA), should be considered for future analyses. A distinct advantage in the using FMA software over NEXUS is the omission of calculating crown bulk density as an input variable.

- ❖ In implementing a prescription, there is evidence this task is not only extremely subjective, but also is one of the most difficult implementation steps in the process of forest restoration.
- ❖ Relative to the first Partner Mark, “Mountaineer_I,” the process of developing the prescription, planning and executing the mark was improved. Although large trees were missed, omissions such as this can only inform and reinforce the task at hand.
- ❖ The Mountaineer_II Partnership Mark encouraged dialogue between the GFFP and the USFS. These communications will only encourage increased collaboration, cooperation and information sharing between the GFFP and the USFS. Additionally, memorializing the entire process in this report will support this trajectory and encourage an adaptive management approach by all parties.
- ❖ The information gained and presented in this report can be used as a vehicle to encourage communication on treatment prescription, marking and implementation within and outside the Partnership. Lessons learned will be carried forward towards similar endeavors and will inform perspective projects to engage and continually improve the process.
- ❖ USFS staff and GFFP members come and go. Occasionally repeating the process of generating prescriptions, marking and subsequent monitoring, as a cooperative experiment between USFS and GFFP serves as a powerful “norming” activity. The process teaches or refreshes all parties on rules, tools, terminology, and other considerations and issues that arise. During this process, USFS and GFFP members come to a common understanding of the processes that are involved in writing a prescription and marking a stand. These types of exercises will only enhance discussions about proposed actions and encourages parties involved to become powerful allies for achieving mutual goals for treatments within the zones of Community Wildfire Protection Plans, State Forest Health Plans, and other novel forest treatment initiatives.

Next Steps

- ❖ Develop a user-friendly, detailed marking guideline template that could be implemented by a forestry student or an inexperienced seasonal marker.
- ❖ Develop a marker training that could be implemented by a forestry student or an inexperienced seasonal marker.
- ❖ Collaboratively develop interagency definitions of “groups,” “clumps,” “interspaces” and “openings” - discrepancies in these definitions remain.

- ❖ Share report/findings with GFFP Partners and other land management agencies (USFS, AZGF, USFWS, The Nature Conservancy, Four Forest Restoration Initiative etc.)
- ❖ Obtain updated post-treatment aerial photos to compare pre- and post-structural changes on the site.
- ❖ Identify a fourth Partner Mark stand, which provides different current conditions than the previous three sites.
- ❖ Continue to test and improve the monitoring protocol so that it could be implemented on larger landscape scale projects.
- ❖ Test and implement new fire modeling for monitoring analyses.
- ❖ Complete monitoring data collection (post) and analysis to assess effectiveness of the MIPM and MIIPM treatments and share results with the USFS.

Introduction/Background

The Greater Flagstaff Forests Partnership (GFFP) had completed its first “Partner Mark” on two US Forest Service (USFS) units, known as the “Mountaineer_I Partner Mark” (MIPM) in July of 2007. Before GFFP members (“Partners”) physically marked the site, a proposal outlining the purpose and objectives, methods, timeline, impact, outreach and budget was approved by GFFP’s Partnership Advisory Board (PAB) on March 7, 2007 (see Appendix A). Since this was the first Partner Mark for GFFP, the prescription and mark drew heightened interest from most Partners as well as Forest Service staff. However, as presented in a letter from the USFS to GFFP on July 30, 2007, the USFS highlighted various concerns regarding the prescription and the mark. More specifically, they questioned the mark, in relation to the Mountaineer Environmental Assessment (EA) and Decision and whether the mark met prescription parameters (see Appendix B). In this letter, Gene Waldrip, of the Peaks and Mormon Lake Ranger District, described his concerns that he had included in a previous letter to Doc Smith (GFFP President at the time) on November 1, 2006. In the letter to Smith, Waldrip identified a number of sideboards that were required to insure this project contained acceptable “adaptive management” parameters. He continued, “All of the sideboards identified have either been met or agreed adjustments made, which included a time extension, except the last one: Partner marks and prescriptions will follow objectives of the EA for sites with the exception of Site 346:14, in which approximately 20 acres will receive an uneven-aged mark to 40% canopy cover instead of a thin from below mark.” Considering this statement, the Forest Service’s primary concern was meeting the objectives of the EA and the prescribed canopy cover levels. The USFS continues to explain within the letter their perceptions and evaluation of the mark:

While there are or will be pockets of forest growth and advancement over time with the Partnership mark, much of the stand will have little to no improvement to current conditions concerning tree growth and regeneration to achieve long term vertical structure and improved age class distribution, and any benefits to those areas that have received some treatment will be very short lived due to little reduction in tree competition and the lack of actual treated area. The Partnership mark relies extensively on existing condition, often maintaining the current over-dense conditions and using existing suppressed and poor form trees in an effort to create vertical diversity. This is especially problematic in VSS 3 structure where density and tree competition reduction is critical from both tree and stand development needs and fire hazard reduction. Our flip side is that we are endeavoring to do treatments with a 20 to 40 year life on a stand and landscape level, using future stand development through regeneration and tree growth over time, while maintaining some of the current structure for wildlife habitat needs. In this way some of the existing “housing” is maintained, while the majority of the stand/landscape is

developing desired conditions. Using this regime we are able to make the trade-offs between wildlife habitat maintenance and development and fire hazard reduction.

We won't get another chance to treat in most of these sites or even whole project areas for many years, and need to make sure we use this entry opportunity to achieve our goals to the greatest extent possible. The concerns of multiple entry and costs also enter into longevity of treatment. We essentially will pay the same price to get an under – short lived treatment as we will for one that can last 20 to 40 years.

Further details of how the prescription failed to meet the EA were extensively outlined in the letter regarding silvicultural considerations, fuels and fire, timber and wildlife. Although the USFS had objections and made them clear, they agreed to implement the mark with the hope that the area becomes a living laboratory to discuss differences of opinion on the ground. These gaps, in the conception of the prescription and interpreting the prescription to the ground, highlight the importance of monitoring to assess whether USFS claims would come to fruition. It was further stated in the letter from the Forest Service their interest in obtaining the monitoring results when complete.

In response to the letter from the Forest Service, Paul Summerfelt, GFFP President, returned comments outlining the Partnership's views to the objections and conclusions in the USFS letter on November 27, 2007 (see Appendix B). In summary, Summerfelt conveyed, implementation and ensuing monitoring results will ultimately demonstrate whether desired future conditions (DFC) would be met as well as overlying goals of improved forest structure. In addition, Summerfelt conveyed the Partnerships' support in viewing this exercise as a "living laboratory," whereas lesson learned will be carried forward in an adaptive management approach and, although agreements are minimal, this has initiated a healthy exchange between the GFFP and the USFS. Moreover, in spite of the USFS concerns, their agreement to move forward was commendable and demonstrated their willingness to experiment, learn and work within a collaborative framework.

Similar to the USFS objections, after reviewing the prescription, Kristen Waring silviculturist from Northern Arizona University's School of Forestry (NAUSF) and GFFP Partner, noted inconsistencies in the silvicultural terminology as well as the mark not meeting the prescription's parameters. Subsequently, this was the impetus for her to become more involved with the next Partner Mark project.

The mark included all interested Partners as well as a Coconino Rural Environmental Corp (CREC) and Highland Fire Department's Fuels crew. The mark occurred over a two-day period, with approximately 20 individuals present on each day, with 10 designated as "markers." Although there was an initial meeting to review the prescription and procedures before all dispersed and proceeded to mark the two units,

the sheer number of people marking very small units (56.5 acres total), coupled with a general lack of knowledge and experience in marking, led to inconsistencies in the mark. However, conclusions regarding the outcome cannot be made until implementation has occurred and pre- post-monitoring data has been analyzed.

