RIM COUNTRY FLEXIBLE TOOLBOX APPROACH FOR MECHANICAL TREATMENTS

It is desirable for the Rim Country Project EIS to give forest and district silviculturists as much flexibility as possible to choose the best treatment for individual stands and portions of stands, and prescribe the right treatment on the right acre. A "toolbox" approach would be used to identify and analyze a suite of possible treatment options and would not tie implementers to a single pre-determined treatment for each individual stand in the project area. Within the broader adaptive management framework, learning from implementation and monitoring of mechanical treatments for restoration, we want to analyze a wide variety of possible treatments across the landscape, and defer the final treatment determination until we have the most accurate and current on-site stand conditions. Using this approach, we will describe a series of current conditions and then identify a mechanical treatment that could be applied to move the landscape toward desired conditions. We will use decision matrices with a set of "if…then" decision points, based on conditions at the time of implementation, that would lead to the desired condition. In its simplest form, if we can describe existing stand conditions and the desired condition for a stand, then the silviculturist on the ground can design the appropriate prescription using guidelines provided in a flexible toolbox and an integrated implementation plan. This document applies only to mechanical treatments, and suggested treatments are intended to be used in conjunction with prescribed fire.

FLEXIBLE MECHANICAL TREATMENT APPROACH: STAND-LEVEL PRESCRIPTIONS

The proposed approach builds on the method used in the 1st 4FRI EIS, but expands upon it to give the desired flexibility in mechanical treatments in areas without other management constraints (such as Mexican spotted owl (MSO) and goshawk (NOGO) habitat, or sensitive soils).

One way we can add the flexibility required to apply the right treatment to the right acre is to use decision matrices to display the different conditions that would lead to different treatments. In this simplified example, we will use %SDI max (measure of existing stand density compared to its theoretical maximum density), site index (measure of site productivity), and dominant diameter class to determine proposed treatments. A simplified decision matrix considering these conditions could look like the following.

%SDI Max	Site Index	Dominant Diameter Class (inches)	Treatment
>35%	>75	12+	Uneven-aged Group Selection, 10-25% interspace
		<12	Stand Improvement, 10-25% interspace
	55-75	12+	Uneven-aged Group Selection, 25-40% interspace
		<12	Stand Improvement, 25-40% interspace

For example, a dense ponderosa pine stand is highly departed from desired conditions. It has a basal area of 150, an SDI of 250 (56% of SDI Max), is dominated by trees greater than 12", and is located in an area with a site index of 80. According to the decision matrix above, the stand would be assigned an Uneven-aged Group Selection, 10-25% interspace treatment. The treatment would be designed to reduce basal area and SDI, while creating up to 25% interspace within the stand in order to move the stand toward desired conditions.

AREAS NOT ASSIGNED TREATMENTS USING THE DECISION MATRICES

Before applying the decision matrices to stands in the Rim Country project area, it is necessary to acknowledge that there are several identified forest cover and habitat types that warrant additional consideration. For example, MSO habitat and certain stand conditions require consideration of additional management constraints before prescribing treatments. While some of these situations warrant treatment considerations completely outside of the decision matrices, some of these conditions are included in the decision matrices with additional design features to ensure resource protection. For example, while MSO PACs may require certain types of treatment without consideration of the decision matrices, treatments in northern goshawk (NOGO) Post-Family Fledgling Areas (PFAs) or in Stands with a Preponderance of Large Young Trees (SPLYT) may only require additional design features to ensure adequate resource protection. Some stands have a particular soil or vegetation characteristic that may warrant particular treatments outside of the matrices (i.e., aspen stands, savannas). Habitat and forest cover types that will require additional consideration before application of the decision matrices are described here.

