

Annex 1

RARE SPECIES MANAGEMENT PLAN

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The goals of TNARNG rare species management are straightforward: to protect populations of rare, threatened, or endangered (RTE) species, to minimize damage to individuals of those species, to maintain and enhance the native communities that support those species, and to remain in compliance with the Endangered Species Act.

To date, TNARNG has identified the large-flowered skullcap (*Scutellaria montana*), which is a federally listed threatened species, and the gray bat (*Myotis grisescens*), which is federally endangered, on the VTS- Catoosa. A survey is being conducted in FY11 to determine the presence of any other rare, threatened, or endangered species on the training site. This plan will be modified to include other species if any are found. The next RTE survey is scheduled for FY16. The survey may be initiated earlier if new information suggests it is needed (i.e., a new species from the region is listed as threatened or endangered or a population of a different RTE species which might occur on VTS-C is identified on neighboring land).

1.0 LARGE-FLOWERED SKULLCAP (*Scutellaria montana*)

The large-flowered skullcap was discovered on VTS-C in 2002, during a survey initiated at the suggestion of the USFWS. Almost 1600 individual plants were counted during that initial survey; they are most extensive on the western side of the training site, but a number of concentrations can be found elsewhere on the site (Figure A1-1).



The skullcap population has been broken down into 26 management groups based on geographic proximity and habitat similarity. Each management group contains at least one monitoring plot (see Section 1.3 below) established in 2004.

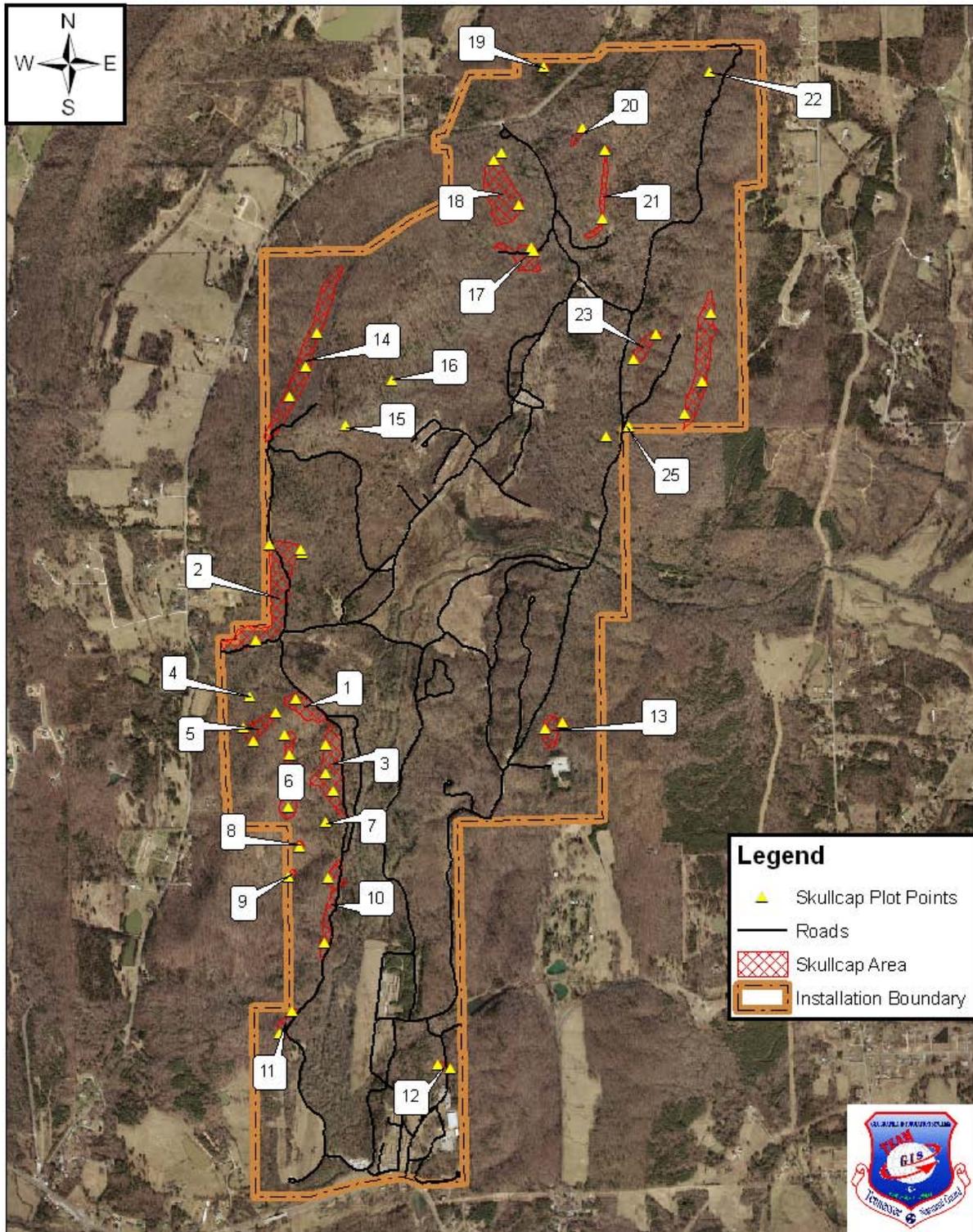


Figure A1-1: Location of large-flowered skullcap management groups at VTS-Catoosa.

1.1 Background

Large-flowered skullcap is a member of the mint family (Lamiaceae) endemic to mature hardwood forests in northwest Georgia and southeast Tennessee. It flowers from mid-May to June, producing a few to many blue and white, two-lobed flowers on a plant. The U. S. Fish and Wildlife Service listed large-flowered skullcap as an endangered species in 1986. At that time there were seven populations known in Georgia and three in Tennessee. Over 90 % of the 7,000 plants known in 1986 occurred at only two sites (USFWS 1996). The USFWS defined a self-sustaining population as containing more than 100 plants. The species was reclassified (down-listed) to threatened in 2002, at which time 48 populations were known for a total of over 50,000 individual plants. Habitat alteration and destruction are considered the most significant threats to this plant.

1.2 Protection

There are a number of factors which pose a potential threat to the large-flowered skullcap: physical damage from human activity, soil disturbance from human activity, browsing or uprooting by wildlife, and wildfire. In order to minimize these threats, TNARNG will take certain steps:

1.2.1 Perimeter posting and mapping:

TNARNG has posted the perimeter of the large-flowered skullcap groups with signs (Figure 3.10 in Chapter 3 or see below) which include a statement of no access during March 1 to June 30 (flowering season) and foot traffic only during the rest of the year. These signs, in conjunction with training and environmental education efforts for the soldiers and training site personnel, should minimize unplanned, human-caused disturbance of the plants.



The signs are easily seen and should discourage accidental vehicular traffic through known clusters of plants. The signs are generally spaced 50 to 65 m apart. Trees between pairs of signs along the edge of a skullcap group will be marked with yellow paint to provide a more continuous visual barrier. The perimeter around each management group is located just outside the existing plants (no “buffer” area) to minimize restrictions on training area, but will be updated annually to ensure the majority of the plants are within the protected boundary. To date, the spatial boundaries of the groups of plants have changed little from

year to year, and it is expected that the locations of the buffer zones will remain relatively constant for the near future. The perimeter of each group has been recorded with GPS, and accurate maps can be produced for training or land management use.

A training module will be developed that explains the purpose behind these signs and provides basic information about the skullcap; this information will be presented to all training site users in their initial on-site briefing. Maps are also available to the training site staff and other users showing the location of the large-flowered skullcap to encourage avoidance of prime skullcap areas during sensitive periods.

1.2.2 Wildlife Control:

Herbivores can pose a threat to large-flowered skullcap. Through the monitoring program, a number of individual plants have been found that have been browsed. It is presumed that white-tail deer are responsible. Browsing does not appear to kill the plant but does limit flowering as the flower buds are typically on the portion that is eaten.

