Cherokee National Forest South Zone Collaborative

Restoration Recommendations

for the Management of Off-site Pine in Dry Forest Communities

Contents

Acknowledgements

The Cherokee National Forest South Zone Collaborative Group was convened in 2017 by The Nature Conservancy with the purpose of providing recommendations for the development of a proposed action to be used in a programmatic EA to address restoration on the South Zone of the Cherokee National Forest. The group was facilitated by Rob Sutter of Enduring Conservation Outcomes, LLC, Savannah GA. Many thanks go to all who participated in the series of workshops leading to the creation of these recommendations:

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Introduction

The Cherokee National Forest South Zone Collaborative (the Collaborative) was convened in 2017 by the Tennessee Chapter of The Nature Conservancy for the purposes of developing a set of restoration recommendations for off-site white pine. The foundation of the work was based in Goal 17 of the Cherokee National Forest Land and Resource Management Plan (CNFLRMP) which states: "**Restore and maintain forest communities to those plant communities predicted as most likely to occur based on the ecological potential of the site potential natural vegetation."**

The goal of the group was to generate recommendations that would be used to help develop a programmatic NEPA document (EA) for restoration activities on the South Zone. A programmatic EA increases restoration and management efficiencies by proactively generating agreement among major stakeholders and creating sideboards for future projects as described in the 2014 Council on Environmental Quality memo regarding the Effective Use of Programmatic NEPA Reviews (https://ceq.doe.gov/docs/ceq-regulations-and-guidance/Effective_Use_of_Programmatic_NEPA_Reviews_Final_Dec2014_searchable.pdf). Public participation is a required part of NEPA and this collaborative effort is not intended to substitute those opportunities.

Process

The Collaborative was charged with developing recommendations for the South Zone of the Cherokee National Forest. Participants included representatives from state and local forestry, state and non-profit wildlife organizations, conservation organizations, and environmental advocacy groups. The Forest Service was represented on the Collaborative by one individual. Other Forest Service staff provided expertise but were not decision-making members of the group.

Five working meetings were held between September 2017 and August 2018, addressing in order, understanding the charge and developing the Collaborative, learning about the communities, off-site species and seeing sites representative of the current and desired conditions, developing recommendations, and obtaining consent on recommendations.

Consent is defined as a general agreement on the recommendation, with no significant objections. Individuals can have concerns about a recommendation, but even with concerns, everyone agrees to move forward. Consent means that an individual will not work to block a recommended action. The recommendations contained within this document represent consent of the participating groups to the course of actions outlined in this document. Consent or agreement to site specific restoration locations are not part of this effort and will be addressed via the public participation portion of the NEPA process.

Consent is nested between consensus and supermajority. With consensus, everyone fully agrees with the recommendation and there are no concerns, although this definition does vary in the literature. With supermajority, while the majority of the participants agree with the recommendation, there are individuals who object.

Any concerns are noted either within the document or in Appendix A to the document.

Scope

The original focus of the group was limited to off-site white pine (*Pinus strobus*) and came from Objective 17.01 of the CNFLRMP that states, "Over the ten-year period, restore at least 5000 acres of diverse native communities appropriate to sites currently occupied by white pine plantations." However, during the course of the workshops, and as the group began to better understand the context of restoration, the focus widened to include similar off-site species where restoration was needed. In the end, the group agreed to focus the scope of the recommendations on two off-site pine species: white pine and Virginia pine (*Pinus virginiana*) and their occurrence in dry forest communities in the South Zone. Removal of uncharacteristic or off-site white pine stands will be a large component of the work that needs to be done and will be the highest priority for restoration work. For the purposes of these recommendations, the Collaborative focused on the dry forest communities listed in Table 1. These systems frequently exist in an ecologically departed state where their canopy is dominated by off site species, usually white pine or Virginia pine. The term off-site species refers to sites where the biological and physical settings in an expected Natural Range of Variation (NRV) would not have the presence or density of the species currently found there. There are a large number of reasons why a site may be dominated by off-site species including fire suppression, past management decisions, planting pines for production, the loss of the American Chestnut, and other ecological and climatic changes.

The Collaborative agreed that restoration should be driven by ecological factors and landscape position. Steve Simon's Ecological Zone modeling provides just such a platform. His model uses 30+ environmental variables to predict the natural vegetation across the landscape (Simon, 2016).

Table 1. Description of Dry Forest Communities.

The following are brief descriptions of the focal dry forest communities taken from Steve Simon's report entitles: "Ecological Zones on the Chattahoochee and Cherokee (south) National Forest: 1st Approximation". For more extensive descriptions, please see Appendix B.

Shortleaf Pine-Oak- This zone includes dry to dry-mesic pine-oak forests dominated by shortleaf pine and/or pitch pine that occur at lower elevations on exposed broad ridges and sideslopes. Indicator species and species with high constancy or abundance include: shortleaf pine, pitch pine, sourwood, sand hickory, scarlet oak, southern red oak, post oak, hillside blueberry, American holly, featherbells, black huckleberry, and spring iris.

Pine-Oak Heath- This zone consists of predominantly evergreen woodland (or more rarely forests) occupying very exposed, convex, often rocky south-and west-facing slopes, ridge spurs, crests, and cliff-tops. Most examples are dominated by Table Mountain pine, scarlet oak, chestnut oak, pitch pine, black huckleberry, mountain laurel, and hillside blueberry

Dry-Mesic Oak-Hickory- This zone includes dry-mesic, mixed-oak forests that occur along broad lower to mid elevation ridges and smooth to concave slopes and lower elevation drainage headlands, and often narrow, drier coves. Indicator species and species with high constancy or abundance include: white oak, black oak, scarlet oak, flowering dogwood, sourwood, low bush blueberry, and huckleberries

Dry Oak Heath Forest and Woodland (can be split into evergreen and deciduous)- This zone includes xeric to dry mixed-oak forests typically dominated by an ericaceous (evergreen or deciduous) understory and represents the driest zone where oaks are the dominant species. Typically dominated by White oak, Black oak, Chestnut oak, and Scarlet oak with lesser amounts of Red maple, Pignut hickory, and Mockernut Hickory. These occur in a variety of situations, most likely on nutrient-poor or acidic soils and, to a much lesser extent, on circumneutral soils. American chestnut was once dominant or codominant in many of these forests and sprouts of American chestnut can often be found where it was formerly a common tree. Small inclusions of Shortleaf pine and/or Virginia Pine may occur, particularly adjacent to escarpments or following fire. In the absence of fire, White pine may invade some stands (Nature Serve). Today, subcanopies and shrub layers are usually well-developed. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers of mountain laurel, fetterbush, or on more mesic sites rhododendron. Other areas have more open conditions

Restoration Framework

The Collaborative has agreed to a framework upon which restoration activities will be built. The frameworks takes into consideration the desired ecological condition of the site at both a landscape and local scale; the current conditions of the site and its ecological trajectory; as well as the potential management options or tools that might be used. The basic framework consists of:

- Current Conditions: Defining the range of starting conditions for restoration that are the focus of the recommendations, off-site pines in dry forest communities, consisting of two categories:
    - A site dominated by off-site pine with dominance defined as the species has a cover of 50% or more in the uppermost vegetation layer
    - A site that is a mix of off-site pine and other species
- Ecological Desired Future Condition: Identify what ecological community type is desired in the future being informed by information from two different scales
    - Landscape Scale
    - Site Scale
- Management Actions: Determine which tools are effective and ecologically appropriate
    - Considerations
    - Guidance
    - Recommendations
        - Fire
        - Herbicide
        - Mechanical (including a landscape context and geographic prioritization)
        - Roads
- Response Management: Continued/iterative restoration of a site based on the outcomes of previous management actions

The restoration of vegetation to its ecological potential has many benefits, including wildlife habitat and native diversity of rare species, as well as the creation of local jobs and valuable wood products. While management actions can be driven by any of these values, the Collaborative recommends developing a stated purpose and need of creating of an Ecological Desired Future Condition that refers to the potential natural vegetation as referenced in Goal 17 of the CNFLRMP. Any management benefits (ex. timber revenue, creation of specific habitat types, etc.) should be ancillary to this goal.