MSO Protected Activity Centers (PACs)

PACs exhibit a variety of topographic and forest conditions and occupied PACs can already be considered successful nesting habitat. Mechanical treatments in PACs should be designed to maintain or improve the characteristics that make each PAC effective at providing habitat while also making them resilient to disturbance. Consideration should be given to 1) increasing the number of large trees; 2) creating additional foraging habitat for MSO; 3) the fire hazard index in the PAC and whether it is

in wildland-urban interface (WUI); 4) restoration/protection of other resource values nearby, such as perennial water; and 5) protecting other values at risk. Treating areas near PACs should be considered in order in improve resiliency in the PACs themselves. PACs should be treated with consideration of the larger landscape and not just separate entities. Specific treatments in PACs would be determined prior to implementation and in consultation with U.S. Fish and Wildlife Service (FWS) personnel.

MSO Nest/Roost Recovery Habitat

Though these areas are distinct from PACs, their management objectives are similar. Any treatment proposed within MSO nest/roost recovery habitat should be designed specifically to maintain or accelerate the trajectory of these stands towards desired habitat conditions in the foreseeable future.

Aspen Restoration

Stands identified for aspen restoration will receive an aspen-specific restoration treatment and treatments will not be determined as a result of the decision matrices. These stands have been identified as those having the majority of live basal area in aspen. Aspen restoration treatments may include conifer removal from within stands, and barriers to reduce browsing pressure on regeneration.

Grassland

Stands designated as grasslands will be given a grassland-specific restoration treatment and will not be assigned a treatment from the decision matrices. Stands or portions of stands that overlap with a grassland terrestrial ecosystem unit (TEU) were identified as grassland. Grassland-specific restoration includes a mechanical treatment that removes post-settlement conifers and manages for at least 90% of the treatment area as grass/forb, using pre-settlement tree evidence as guidance.

Savanna

Stands designated as savanna will be given a savanna-specific treatment and will not be assigned a treatment as a result of the decision matrices. Stands or portions of stands that overlap with a savanna terrestrial ecological unit (TEU) and are adjacent to stands identified for a grassland treatment are classified as savanna. Also, those stands or portions of stands that overlap with a savanna TEU and with an existing condition of less than 25% max SDI were identified as savanna. Savanna restoration includes a mechanical treatment that restores pre-settlement tree density and pattern, and manages for a range of 70 to 90% interspace between groups or individual trees, using pre-settlement evidence as guidance.

Severe Disturbance Areas

Severe disturbance areas are those where the spatial extent and/or the pattern of high severity effects is not within NRV. In some places this has resulted in aggressively sprouting species, such as alligator juniper and various species of oak dominating the vegetative response, making it difficult or impossible for ponderosa pine to establish or thrive. In other areas, extensive, overly dense patches of

ponderosa pine regeneration have put stands on a trajectory toward stagnation, density-related mortality, or additional severe disturbance. In these areas of extensive, pure ponderosa pine regeneration, the decision matrices would be applied.

Restoration treatments in severe disturbance areas will include combinations of reforestation, prescribed fire, lopping/scattering, mastication, and other mechanical methods with the objective of identifying treatments that would be effective in restoring the fuel structure that produces the types of fire to which ponderosa pine is adapted.

Non-target Cover Types (Facilitative Operations)

Facilitative operations (FO) are treatments implemented in non-target cover types as needed to support the use of prescribed fire in target cover types. FO would be used in non-target cover types that lie between target cover types and existing features appropriate to use as prescribed fire boundaries, or that are surrounded by target cover types. FO treatments would either move these areas towards desired conditions as described in the forest plans or maintain the current condition. The inclusion of FO in burn units would be designed to improve safety, improve treatment effectiveness, expand burn windows, and minimize disturbance.

AREAS ASSIGNED TREATMENTS USING THE DECISION MATRICES

MSO Recovery Habitat

Achieving management objectives within MSO recovery habitat can be addressed with the flexible toolbox approach. Stands in recovery habitat would be assigned a treatment using the decision matrices; however, additional management direction would be applied such as maintaining increased basal area (40-110 BA for pine-oak and 40-135 BA for mixed conifer). This additional direction will be included in the project design features to ensure resource protection.