Feral hogs are a more substantial danger to the plant. Areas of disturbance indicative of hog rooting have been found within skullcap groups. It is presumed that hogs will feed on the perennial root of the skullcap and, therefore, could substantially impact the skullcap population.

Feral hog numbers on the training site have been controlled in the past through professional removal. If hog sightings or damage increase above acceptable levels, a project will be initiated to reduce their numbers. White-tailed deer are not currently controlled at VTS-C; there is no hunting on the training site. If monitoring results indicate that deer are significantly impacting the skullcap, a program will be developed to limit the numbers of deer.

An additional wildlife problem on VTS-C is a large population of beavers that are causing extensive flooding. This should not impact large-flowered skullcap, however: all skullcap populations are located at an elevation above those areas threatened by flooding.

1.2.3 Invasive Pest Plants Control:

Invasive exotic plants are becoming a problem throughout the world. Some large-flowered skullcap management groups do contain invasive plants (this information is collected as part of the monitoring described below). The principal problem species are Japanese honeysuckle and Chinese privet. At this time, the infestations do not appear to seriously impact the skullcap, but over time this status may change. A program for control of these problem plants around the skullcap groups will be developed (see Research section below) in conjunction with the overall training site invasive species control plan.

In the vicinity of large-flowered skullcap management groups, herbicide use will be strictly controlled. Only chemicals which are not soil active and are unlikely to translocate will be applied to invasive plants within 50' of a skullcap management group. Applications will be made in the late fall after the skullcap has gone dormant, and application methods will be utilized which minimize the risk of chemical drift. Additional monitoring will track any changes to treated management groups, and the methodology will be revised if there appears to be any damage to the large-flowered skullcap.

1.2.4 Fire Protection:

Fire is a tool used for natural resources management on VTS-C. The tank range and other open grassland areas are burned regularly to control woody encroachment. Most of the forested areas on the training site are dominated by hardwood species, and so have not been burned regularly in the past. TNARNG has developed a prescribed burn plan for the purposes of fuel reduction and habitat improvement and will begin implementation in 2010 (see Annex 3).

Little is known about the susceptibility of large-flowered skullcap to fire. One research goal of the TNARNG is to address this lack of knowledge through experimentation (see Research section below). Management groups not involved in a study of fire impact will be protected from prescribed burns with fire lines located well outside the boundary of the management group. Whenever possible, these fire lines will be made by removal of vegetation rather than by plowing.

1.3 Monitoring

A monitoring protocol has been developed and implemented. FY2008 was the fifth year of data collection following this protocol. There were significant fluctuations in the plant counts in 2007 and 2008 – likely due to drought – and so the monitoring program will be continued for several more years to track these changes. The protocol will again be reviewed in FY2012.

The monitoring protocol is based on 10-meter radius circular plots. Forty-six of these plots have been established within the 26 management groups (at least one plot in each management group) (Figure A1-2). The plots are not randomly located but are placed subjectively in areas known to contain skullcap plants. The plot centers are permanently marked and recorded via GPS for repeat sampling.

Monitoring is conducted during the flowering season for the large-flowered skullcap which begins in mid-May and runs into June with the peak usually in the end of May. Availability of flowers makes identification simpler and more accurate. Non-flowering specimens are also recorded, however.

Within each monitoring plot, the following information is recorded: each individual *S. montana* plant is identified and characterized in terms of number of stems, flowering/nonflowering, browse or insect damage indications, adult or juvenile (under 10 cm tall). The distance and bearing from the center point of the plot to each plant is measured, allowing mapping of plant locations. In addition, a habitat description, associated plant species, threats, and evidence of disturbance are also noted for each plot. Figure A1-3 shows the datasheet used for recording this information.

Results from each year of monitoring will be compiled and comparisons made as multiple years' data become available. After a period of five years of monitoring, the trends at each monitoring plot (increasing, decreasing, minimal change) will be evident. At that time, the monitoring protocol will be evaluated and modified, if needed.

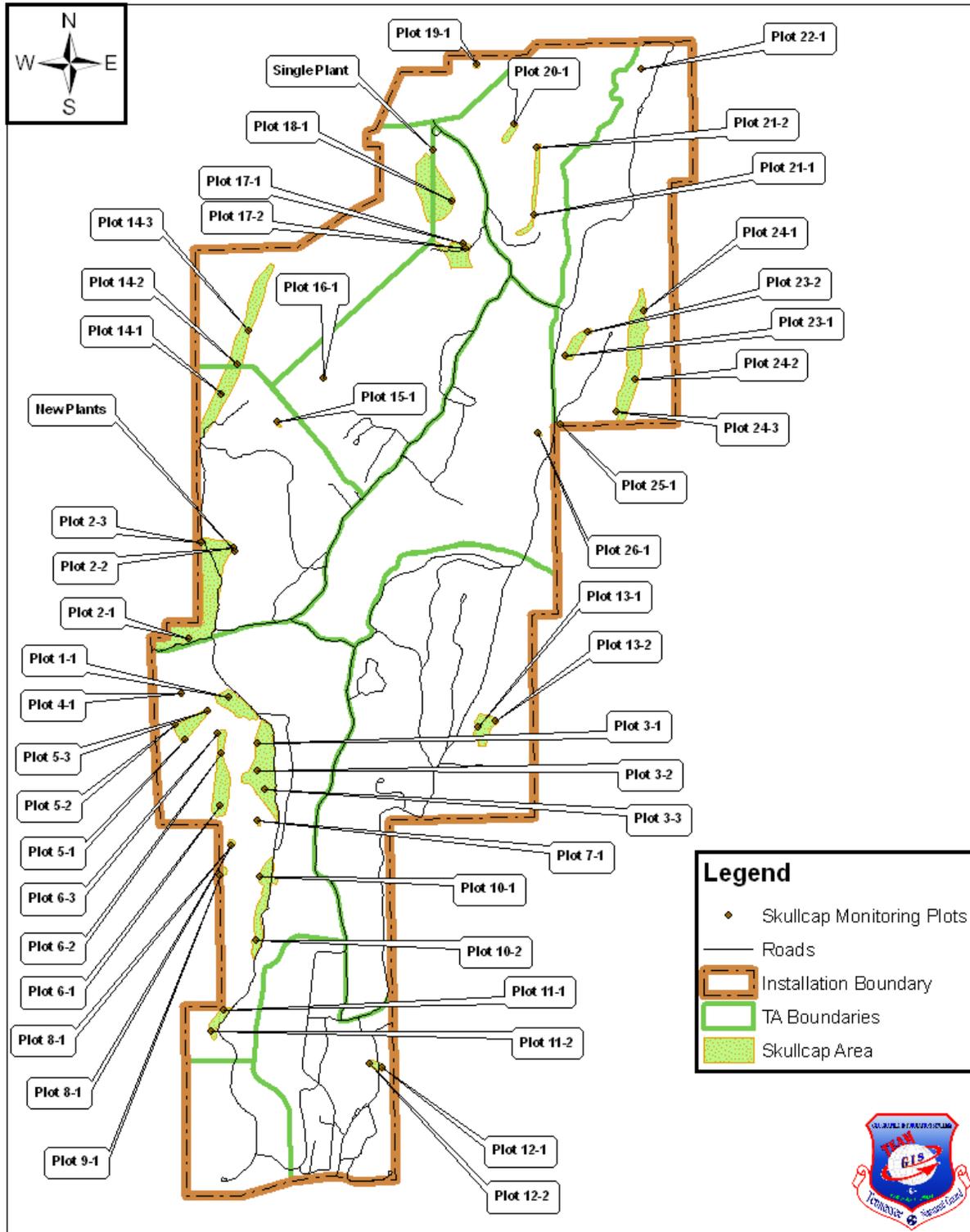
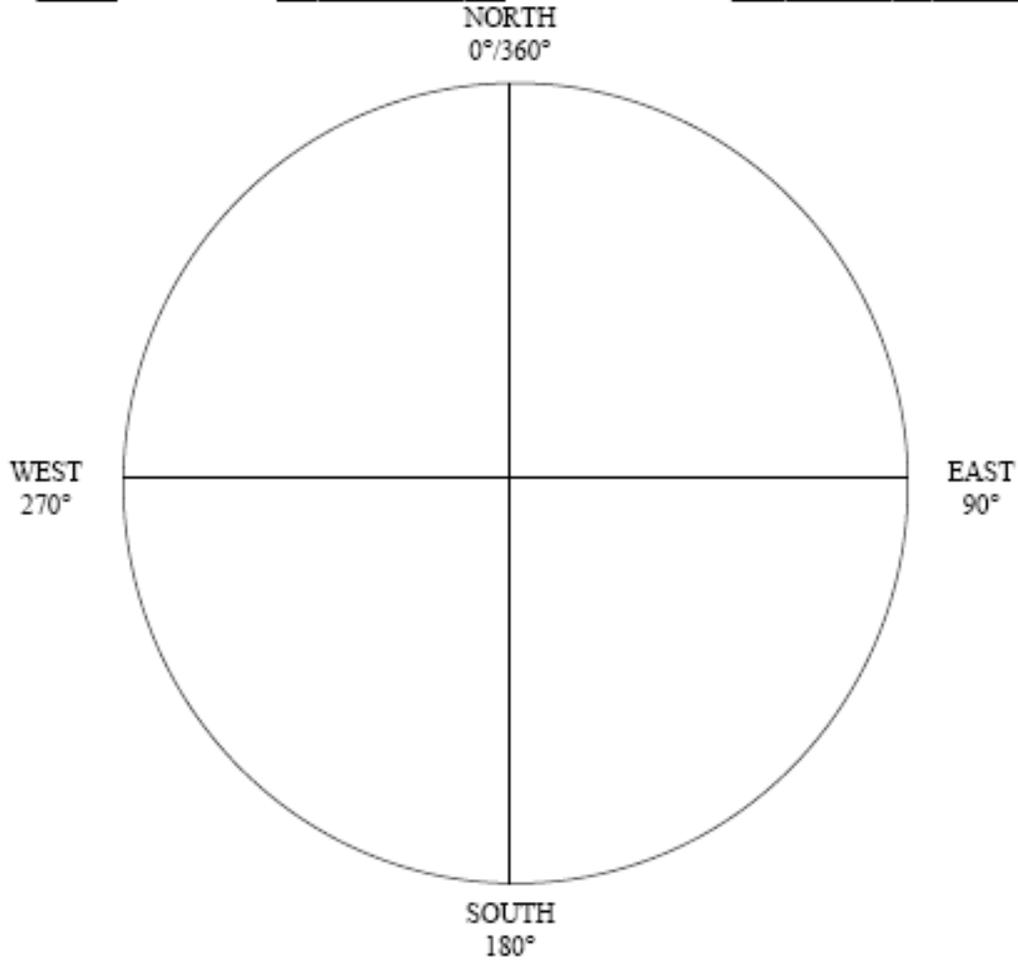