Current Conditions

Off-site pines can be found in many ecological situations in several ecological systems throughout the South Zone of the Cherokee National Forest. The departed condition of these

forests can be defined by two primary characteristics, the canopy position the off-site pine and percent cover of off-site pine. Treatments will vary based on the extent and combination of these characteristics.

Current conditions can be grouped by the dominance and encroachment of off-site pine, although these exist on a continuum and have extensive internal diversity on the landscape.

Dominant Off-site Pine: Off-site Pine is the dominant canopy species in the uppermost level of the vegetation, regardless of age or size.

Encroaching Pine: Off-site pine species are not the dominant tree in the site but has encroached where it would not naturally occur.

- Under-Story- off-site trees in the understory of a stand that is dominated by shortleaf, pitch, or table mountain pine or hardwoods.
- Mid-Story- off-site trees are in the mid-story of a stand that is dominated by shortleaf, pitch, or table mountain pine or hardwoods.

Ecological Desired Future Condition

The success of restoration efforts is dependent upon the clarity of the stated end goal, or Desired Future Condition (DFC). DFCs can be expressed at two scales: at the scale of the landscape and at the stand or site scale. It is imperative that the DFC for restoration efforts (at either scale) be based on the best available science.

At the landscape scale, The Collaborative recommends the use of Steve Simon's Ecological Zone mapping (Simon, 2016) for determination of the DFC. Simon's modeling uses multiple environmental and ecological parameters to predict the natural vegetative communities at a landscape scale. This is an excellent tool for planning at the landscape scale, however, it is not intended to be prescriptive and is not a substitute for site or stand scale assessments. The ecozone data is best used for assessing ecological potential and landscape scale priorities.

At the stand or site scale, site specific information should be used to refine the desired future condition. This refinement is based on field observations by qualified staff looking at advanced regeneration of desirable species, presence of stumps, evidence of past fires, remnant or relic trees within the stand or adjacent stands, among other indicators of the natural forest condition.

Management Action Considerations

For restoration to be successful, one needs to determine which tool or tools are effective and appropriate to achieve the desired goal. Following the intent of Goal 17 of the CNFLRMP, the best restoration management tools are best if they:

1. Encourage, sustain and restore ecologically appropriate natural processes
2. Preserve and promote desired advanced regeneration
3. Preserve and promote biodiversity
4. Avoid and respond to unintended consequences (i.e. introduction of non-native invasive species and extensive or continuous levels of soil erosion)
5. Recognize that restoration is a long-term commitment and that sequential actions and monitoring are essential to success

Management Action Guidance

A full suite of management actions should be considered for any restoration effort and the most effective methods should be used in furtherance of achieving the stated DFC. These include mechanical treatments from clearcutting and herbicide to prescribed fire or wildland fire use for ecological benefit. However, the Collaborative recommends the following primary guidance.

1. Species diversity of the future stand should be of paramount importance when conducting any operations. Whenever possible, leave trees should include a full range of the native tree diversity appropriate to the site with the intention of a mixed age or size class stand.
2. Soil health is vital to the health of future stands. There should be minimal soil disturbance and coarse woody debris should be left on the forest floor as a contributor to future soil health wherever feasible.

Inherent within a programmatic EA approach is the assurance that site specific surveys will be conducted to avoid, minimize or mitigate impacts to cultural or archeological resources; threatened, endangered, or sensitive species; steep slopes and erodible soils; scenic values; potential for the spread of invasive species.

Management Action Recommendations/Sideboards

Prescribed Fire

Background:

The Dry Forest Communities addressed in these recommendations are widely considered fire-adapted systems. This is evident in the descriptions and associated fire return intervals found in USDA FS Southern Research Station General Technical Report SRS-219 (Lafon et al, 2017), Guyette, et. Al. (2012), and NatureServe (http://explorer.natureserve.org/classeco.htm).

However, the intensity and frequency of fire expected for each community is inherently variable. As we live in an increasing human-built environment, the natural occurrence of fire on the landscape has been suppressed in order to provide safe living spaces. The result has necessitated the use of prescribed fire as a management tool to restore native vegetative communities.

Prescribed Fire Recommendation:

In situations where the off-site pines are encroaching in the understory into an otherwise diverse and characteristic dry forest community, preference should be given to the use of prescribed fire. Fire would be used at its ecologically appropriate intensity, duration, frequency and spatial extent. It is generally the most cost-effective treatment in these situations and provides a multitude of additional ecological benefits.

Herbicide Use

Background:

While the use of herbicides is a generally agreed upon management option and can be used effectively and efficiently to achieve a desired condition, it is not without some ecological risk. Standard safety and precautionary practices found within the CNFLRMP help minimize and mitigate that risk.

Herbicide Use Recommendation:

The use of herbicides for restoration purposes should be for a targeted species in a targeted manner. Herbicide use is most beneficial where prescribed fire or mechanical treatments alone cannot meet the desired objective. It may also be beneficial in conjunction with other treatments.

Herbicide Use Concern:

While there was general agreement that herbicides might be necessary for restoration purposes. It is important to note that some participants expressed a general opposition to the use of herbicides on the Cherokee National Forest, particularly in proximity to streams and sensitive habitats.

Mechanical Treatments

Background:

Geographic prioritization within a landscape will provide for efficient operations. In order to maximize efficiencies, restoration efforts are best clustered together. This is especially important for white pine removal efforts because it is a prolific seed producer and disperser. Once core areas of restoration have been established, additional adjacent areas can be added.

Therefore, the Collaborative recommends the creation of a Zone-wide prioritization of restoration locations. The next section details some initial filters that should be used for the purpose of creating a restoration prioritization map. Prioritization has already been done for ecologically appropriate prescribed fire operations (See South Zone Ecomath).

Mechanical Treatment Recommendation:

In situations where the site is dominated by off-site pine species, preference should be given to mechanical treatments (thinning or regeneration). It is important to consider the landscape context for each restoration project, for two reasons, restoration success and project efficiencies. Success is influenced by landscape context, both positives (ex. adjacent to other restoration actives, inclusion within burn units, accessibility) and negatives (ex. adjacent to seed sources, near existing invasive species) should be considered.

The following criteria should be used to prioritize locations for ground based harvesting treatments:

1. Slopes </= 35%
2. Within ½ mile of existing FS inventoried roads
3. Are areas mapped as dry forests as defined by Simon's Ecological Zones.
4. Contained within or adjacent to a burn unit, or easily included in a burn unit

Appendix D provides a series of maps outlining this prioritization.

Soils

Background:

Protection of soil resources is important to maintain productivity, support high-quality wildlife habitat, and protect aquatic habitat. Ground-based logging can be done without irreversibly damaging soil resources, but that becomes more and more difficult as slope increases.

The CNFLRMP is very flexible when it comes to steep slopes. It doesn't include cutoffs for slope or limits for particular kinds of logging systems (like ground-based logging that requires bladed skid trails on steep side slopes). Instead, the CNFLRMP sets limits on how much total disturbance can happen in a project area. As a result, we have the flexibility to log on steep slopes, but the tradeoff is that each project has to do a site-specific analysis to make sure that the disturbance limits aren't exceeded.

The Collaborative Group recommended that mechanical operations with rubber-tired equipment on slopes less than 35% was generally not a cause for concern. Above that threshold, additional mitigation or consideration, or different types of operation like aerial/skyline logging would be needed.

Soil Protection Sideboard:

Mechanical treatments on slopes equal to or less than 35% will be covered by this programmatic analysis. Operations on slopes greater than 35% should be considered a special circumstance and will require additional analysis.

Stands that don't meet these sideboards could still be included in future projects. When future projects tier to this programmatic analysis, they could identify "covered" impacts on these less steep slopes (which wouldn't require additional analysis). If necessary to include steeper areas in a project, then those impacts could be addressed and mitigated separately.

Soil Protection recommendation:

The Collaborative Group recommended that the Forest Service consider the development of a white paper addressing soils, slopes, and ground-based operations. Specifically, to address whether or not 35% is the right cutoff for allowing ground-based operations without additional analysis or mitigation. This would help ensure that the best available science was utilized during future analysis.

Roads

Background:

There is a need to identify sideboards that place an "upper limit" on the impacts from roads associated with the project. In order to move forward with an Environmental Assessment (as opposed to a more time-consuming Environmental Impact Statement), we need to have sufficient confidence that the upper limit on impacts will not be significant.