During the next Partner Mark project, the “Mountaineer_II” Partner Mark (MIIPM), GFFP adapted the process by using fewer and more experienced markers familiar with the prescription, as well as recording and documenting the mark as a qualitative assessment. Thus, the Partnership will use the insights gathered through this assessment to further improve each rendition of the process from prescription through implementation.

Purpose/Objective

The GFFP developed a prescription to provide a sample/demonstration Partnership Mark (“Mountaineer_II Partner Mark”) on 27.9 acres in the Mountaineer Healthy Forest Restoration Act (HFRA) Project (Site: 348:14, Unit 2). The prescription and mark would emphasize restoring natural ecosystem composition, structure and function and while reducing forest fuel levels. The mark would follow the project’s EA to every extent possible and would reflect an adaptive approach from the last GFFP collaborative mark, which was completed on the Mountaineer_I site. More specifically, in marking the stand, GFFP hopes to improve translating the prescription to the actual mark and management of the marking process. The GFFP sees this as an opportunity to move the adaptive management process forward, and the information gained can be used as a vehicle to encourage communication on treatment prescription, marking and implementation within and outside the Partnership.

The following objective was adopted by the PAB on September 12, 2007 as a guiding principle for design and implementation of the Partner Marks: The GFFP will develop a prescription and implement a mark that reflects attributes that include a clumpy, groupy forest structure with openings, containing horizontal & vertical heterogeneity. The mark will include processes in a methodology that describes and documents all steps sufficiently so that it can be demonstrated and discussed with all Partners, the USFS and other interested parties.

A benefit of data collection on the Mountaineer_I project was the modification of the USFS Region 3 Fuels Sampling Protocol. As the Partnership completed data collection for a National Forest Foundation Grant in 2006, slight refinements were made to the protocol. In utilizing this version of the protocol for the Mountaineer_II Project, further revisions were made. These modifications include a reordering of the protocol’s steps as well as explanatory diagrams that aid in data collection efforts by less experienced markers such as seasonal employees, forestry students, or volunteers. This, in effect, has created an improved tool that outlines data collection steps that facilitates the efficiency and accuracy of the data collection effort. GFFP would like to carry this

forward to continue to test and improve the protocol so that it could be used in larger landscape scale projects.

The GFFP Monitoring and Adaptive Management Action Team, in conjunction with Northern Arizona University's School of Forestry, has gathered pre-treatment data so the effectiveness of this treatment can be analyzed once implementation is complete. This analysis will verify whether the resulting forest structure will simultaneously meet desired conditions for wildland fire severity and behavior while providing for greater overall ecological benefit. Upon implementation completion, GFFP will complete a comprehensive pre- post-monitoring report.

Methodology

This project had multiple steps that included: 1) developing a prescription, 2) developing marking guidelines, 3) marking the site and, 4) modifying the USDA Forest Service Southwestern Region Fuels Sampling Protocol (USFS Region 3 Common Stand Exam Field Guide; Version 1.7). In addressing all aspects of the project, multiple field trips to the site were made to foster discussions among Partners and with the USFS.

To complete a viable prescription, visiting the site before writing the prescription was an important first step. GFFP Board of Directors met with USFS silviculturist, Patty Ringle, to tour the site and view the site's current conditions. The site was very different from the first Partner Mark, the Mountaineer_I site, which was denser, and at times, contained areas of thickly stocked dog haired thickets. In contrast, the Mountaineer_II site contained a good proportion of larger trees (24 inch + diameter at breast height (DBH)) with various sizes of natural openings meandering throughout the site. In addition, Mountaineer residents heavily used this area, with evidence of hiking trails, Frisbee golf, readings areas, forts, archery, etc. Since the prescription was collaboratively developed by GFFP, USFS and NAUSF, there were no distinguishing contradictions in the prescription, leading to approval by the USFS. Therefore, the primary objective of the MIIPM exercise was translating the prescription to the ground. In other words, based on the prescription, how was the stand marked and what inconsistencies and/or questions arose in marking the stand?

Four additional visits were made to the site that included multiple partners, other interested parties and USFS personnel. Each visit to the site is described below and includes the date, purpose, attendees and their respective affiliations.

1) **Date:** July 21, 2009 **Purpose:** Initial Discussion – Application of the Prescription

Present: GFFP Partners:

(Paul Summerfelt (Flagstaff Fire Department (FFD)), Steve Gatewood (Wildwood Consulting (WWC)), Mark Sheiry (FFD), Anne Mottek Lucas (Mottek Consulting (MC)) and, Scott Harger (Coconino Natural Resource Conservation District (CNRCD)).

USFS personnel: Joe Luttmann, Contracting Forester, Peaks Mormon Lake District (PMLD); Amber Dorsch, Pre-sale Forester (PMLD) and; Harmony Hall, Environmental Coordinator (PMLD).

Other Parties: Fenner Yarborough (Arizona Game and Fish (AZGF)), Steve Rosenstock (AZGF), Chad Loberger (AZGF), Paul Whitefield (National Park Service (NPS)).

2) **Date:** July 30, 2009 **Purpose:** Partner Mark Layout and Actual Mark

Present: GFFP Partners:

Mark Shiery (FFD), Mark Brehl (FFD), Kristen Waring (NAUSF) and, Steve Gatewood (WWC).

Note: During this site visit, Waring, one of the authors of the prescription, reviewed with the markers how this prescription should be translated to the ground. Shared by Waring as well as Ringle, training markers by the silviculturist who wrote the prescription is a critical step in assuring success of the mark.

3) **Date:** July 31, 2009 **Purpose:** Review Actual Mark, Collect Cruise Data

Present: GFFP Partners:

Mary Shiery (FFD), Steve Gatewood (WWC) and, Anne Mottek Lucas (MC).

4) **Date:** August 10, 2009 **Purpose:** Revisit Partner Mark

Present: GFFP Partners:

Steve Gatewood (WWC), Anne Mottek Lucas (MC) and, Shaula Hedwall (US Fish and Wildlife Service (USFWS)).

Note: Due to comments received from several residents that they were concerned with the lack of trees left by the trail, the purpose of this visit was to check the mark by the trail.

During the four field visits, extensive notes were taken (July 21, 30, 31 and August 10, 2009) to record relevant comments that are used throughout this report (see Appendix C).

Qualitative Review

Prescription

Once the initial site visit took place, the Partnership asked Ringle (USFS) and Waring (NAUSF, GFFP Partner) to collaboratively develop a prescription (see Appendix D). In developing the prescription collaboratively, controversy and disagreements between GFFP and USFS within this phase of the project were minimized.

The prescription's silvicultural treatment was Uneven-aged Management – Group Selection and included existing conditions, desired future conditions, treatment objectives, opening guidelines (in order of priority), stocking guidelines (in order of priority), special considerations within the stand, layout recommendations, directions to the stand and a map of the stand. This prescription included a diameter cap that stipulates trees 24 inches DBH or greater will be retained.

As the prescription was developed, Ringle incorporated GFFP Board of Director's comments from the initial site visit as well as USFS forest plan standards, USFS goshawk guidelines and the USFS proposed action in the Mountaineire EA. Under the proposed action in the Mountaineire EA, this stand was treated as an uneven-aged management - group selection, with a residual canopy cover of 40% averaged across the entire stand (including both openings and groups). Ringle used a conversion of canopy cover to basal area (BA), equating a 40% canopy cover to an approximate BA of 50 ft²/ac (Sheppard et al. 2002). Taking these factors into consideration, Ringle suggested omitting "thin from below" from the prescription, as this premise is contradictory and did not meet the goals of the project.