Figure A1-2: Large-flowered skullcap monitoring plot locations on VTS-Catoosa.

Scutellaria montana Monitoring Sheet

DATE _____ INVESTIGATORS _____
 STATE _____ COUNTY _____ POPULATION _____



Plant #	# Stems	Flowers ¹	Dist ²	Dir ³	Plant #	# Stems	Flowers ¹	Dist ²	Dir ³	Plant #	# Stems	Flowers ¹	Dist ²	Dir ³
1					10					19				
2					11					20				
3					12					21				
4					13					22				
5					14					23				
6					15					24				
7					16					25				
8					17					26				
9					18					27				

Additional Comments _____

¹: Plants in flower or not? (yes or no?); ²: Distance in meters from the plot center; ³: Compass bearing from the plot center

Figure A1-3: Monitoring datasheet for large-flowered skullcap.

1.4 Research

There are a number of gaps in our knowledge of large-flowered skullcap, and TNARNG has a population suitable for study. Certain questions pertaining to management issues are of particular interest, and TNARNG ENV would like to address these questions experimentally with the assistance of USFWS, GADNR, and other interested cooperators.

1.4.1 Transplantation

Certain management groups are threatened by required or anticipated training site construction and other activities (see Section 1.5 below). There are security requirements for a fence and a 25 ft cleared buffer to surround the entire training site. Several management groups lie along this boundary and will be impacted by this clearing: 2, 9, 14, and 24. Other groups (17 and part of 18) fall in areas that will potentially be impacted by proposed range construction. TNARNG is interested in the possibility of transplanting individuals from threatened groups to other “safer” areas on the training site. Large-flowered skullcap have been transplanted in the past onto the Chattahoochee National Forest with mixed results (Cindy Wentworth and Keith Wooster, personal comm.).

Preliminary Protocol:

- Plants will be transplanted within their region on training site; i.e., group 9 plants will stay in the southwest cluster of management groups, group 17 plants will stay within 18-20-21 area.
- Appropriate habitat will be identified within 250 m of the existing group, out of danger of the construction or clearing project.
- Transplant sites will be as similar as possible to the original habitat in terms of slope, aspect, elevation, soil series, canopy cover.
- No more than ½ of a group’s plants will be moved initially. A mix of both flowering adults and non-flowering juveniles will be moved. Plants will not be taken from within existing monitoring plots in the initial test.
- Plants will be marked with flags during flowering season.
 - Plants will be dug up either after seed set (July) and maintained in a greenhouse over winter or after initiation of dormancy (October) and transplanted immediately.
- As much soil as is feasible to transport will be dug up with each plant to preserve fine roots and mycorrhizal associations.
- Plants will be watered at transplanting to settle the soil, but will be subject to natural conditions after that.
- Transplant sites will be marked and individual plants mapped to allow monitoring of individual success.
- If the initial transplant success is reasonable, the remainder of the plants that are threatened by immediate military development will be relocated using the most successful methods.
- Plants will be monitored for at least 3 years.

Note: TNARNG will not depend on transplant success to maintain the skullcap population on VTS-C. If a large number of plants are to be destroyed by any given project, arrangements will be made for the greenhouse propagation of new plants, which will be transplanted into training site locations chosen in coordination with the USFWS.

1.4.2 Fire Impact

As noted above, prescribed burning is a tool that will be utilized for natural resources management on VTS-C, but there is currently limited understanding of the impacts of fire on large-flowered skullcap. It would be useful to know whether the skullcap can withstand occasional burning or whether all management groups within a burn area will always require protection. Information about the effect of

burning at other locations in Georgia/Tennessee would assist in better understanding the effect of burning at VTS-C, but a local experiment would ultimately provide the best information with little extrapolation needed.

Preliminary Protocol:

- Large concentrations of large-flowered skullcap will be protected from prescribed fire, either by complete restriction on burning (training area 2 and populations within SMZs such as management group 24) or by construction of a temporary fire break surrounding the group with at least 50 feet of buffer.
- Certain groups will be allowed to burn on the rotation schedule recommended in Annex 3, Prescribed Burn Plan, for fuel control in the hardwood forests of the site.
- Groups which may be subject to burning are 12, 15, 16, 17, and 19. These are all small management groups – relatively low numbers of skullcap present – in areas that will be subject to fuel-control fires in accordance with the prescribed fire plan.
- Groups 15 and 16 fall within the tank range target area which is subject to burning every 2-4 years; groups 12, 17, and 19 will be burned on a 5-7 year rotation.
- All skullcap-impacting burns will be cool, dormant season burns.
- Pre- and post-burn sampling will assess fire weather, fire behavior, flame temperature, litter consumption and impacts on vegetation.
- Data from the permanent monitoring plots will be used to assess skullcap recovery in the years following the burn, relative to pre-burn levels. If response to the initial fire is bad (more than 50% loss of plants), the fire study will be discontinued and all management groups will be protected with plowed firebreaks in all future prescribed burn events.