The Cherokee National Forest has provided a thorough analysis of its current transportation system in its 2016 Transportation Analysis Report. Within that document, the CNF describes a serious maintenance backlog for its road system. The Forest has 1,569 miles of "system" roads (1.62 miles per square mile) and there are many more "unauthorized" legacy roads. The Forest's allocated budget for roads has not kept up with maintenance costs, and this creates shortfall. It is estimated that the allocation for the roads maintenance is approximately 30% of what's needed.

The shortfall is exacerbated due to the fact that many system roads were poorly located or constructed when they were first built (e.g., too close to streams, culverts that don't allow fish passage). The Forest is slowly relocating and fixing them, however, this requires a big "up front" investment in the road that isn't covered by routine maintenance costs. In addition, decommissioning or otherwise addressing the problems caused by legacy roads can be expensive, too.

Inadequately maintained roads can cause serious impacts to water quality. The biggest source of pollution for national forest streams is sediment runoff from roads. Most sediment is not

contributed by properly located and well-maintained roads, but instead comes from BMP failures and washouts caused by a lack of maintenance. In addition, most culverts (especially "pipe" style culverts) do not allow for the passage of aquatic organisms, which negatively impacts connectivity and the aquatic food chain. Furthermore, many roads have unaddressed and worsening problems with non-native invasive plants, which are spread by trucks and maintenance equipment.

Finally, a related but separate issue: there are several areas of the Forest without the permanent infrastructure to support timber harvest, but which may have a few roads. These relatively undeveloped areas are documented in the "Tennessee Mountain Treasures" book. For many stakeholders and forest users, the special and unique attributes of the Mountain Treasures Areas are top priorities. Increasing road density in the interior of these areas can have negative impacts to undeveloped character, habitat connectivity for disturbance sensitive and dispersal limited species, and remote recreation. Everyone agrees that road construction in these areas might sometimes be needed or appropriate for ecological restoration. However, interior roads will almost always need additional analysis because they will create greater tradeoffs with other values.

Roads Sideboards:

In order to qualify as a covered activity, road impacts would be limited as follows.

i. Temporary roads
    1. In general, temporary roads would be limited to 1/2 mile each for each unit.
    2. Any temporary road constructed in an area identified in the Mountain Treasures book beyond ¼ mile would be recontoured.
    3. Skid trails and temporary roads for the purpose of timber harvest would not be constructed for sustained distances over 200 feet in areas with slopes of 40% or greater ("steep area"). The 200-foot length can be exceeded however where the skid trail and/or temporary road is needed to traverse a steep area in order to access the remaining harvest unit(s) (this is a standard practice within the design criteria for the North Zone).

ii. Spot reconstruction of existing roads would be allowed unless it changes the RMO.

Monitoring and Responsive Management

The recommendations of this Collaborative Group are intended to guide the implementation of ecological restoration efforts and are based on the use of Ecozones. Uncertainty is inherent when modeling ecological systems, predicting their NRV, assessing current conditions and predicting responses to management strategies. The USFS and the Collaborative Group will need to monitor and evaluate the effectiveness of the restoration recommendations and opportunities for adapting them when there is a need to do so. To do that, it is recommended that the USFS will need to develop an adaptive management framework, here called responsive management. And key to that process will be to explicitly acknowledge the uncertainty faced in developing these recommendations.

- In order to ensure that each restoration project is successful, the CNF should include:
    - Clear goals and measurable objectives for achieving ecosystem structure and composition.
    - Project level monitoring to measure whether, and to what extent, those objectives are achieved.
    - Evaluation of the results, including consideration of whether and how this and future projects should be modified. To that end, flexibility should be built into each project at the planning stage so that the project can be modified as necessary.

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Appendix A. Additional concerns

Concerns

One of the members of the collaborative group had concerns in addition to those outlined in the recommendations. These are best expressed in his own words below.

> We've been reviewing the final draft, and we are pleased that it shows attention to the problems of sensitive soils and slopes. Past projects, including several addressed by the agency in monitoring conducted over the last four years, have shown that in the series of sites listed under "Soils of Concern" there are significant problems with regeneration cuts from the issues of cost, erosion, soil compaction, and persistent skid roads. There is also the matter of the sheer fragility of land productivity at these sites, many of which are limited in their resiliency to regenerate forest stands in a timely manner. Also of concern- from what we have seen in our visits to past projects- is the tendency of these sites to regenerate poplars, maples, and white pine, even following a variety of silvicultural pre- and post- harvest treatment strategies.
>
> The 35% sideboard standard is an important step forward in overall lowering the risk of negative long-term impacts on the land. The "index" of concerns listed in the draft like soil type, slope, and road proximity also helps create an ecological risk/cost benefit analysis for land managers to consider. We're glad to see how folks worked on putting that together.
>
> It's good that roads are a primary topic addressed in the document. Roads have been a longtime concern from both an ecological and economic standpoint and have been a stated priority of the Forest Service at least since the Roads Rule of 2000. Ensuring that the agency avoids adding more roads and the attendant BMP issues that come along with them is clearly on a lot of minds. We hope that the need to not only close or downgrade the status of roads is seen as important, but the need to remove, revegetate, and obliterate roads as well- as permanent road removal is the most effective solution to these long-term budgetary problems, which will both lessen negative ecological impacts and free up fiscal and law enforcement resources. This is particularly important in light of work that the South Zone has done in recent years analyzing BMP's. Also, information found in a recent Freedom of Information Request contain parts of a FY2017 Soil Disturbance Monitoring Report as well as a FY2017 Monitoring Report that study impacts from past project-related roads. It would be great for the agency to have full versions of these reports made publicly available to help both the agency and the public to better understand road impacts.
>
> Regarding non-logging treatments to the land in projects, we wish to restate our opposition to the use of herbicides as both unnatural and ecologically destructive. We also hope that fire and fire management resources will be considered in a nuanced way

in projects. There is some discussion of the complexities of fire frequency and intensity, and we hope that project-level considerations can fine-tune this further, avoiding too broad of an application and taking into consideration the many ways differing fire applications historically had a role in some of our lesser-understood forest communities.

Regarding ecological modeling, it is good that the draft recommends that the agency not take the listed models too literally, and fine tune its analysis at a project level. While the Simon models and spot checks have some usefulness in analyzing possible historic conditions, there are also numerous records, both written and mapped from early agency documents and before that may help shed further light on this history, and we encourage the agency to take them into consideration. For example, this can be useful in studying lower elevation watersheds where often poorly-understood communities thrived. That these areas probably had significant megafauna and indigenous drivers historically due to their location and topography can be challenging, but it is important- particularly when once considers how these communities make up for less of the acreage of federal ownership compared to higher elevation areas. Some places that fit this profile may include the Brush Creek, Sheeds Creek, Spring Creek, and Bullet Creek watersheds.

We are glad that there is language in the draft that calls for focusing on more than on the “big three” species (white oak, northern red oak, and shortleaf pine), and that some of the other species of trees, shrubs, and grasses that make up the diversity of the South Zone will get appropriate attention. This certainly makes for professional and logistic challenges, but it is needed if these forests are to be managed in the spirit of biodiversity and a return to a semblance of natural conditions. It is important that some of the “less popular” native species that may be currently underrepresented in the forest be a part of that.

While we have expressed concerns about process, we appreciate that these concerns have gotten a hearing, and that the draft has clarified how decisions are made.

Finally, we appreciate Mike and Hollister’s presentations early in the process. They were very informative and clear.

Once again, thank you for your taking the time to organize this work and being so professional and thoughtful as you always are.

Davis Mounger

On behalf of the Tennessee Chapter of the Sierra Club and Tennessee Heartwood

Appendix B. Vegetative Community Descriptions

The following descriptions of the focal dry forest communities are taken from Steve Simon's report entitled: "Ecological Zones on the Chattahoochee and Cherokee-(south) National Forests: 1st Approximation". which in turn was taken from NatureServe. 2013. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 12 July 2013', and the 'Guide to the Natural Communities of North Carolina, Fourth Approximation (Schafale 2012), unless otherwise noted.