Also, Ringle disclosed mandated changes in USFS procedures to omit the "new clarified" goshawk guidelines in prescriptions, thus continuing to limit openings to a maximum of 20%. Therefore, 10% openings were allocated to Vegetation Structural Stage 1 (VSS 1) (+ or - 3%) and 10% of the openings for VSS 2 (+ or - 3%), translating to a maximum of 26% openings, as was stipulated in the prescription. Lastly, Ringle informed the Partnership the USFS no longer uses the term "interspace" [or "clump"] in a prescription, therefore these terms were omitted.

Prescription Comparison

As suggested at one of the field trips, a comparison of the prescription to the adjacent stand, known as Mountaineire Schoolhouse FY09 (SH) (Cutting Unit: 01, Locations/Site: 0003480001, Acres: 158) (see Appendix E) to the Mountaineire_II Partner Mark site

(MIIPM) (Cutting Unit: 2, Location/Site: 0003480014, Acres: 27.9) is outlined in detail below.

Existing Conditions

- Mountaineer HFRA Project contains mostly mid-aged to mature ponderosa pine (18-24" DBH, VSS 5B), while Mountaineer Schoolhouse FY09 (SH) contains a majority of young to mid-aged ponderosa pine (5-18" DBH, VSS 4C).
- Average BA in the MIIPM is 115 ft²/ac and the SH area has a higher average BA of 150 ft²/ac.
- Large groups of yellow pines can be found throughout both units.
- Although this is only stated in the SH prescription, both units contain a good proportion of trees with poor form (crooks, multiple tops etc.).
- Stated in the MIIPM prescription, there is a large oak in the northwest portion of the stand, near the hiking trail; however two large oaks were observed in this area.
- Regeneration in both stands is found in openings; however, in SH advanced regeneration was noted in groups up to one-half acre in size.
- In the MIIPM stand, there is an average of 10-20 pre-settlement evidences per acre.
- Slopes in the MIIPM are relatively insignificant (0-3%), while the SH stand contains steep slopes of 30% or more. In addition the SH stand has two drainages located in the northeast and southwest portions of the stand.

Desired Future Conditions

- The MIIPM stand will exhibit an increase in age class diversity, while the SH stand will exhibit an increase in age class. *[These differences are demonstrated by the difference in existing conditions, whereas the MIIPM contains larger VSS 5B (18-24" DBH) trees and the SH stand currently contains VSS 4C (5-18" DBH)].*
- Due to the distinct differences in current conditions, the MIIPM notes a desire to decrease average stand densities to reduce the risk of bark beetle attack and subsequent mortality.
- In the MIIPM an increase in understory productivity and diversity is desired.
- Notably different between the two areas is a desire to maintain squirrel habitat in the SH site.
- Tree groups in the MIIPM stand will range from 2 trees up to 3 acres in size, while in the SH area trees will be left in groups ranging from 2-40 trees up to one acre in size.
- Basal area within the groups of the MIIPM unit will range from 60 - 120 ft²/ac, while the SH stand group BA is set at a density of 140 ft²/ac.
- At the stand level, BA in the MIIPM should meet a minimum of 50 ft²/ac (40% canopy cover), averaged across openings and tree groups compared to 70 ft²/ac or greater for the SH site.

Treatment Objectives

- Notable difference in MIIPM is to reduce canopy cover to 40%+ at stand level and improve understory productivity and diversity.
- MIIPM prescription notes trees will be left in groups that vary in shape, size and number of trees. In addition, a maximum of 26% of the area will be openings for regeneration.
- Both prescriptions provide for decreasing inter-tree competition to offset the risk of bark beetle attack and mortality, however it is stressed in the MIIPM prescription to reduce stand densities below critical thresholds in order to accomplish this goal.
- Improving goshawk habitat by improving understory productivity and diversity is only found in the MIIPM prescription.

Silvicultural Treatment

The silvicultural treatments are the same in both prescriptions: Uneven-aged Management - Group Selection

Opening Guidelines (in order of priority)

Opening guidelines are only outlined in the MIIPM prescription and are not specified as a separate section in the SH prescription. Main points in MIIPM prescription consist of:

- Opening across the stand should not exceed 26% (7.3 acres) for natural regeneration (VSS 1 and 2).
- Openings vary in size from .25 to 4 acres, with a maximum width of 200 feet.
- If an opening is greater than one acre in size, one group of reserve trees (seed bearing) containing 3-5 per group will be retained.
- Leave VSS 1 and 2 groups in openings varying from 2-20 trees with spacing of trees ranging from 3-15 feet.

Stocking Guidelines (in order of priority)

- In the MIIPM prescription, leaving trees in a mosaic pattern and clustered trees group is stipulated, however in the SH prescription, it is described as “primarily in groups.”
- Tree spacing within groups in MIIPM is 3-30 feet, however in the SH area, tree spacing is not stipulated by an exact amount, but with “irregular tree spacing within groups is highly desirable.”
- Although, not described in the DFC section of the MIIPM, it is described in the SH prescription that groups less than 12” DBH will be left at a lower basal area (60-80 ft²/ac) as well as 20% of the stand (5.6 acres) will be left at a higher BA (100-200 ft²/ac). Further explanation reveals these denser groups will contain large diameter trees (yellow pines).
- In the MIIPM, leaving trees to increase age diversity is stressed and especially accomplished by leaving seedlings and saplings. Similarly, the SH area describes

placement of groups, [*or maybe this would be better described as “retention of groups”*]) should be those that are not in the most prevalent class size.

- In the SH stand, leave trees are described as those that are not suppressed or over-topped.
- In the SH prescription, a chart describing VSS class 1 through 6 containing 20% in each VSS class is a desired long term VSS distribution.

Although an opening guideline section was not in the SH prescription, openings described in the stocking guidelines section are described below:

- SH prescription stipulated to “regenerate” 20% of tree groups to create openings for regeneration (VSS 1 and 2) and openings will range from .02 to 1 acre. This is noticeably different from the MIIPM whereas openings vary in size from .25 to 4 acres.
- In the SH area, if distance to the nearest seed tree is greater than 100 feet, then leave 1-2 seed trees and this is described in the MIIPM area as, if opening is greater than one acre in size, one group of reserve trees (seed bearing) containing 3-5 per group will be retained.
- In the SH prescription it is stressed (*italic and bold*) to create openings, select areas with groups of trees with poor form.
- In the SH, spacing between groups of trees will vary from 25 to 100 feet. Spacing between groups is not stipulated in the MIIPM.
- Using pre-settlement evidences to determine the location and size of tree groups is described at length in the MIIPM and mentioned as a bullet in the SH prescription.

Special Considerations Within Unit

Wildlife

In the MIIPM, a Cooper’s hawk nest was identified; however, this was not confirmed, therefore treatment was not adjusted. In the SH site, turkey roosts were identified and will have a metal wildlife tag applied to protect these trees.

Harvesting Operations

MIIPM has a large oak in the northwest portion of the stand and mitigation measures will ensure that it will not be damaged.

Broadcast Burning

To decrease mortality from a broadcast burn, raking around old growth ponderosa pine and Gambel Oak with high litter depth is recommended in the MIIPM area.

Slash Treatment

Both sites will protect large logs (greater than 12 inches DBH) that are on the site prior to treatment; they will not be piled during slash treatment.