1.4.3 Invasive Pest Plant Control

Weed control is necessary at VTS-C, especially for invasive exotic plants. In areas where such pest plants threaten the skullcap, careful application of herbicides will allow improvement of the skullcap habitat and the opportunity to monitor the impact of invasives and release from invasives. The treatment protocol will include provisos such as no accidental herbicide application to *Scutellaria montana* and no application of translocating chemicals upslope. Management groups 12, 18, 19, 23, and 24 are currently threatened by both privet and Japanese honeysuckle and so are candidates for this investigation. Careful monitoring of the groups which are treated for invasive pest plants will allow both the identification of any detrimental effects that herbicide use might have on large-flowered skullcap and a determination of whether the beneficial effects for the skullcap justify the expense and effort of focused IPP control.

Preliminary Protocol:

- Environmental personnel with appropriate pesticide applicator certification will apply all herbicides.
- Applications will be made during the late fall or early winter after the skullcap has become dormant.
- Privet will be managed primarily by cut-stump method with application of Garlon 3A or a glyphosate herbicide. Small privet plants (under 1 m tall) may be treated by foliar application of glyphosate.
- Japanese honeysuckle will be treated with foliar application of Garlon or a glyphosate herbicide.
- No more than half of a management group will be treated in the first year.
- Control and treatment plots will be established within each management group.
- Skullcap will be mapped in the study plots in the spring prior to treatment and reassessed the following spring.
- If initial results indicate little damage to the skullcap from the herbicide applications, the pest plant treatments may be expanded to include the entirety of the threatened plots.

- Monitoring of skullcap response will continue for at least 2 years following the last herbicide application.

1.5 Assessment of Impacts on Large-Flowered Skullcap and Mitigation

Many aspects of TNARNG management and use of the VTS-C have the potential to impact the large-flowered skullcap. It is one goal of this management plan to ensure that those impacts are as benign and minimal as possible while still allowing the essential military training mission to continue unhindered. Table 4.3 in Chapter Four of the INRMP provides a list of all anticipated environmental projects for 2010-2014, as well as the primary ITAM and site improvement projects planned. The majority of these projects will have little influence on the skullcap due either to the non-impact nature of the project (e.g., wildlife surveys) or its location (e.g., management of existing grassland ranges). Those projects which could influence the large-flowered skullcap are presented below with more detail on the possible impacts and the measures to be taken to ensure protection of the VTS-C large-flowered skullcap population.

1.5.1 Skullcap management

A number of projects planned for the 2010-2014 period are designed to improve conditions for the large-flowered skullcap on VTS-C. These projects should have a positive influence on the threatened species and negative impacts should be minimal. Such projects include: annual monitoring, maintaining the posted perimeter around *S. montana* management groups, and controlling pest animals which may threaten the flower (feral hogs and white-tailed deer).

In order to investigate management alternatives and impacts on *S. montana*, three research projects are proposed: transplanting of individual skullcap plants, assessing fire impacts, and monitoring the influence of chemical and manual control of invasive pest plants. These are described in more detail in Section 1.4 above. The transplant experiment will not result in any additional take of large-flowered skullcap plants: the only individuals to be transplanted will be a part of the anticipated “take” of the fence-line clearance project (see below under “Training Site Maintenance”). These plants will be relocated prior to the planned disturbance and, if the transplant process is successful, will provide a reduction in the take from the clearing project. However, because of the uncertainty involved in transplantation, it will not be considered an official mitigation to the take.

The fire impact study will involve 5 management groups which totaled 191 large-flowered skullcap plants in the 2002 survey. This is approximately 12% of the training site total in 2002. Application of prescribed fire to these groups may result in the death of individual plants. In the worst case scenario, between 50 and 100% of these plants could be killed in the first fire, and the experiment would be terminated. Maximum loss possible would be 12% of the training site population, located in 5 discrete groups. The concentration of large-flowered skullcap groups in the southeastern region of the training site would be unaffected. It is anticipated, however, that fire will not be so damaging and that while there will be a percentage of plants killed, the majority will survive.

Herbicide treatment of invasive pest plants within large-flowered skullcap groups carries some risk for the protected plants from chemical drift and translocation. Careful choice of herbicide and treatment methods, as discussed in Section 1.4 will minimize the hazard. As a precaution, initial treatments will only cover one-half of any IPP infested management group. Any herbicide damage to large-flowered skullcap in these groups will require a revision of methods prior to any further chemical IPP control efforts within the management groups. It is anticipated that there will be no detrimental impacts from this controlled herbicide use on the large-flowered skullcap. If IPP can be controlled in the vicinity of the large-flowered skullcap, it will be a beneficial impact.

Overall, the skullcap management projects included in this plan are expected to improve conditions for the large-flowered skullcap on the VTS-C. There will probably be some take of individual plants associated with the fire research projects, but the number of lost plants is anticipated to be low and non-significant to the population as a whole.

1.5.2 General natural resources management actions:

Most of the projects identified in Table 4.3 for natural resources management, other than the RTE projects discussed above, will have little impact on *S. montana*. Wildlife surveys, riparian restoration, and wetlands protection have little relation to the protected plant. Three areas of management, however, could affect the skullcap: forest management, prescribed fire, and chemical pest plant control.

TNARNG intends to conduct timber harvests on approximately 550 acres of VTS-C over the 2010-2014 period (see Annex 2). These harvests will predominantly be commercial thinnings of either overmature timber or dense sub-dominant timber. There is significant temporary soil and understory disturbance associated with timber harvest, and so efforts will be made to avoid impacting large-flowered skullcap during these actions:

- Known large-flowered skullcap groups will be reserved from timber sales with an additional 50' buffer surrounding. No trees will be harvested within these protected areas, nor will any equipment be allowed to pass through these areas. Additional signs or other markings will be installed around the groups and buffer prior to any nearby timber sale.
- Timber harvests within stands that contain or are adjacent to known skullcap groups will be conducted during the fall or winter when the plant is dormant to minimize any accidental damage which may occur.

No direct take of large-flowered skullcap plants is anticipated from the timber harvests scheduled for 2010-2014 on VTS-C. There is the potential for a flush of growth by invasive pest plants such as privet and honeysuckle following the opening of the canopy by timber harvest. It is anticipated that the 50' buffer will help minimize such a threat to the large-flowered skullcap, but IPP presence will continue to be monitored in conjunction with the annual RTE monitoring, and specific control efforts will be initiated if needed.

Prescribed burning is a useful tool for land management, but the resilience of large-flowered skullcap to various fire regimes is not well-known. Most burning at VTS-C will be conducted in the grassland areas, thus posing no threat to the skullcap. However, longer-interval burns will be conducted within forest stands as needed to lower fuel loads and minimize wildfire risks. See Annex 3 for the schedule of burns for VTS-C. The majority of large-flowered skullcap management groups will be protected from these burns by firebreaks installed at least 50' outside the edge of the group, and Training Area 2 will not be subject to any prescribed burns due to the extensive skullcap presence, pending results from fire impact research.

As discussed above in Section 1.4, certain skullcap management groups (12, 15, 16, 17, and 19) will be subjected to the scheduled prescribed burns for experimental purposes. These five management groups represent 191 plant, or approximately 12% of the total VTS-C population in the 2002 survey. If post-burn sampling indicates a mortality rate of 50% or higher, the burn study will be discontinued. Some take of large-flowered skullcap plants is anticipated as a result of the experimental prescribed fire evaluation, but will be limited by the constraints of the experimental design. Damage to the overall population from fire impacts should be negligible.

Chemical weed control is utilized on VTS-C against both invasive exotic pest plants and the more benign weeds degrading parking areas, roads, and the managed landscape of the cantonment. Annexes 4 and 5

discuss both occasions of herbicide use and the restrictions thereon. Care will be taken to avoid accidental contamination of large-flowered skullcap with herbicide:

- There will be no application of any herbicide for general weed control within 50' of a large-flowered skullcap management group.
- There will be no application of any soil active herbicide within 50 yds (or directly uphill) of a management group.
- All appropriate efforts (IAW the label) will be made to avoid drift of herbicide products.