Shortleaf Pine-Oak Forest

This zone includes dry to dry-mesic pine-oak forests dominated by shortleaf pine and/or pitch pine that occur at lower elevations on exposed broad ridges and sideslopes. Indicator species and species with high constancy or abundance include: shortleaf pine, pitch pine, sourwood, sand hickory, scarlet oak, southern red oak, post oak, hillside blueberry, American holly, featherbells, black huckleberry, and spring iris. Ecological Zones within the Chattahoochee and Cherokee (south zone) National Forests include 3 subtypes (aggregated in the final model):

* map unit 161 = south to west facing steep slopes that are likely driven by stand-replacement fire,
* map unit 162 = mid to lower elevation tertiary ridges where surface fire is more common than stand replacement fire, and
* map unit 163 = lower elevation primary ridges where surface fire is more common than stand repla cement fire.

- BpS / Nature Serve --Southern Appalachian Low-Elevation Pine: This system consists of shortleaf pine-and Virginia pine-dominated forests in the lower elevation Southern Appalachians and adjacent Piedmont and Cumberland Plateau.
  Examples can occur on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, as well as low elevation mountain valleys in the Southern Appalachians. Under current conditions, stands are dominated by shortleaf pine and Virginia pine. Pitch pine may sometimes be present and hardwoods are sometimes abundant, especially dry-site oaks such as southern red oak, chestnut oak, scarlet oak, but also pignut hickory, red maple, and others. The shrub layer may be well-developed, with hillside blueberry, black huckleberry, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include narrowleaf silkgrass and goat's rue.

Pine-Oak Heath Woodland

This zone was included in the Xeric Pine-Oak Heath-Oak Heath type in the 1st approximation NC but separated into three pine-oak heath types in the VA_WVA FLN and GW study areas. This differentiation was not made in the SBR study area. Indicator species and species with high constancy or abundance in all three types include: Table Mountain pine, scarlet oak, chestnut oak, pitch pine, black huckleberry, mountain laurel, and hillside blueberry. Ecological Zones within the Chattahoochee and Cherokee (south zone) National Forests include 4 subtypes (aggregated in the final model:

* map units 181 and 182 = tertiary and primary ridges with Pitch Pine as the diagnostic fire-adapted species (this Zone resembles the Pine-Oak Heath [Eastside] Zone identified on the GW National Forest that includes landscapes located on the east side of major ridges where patch sizes are smaller, pitch

pine is more common, and huckleberry and blueberry is normally more abundant than mountain laurel). These subtypes are likely driven by mixed-stand replacement and surface fire disturbances.
* map units 183 and 184 = tertiary and primary ridge with Table Mountain Pine as the diagnostic fire-adapted species. These subtypes are likely driven primarily by stand-replacement fire disturbance.

- Bps / Nature Serve –Southern Appalachian Montane Pine Forest: This system consists of predominantly evergreen woodland (or more rarely forests) occupying very exposed, convex, often rocky south-and west-facing slopes, ridge spurs, crests, and cliff-tops. Most examples are dominated by Table Mountain pine, often with Pitch pine and / or Virginia pine and occasionally Carolina hemlock. Based on the component Associations, understories commonly include mountain laurel, black huckleberry, and hillside blueberry.

Montane Pine Forest and Woodland
Below Rocky Top Gap, TN. Credit: Steve Simon

Dry-Mesic Oak-Hickory Forest

This zone was included in the Dry and Dry-Mesic Oak-Hickory type in the 1st approximation NC but separated into its components --Dry Oak and Dry-Mesic Oak in the 2nd–3rd approximations, in the KY FLN (Simon 2009), and in the VA_WVA FLN study areas (Simon 2010). This zone is very similar to the Montane Oak-Hickory zone but occurs at lower elevations. It includes dry-mesic, mixed-oak forests that occur along broad lower to mid elevation ridges and smooth to concave slopes and lower elevation drainage headlands, and often narrow, drier coves. Indicator species and species with high constancy or

abundance include: white oak, black oak, scarlet oak, flowering dogwood, sourwood, low bush blueberry, and huckleberries.

- BpS / Nature Serve --Southern Appalachian Oak Forest: This system consists of predominantly dry-mesic (to dry) forests occurring on open and exposed topography at lower to mid elevations. Characteristic species include chestnut oak, white oak, red oak, black oak, scarlet oak, with varying amounts of hickories, blackgum, and red maple. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers. Northward this system grades into Northeastern Interior Dry-Mesic Oak Forest type.

Photo Credit: Steve Simon

Dry Oak Heath Forest and Woodland (Evergreen and Deciduous)/Chestnut Oak Heath

This zone, called Chestnut Oak Heath in the 1st approximation NC, includes xeric to dry mixed-oak forests typically dominated by an ericaceous (evergreen or deciduous) understory and represents the driest zone where oaks are the dominant species. In general, in the study area, the Dry Oak/deciduous heath zone is more transitional to the Dry-Mesic Oak Ecological Zone and the Dry Oak/evergreen heath zone is more transitional to the Pine-Oak Heath Ecological Zone, however, this varies considerably according to slope position. Further work is needed to differentiate these two zones to separate what is truly an environmental influence and what may be an influence of current fire return interval. Indicator species and species with high constancy or abundance include: chestnut oak, scarlet oak, northern red oak, mountain laurel (in the evergreen heath type), black huckleberry & hillside blueberry (in the deciduous type), red maple, great rhododendron, and sourwood.

- BpS / Nature Serve --Allegheny-Cumberland Dry Oak Forest and Woodland:
  These forests were typically dominated by White oak, Black oak, Chestnut oak, and Scarlet oak with lesser amounts of Red maple, Pignut hickory, and Mockernut Hickory. These occur in a variety of situations, most likely on nutrient-poor or acidic soils and, to a much lesser extent, on circumneutral soils. American chestnut was once dominant or codominant in many of these forests and sprouts of American chestnut can often be found where it was formerly a common tree. Small inclusions of Shortleaf pine and/or Virginia Pine may occur, particularly adjacent to escarpments or following fire. In the absence of fire, White pine may invade some stands (Nature Serve 2010). Today, subcanopies and shrub layers are usually well-developed. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers of mountain laurel, fetterbush, or on more mesic sites rhododendron. Other areas have more open conditions.

Photo credit: Steve Simon

Appendix C. Crosswalks of Vegetative Communities

The following table shows a crosswalk between the Ecological Zones and NatureServe Ecological Systems.

ECOLOGICAL ZONE	NaturServe ECOLOGICAL SYSTEM
Grassy Bald	Southern Appalachian Grass and Shrub Bald
Heath Bald	Southern Appalachian Grass and Shrub Bald
Spruce-Fir	Central and Southern Appalachian Spruce-Fir Forest
Northern Hardwood Slope	Central and Southern Appalachian Northern Hardwood Forest
Northern Hardwood Cove	Central and Southern Appalachian Northern Hardwood Forest
High Elevation Red Oak	Central and Southern Appalachian Montane Oak Forest
Mesic Oak-Hickory	Southern and Central Appalachian Oak Forest
Dry-Mesic Oak-Hickory	Southern and Central Appalachian Oak Forest
Mixed Oak Heath	Southern and Central Appalachian Oak Forest
Chestnut Oak Heath	Central Appalachian Dry Oak-Pine Forest
Alluvial Forest	South-Central Interior Large Flood plain
	South-Central Interior Small Stream and Riparian
Acidic Cove	Appalachian Hemlock-Hardwood Forest
	Southern and Central Appalachian Cove Forest
Rich Cove	Southern and Central Appalachian Cove Forest
Shortleaf Pine-Oak	Southern Appalachian Low Mountain Pine Forest
Shortleaf Pine-Oak Heath	Southern Appalachian Low Mountain Pine Forest
Pine-Oak Heath	Southern Appalachian Montane Pine Forest and Woodland

The Following table shows a crosswalk from Ecozones to Forest Service Forest Types