Invasive Weeds/Sensitive Plants

Recommended for both projects to use Best Management Practices and wash all machinery prior to working in the stand.

Recreation

SH calls for leaving groups of trees along main hiking trails; however, in the MIIPM it states, leave individual trees and variable groups at irregular intervals along main hiking trails and to leave groups between hiking trail and private property as a screen.

Conclusions Prescription Comparison

Since the two prescriptions were written approximately eight months apart (MIIPM: 9/12/08 and SH: 6/11/09), Ringle, USFS silviculturist, indicated differences in the prescriptions are based on an adaptive management philosophy, reflecting modifications over time. These changes reveal what worked and did not work, leading to adaptations from the MIIPM prescription to the one written for the SH unit. As an example, Ringle explained, during the time period between writing the two prescriptions, some of the areas in the Mountaineer project were harvested; therefore, proceeding prescriptions (SH) were adjusted to better meet the DFCs for the project.

Ringle explained further, other differences reflect comments that were incorporated into the MIIPM prescription from the first GFFP site visit where Partners suggested releasing the large oak, leaving trees near the hiking trails, leaving larger groups of trees, etc. Lastly, Ringle explains, some of the variations between the two prescriptions are simply differences in word choice or attempting to improve explaining the "whys," not because of differences in DFCs or treatment objectives.

Desired Future Conditions

As outlined above, there are distinct differences in the current conditions of the two stands. These differences are described in the existing conditions, whereas the MIIPM contains larger VSS 5B (18-24" DBH) trees and the SH stand primarily contains VSS 4C (5-18" DBH). Therefore, requirements differ in each prescription to meet DFC. To add to this, the EA identified different residual densities, therefore, each prescription reflected these provisions (MIIPM: 50 BA ft_/ac, versus SH: 70 BA ft_/ac).

Wildlife

DFC in the MIIPM prescription stipulates sustaining northern goshawks and their principal prey species (Reynolds 1992). However, there is no direct mention of maintaining squirrel habitat. Ringle explains, in both units and in the majority of the project area, there is an overlying goal to maintain squirrel habitat. Although not directly stated in the prescription, in considering squirrels as a principal prey species of northern goshawks, an intrinsic connection of squirrels to goshawks is implied and their habitat

should be considered and protected. To be more clear, in the SH prescription, squirrel habitat is directly addressed. Ringle explained, “Recently, I have come to realize that, unfortunately, some STILL want to believe that we are in ‘timber production mode’ and that managing for wildlife is not a priority. So I am trying to do a better job of explaining why we do what we do.”

Marking Guidelines

Prior to marking, a Marking Guideline was created by the parties that wrote the prescription, Ringle (USFS) and Waring (NAUSF). The Marking Guidelines are derived from the stocking guides in the prescription. Important points were highlighted in yellow and were arranged for ease of use in the progression of marking a stand (see Appendix F).

In reviewing the Marking Guideline, one of the designated markers, M Sheiry (FFD), noted there is a discussion of “groups” in the guidelines, but not “clumps” as is described by the GFFP as “groupy/clumpy structure.” Ringle explained, the USFS recently decided to omit the terms “clumps” [and “interspace”] and use only “groups” in their prescriptions. Therefore, the Marking Guidelines were finalized and markers worked within the concept of delineating “groups.”

As the Partnership progressed through this process - from developing the prescription, the marking guidelines, to the mark, Partners suggested developing a user-friendly, detailed marking guideline that could be implemented by a forestry student or an inexperienced seasonal marker.

Marking the Mountaineer II Site

Marking the 27.9 acres took approximately 4.5 hours, which translates to 6.2 acres per hour. The three-person crew used approximately three cases of paint that costs \$48 per case, totaling \$144. The USFS remarked the Partnership’s original mark with an orange slash of radioactive paint above and below stump height to assure trees that were marked as leave trees would not be cut. In addition, the USFS marked the corners of the unit with a pink butt mark and a single band of pink that spanned three quarters near DBH, facing into the unit. Trees designated as boundary trees (corners), would not be cut. The Forest Service intends to cut exactly what is marked by the Partnership. The mark is considered by the USFS as the Partnership’s intentions; therefore, with the exception of trees 24+ inches DBH that were missed by the markers, there would be no judgment calls and/or changes made by the USFS. The contract to cut the unit is planned for implementation in 2010.

Basal area was measured in a “check-cruise” on 27 plots (one plot per acre) to assess whether the leave tree mark met the BA requirements of the prescription (see Appendix G). The results indicated that the current condition average total BA was 115 ft²/ac and the average leave tree BA was 59 ft²/ac (these figure reflect the original mark and do

not include 24"+ trees that were missed). The 115 ft₂/ac BA is exactly the same as current conditions described in the prescription. The leave tree BA of 59 ft₂/ac meets requirements of the DFC in the prescription, whereas “basal areas at the stand level will meet a minimum of 50 ft₂/ac per acre (40%+ canopy cover) when averaged across openings and tree groups.” Within groups, BA should range from 60-120 ft₂/ac however; at least one group had a BA greater than 120 ft₂/ac.

Prescription Considerations

According to the Partnership, the basic premise on how the forest is viewed and translated to a prescription is distinctly different in relation to the Forest Service. On one side of the coin, the Forest Service perceives the forest as one with proportionally fewer openings and 40-60% of the landscape occupied by trees. On the flip side of the coin, the Partnership sees the forest landscape comprised of a greater proportion of openings (40-60%) scattered with groups of trees.

The resulting silvicultural treatment was described as “Uneven-Aged Management - Group Selection” by the USFS; however, the Partnership would prefer the term “Group Retention.” The differentiation in terminology reflects silvicultural nomenclature and connotation of terms. Generally, “selection” has been based on choosing trees to remove to create openings, whereas “retention” signifies trees that remain.

Within the prescription it is stated, “Leave trees will exhibit good tree health, vigor, and form.” However, majorities of trees in this unit do not exhibit desired tree health and vigor, most are double and triple forked and contain twisted branches and trunks. Therefore, if the markers followed the prescription *verbatim*, they would not be able to leave many trees and possibly not meet the requirements of the prescription. In addition, the Partnership believes it is beneficial to leave some “wolf” or “apple” trees, as these are valued for wildlife, aesthetics, and recreation. This is an ongoing dispute between the USFS and GFFP. While it is understandable the USFS wants to retain the most vigorous and healthy trees for optimal growth production, GFFP argues leaving some less desirable trees that exhibit lower crown ratios, forks, and twisted branches. The Partnership views these as valuable attributes, ultimately retaining variability within the forest.

It is also disputed by the Partnership that an “artificial BA cap” of 120 ft₂/ac has been arbitrarily set by the USFS to mitigate severe fire behavior. However, if clumps of old growth are retained, the old yellow pines contained in these are fairly resistant to fire. Due to the current condition of the stand, predominantly VSS 5B (18-24” DBH), these older, larger trees increase the BA, and at times, it is greater than 120 ft₂/ac. This could be rectified by prescribing greater basal areas (160 ft₂/ac BA) in groups or clumps of trees where a majority exhibits old growth characteristics: large scaly yellow/orange bark, and have a DBH ranging from 18-24 inches. Moreover, the prescription stipulates, “Approximately 20% of the stand (5.6 acres) will be left at higher basal areas (100-120

ft_/ac per acre).” In taking this into account, another way to reach middle ground is to allow a maximum area of greater than 120 ft_/ac BA to occur in only 10% of the stand verses 20% as stipulated in the prescription. In considering BA as a pre- post-metric, this may be better judged as an overall BA of the stand verses calculating BA in the middle of a group of large old growth. Another way to look at this discrepancy is to state, based on the diameter cap of 24”+ DBH, this parameter may not be met in some groups. Lastly, in some cases, to achieve desired BA, markers selected some clumps for removal.