NOGO Nest Stands

Achieving management objectives for northern goshawk nest stands can be addressed with the flexible toolbox approach. NOGO nest stands would be assigned a treatment using the decision matrices. However, additional direction would be included in project design features, such as maintaining increased basal area within nest areas, to maintain or improve habitat and ensure forest plan compliance.

NOGO Post-Fledging Areas (PFAs)

Management objectives in NOGO PFAs are similar to those in NOGO nest stands and can be addressed with the flexible toolbox approach. NOGO PFA stands would be assigned a treatment using the decision matrices; however, additional direction would be included in project design features, such

as maintaining increased basal area within PFAs, to maintain or improve habitat and ensure forest plan compliance.

Stands with a Preponderance of Large Young Trees (SPLYT)

The iterative spatial analysis and field validation effort undertaken by the Forest Service and stakeholders yielded an initial filter for SPLYT located outside of MSO PACs, MSO recovery habitat, and wildland urban interface (WUI). For ponderosa pine SPLYT, criteria are that: a) the Quadratic Mean Diameter (QMD) of the top 20% of trees is >15" diameter at breast height (DBH), and b) there is >50 square feet/acre of basal area (BA) in trees >16" DBH. All stands would be field-verified prior to mechanical thinning. Stands (or portions thereof) meeting SPLYT criteria, including those not captured by the data filter, would be treated at the lowest range of intensity within the identified silvicultural prescription. For example, a stand identified by the decision matrices to receive an uneven-aged treatment leaving 10 to 25% interspace (UEA 10-25), would be treated to 10% interspace and to the upper end of its natural range of variation (NRV) for trees per acre (TPA) and BA in order to maintain large tree dominance and conditions favorable to canopy-dependent species. Stands (or portions thereof) that are identified by the SPLYT criteria data filter but, upon field verification, are determined not to meet the SPLYT criteria, will be treated within the range of intensities applied to other non-SPLYT stands.

Sensitive Soils

Achieving management objectives on stands with sensitive soils can be addressed with the flexible toolbox approach. Stands or portions of stands with sensitive soils will be identified in the project implementation plan and protection measures employed in the project layout process. Additional design features will be included to prevent soil displacement and compaction, and ensure resource protection and forest plan compliance.

Dwarf Mistletoe

While the overall incidence (distribution and percent of landscape affected) of dwarf mistletoe (DM) is thought to have increased only modestly compared to historic conditions, the overall intensity and abundance of DM is thought to have increased considerably (Conklin and Fairweather 2010). In order to meet the purpose of increasing the resiliency and sustainability of ponderosa pine ecosystems within the Rim Country project area, it would be beneficial to develop treatments that focus on reducing the abundance and intensity of DM infection in stands. This section hopes to clarify the conditions that warrant various treatments in order to meet the Purpose and Need and move toward desired conditions in the Rim Country project area.

Because of the patchy nature of DM infections, it is recommended that the district silviculturist consider re-delineating a stand with high DM infection and treating the healthy and infected portions with separate prescriptions.

In lightly (0-20% DM infection) and moderately (20-80% DM infection) infected stands, the restoration treatments in the modified proposed action will address DM. In stands with light infections, project design features will be included to allow for removal of DM-infected trees as part of the uneven-aged group selection, single-tree selection, stand improvement, weed and release, and grassland treatments. Pockets of DM infection would be addressed through the reduction of basal area as well as the creation of openings and interspaces as part of these treatments.

In moderately-infected stands, the intermediate thin treatment would be particularly effective at addressing DM, especially at the lower part of the moderate range (20-50%). Towards the higher end of the moderate range (50-80% infection), mistletoe would remain as a component of the stand, while remaining basal area would be sufficient to prevent the stimulation of DM in the remaining trees. Pockets of DM infections could be addressed through the reduction of basal area as well as the creation of small openings and interspaces.