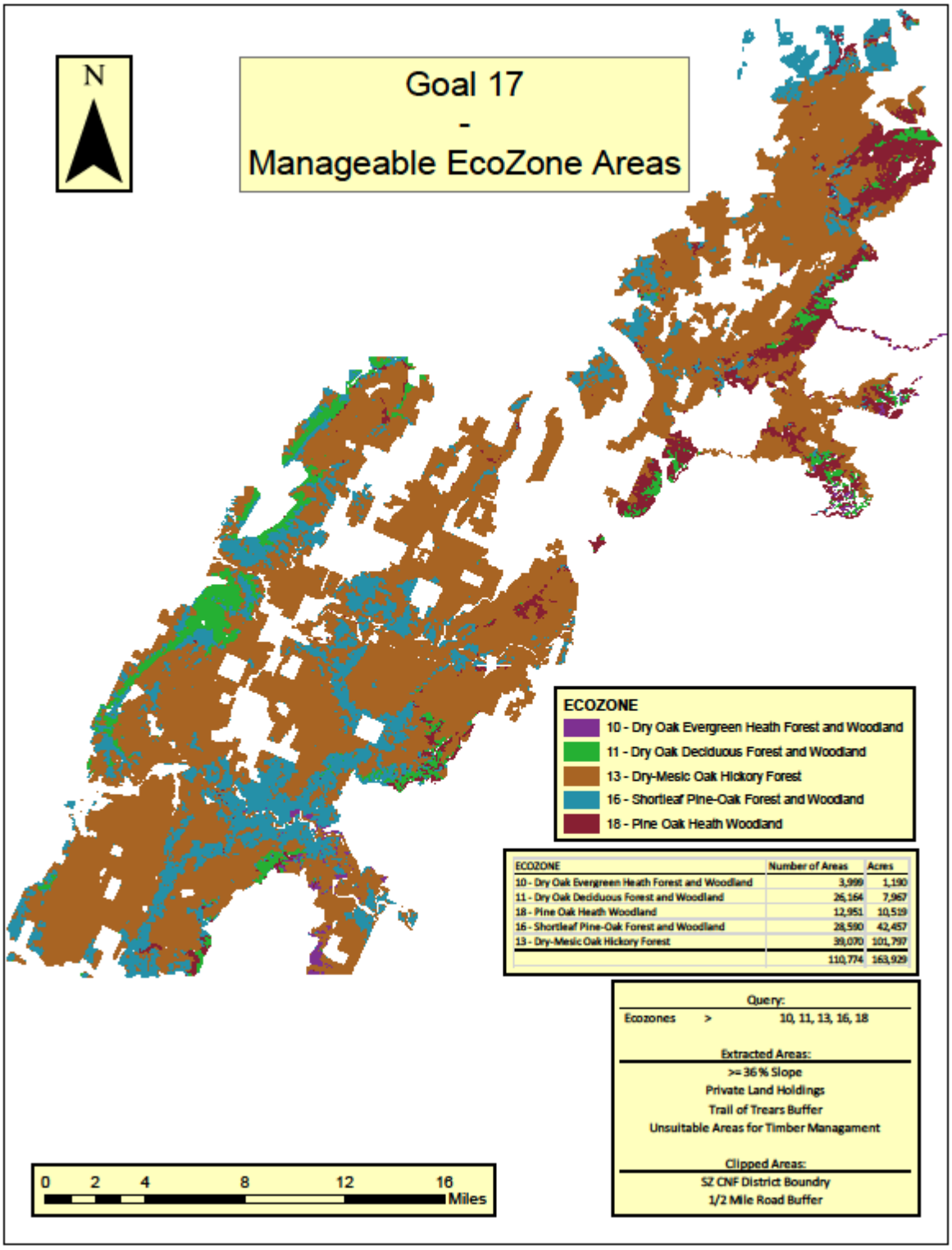
FT	FT NAME	Crosswalk to NEW BpS modeled from Ecological Zones = (Bps Code), Name
53	White Oak-Red Oak-Hickory	(9) Southern and Central Appalachian Red Oak-Chestnut Oak
56	Yellow Poplar-White Oak-Red Oak	(4) Southern and Central Appalachian Cove Forest
45	Chestnut Oak-Scarlet Oak-Yellow Pine	(10) Allegheny-Cumberland Dry Oak Forest and Woodland
60	Chestnut Oak-Scarlet Oak	(10) Allegheny-Cumberland Dry Oak Forest and Woodland
	unknown	DOES NOT CROSSWALK, INSUFFICIENT DATA, DROP FROM THE ANALYSIS
52	Chestnut Oak	(13) Southern Appalachian Oak Forest
81	Sugar Maple-Beech-Yellow Birch	(2) Northern Appalachian Northern Hardwood
41	Cove Hardwoods-White Pine-Hemlock	(4) Southern and Central Appalachian Cove Forest
3	White Pine	UNCHARACTERISTIC except in BpS (16) and BpS (18)
42	Upland Hardwoods-White Pine	(4) Southern and Central Appalachian Cove Forest, and (13) Southern Appalachian Oak Forest mostly
50	Yellow Poplar	UNCHARACTERISTIC except in BpS (4) = Southern and Central Appalachian Cove Forest
15	Pitch Pine-Oak	(18) Southern Appalachian Montane Pine Forest and Woodlands
39	Table Mountain Pine	(18) Southern Appalachian Montane Pine Forest and Woodlands
59	Scarlet Oak	(10) Allegheny-Cumberland Dry Oak Forest and Woodland
38	Pitch Pine	(18) Southern Appalachian Montane Pine Forest and Woodlands
55	Northern Red Oak	(9) Southern and Central Appalachian Red Oak-Chestnut Oak & (8) Central and Southern App. Montane Oak
33	Virginia Pine	(16) Southern Appalachian Low-Elevation Pine
16	Virginia Pine-Oak	(16) Southern Appalachian Low-Elevation Pine
10	White Pine-Upland Hardwood	(4) Southern and Central Appalachian Cove Forest, and (13) Southern Appalachian Oak Forest mostly
20	Table Mountain Pine-Hardwoods	(18) Southern Appalachian Montane Pine Forest and Woodlands
48	Northern Red Oak-Hickory-Yellow Pine	use BpS to separate this type into TNC Ecological Systems
8	Hemlock-Hardwood	(4) Southern and Central Appalachian Cove Forest
9	White Pine-Cove Hardwood	(4) Southern and Central Appalachian Cove Forest
32	Shortleaf Pine	(16) Southern Appalachian Low-Elevation Pine
99	Brush, kallat, rhodo	UNCHARACTERISTIC except in BpS (27) = Southern Appalachian Grass and Shrub Balds

83	Black Birch	(4) Southern and Central Appalachian Cove Forest
44	Southern Red Oak-Yellow Pine	(16) Southern Appalachian Low-Elevation Pine
7	Red Spruce-Fraser Fir	(1) Central and Southern Appalachian Spruce-Fir Forest
12	Shortleaf Pine-Oak	(16) Southern Appalachian Low-Elevation Pine
4	White Pine-Hemlock	(4) Southern and Central Appalachian Cove Forest
47	White Oak-Black Oak-Yellow Pine	(13) Southern Appalachian Oak Forest
5	Hemlock	(4) Southern and Central Appalachian Cove Forest
54	White Oak	(13) Southern Appalachian Oak Forest
58	Sweetgum-Yellow Poplar	(23)&(6) = Floodplain and Riparian
90	no matching FT	DROP FROM ANALYSIS
72	River Birch-Sycamore	(6) Central Interior and Appalachian Riparian Systems
31	Loblolly Pine	(16) Southern Appalachian Low-Elevation Pine
76	Silver Maple-American Elm	(6) Central Interior and Appalachian Riparian Systems
13	Loblolly Pine-Hardwood	(13) Southern Appalachian Oak Forest
98	Undrained Flatwoods-Savannas	DROP FROM ANALYSIS
17	Red Spruce-Northern Hardwood	(1) Central and Southern Appalachian Spruce-Fir Forest
46	Bottomland Hwoods-Yellow Pine	(13) Southern Appalachian Oak Forest
88	Black Locust	(10) Allegheny-Cumberland Dry Oak Forest and Woodland