Openings within the prescription were described as ranging in size from 0.25 to 4 acres with a maximum width of 200 feet. However, according to the Partnership, openings of this size could be easily encroached by regeneration within the average span of time of 20-40 years for reentry, and eventually will no longer be an opening. The Partnership argues that openings as large as 5-10 acres could be created, so they will remain open for an extended period of time. These considerations are further demonstrated in the letter (previously referenced, see Appendix B) from the USFS as they rebutted the Mountaineer_I Mark, “...we are endeavoring to do treatments with a 20 to 40 year life on a stand and landscape level, using future stand development through regeneration and tree growth over time...” Moreover, the Partnership suggests openings could be greater than 200 feet wide in some places and greater than 4 acres, if they are linear and connected. If this would be the case, what is the protocol in measuring the widest distance? Lastly, as openings are considered, goshawk guidelines also require leaving one group per acre of 3-5 seed bearing trees in openings over 1 acre, therefore this area is no longer an opening per se.

Marking Procedures

Before markers began the process of delineating groups, clumps and openings in the unit, as an initial assessment, aerial photographs were referenced (see Appendix H). Using the aerials prior to marking, added greater efficiency and effectiveness in completing the mark. Once aerials were assessed, the order of the mark was to first identify groups, then look for historic evidences and, based on these, identify clumps within the groups. Yellow pines (= or > 24 inches DBH), as stipulated in the prescription, were always marked to leave. This stand, not representative of most of the forests around Flagstaff, contained a good proportion of yellow pines and VSS 5 (18-23.9” DBH) and had a noticeable smaller proportion of VSS 1 and 2 (0-4.9” DBH). In addition, openings were worked into the marking plan for the desired forest structure by enhancing the distinct existing openings, and creating new smaller openings when necessary.

Initially, the three markers (M Brehl (FFD), M Shiery (FFD) and, S Gatewood (WWC)), using the aerial photos, worked together to mark the parameters of all groups with a slash and a dot on the side of the tree that faced inside the group. This was completed so groups were easily identified. Once all three markers delineated groups, they divided

the area into thirds and simultaneously marked leave trees within the groups that they identified as “clumps.” Although clumps were not described in the prescription, markers felt they could not mark to prescription within groups without conceptualizing clumps. Within this smaller scale, marking within a group, markers naturally conceptualized the smaller set of trees as “clumps.” As noted by Mark S. (FFD), during the next GFFP mark, to make the marking process more efficient, he suggests, once all groups were identified and marked, immediately mark clumps within the group before moving on and duplicating this process.

Marking was completed within the group from assessing both historic evidences and current structure. In general, historic evidences were well separated from the existing trees, which indicates the historic composition of this area was likely more of a savannah than a dense forest. Over time, openings and groups of trees alternate locations. For example, areas that are currently occupied by trees will eventually evolve into an opening. These trees will die and/or be harvested and the newly established seedlings will grow and become the new group in the present openings.

If evidences were found, markers left trees nearby when feasible. As an example, 3-4 historic evidences (stumps, pit and mound (tree root observed, but mostly decomposed)) were identified; however, they were not in close-proximity of possible leave trees. As the markers studied the area, 10-20 feet away, there was a reasonable clump of trees that could be marked and left to account for the nearby evidences. Another scenario proved similar, where six evidences were observed, however the nearest tree was approximately 30 feet away. Clumps within the groups were selected based on evidences, however sometimes clumps were selected farther away from the evidences to make way for openings. Some of the clumps were left thick, and some were released. There was no concrete delineation in determining which clumps to leave undisturbed and which to release. Markers varied this judgment to add variability to the stand.

As demonstrated by the Ecological Restoration Institutes’ (ERI) restoration guidelines, replacement trees are selected within 60 feet of indicators, though smaller distances (15-30 feet) may produce a more desirable clumping pattern (Friederici, 2005). Therefore, methodology used by the markers was sufficient in distances for selecting trees for retention. In addition, ERI’s guideline stipulates, “where possible, replacements should contain the largest, healthiest post-settlement trees, and/or clumped trees especially those with interlocking canopies” (ibid) (see Appendix I). Markers used a variation of the 1.5/3 restoration treatment (full restoration - “If replacement trees are over 16 inches in diameter, 1.5 trees are left standing for each pre-settlement indicator. If they are smaller, 3 trees are left standing for each indicator” (ibid). However, in considering current structure, markers modified the full-restoration technique by using a 1:1 ratio, translating to, observing one evidence, retaining one tree. The remaining .5 trees not retained, accounted for adjustments made as current structure was considered. In general, as both current conditions and historic evidences were

considered in retaining leave trees, trees were retained near evidences approximately 75% of the time and the remaining proportion of the mark was based on current condition judgments. Additionally, markers did not specifically focus on the DBH of the reference trees.

In retaining clumps of old growth, the Partnership's strategy differed from the USFS. During a site visit, the group looked at a clump of old growth, debating whether it should be opened up, or left undisturbed. The prescription delineates to space trees in groups 3-30 feet apart. Many times, trees within these clumps had little space (less than one foot or one foot apart). The Partnership views these scenarios as the natural progression of regeneration and spacing in ponderosa pine stands, wherein these trees tend to grow adjacent to each other, surviving and growing into mature, old yellow pines. The Partnership believes harvesting some of the large trees within the clump does not make sense. GFFP chose to retain those trees and not follow the prescription in this regard. To balance leaving more trees in a clump, the Partnership suggests that a diligent effort is made to clear fuels on the ground within clumps/groups. In doing so, the clumps of trees containing mature old growth would have a better chance of survival during prescribed fire and/or wildfires.

Trees in VSS 1 and 2 (less than 5 inches DBH) were not marked as leave trees as it was assumed by markers the "cutting guidelines" would include retaining and not skidding over areas of regeneration and smaller trees (there was a good example of a relatively good amount of regeneration in the southwest corner of unit). However, trees greater than 5 inches DBH (VSS 3, 5-11.9 inches) that should be retained were marked.

This seemed to be an area of uncertainty for the markers, therefore Joe Luttmann, Forester and Contracting Officer of the Peaks and Mormon Lake District on the Coconino National Forest, was contacted for clarification. Luttmann qualified how markers know whether trees in VSS 1 and 2 classes are handled. There are "operational guidelines" in contracts and, based on the type of contract, marking smaller trees are addressed differently. There are three possible scenarios in contracts: 1. stewardship, 2. thin from below and, 3. uneven-aged.

As a leave tree mark, if the contract is stewardship, and pre-commercial thinning (PCT) is warranted in a particular unit (deemed economical), markers should mark trees less than 5 inches DBH. However, Luttmann further explained at times, if PCT is not recommended, USFS crews may enter a unit and complete an abbreviated form of PCT called "Force Act Thinning" (FAT). He estimates his crews treat 50-200 acres per year as FAT. The Mountaineer Partner Mark did not warrant PCT. In the case of thin from below, generally, PCT thinning occurs; therefore, markers should mark trees less than 5 inches DBH. Lastly, if it is uneven-aged, operational guidelines will stipulate to leave all trees less than 5 inches DBH. The Mountaineer Partner Mark prescription was Uneven-aged Management – Group Selection, therefore small trees falling within VSS 1 and 2

did not need to be marked. Luttmann cautioned, there are always exceptions to these parameters, depending on site conditions etc.; however, this is a good rule of thumb.