With the modified proposed action, heavily infected stands (>80% DM infection, Table 1) would be treated with the UEA 55-70 treatment. This approach would maximize interspace and minimize residual basal area in order to retain the uninfected component of the stand as well as control DM spread. Deferment of mechanical treatment would be another option in these stands.

Table 1. Level of Dwarf Mistletoe (DM) Infection in Ponderosa Pine (PP) Forest

		Level of DM infection (all trees)			
		>80% DM	>70% DM	>60% DM	>50% DM
Total PP acres*	679,167	14,311	26,122	48,063	76,355
% of total PP acres		2.1%	3.8%	7.1%	11.2%

* outside of MSO PACs and MSO nest/roost recovery habitat and severe disturbance areas

Conklin, D.A.; Fairweather, M.L. 2010. Dwarf mistletoes and their management in the Southwest. USDA Forest Service, Southwestern Region, R3-FH-10-01. 23 pp.

DECISION MATRICES

Once these areas that will not be considered for regular restoration treatment types were identified, a treatment strategy for the remaining conditions was developed. Decision matrices have been built that incorporate discrete attributes that can be used to segregate the stands for different treatments and build diversity across the landscape. There are two basic matrices: one for the Apache-Sitgreaves and Coconino NFs and one for the Tonto NF. The Tonto matrix was developed separately because of the large amount of the ponderosa pine/evergreen oak cover type on the Tonto.

If the goal of a flexible toolbox is to prescribe the right treatment on the right acre, then vegetation condition should guide management decisions. One way to do this is to describe the stand structure,

for example if it is even-aged or uneven-aged. We may want to thin even-aged stands differently than uneven-aged stands to move them toward the desired condition of uneven-aged stand structure. An even-aged stand would be treated to develop more openings, to encourage new cohorts and a more uneven-aged structure, and to develop one or two more age classes (additional age classes could be developed in later entries). An uneven-aged stand would be thinned to develop larger groups, in all diameter ranges, to maintain or enhance the current uneven-aged structure.

Another way to provide more flexibility is to consider the variety of site classes that occur across the project area. Stands with a higher site class may be able to be managed at a higher residual basal area and with less interspace. Additionally, the level of dwarf mistletoe infection should be considered in prescribing treatments in order to most effectively improve resilience without releasing or stimulating the infection.

Decision Matrix for the CNF and ASNF

%SDI Max	Site Index[1]	Structure	Dominant Diameter Class (inches)	Dwarf Mistletoe[2]	Treatment[3]	Treatment 2 (open reference condition)
>25%	>75	EA or UA	12+	None to light	UEA10-25	UEA25-40
		UA	<12		UEA10-25	UEA25-40
		EA			SI10	SI40
		All	All	Moderate	IT10	IT40
	55-74	EA or UA	12+	None to light	UEA25-40	UEA40-55
		UA	<12		UEA25-40	UEA40-55
		EA			SI25	SI40
		All	All	Moderate	IT25	IT40
	40-55	EA or UA	12+	None to light	UEA40-55	UEA40-55
		UA	<12		UEA40-55	UEA40-55
		EA			SI40	SI40
		All	All	Moderate	IT40	IT40
<25%	>55	All	All	None to light	UEA40-55	UEA40-55
				Moderate	IT25	IT40
	<55	All	All	None to light	UEA40-55	UEA40-55
				Moderate	IT40	IT55
All	All	All	All	Severe	UEA55-70	UEA55-70