These rules have been in effect for all roadside and other general herbicide applications made by contract or TNARNG personnel since the large-flowered skullcap was found on VTS-C, and to date there have been no indications of damage to individual plants or to the population as a whole from these treatments.

The INRMP includes a plan (Annex 4) for attempting to control the invasive pest plants on the training site, as well. These control efforts will include the large-flowered skullcap management groups and so will negate the first of the above restrictions. However, within management groups and the 50' buffer herbicides will be very carefully applied to avoid accidental damage:

- There will be no foliar application of any herbicide during the large-flowered skullcap growing season.
- Stem treatments (basal bark, cut-stump, stem injection) will be the preferred methods of application whenever feasible.
- There will be no use of soil active herbicides.

As noted in Section 1.4 above, initial treatments will only cover one-half of any IPP infested management group. Any herbicide damage to large-flowered skullcap in these groups will require a revision of methods prior to any further chemical IPP control efforts within the management groups. No significant detrimental impacts are expected from the careful application of chemical weed control at VTS-C.

1.5.3 Training activities:

Training activities on the VTS-C have the potential for minor impacts on the large-flowered skullcap, but in practice such impacts are easily avoided. Due to the topography of the region and the forested condition of most of the site, vehicular traffic is restricted to established roads and trails and to prepared open maneuver areas, thus avoiding known large-flowered skullcap groups. Foot traffic can have some impact, especially in the Land Navigation Course in the north-central portion of the site. All known large-flowered skullcap groups are posted with signs restricting entry during the growing season (vehicular traffic is prohibited at all times), and training maps display the skullcap locations as off-limits, so there is limited threat to the plants from soldiers on foot. Likewise, bivouac sites experience high foot traffic, as well as vehicular disturbance immediately off-road, but such training areas are situated at a distance from known large-flowered skullcap groups to avoid disturbance. Range operations hold little threat to the protected plants on the existing live-fire and non-live-fire ranges (range maintenance, on the other hand, is discussed below). Overall, TNARNG training operations have little impact on the large-flowered skullcap.

1.5.4 Training Site Maintenance and Improvement Projects:

Training site maintenance and improvement involves a wide variety of actions; most will have little effect on the large-flowered skullcap, but certain construction projects, in particular, may have a substantial impact on the large-flowered skullcap on VTS-C. Maintenance of range facilities and grounds has little influence on the skullcap, which are generally not located in close proximity to these heavily managed portions of the training site. The use of prescribed fire to maintain the target area of the tank range has affected management groups 15 and 16 in the past; these two groups are now protected by a fire break and will remain so protected until the prescribed fire experiment discussed in Section 1.4 (and above

under “Skullcap management”) is initiated. Road maintenance has the potential to impact those management groups located directly beside the major roads, but all groups have been marked, and training site personnel avoid altering the road shoulder in the vicinity of the large-flowered skullcap.

Several construction and training site improvement projects are planned for the 2010-2014 period; these are listed at the end of Table 4.3. Several buildings and associated parking areas will be added to the cantonment area. This area is already developed and contains only one small management group (#12) on the eastern side. All building, road, and parking area construction will be located well away from this group and so there will be no impact on the large-flowered skullcap. Reclamation of an old roadway across the northern edge of the training site is anticipated. This will be routed around management groups 20 and 21, and so will have little impact on the skullcap (see Figure A1-4).

Portions of the Land Navigation Course in the north-central portion of the training site are overgrown with dense understory vegetation that makes foot travel difficult. These areas will have their understory opened up by mechanical vegetation removal. Several management groups fall within this area (17, 18, 19, and 20), but they are posted and mapped, and vegetation removal will occur no closer than 50' from the group edges. No direct impact on the large-flowered skullcap is anticipated. Annual monitoring will continue to track IPP presence, and if the understory clearing leads to greater competitive stress from exotic plants, pest plant control will be initiated.

Security requirements include complete fencing around military installation boundaries. At this time the VTS-C perimeter is only partially enclosed. Fencing efforts will continue during 2010-2014, typically in 2500'-5000' segments. Several management groups (2, 9, 11, 14, 19, 24, and 25) abut or straddle the boundary. In order to minimize impact on these plants, all fence building activities will occur during the dormant season. Due to the terrain of the training site, erection of the fence is done manually, with minimal disturbance to the soil. Transport of the equipment to the boundary is typically via ATV. Pathways are marked in advance by the ENV office if there are any nearby skullcap management groups to be avoided. There is potential for damage to individual plants that lie directly on the fenceline, but there should be minimal peripheral impact from the construction of the security fence.

Security requirements also dictate that 25' line-of-sight clearance be maintained on either side of the boundary fence. This clearing of trees and routine mowing will significantly impact management group 2 and will somewhat impact other groups, including 9, 14, 24, 25, and possibly 8, 11, and 19 (see Figure A1-1). The degree of impact will be dictated by the number of plants within that 25' buffer. Clearing of the trees will vastly alter the habitat. In addition, the process of cutting the timber and clearing the lower vegetation will probably damage many of the large-flowered skullcap plants in that strip. TNARNG anticipates eventual loss of all skullcap plants within 30' of the fenceline after the clearing is completed; TNARNG estimates as many as 100 plants will be lost.

In order to mitigate this loss, the TNARNG will tally the number of plants which fall within this hazard zone prior to any clearing. A nursery (the Atlanta Botanical Garden or other acceptable to the USFWS) will be contracted to propagate large-flowered skullcap from the VTS-C population (if possible, from the threatened management groups). When ready, the nursery stock will be out-planted to an appropriate location on the VTS-C, as determined from soil, slope/aspect, and vegetative characteristics, which is not subject to immediate military need. The goal will be 75% replacement of plants lost to fenceline clearing.

Although nursery-propagated large-flowered skullcap plants will be used as replacements for the take associated with the fenceline clearing and the new range complex, the TNARNG will utilize some of the “taken” individuals for the transplant experiment described in Section 1.4.

Construction of a new range complex is scheduled to begin in 2010 (Figure A1-4). Three ranges will be established in the north-central portion of the training site in the vicinity of large-flowered skullcap management groups 17 and 18: a 300m x 300m Modified Record Fire Range (MRFR), a 100m x 30m Zero Range, and a 100m x 30m Combat Pistol Range. Topography, the shape of the VTS-C, the location of existing ranges, and surface danger zone requirements dictate the location of these ranges. None of the ranges will directly impact any known large-flowered skullcap; however, the support facilities for the MRFR and the Zero Range may impinge upon skullcap group 17. Support facilities to be developed will include: an access road, three parking areas of approximately 1/3 acre each, and an observation tower, ammo breakdown area, target house, and covered training area at each range. Approximately 40 acres will be cleared for the range complex construction.

Grading for the access road and the support facilities at the Zero Range will likely result in incidental take of some large-flowered skullcap from management group 17 (69 plants). It is anticipated that less than 25% of plants in management group 17 will be lost during construction. Management group 18 (94 plants) will be thoroughly marked and completely avoided with all construction and earth-moving efforts.

TNARNG will mitigate the loss of plants from management group 17 as for the fenceline clearing: large-flowered skullcap will be nursery propagated to replace the individuals lost, with a goal of at least 75% successful replacement. The replacement plants will be out-planted to the west of the management group, if appropriate habitat is available. If not, they will be planted in appropriate habitat in another part of the training site. Aside from the direct take associated with clearing ground for the range and associated construction, there is the potential for loss of large-flowered skullcap plants to excess competition which may arise when the forest cover just beyond the management group is removed. To minimize this impact, TNARNG will plant evergreen tree species (eastern red cedar, shortleaf pine, and/or Virginia pine) along the edges of cleared areas that lie within 30 feet of a large-flowered skullcap group. The goal is to provide a dense edge to minimize increased sunlight intrusion into what had been forest interior.