An interesting caveat in marking VSS 1 and 2, is in most cases, the markers do not know what type of contract will be awarded to unit they are marking. However, unless the prescription is uneven-aged, markers should mark leave trees in size classes VSS 1 and 2. Lastly, in an example of a Timber Sale Contract provided by Luttmann, a provision entitled "Protection of Residual Trees" (BT6.32) states "Purchaser's Operations shall not unnecessarily damage young growth or other trees to be reserved."

Marking Considerations

According to the USFS, an ideal reentry would be 30 years. Some areas are treated again within 15 years, due to light cutting in the first entry. Luttmann explained, it is a double-edged sword in deciding whether you cut heavier, that results in a longer reentry time, or cut fewer trees, that results in a shorter reentry. There are costs and benefits to both scenarios and decisions should be based on site conditions. In contrast, S Gatewood (WWC) believes reentry in this unit would not be necessary; after treatment, through the use of prescribed fire or wildland fire use, the fire-adapted ecosystem should self-perpetuate and remain in a healthy state into the future.

Due to the close-proximity of the unit to the Mountaineer neighborhood, specific procedures in marking and residents' requests were considered by the USFS. To identify corners of the unit, trees closest to the corner were marked with a pink stripe by USFS markers. These marks should be located on the opposite side of trees when they are near residents' homes. However, observed in the southwest corner of the unit during a GFFP site visit, the corner stripe faced homes. Before GFFP began its marking process, a resident requested three trees on eastern boundary of unit were retained. Based on this request, these trees were marked to leave by the USFS prior to GFFP's mark.

Special considerations are referenced in the prescription and were made towards specific flora and fauna habitat. For example, two large oaks on the east side of the unit should be "released" by removing all pines in vicinity (unless they are yellow or greater than 24" DBH). Also, trees other than ponderosa pine, such as a small juniper, observed on the west side of the unit, were marked to leave to retain diversity and variability in the stand.

In some cases, additional trees were marked for silvicultural considerations. For example, four smaller trees (less than 12" DBH) were marked as replacement trees located in a grove of old growth. Discussions led to smaller trees surviving in conditions of drought; they are stressed, but have survived, so why not save some? A large cone-producing clump was observed. This is another reason to retain; cone production is cyclical, therefore if the clump is productive, be sure to retain for future regeneration. As

plentiful groups of yellow pine were observed in the unit, comments reflected their relative rarity and agreement that there is little reason to remove them. On the other hand, due to the abundance of blackjacks across the landscape, they are much more expendable.

Lastly, noted in some areas of the stand, it is difficult to avoid a “jail bar” look due to current structure/conditions (homogenous). Consequently, to create vertical structural diversity in these areas of the unit, numerous entries would be necessary.

Implementation Considerations

In marking a stand, markers need to consider the logistics of operations - What equipment will be use? How much room will contractors need to cut trees without damaging residual trees? For example, if contractors are using mechanical equipment, they require approximately one foot between the trees to “grab” them with their equipment so they are not forced to take multiple trees. Therefore, when two trees are sandwiched together, markers should either mark both as leave trees or, both are marked for removal. Similarly, if adjoining trees are split at or above DBH, then both trees should be identically marked (or not).

Wildlife Considerations

In considering the prescription as written, there was no mention of protecting squirrel habitat, however considerations for northern goshawk and a Cooper’s hawk nest were noted. After inspection by a USFS wildlife biologist and S Hedwall (USFSWS), a Cooper’s hawk nest in the unit was not identified; therefore, special consideration for the area initially flagged for a Cooper’s hawk nest was not considered. At times, markers left a large tree, or a small group of trees in openings to meet goshawk guidelines. At the same time, these trees could be used as “get-away-trees” for squirrels and other small mammals (see Figure 1).

Figure I. “Get-away tree,” valuable for wildlife.



Although omitted from the prescription, as squirrels were discussed by AZGFD during a site visit, markers should look for evidence of squirrel use by looking up into the trees for squirrel nests or, on the ground for squirrel middens and squirrel holes that are made when they are digging for fungi. If evidence of squirrel use is observed, in or around trees, these trees should be retained. In addition, it is protocol for contractors to examine the tops of the trees for nest referred to as “cutter select.” AZGFD added that squirrel populations are presently artificially high. They cautioned when you think about squirrels, you need to consider winter conditions. In the winter, they subsist on the phloem, the inner bark of branches of ponderosa pine. These are critical months for squirrels and have the greatest impact on their survival. Although research is still underway, squirrels are known to select a range of trees and their territories overlap.

In considering wildlife value in the forest, protocol dictates all snags are retained, as well as most “leaners.” Trees that lean, and are stable, should be retained for future snags that are valuable for a variety of wildlife. Lastly, a comment made by the USFS noted that after thinning, ample buck brush recovery has occurred approximately one-and-a-half years post-treatment, which provides sought after and nutritious elk browse. In this regard, this area has a good amount of elk, and relatively small numbers of deer.

A reflection of some Partners reveals their perceptions of the general premise of the Forest Service’s work on the ground. In summary, some Partners believe the USFS is still working in “old school” silvicultural principles, in a timber production mode, where wildlife and other values of the forest are not much of a consideration. These Partners wonder: What is the mission of the Forest Service? Is it to produce fiber, or is it for multiple uses? If multiple uses are the objective, then the prescription, mark and cut should reflect this premise (e.g. watershed, recreation, aesthetic, wildlife values, etc.).

In writing the SH prescription, Ringle (USFS Silviculturist) explained she is attempting to be more clear and stated, “Recently, I have come to realize that, unfortunately, some STILL want to believe that we are in ‘timber production mode’ and that managing for wildlife is not a priority. So I am trying to do a better job of explaining why we do what we do.”

Grasses/Understory

There were large patches of cheat grass and toadflax on the southern part of the unit as well as an abundance of natives in the area. When Partners observed exotics, they questioned: What will be done to stop the spread of invasive? Will the contractors clean their machines once the work is complete in the unit? In addressing these questions, there is a weed Environmental Impact Statement (EIS) in the EA as well as a statement in the prescription that operators should use Best Management Practices that includes washing machinery prior to entering the stand. It was also noted that in the last couple of years, toadflax invasion has increased across the forest. As a suggestion, to mitigate its spread in the area, the USFS could spray the two large patches of toadflax and/or mulch disturbed areas with the duff that is extracted from raking in groups of mature trees.

Recreational/Social Value - Revisit the Mark (August 10, 2009)

Once the mark was complete, S Hedwall (USFWS) requested an additional site visit. This was precipitated by her observation of trees marked (or not) by the trail that is heavily used for recreation, coupled with comments she heard from numerous residents who were concerned special trees or groups of trees would be removed. GFFP BOD members (S Hedwall (USFWS), A Mottek Lucas (MC) and, S Gatewood (WWC)) revisited the mark to assess the mark by the trail. The main objective of this last visit was to ensure the recreational value of the area was conserved and protected. Further, as this unit was adjacent to the Mountaineer neighborhood, the Partnership realized there was much less room for mistakes in the mark.

In some areas next to the trail, a good proportion of trees were retained, however in other areas, many trees were not marked as leave trees. In assessing the mark by the trail, M Shiery (FFD) was asked, why were so many trees going to be cut by the trails? Shiery responded, his judgment was based on the prescription that stated: “Leave individual trees and variable groups at irregular intervals along the main hiking trail.” He further explained, this will add variability; some sun, some shade to the trail.