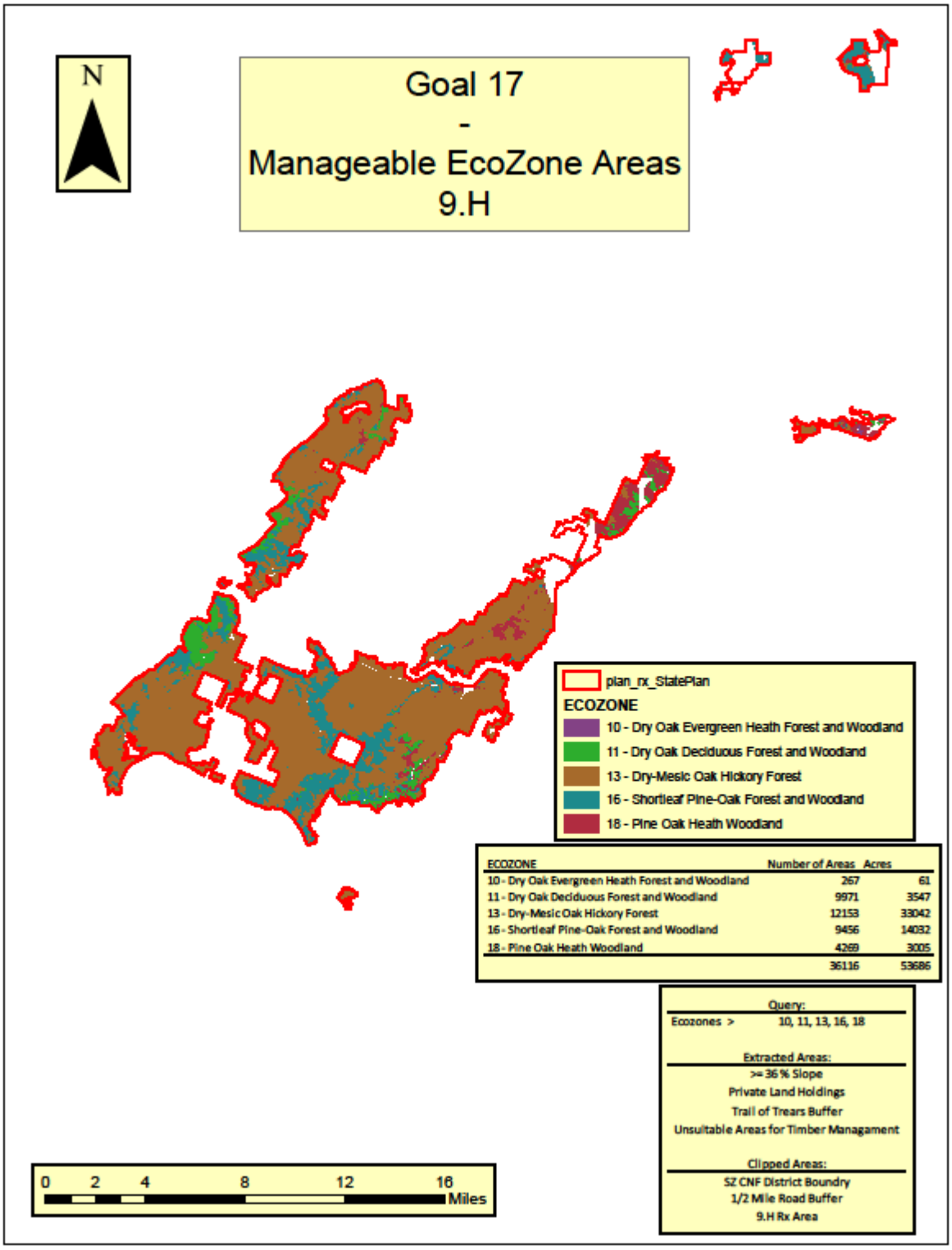
Appendix D. Geographic Prioritization

The following maps show layers of potential prioritizations for restoration activities. They focus on the priority Ecozones, known locations of White Pine (WP) and Virginia Pine (VP), and the 9.H Prescription of the CNFLRMP which is "Management, maintenance, and restoration of plant associations to their ecological potential". The sideboards found in this document (ex. Slopes </= 35% ,within ½ mile of existing FS inventoried roads) have been removed from the maps.

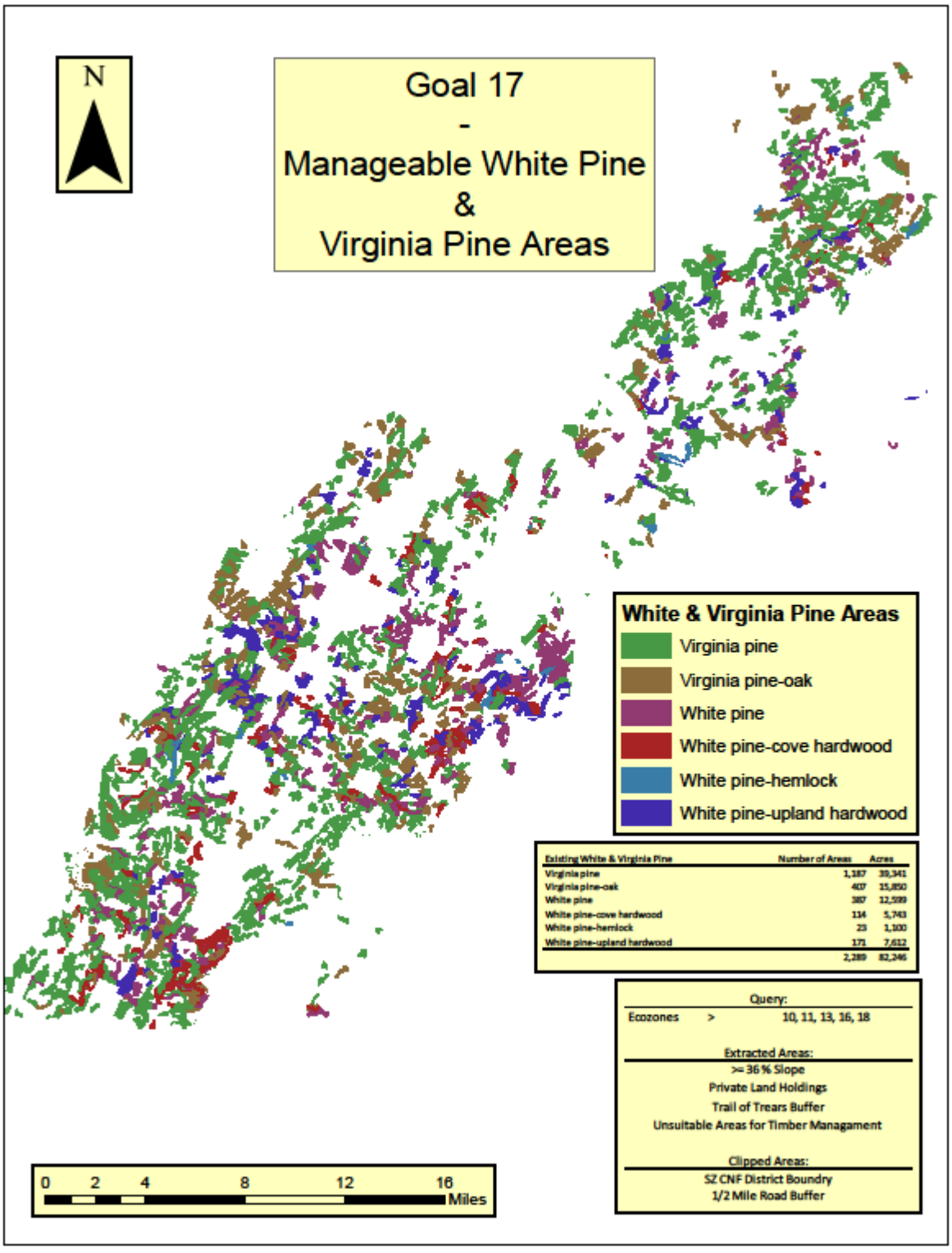
D.1. Map


N
Goal 17
-
Manageable EcoZone Areas
ECOZONE
10 - Dry Oak Evergreen Heath Forest and Woodland
11 - Dry Oak Deciduous Forest and Woodland
13 - Dry-Mesic Oak Hickory Forest
16 - Shortleaf Pine-Oak Forest and Woodland
18 - Pine Oak Heath Woodland
ECOZONE | Number of Areas | Acres
10 - Dry Oak Evergreen Heath Forest and Woodland | 3,999 | 1,190
11 - Dry Oak Deciduous Forest and Woodland | 26,164 | 7,967
18 - Pine Oak Heath Woodland | 12,951 | 10,519
16 - Shortleaf Pine-Oak Forest and Woodland | 28,590 | 42,457
13 - Dry-Mesic Oak Hickory Forest | 39,070 | 101,797
110,774 | 163,929
Query:
Ecozones > 10, 11, 13, 16, 18
Extracted Areas:
>= 36% Slope
Private Land Holdings
Trail of Trears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
0 2 4 8 12 16
Miles