Overall, the projects identified in this INRMP will influence the large-flowered skullcap. While many of the impacts will be positive, a small number of projects will result in incidental take of protected plants. Implementation of this plan will likely have an adverse effect on individual large-flowered skullcap plants on the VTS-C. However, it is not likely to adversely affect the total large-flowered skullcap population health on the training site, and the projects presented in this plan are necessary for the training site to provide needed training facilities and to remain in compliance with DoD security standards.

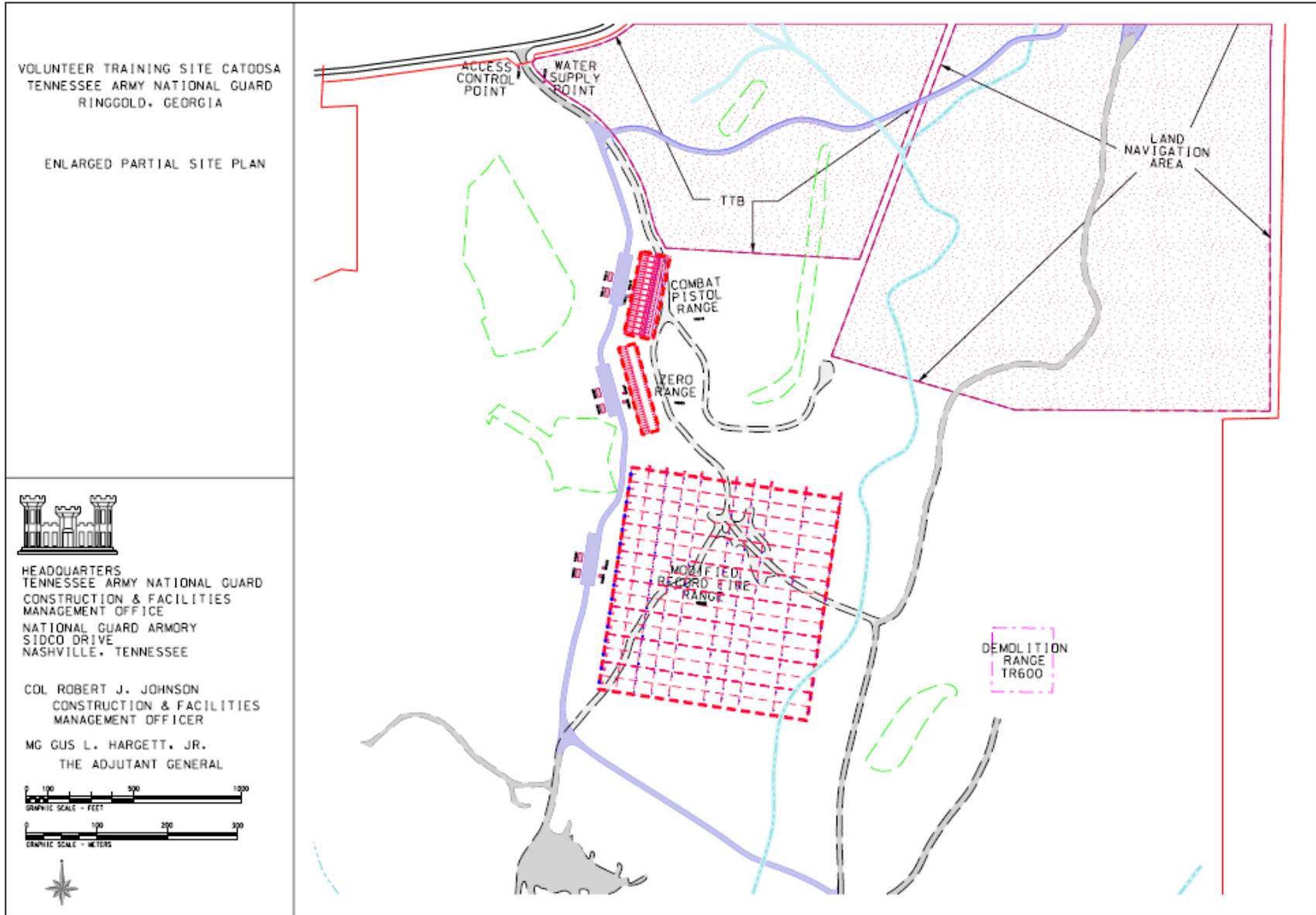


Figure A1-4: Proposed ranges and associated construction for the VTS-Catoosa. — indicates new road construction.
 - - delineates existing large-flowered skullcap management groups.

2.0 GRAY BAT (*Myotis grisescens*)

Gray bats were captured on VTS-C during a baseline bat survey in 2006. Ten individuals were trapped along Tiger Creek during the June mistnetting session; three individuals (one a recapture from summer) were caught in September. No cave habitats have yet been located on the training site. Due to the distances gray bats may travel while foraging (up to 20 km), it is uncertain whether these bats are resident on the training site or merely utilizing the foraging habitat. However, several of the females captured in June 2006 were pregnant, indicating the likelihood of a maternity colony near the training site.

Further surveys will be conducted as funding becomes available to more completely characterize the gray bat usage of VTS-C. As a part of this investigation, a project is planned to radio-track the bats foraging on the training site to locate their roosting habitat.

2.1 Background

Gray bats occur primarily in the karst regions of the southeastern United States. They migrate between winter hibernation sites and summer maternity caves. Gray bat colonies are usually restricted to caves or cave-like habitats located within one kilometer of a river or reservoir. In winter they utilize only deep, vertical caves having a temperature of 6-11°C. The largest member of its genus in the eastern United States, the gray bat weighs from 7 to 16 grams. Its forearm ranges from 40 to 46 millimeters in length (U.S. Fish and Wildlife Service, 1982). One feature which distinguishes this species from all other eastern bats is its uni-colored dorsal fur. The other bats have bi- or tri-colored fur on their backs. Also, the gray bat's wing membrane connects to the foot at the ankle instead of at the base of the first toe as in other species of *Myotis* (U.S. Fish and Wildlife Service 1982). Gray bats feed on insects, of which the majority are aquatic species, particularly mayflies.

The gray bat was listed as federally endangered in 1976. The principle reasons for decline are believed to be human disturbance of caves and loss of appropriate cave habitat through human alteration or natural change.

2.2 Protection

The principle protection for gray bat on the training site will be maintenance of the quality foraging habitat that Tiger Creek provides. Gray bats feed primarily on aquatic insects, especially mayflies, which are particularly susceptible to pollutants. Objectives described in Section 4.2.5 are intended to maintain or improve water quality through the protection of riparian habitat. Careful implementation of Streamside Management Zones and attention to erosion issues should ensure appropriate feeding habitat for the gray bat. SMZ restrictions on timber harvest and construction will also maintain forested travel corridors along streams for bats.

A project completed in 2009 utilized radio-tracking to try to locate the local roost sites. Seven gray bats were radio-tagged and tracked for several days. The tagged bats included three reproductive males, two adult females, and two juvenile females. None of the bats was successfully followed to its roost; however, no transmitter signals could be located on or in the immediate vicinity of the training site during the daylight hours. At this time, it appears that gray bats are utilizing the VTS-C only for foraging habitat. If a cave or other hibernaculum is found in the future, a plan will be developed with the help of USFWS to protect the site, gate the opening, if necessary, and post or fence the immediate surroundings to minimize disturbance from training activities.

In addition to maintaining habitat, training will be developed to educate training site personnel and users on the significance of bats for insect control and to debunk fears commonly associated with bats such as the threat of rabies.

2.3 Monitoring

A monitoring protocol for gray bats on VTS-C will be developed if it is determined through consultation with the USFWS that the population utilizing the site warrants on-going monitoring.