Hedwall lives in the neighborhood and explained, there are areas that are heavily used by residents that have important social value. She illustrated this in an area where the trails converged with five large down logs (14-24” DBH) laying under a group of trees that were not marked as leave trees (see Figure II). Many times, she had observed elderly sitting on these logs in the shade of the trees, reading. In addition, with the high

use of the trails, Hedwall had previously walked the unit around noon, during the hottest part of the day, to assess the trail's heat and shade issues. From this she concluded, during the extreme heat of the day, the more shade that is provided on the trail, the better.

Figure II. Trail intersection. Large downed logs used as a reading area by residents.



During this visit, BOD members were approach by a resident that lived nearby. This individual, as well as others that Partners spoke with, were concerned with the mark as they thought it was a cut tree mark. This led the Partnership to believe it would be a good idea for the USFS to sign the area so residents were not alarmed and have an understanding of what is occurring in their backyard.

Trees marked during this last site visit primarily took into account trees valuable to recreation; however, some were retained for silvicultural, operational and wildlife considerations. For example, when trees 24+ inches DBH were observed unmarked, several were marked to leave. In the end, a total of 38 trees were marked to leave during the last visit to the site. Of these, 20 were approximately 24" DBH, 7 trees were 5-22" DBH and, 11 trees were less than 5 inches DBH.

US Forest Service Mark

Once the Partnership completed the mark, two seasonal employees from the USFS followed the mark with tracer paint. The USFS agreed to follow the Partnership Mark as marked, with the exception of missed trees, 24 inches DBH and greater. During this exercise, the USFS crew counted 43 trees that were missed by the Partnership that were VSS 6 class. The USFS crew also found forked trees (at DBH or above) where

only one tree was marked. Similarly, these were also marked to alleviate operational damage from mechanical equipment.

In considering the trees marked by GFFP BOD members on August 10, 2009 (n=38), in addition to the missed old growth and adjoining trees marked by the USFS (n=43), a total of 81 additional trees were marked to leave. These were added after the check cruise was performed on July 31, 2009 (residual BA 59 ft_/ac). This could have significant impact on the residual BA, which can be assessed with post-monitoring measurements.

Monitoring Protocol

In utilizing the USDA Forest Service Southwestern Region Fuels Sampling Protocol (FSP) (USFS Region 3 Common Stand Exam Field Guide; Version 1.7) (USFS 2005), adaptations were initially implemented during data collection efforts for the National Forest Foundation (NFF) Grant completed by the Partnership in 2006. In addition, prior to beginning monitoring data collection for the Mountaineer_I Partner Mark (July 2007), based on recommendations of the PAB, further adaptations were made to the protocol (see Appendix J). Within the protocol two metrics were omitted that included: 1. species-specific floral inventory and the life form cover and, 2. estimates of cover of vertical layers. Three metrics that were added to the protocol included: 1. estimates of five categories of ground cover in a 3'x3' quadrat, 2. estimates of cover classes of weed species and, 3. canopy cover estimated as the average of four spherical densiometer readings.

To promote data collection efficiency, further revisions included reordering of the protocol's steps as well as adding explanatory diagrams and tables, such as, downed woody debris, ranking log decay class, crown class categories and snag decay classes. A diagram was added at the end of the protocol that illustrates the layout of a plot. More specifically, it shows the relative location of the 1/10th acre fixed plot, the 1/100th acre fixed plot, the fuel transect and, the ground cover quadrat. Lastly, changes were made to the data collection forms that more closely matched the protocol's instructions (see Appendix K).

Conclusions/Lessons Learned

Prescription Comparison

An important revelation in comparing prescriptions came when P Ringle (USFS Silviculturist) was asked to comment on the variations between the Mountaineer Partner Mark and the School House (SH) Unit's prescriptions. As Ringle suspected, some still view the Forest Service's primary consideration as a "timber production mode." Without knowing these were comments from some Partners, Ringle had provided written rebuttal. She explained, in attempting to counter these inferences,

further reference and details are included in the SH prescription that reflect multiple use concepts, such as managing for wildlife. For example, in the SH prescription, developed after the MIIPM, detailed references are made for both squirrel and turkey habitat. Ringle went on to say, "...I am trying to do a better job of explaining why we do what we do."

Deviations from the Prescription

The Mountaineire_II Partner Mark was based on the premise of translating a collaboratively developed prescription to the ground. Based on the prescription: How was it marked? Why did markers deviate from the prescription? What were the concerns or objections to the prescription? How could the prescription be improved?

While it is understandable the USFS wants to retain the most vigorous and healthy trees for optimal growth production, GFFP argues leaving some less desirable trees, exhibiting lower crown ratios, forks, and twisted branches, for example. The Partnership views these attributes as valuable to both wildlife and aesthetics, ultimately retaining variability within the forest. Therefore, the mark reflects this premise by leaving some "less desirable" trees.

The Partnership also deviated from the prescription in residual BA in the groups/clumps. Although the prescription denotes a maximum BA of 120 ft_/ac in groups, GFFP markers noted a few groups may contain BA greater than 120 ft_/ac. GFFP defends this position in attributing the higher BA to groups of yellow pines that are inherently more resistant to fire. GFFP further justifies this judgment by encouraging the USFS to increase maximum BA to 160 ft_/ac, allowing this in only 10% of the stand (or some variation thereof e.g. 160 ft_/ac in 10% and 120 ft_/ac in 10%), versus a maximum BA of 120 ft_/ac in 20% of the unit.

Instead of following the prescription to space trees in groups 3 to 30 feet apart, GFFP chose to retain adjacent large trees in groups, sometimes sandwiched together or only one foot apart. To offset the increases in BA in groups as well as allowing close spacing of trees within the groups, the Partnership suggests increasing efforts in clearing duff within the groups to balance fire hazard mitigation efforts. These recommendations are also prescribed in raking around old growth before controlled burns that not only mitigate tree mortality, but also discourage uncharacteristic fire behavior.

Prescription Considerations

Prior to developing the prescription, visiting the site to assess special considerations and specific needs for the unit was a crucial step. This was demonstrated in recommendations by the Partnership in the large oak release, consideration of high recreational use and various wildlife concerns, all specified in the prescription. In addition, the initial site visit gave the team a sense of the current conditions of the unit,

containing a good proportion of large yellow pines with distinct natural openings, and how this scenario was distinctly different from the previous Partner Mark site.

For the next Partner Mark project, GFFP recommends describing the silvicultural treatment as “Uneven-aged Management - Group Retention.” The current prescription describes the silviculture treatment as “Group Selection.” “Selection” is a term that denotes choosing trees to remove to create openings, whereas “retention” signifies trees that remain. In silvicultural terms, “Group Retention” will better reflect retaining groups that already exist.

The USFS no longer uses the term “clumps” or “interspaces,” only “groups” within their prescriptions. Although markers delineated groups, clumps within groups were also conceptualized and identified. Clumps were marked primarily based on evidences and, by conceptualizing clumps; this reduced the scale to simplify marking. Given this scenario, if groups, clumps, interspaces and openings were universally defined across agencies, these spatial/structural scales could be regularly employed in prescriptions.

Marking Guidelines

Congruity of the mark did not occur between the three markers. This could be due to the Marking Guidelines, the interpretation of the Guidelines or the marker’s relative experience and/or training. This leads the Partnership to believe marking guidelines and/or training can be improved by developing a user-friendly, detailed marking guideline template and/or developing a marker training that could be implemented by a forestry student or an inexperienced seasonal marker.