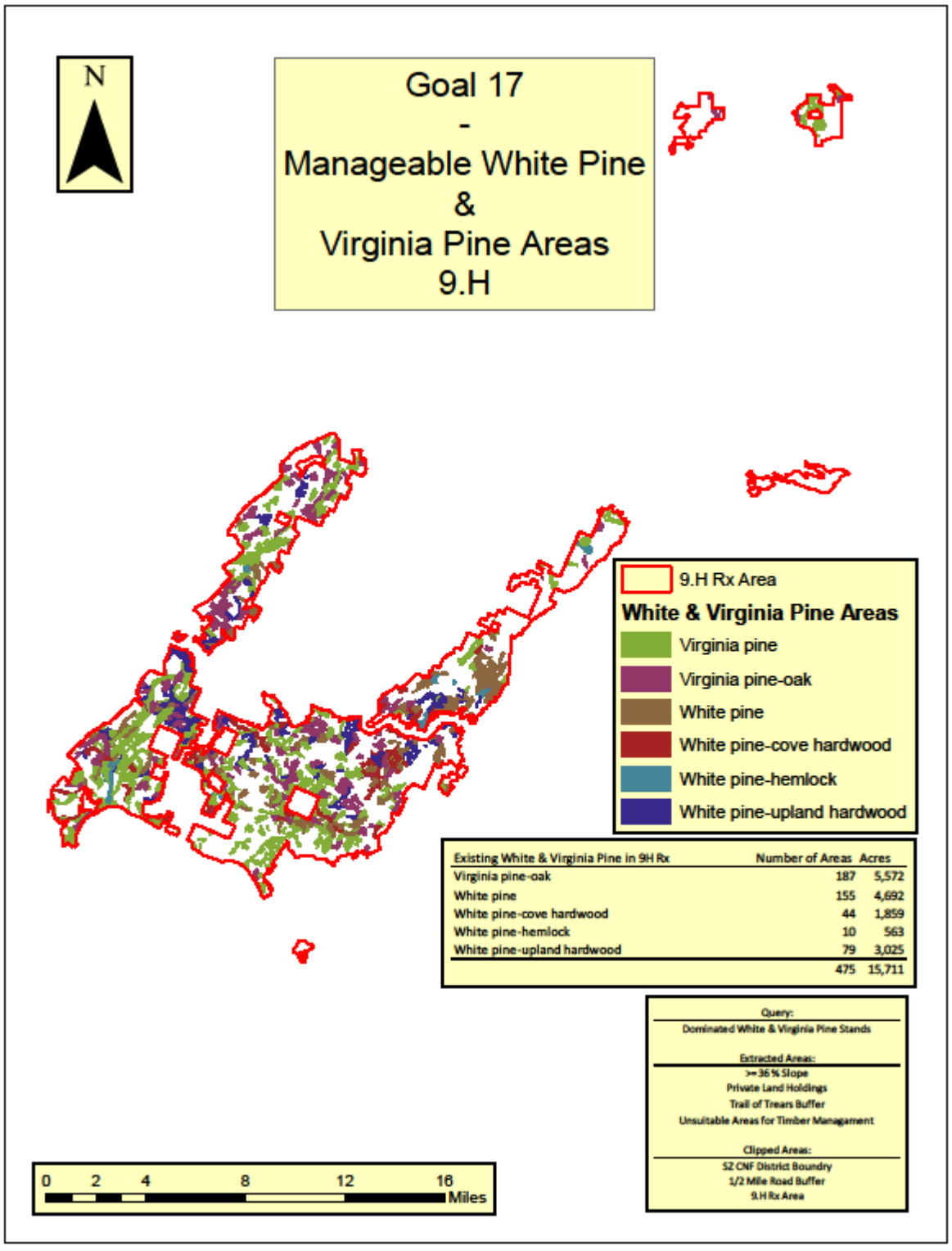
D.2. Map


N
Goal 17
-
Manageable EcoZone Areas
9.H
plan_rx_StatePlan
ECOZONE
10 - Dry Oak Evergreen Heath Forest and Woodland
11 - Dry Oak Deciduous Forest and Woodland
13 - Dry-Mesic Oak Hickory Forest
16 - Shortleaf Pine-Oak Forest and Woodland
18 - Pine Oak Heath Woodland
ECOZONE Number of Areas Acres
10 - Dry Oak Evergreen Heath Forest and Woodland 267 61
11 - Dry Oak Deciduous Forest and Woodland 9971 3547
13 - Dry-Mesic Oak Hickory Forest 12153 33042
16 - Shortleaf Pine-Oak Forest and Woodland 9456 14032
18 - Pine Oak Heath Woodland 4269 3005
36116 53686
Query:
Ecozones > 10, 11, 13, 16, 18
Extracted Areas:
>= 36 % Slope
Private Land Holdings
Trail of Trears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
9.H Rx Area
0 2 4 8 12 16
Miles