2.4 Research

No research projects are planned for the gray bat on VTS-C at this time.

2.5 Assessment of Impacts on Gray Bat

VTS-C contains no known roost sites or hibernacula. The gray bat is known to forage over Tiger Creek, but no other use of the training site has been documented. Training activities on the site have minimal impact on the riparian areas: utilization of the riparian areas is limited to established road crossings and some foot traffic within the land navigation course. Riparian areas on the training site are protected by streamside management zone best management practices for all land management activities. This INRMP includes projects designed to maintain or improve water and habitat quality in the streams and riparian areas (see Section 4.2.5 and Table 4.3 in Chapter 4 for more detail). The gray bat may benefit from such habitat improvement actions. Overall, the TNARNG anticipates that the implementation of this INRMP is not likely to significantly affect the gray bat.

**BIOLOGICAL OPINION OF THE U.S. FISH AND WILDLIFE SERVICE
Regarding Impacts on the Large-flowered Skullcap
(*Scutellara montana*)**



United States Department of the Interior

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JUN 12 2009

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Military Department of Tennessee
Office of The Adjutant General
Houston Barracks
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Nashville, Tennessee 37204-1502
ATTN: Laura Lecher

RE: USFWS Log# 41460-2009-F0344, VTS-Catoosa INRMP

Dear General Hargett:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the Tennessee Army National Guard (TNARNG) proposed Integrated Natural Resources Management Plan (INRMP) for Volunteer Training Site-Catoosa (VTS-C) in Catoosa County, Georgia and its effects on the threatened large-flowered skullcap (*Scutellaria montana*) in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended, (16 U.S.C. 1531 *et seq.*). Your January 30, 2009, request for consultation was received on February 2, 2009, with adequate information to initiate formal consultation.

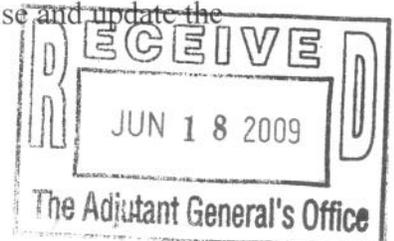
CONSULTATION HISTORY

This biological opinion is based on: (1) the December 2008, Draft Environmental Assessment; (2) multiple letters, emails and phone calls between TNARNG personnel and the Service; and (3) multiple visits to the project site by the Service. A complete administrative record of the consultation is on file in the Athens Ecological Services office.

2002: The original VTS-C INRMP was implemented. During the first years of implementation, it became apparent that the format and content of the original INRMP were not conducive to applied management. In addition, the discovery of a federally-listed threatened plant species required substantive changes in the VTS-C management plan.

December 15, 2003: TNARNG informed the Service of large-flower skullcap on the property.

October 11, 2005: The TNARNG informed the Service of the intent to revise and update the INRMP.



May 30, 2006: The TNARNG and Service met on site to discuss management options.

November 22, 2006: The TNARNG and Service met in Athens, Georgia to discuss the INRMP.

April 16, 2007: The TNARNG provided a draft INRMP for the Service to review.

January 30, 2009: Formal consultation was initiated on the INRMP.

February 12, 2009: The Service provided a letter (re: USFWS Log# 41460-2009-F0344, VTS-Catoosa INRMP) to inform the TNARNG that the Service had sufficient information to initiate consultation on the large-flower skullcap and that we concurred with the TNARNG's finding that the INRMP was "not likely to adversely affect" the gray bat (*Myotis grisescens*).

BIOLOGICAL OPINION

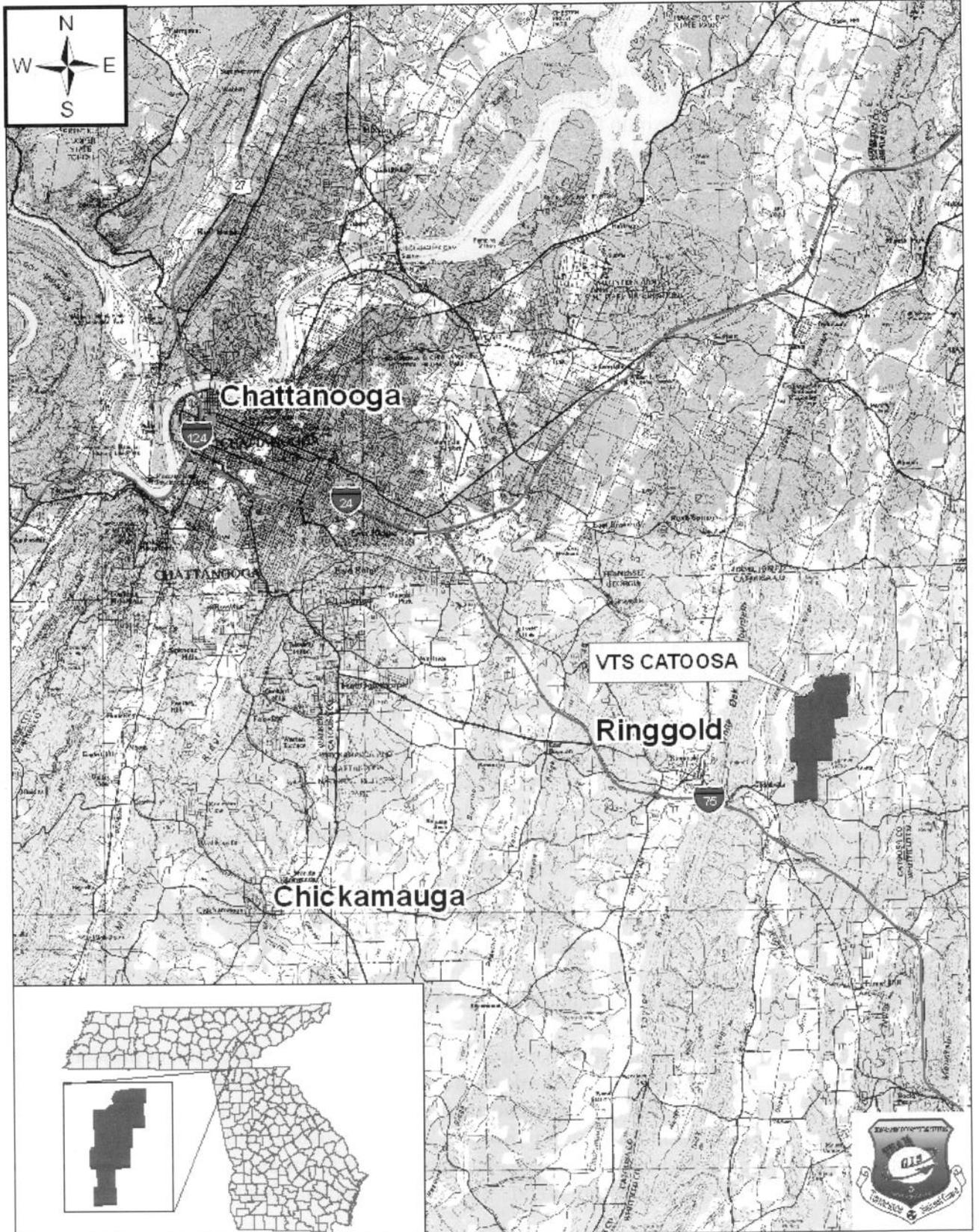
I. DESCRIPTION OF PROPOSED ACTION

The VTS-C is located in east-central Catoosa County in northwestern Georgia (Figure 1), approximately two miles east of Ringgold, Georgia. The 1,628-acre training site is in the Appalachian Highlands physiographic province, approximately 90 miles northwest of Atlanta, and approximately 20 miles southeast of Chattanooga, Tennessee. Georgia State Highway 2 borders the site on the south, and Rifle Range Road accesses the northern boundary. VTS-C is owned by the U.S Army Corps of Engineers and has licensed its use to the TNARNG since 1960. The TNARNG maintains the VTS-C for the purpose of training Tennessee National Guardsmen. The TNARNG manages the land on this training site with the goal of no net loss of training land resulting from training or natural resources management activities.