Decision Matrix for the TNF

%SDI Max	Site Index[1]	Structure	Dominant Diameter Class (inches)	Dwarf Mistletoe[2]	Treatment 1[3] (<40% cover of shrub or EO)	Treatment 2 (>40% cover of shrub or EO)
>25%	>75	EA or UA	12+	None to light	UEA10-25	ST
		UA	<12		UEA10-25	ST
		EA			SI25-40	SI10-25
		All	18+	Moderate	IT25-40	IT10-25
			<18		IT40-55	IT25-40
	55-74	EA or UA	12+	None to light	UEA25-40	ST
		UA	<12		UEA25-40	ST
		EA			SI40-55	SI25-40
		All	18+	Moderate	IT40-55	IT25-40
			<18		IT55-70	IT40-55
<25%	>55	All	All	None to light	UEA 40-55	ST
				Moderate	IT55-70	IT40-55
All	<55	All	>12	None to light	UEA 40-55	ST
				Moderate	IT40-55	IT25-40
			<12	None to light	SI40-55	SI40-55
				Moderate	IT40-55	IT25-40
All	All	All	All	Severe	UEA55-70	UEA55-70

[1]Stands with a Site Index less than 40 are confined to woodland sites.

[2]**Dwarf Mistletoe Infection:**

Light: < 20% Susceptible TPA infected.
Moderate: 20-80% Susceptible TPA infected
Severe: > 80% Susceptible TPA infected

[3]**Treatment**: The number following to the treatment type (10-25, 25-40, 40-55, and 55-70) refers to the approximate percentage range of grass/forb (non-forested) interspace that will be established by the treatment.

- UEA = Uneven-aged (thinning throughout all diameters)
- IT = Intermediate Thin (thinning with a dwarf mistletoe cutting bias)
- SI = Stand Improvement Thin (thinning young stands to select best future trees)
- ST = Single Tree (reduce BA but maintain cover to suppress brush response)

The advantage of using this type of matrix is that we are looking at "conditions" and not necessarily "stands." Many of the stand delineations are dated and there is a chance that the conditions that set the stand boundaries have changed, or that conditions within a stand are now changed (partial burns, partial thinning). This flexible approach prescribes treatments according to pre-defined conditions and

not necessarily by previously defined stands, so that stand boundaries can be re-delineated based on current conditions. This is particularly important where there is a patchy condition in a stand, such as that caused by dwarf mistletoe or a group of large young trees. If it is necessary to have two or more distinct treatment prescriptions in one stand to accommodate intra-stand variability, then the silviculturist should delineate new stand boundaries.

While the decision matrices lead us in the right direction to apply the right treatment to the right acre, there is still a need to ensure that silviculturists have the flexibility to move toward desired conditions across the landscape. This method also allows, based on specific conditions, for a broad range of densities within the individual treatments identified in the decision matrices. We recognize that there will be a broad range of responses of vegetation, wildlife, and water to our proposed treatments, some unanticipated. This approach gives us the ability to make adjustments to treatments in response to monitoring results or other new information.

This is somewhat of a hybrid approach which helps give fine-, mid-, and landscape-scale perspectives across the project area, in order to determine if proposed treatments are moving toward desired conditions at multiple scales. Acres of "conditions" and "outcomes" at multiple scales will be used to drive the analysis. Stand-level data can be aggregated up to the mid- and landscape-scales.

General Treatment Types

- Uneven-aged Management (UEA)
  - Establish grass/forb (non-forested) openings between residual tree groups and clumps.
  - Establish regeneration openings where seedling/sapling size class trees are underrepresented.
  - Establish gaps between individual trees and clumps of trees within a group.
  - Enhance growing space for younger age classes to become free to grow with limited competition.
  - Retain as many old and/or large trees as possible.
- Intermediate Thin (IT)
  - Thin stands that are up to moderate infection levels of dwarf mistletoe to improve growth and vigor. Retain the best dominant and co-dominant trees with the least amount of mistletoe.
  - Establish grass/forb (non-forested) openings between residual tree groups and clumps.
- Stand Improvement (SI)
  - Thin young, even age stands to improve growth and vigor.
  - Begin conversion to uneven age condition and establish grass/forb (non-forested). openings between residual tree groups and clumps.
  - Retain as many old and/or large trees as possible.
- Single Tree (ST)

- Individual tree selection treatment leaving fewer tree groups and clumps and more evenly spaced trees.
- Designed to reduce understory brush and shrub response.
- Retain as many old and/or large trees as possible.