Marking Procedures

During the visit on July 30th, the three markers and K Waring (NAUSF/Silviculturist) discussed the interpretation of the prescription to the ground. Similarly, before markers begin to work on a site, USFS silviculturist will visit the stand to relay the concepts of the prescription to the ground. This is a critical step if the markers are to fully grasp the intent of the silvicultural treatment as well as a holistic perspective of the DFCs on the unit.

Although a silviculturist initially guided markers, K Waring surmised markers might have focused on character trees or other aspects of the prescription, causing them to miss 43 trees above the diameter limit. In the future, markers should run a diameter tape to be sure large trees are not missed as well as a walk and check the unit once marking is complete. In hindsight, Waring thought extending the time she was with the markers and additional coaching may have added to consistency in the mark.

To make the marking process more efficient, during the next GFFP mark, once a group is identified and marked, immediately mark within the group before moving on to the

next group. After that, delineate the perimeter of the next group and mark the trees within that group and continue with this pattern in marking the stand.

Clarification of trees falling in either VSS 1 or 2 classes (< 5" DBH) was necessary and resulted in knowing the type of operational contract/prescription and understanding the subsequent protocols. In general, if the silvicultural treatment is uneven-aged, then it is not necessary to mark trees less than 5 inches DBH. With other types of contracts that include stewardship or thin from below, trees that fall in these classes should be marked as leave trees.

Recreation/Social Value

In areas such as the MIIPM site, abutting a neighborhood as well as having an exorbitantly high amount of recreational activity, extra care needs to be taken in both writing the prescription as well as in marking. Although there was a clause highlighting the trails in the unit (Visual Quality section), misinterpretations were made by markers when the leave mark should reflect, "Leave individual trees and variable groups at irregular intervals along the main hiking trail." Although markers considered the "variable groups" description in the prescription, accounting for ample shade on the trail as well as "trail hot spots," where residents/visitors regularly used areas (sitting/reading areas etc.) was not properly assessed.

It was evident with so many residents' inquiries, conveying their concern about the mark, believing it was a "cut tree mark," that land management agencies responsible for treating the unit should place signage in the area. This should explain the intent of the treatment and what the mark on the trees means, whether it is a leave tree or cut tree mark. This would not only put residents at ease but also, would allow an opportunity to further educate the public about forest restoration principles and ongoing efforts.

Wildlife Considerations

During the last visit to the MIIPM unit, additional trees were marked, as they were deemed valuable to wildlife. These included "character" trees and "leaners" as well as small groups of trees with good-sized (16" DBH+) downed logs between them.

Operational Considerations

In considering operational logistics, trees that are adjoining with the split occurring at DBH or above, or those that are sandwiched together, should either both be marked to leave or both marked to cut. Given operational restrictions of the machinery used, if they are not both marked in the same way, operational damage could occur. Markers missed a good amount of split trees and should look for these characteristics when marking.

Monitoring Protocol

The USFS Common Stand Exam Field Guide Region 3, Version 1.7 Monitoring Protocol that the Partnership originally revised was last updated in 2005. For the next round of protocol revisions, the Partnership should entertain the possibility of incorporating relevant changes/additions from the 2009 version as well as adaptations derived from collecting data in the field.

Fire Models

To parallel USFS fire modeling, previous GFFP monitoring studies have incorporated NEXUS software that calculates a suite of fire behavior metrics including torching and crowning indices, fire spread rate, and fire type. New fire modeling software, Fuel Management Analyst (FMA), is being tested in at NAU's School of Forestry. This contains a suite of fire management software tools that calculates crown fuel and downed dead woody fuel characteristics. A distinct advantage in the using FMA software over NEXUS is the omission of calculating crown bulk density as an input variable (this is completed by the program).

Summary

Based on the various discrepancies, inconsistencies and uncertainties outlined in this report, marking a site to a prescription has proven challenging at best. In implementing a prescription, there is evidence this task is not only extremely subjective, but also is one of the most difficult implementation steps in the process of forest restoration.

Although these processes are challenging, the vision of the Partnership to treat the forest within a holistic perspective is clear. Throughout the exercise, the Partnership emphasized restoring natural ecosystem composition, structure and function, while reducing forest fuel levels. To this end, the Partnership adopted an adaptive approach from the last GFFP collaborative mark. More specifically, GFFP collaboratively designed the prescription with the Forest Service that included appropriate silviculture terminology and considered the proposed action of the Environmental Assessment, as well as forest plan provisions, such as goshawk guidelines. Not only was the process of developing the prescription improved, but also, in planning and executing the mark, steps were taken to assure an enhanced approach. Although large trees were missed, omissions such as this can only inform and reinforce the task at hand.

The second Partner Mark also encouraged dialogue between the GFFP and the USFS. When there were uncertainties, a USFS' forester and silviculturist were consulted for clarity. These communications will only encourage increased collaboration, cooperation and information sharing between the GFFP and the USFS. Additionally, memorializing the entire process in this report will support this trajectory and an adaptive management approach by all parties.

The information gained and presented in this report can be used as a vehicle to encourage communication on treatment prescription, marking and implementation within and outside the Partnership. Lessons learned will be carried forward towards similar endeavors and will inform perspective projects to engage and continually improve the process. Ultimately, this reinforces and brings the Partnership closer to fulfilling its mission: to restore natural ecosystem structures, function, and composition; manage forest fuels to reduce the probability of uncharacteristic wildfire and; to research, test, develop, and demonstrate key ecological, economic, and social dimensions of restoration efforts.

USFS staff and GFFP members come and go. Occasionally repeating the process of generating prescriptions, marking and subsequent monitoring, as a cooperative experiment between USFS and GFFP serves as a powerful “norming” activity. The process teaches or refreshes all parties on rules, tools, terminology, and other considerations and issues that arise. During this process, USFS and GFFP members come to a common understanding of the processes that are involved in writing a prescription and marking a stand. These types of exercises will only enhance discussions about proposed actions and encourages parties involved to become powerful allies for achieving mutual goals for treatments within the zones of Community Wildfire Protection Plans, State Forest Health Plans, and other novel forest treatment initiatives.

Next Steps

Based on information in this report and efforts that have been made in designing a prescription and marking guidelines, marking the site based on the prescription and, revising and fine-tuning a monitoring protocol, it only seems prudent to say, “Where do we go from here?” The following outlines future endeavors that the Greater Flagstaff Forests Partnership can engage in to move forest restoration efforts forward. By implementing some or all of these efforts, the Partnership will align with its mission and goals to promote healthy and sustainable forests in Northern Arizona.

- Develop a user-friendly, detailed marking guideline template that could be implemented by a forestry student or an inexperienced seasonal marker.
- Develop a marker training that could be implemented by a forestry student or an inexperienced seasonal marker.
- Collaboratively develop interagency definitions of “groups,” “clumps,” “interspaces” and “openings” - discrepancies in these definitions remain.

- Share report/findings with GFFP Partners and other land management agencies (USFS, AZGF, USFWS, The Nature Conservancy, Four Forest Restoration Initiative etc.)
- Obtain updated post-treatment aerial photos to compare pre- and post-structural changes on the site.
- Identify a fourth Partner Mark stand, which provides different current conditions than the previous three sites.
- Continue to test and improve the monitoring protocol so that it could be implemented on larger landscape scale projects.
- Test and implement new fire modeling for monitoring analyses.
- Complete monitoring data collection (post) and analysis to assess effectiveness of the MIPM and MIIPM treatments and share results with the USFS.

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