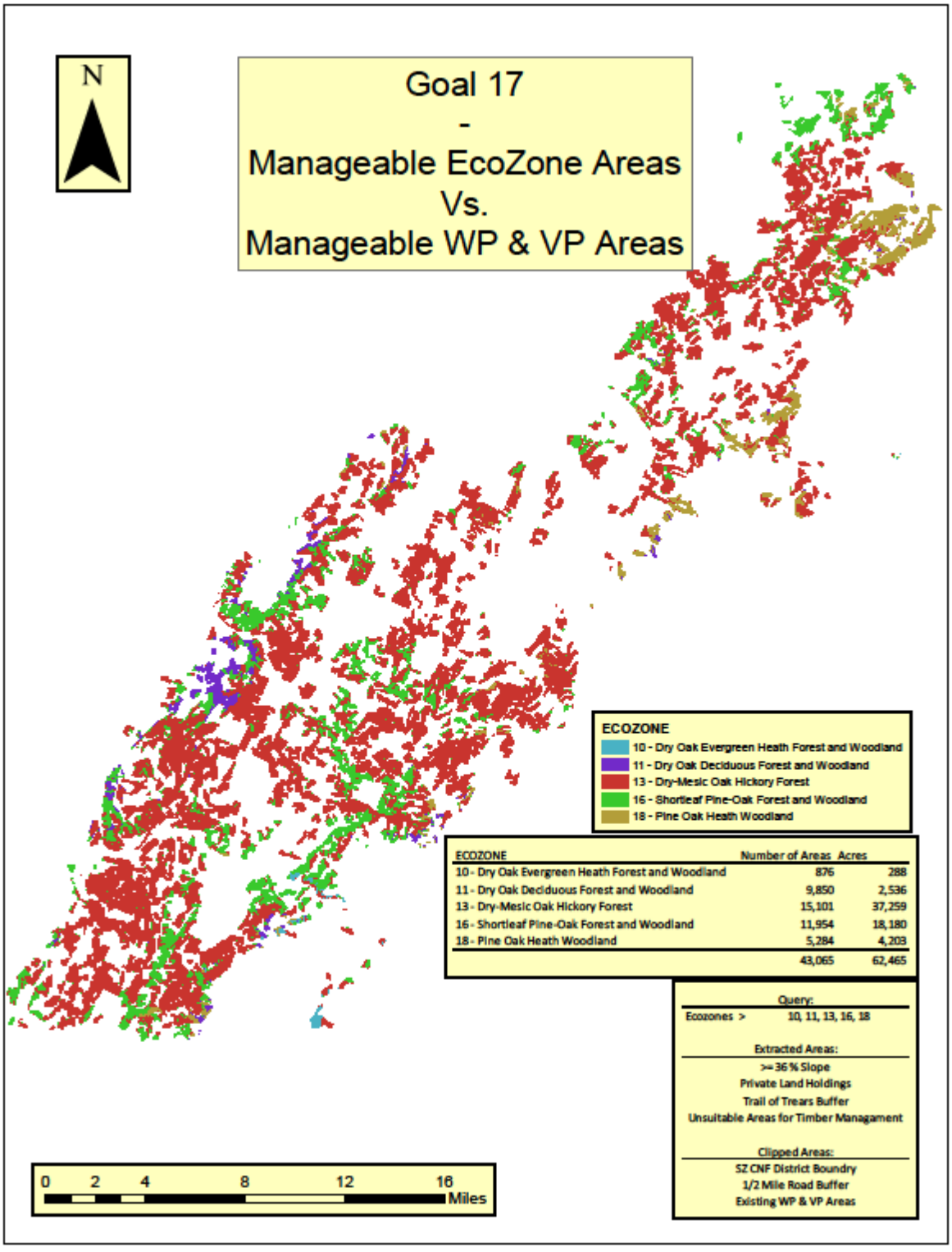
D.3. Map


N
Goal 17
-
Manageable White Pine
&
Virginia Pine Areas
White & Virginia Pine Areas
Virginia pine
Virginia pine-oak
White pine
White pine-cove hardwood
White pine-hemlock
White pine-upland hardwood
Existing White & Virginia Pine | Number of Areas | Acres
Virginia pine | 1,187 | 39,341
Virginia pine-oak | 407 | 15,850
White pine | 387 | 12,599
White pine-cove hardwood | 114 | 5,743
White pine-hemlock | 23 | 1,100
White pine-upland hardwood | 171 | 7,612
2,289 | 82,246
Query:
Ecozones > 10, 11, 13, 16, 18
Extracted Areas:
>= 36 % Slope
Private Land Holdings
Trail of Trears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
0 2 4 8 12 16
Miles

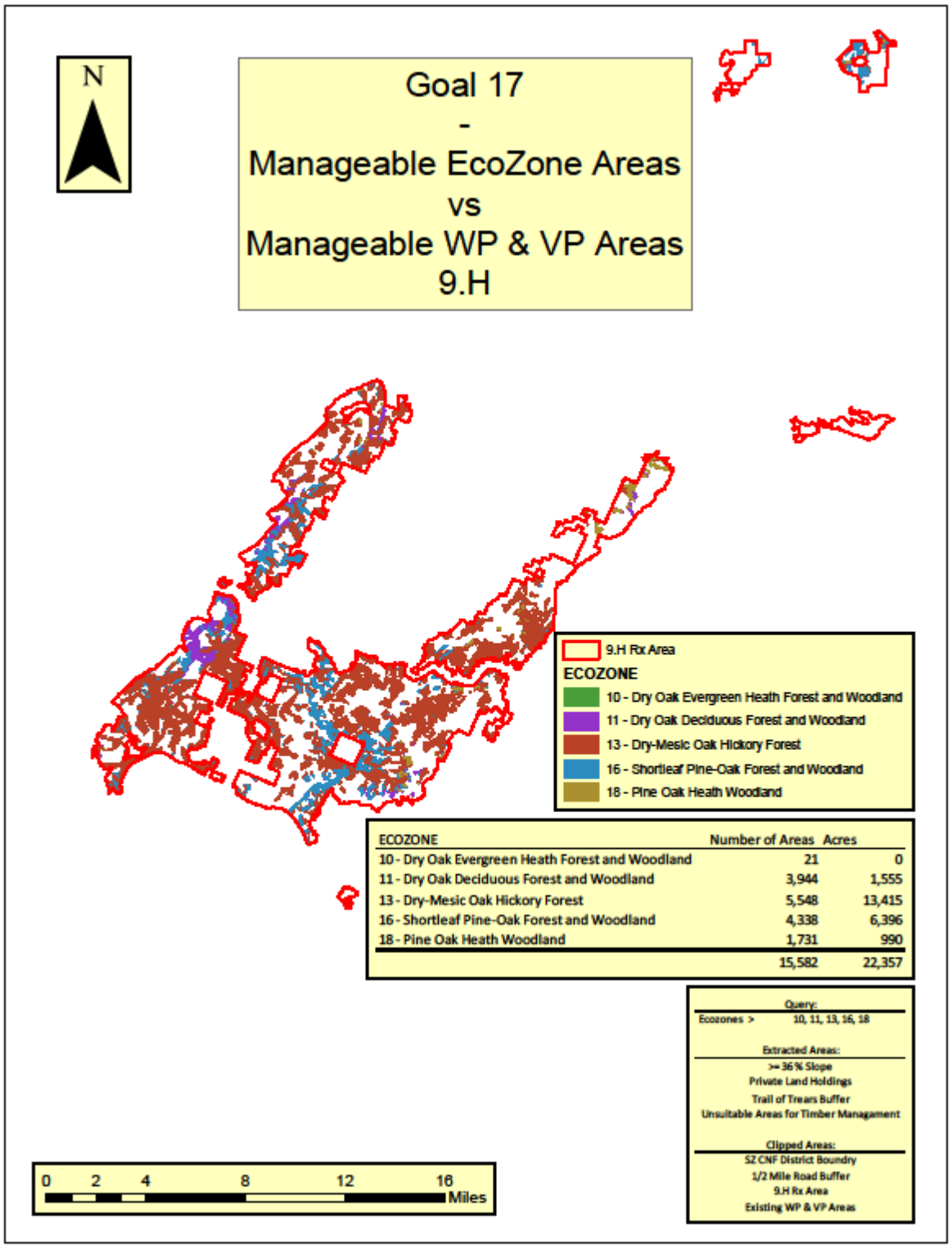
D.4. Map


N
Goal 17
-
Manageable White Pine
&
Virginia Pine Areas
9.H
9.H Rx Area
White & Virginia Pine Areas
Virginia pine
Virginia pine-oak
White pine
White pine-cove hardwood
White pine-hemlock
White pine-upland hardwood
Existing White & Virginia Pine in 9H Rx | Number of Areas | Acres
Virginia pine-oak | 187 | 5,572
White pine | 155 | 4,692
White pine-cove hardwood | 44 | 1,859
White pine-hemlock | 10 | 563
White pine-upland hardwood | 79 | 3,025
475 | 15,711
Query:
Dominated White & Virginia Pine Stands
Extracted Areas:
>=36 % Slope
Private Land Holdings
Trail of Trears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
9.H Rx Area
0 2 4 8 12 16
Miles

D.5. Map


N
Goal 17
-
Manageable EcoZone Areas
Vs.
Manageable WP & VP Areas
ECOZONE
10 - Dry Oak Evergreen Heath Forest and Woodland
11 - Dry Oak Deciduous Forest and Woodland
13 - Dry-Mesic Oak Hickory Forest
16 - Shortleaf Pine-Oak Forest and Woodland
18 - Pine Oak Heath Woodland
ECOZONE | Number of Areas | Acres
10 - Dry Oak Evergreen Heath Forest and Woodland | 876 | 288
11 - Dry Oak Deciduous Forest and Woodland | 9,850 | 2,536
13 - Dry-Mesic Oak Hickory Forest | 15,101 | 37,259
16 - Shortleaf Pine-Oak Forest and Woodland | 11,954 | 18,180
18 - Pine Oak Heath Woodland | 5,284 | 4,203
43,065 | 62,465
Query:
Ecozones > 10, 11, 13, 16, 18
Extracted Areas:
>= 36 % Slope
Private Land Holdings
Trail of Tears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
Existing WP & VP Areas
0 2 4 8 12 16
Miles

D.6. Map


N
Goal 17
-
Manageable EcoZone Areas
vs
Manageable WP & VP Areas
9.H
9.H Rx Area
ECOZONE
10 - Dry Oak Evergreen Heath Forest and Woodland
11 - Dry Oak Deciduous Forest and Woodland
13 - Dry-Mesic Oak Hickory Forest
16 - Shortleaf Pine-Oak Forest and Woodland
18 - Pine Oak Heath Woodland
ECOZONE Number of Areas Acres
10 - Dry Oak Evergreen Heath Forest and Woodland 21 0
11 - Dry Oak Deciduous Forest and Woodland 3,944 1,555
13 - Dry-Mesic Oak Hickory Forest 5,548 13,415
16 - Shortleaf Pine-Oak Forest and Woodland 4,338 6,396
18 - Pine Oak Heath Woodland 1,731 990
15,582 22,357
Query:
Ecozones > 10, 11, 13, 16, 18
Extracted Areas:
>= 36 % Slope
Private Land Holdings
Trail of Trears Buffer
Unsuitable Areas for Timber Managament
Clipped Areas:
SZ CNF District Boundry
1/2 Mile Road Buffer
9.H Rx Area
Existing WP & VP Areas
0 2 4 8 12 16
Miles