TNARNG will use the VTS-C INRMP as the principle guiding document for land management activities taking place on the training site for the next five years (2009-2013); it is a revision of the original VTS-C INRMP which covered the period 2002-2006. The proposed action is to implement the revised VTS-C INRMP to guide all natural resource management practices, on-site training, and training site maintenance and improvement projects on the facility from 2009 to 2013. This action is designed to integrate all management activities to support the military mission by protecting and enhancing training lands (vegetation, soils, water quality, and wildlife) while providing quality conditions for training.

The revised INRMP identifies multiple natural resources management goals and the objectives and tasks that are necessary to accomplish those goals for integrated, sustainable land management at the VTS-C. The revised INRMP also contains four specific management components: the Endangered Species Management Plan for large-flowered skullcap and gray bat, the forest management plan, the prescribed fire plan, and the invasive pest plant control plan (TNARNG 2008).

Figure 1 Location Map



Training Activities

Training activities on VTS-C are variable and during FY2009-2013 are expected to be similar to previous years. Typical uses include small arms range firing, maneuvering, and combined arms training including field bivouac; tracked and wheeled vehicle operations on developed roads and major trails; mounted and dismounted maneuvers; and weapons firing. Off-road maneuvers are permitted within designated open terrain areas and in designated fringe areas within 100 feet of specified roads and trails within the maneuver area. Up to one battalion-size infantry, artillery, engineer, or combat service support unit, conducting non-live fire exercises, can be accommodated at one time. Average training site usage over the past four years has been approximately 42,700 soldiers per year, a decrease from the average of 50,400 during the late 1990's. Training site use is generally dispersed across the year with peaks of National Guard usage occurring in October-November, February-April, and June (TNARNG 2008).

In order to educate land users on their environmental stewardship responsibilities the VTS-C implements a Sustainable Range Awareness (SRA) program. The SRA program provides for the development and distribution of educational materials to land users, including maps marking environmentally-sensitive areas and the VTS-C field card that identifies environmental considerations and guidelines for military tenants utilizing the facilities. These materials relate the principles of land stewardship and the practices of reducing training and/or testing impacts. Environmental Outreach also includes information provided to environmental professionals concerning operational requirements. The purpose of the SRA program is to prevent unnecessary damage to the environment and in particular, training lands, by providing information to all site users. The SRA program targets all land users to include soldiers, leaders, Department of Army (DA) civilians, and the local community who may use training lands for recreational purposes. The SRA program is designed to improve understanding of the effects of the mission, training, or activity on the natural resources of the VTS-C and seeks to create a conservation ethic that will minimize damage to training lands and natural resources (TNARNG 2008).

Training Site Maintenance and Improvement Projects

The primary objective of VTS-C natural resources management is to ensure the availability of mission-critical training land now and for the future. Mission-related objectives that will be accomplished by or in cooperation with the natural resources management actions proposed in the VTS-C INRMP include: increasing number of bivouac sites, increasing mounted and dismounted mobility by opening up the forest understory through silvicultural treatments in accordance with the forest management plan, creating additional open maneuver areas for tracked and wheeled vehicles, ensuring there is no net loss of training land due to environmental and/or natural resources management issues, and developing a plan to avoid encroachment of natural resource management on training (TNARNG 2008).

The TNARNG intends to implement construction and training site improvement projects during 2009-2013. Buildings and associated parking areas will be added to the cantonment area. Reclamation of an old roadway along the northern edge of VTS-C is anticipated. The Land Navigation Course in the north-central portion of VTS-C is covered with dense understory vegetation that makes foot travel difficult, reducing the effectiveness of the course, and will be opened by mechanical vegetation removal. Security requirements include complete fencing

around military installation boundaries. At this time the VTS-C perimeter is only partially enclosed. Fencing efforts will continue during 2009-2013, typically in 2500-ft to 5000-ft segments. Security requirements also dictate that 25-ft, line-of-sight clearance be maintained on either side of the boundary fence, requiring clearing of trees and routine mowing (TNARNG 2008).

Construction of a new range complex is proposed to begin in 2010. Approximately 40 acres will be cleared in the north-central portion of VTS-C for three ranges: a 300m x 300m (984ft x 984ft) Modified Record Fire Range (MRFR), a 100m x 30m (328ft x 98ft) Zero Range, and a 100m x 30m Combat Pistol Range. Topography, the shape of the VTS-C, the location of existing ranges, and surface danger zone requirements necessitate the location of these ranges. Support facilities to be developed will include: an access road, three parking areas of approximately 1/3 acre each, and an observation tower, ammo breakdown area, target house, and covered training area at each range (TNARNG 2008).

General Natural Resources Management Actions

The forestland inventory conducted in 2005 was used to develop a management plan based on forest health and timber management needs, as well as military needs and plans. It presents the recommended forestry management prescriptions for the forest stands occurring within the Cantonment Area and each of the 10 training areas that comprise VTS-Catoosa. Individual forest management prescriptions are provided for the forest stands occurring within each training area. The forest management prescriptions are generally focused on actions that would enhance the quality and economic value of the forestry resources on VTS-C. The use of prescribed fire is also addressed for each forest stand (TNARNG 2008).

Fire Protection

Fire is a tool used for natural resources management on VTS-C. The tank range and other open grassland areas are burned regularly to control woody encroachment. Most of the forested areas on the training site are dominated by hardwood species, and have not been burned regularly in the past. TNARNG has developed a prescribed burn plan for the purposes of fuel reduction and habitat improvement and will begin implementation in 2009. Prescribed burning will generally be restricted to burns that would reduce excessive accumulation of fuels thereby reducing wildfire risks. In forested areas, prescribed fire would be infrequently used at intervals of between 5 to 7 years. Managing with fire is expected to provide for the safety of fire crews, be a cost-effective means to reduce wildfire potential on the training site, maintain and improve the usability of the training site, effectively protect and enhance natural resources, and facilitate ecosystem management (TNARNG 2008).

1. Avoidance/Minimization Measures Incorporated Into the Proposed Action

Skullcap Management

TNARNG has mapped and designated 26 skullcap management groups on VTS-C (Figure 2). At VTS-C, there are a number of factors that pose a potential threat to the large-flowered skullcap: physical damage from human activity, soil disturbance from human activity, browsing or uprooting by wildlife, and wildfire. In order to minimize these threats, TNARNG has developed the skullcap management plan and will implement the following avoidance and minimization

efforts: Perimeter posting and mapping, wildlife control, invasive pest plants (IPP) control and fire protection (TNARNG 2008).

Perimeter Posting and Mapping

TNARNG has posted the perimeter of all large-flowered skullcap groups with signs that include a statement of no access during March 1 to June 30 (flowering season), and foot traffic only during the rest of the year. These signs, in conjunction with training and environmental education efforts for the soldiers and training site personnel, should minimize unplanned, human-caused disturbance of the plants. The signs are easily seen and should discourage accidental vehicular traffic through known clusters of plants. The signs are generally spaced 50 to 65 m apart. Trees between pairs of signs along the edge of a skullcap group will be marked with yellow paint to provide a more continuous visual barrier. The perimeter around each management group is located just outside the existing plants (no buffer area) to minimize restrictions on training area, but will be updated annually to ensure the majority of the plants are within the protected boundary. To date, the spatial boundaries of the groups of plants have changed little from year to year, and it is expected that the locations of the buffer zones will remain relatively constant for the near future. The perimeter of each group has been recorded with a GPS, and accurate maps can be produced for training or land management use. A training module will be developed that explains the purpose behind these signs and provides basic information about the skullcap; this information will be presented to all training site users in their initial on-site briefing. Maps are also available to the training site staff and other users showing the location of the large-flowered skullcap to encourage avoidance of prime skullcap areas during sensitive periods (TNARNG 2008).

Wildlife Control

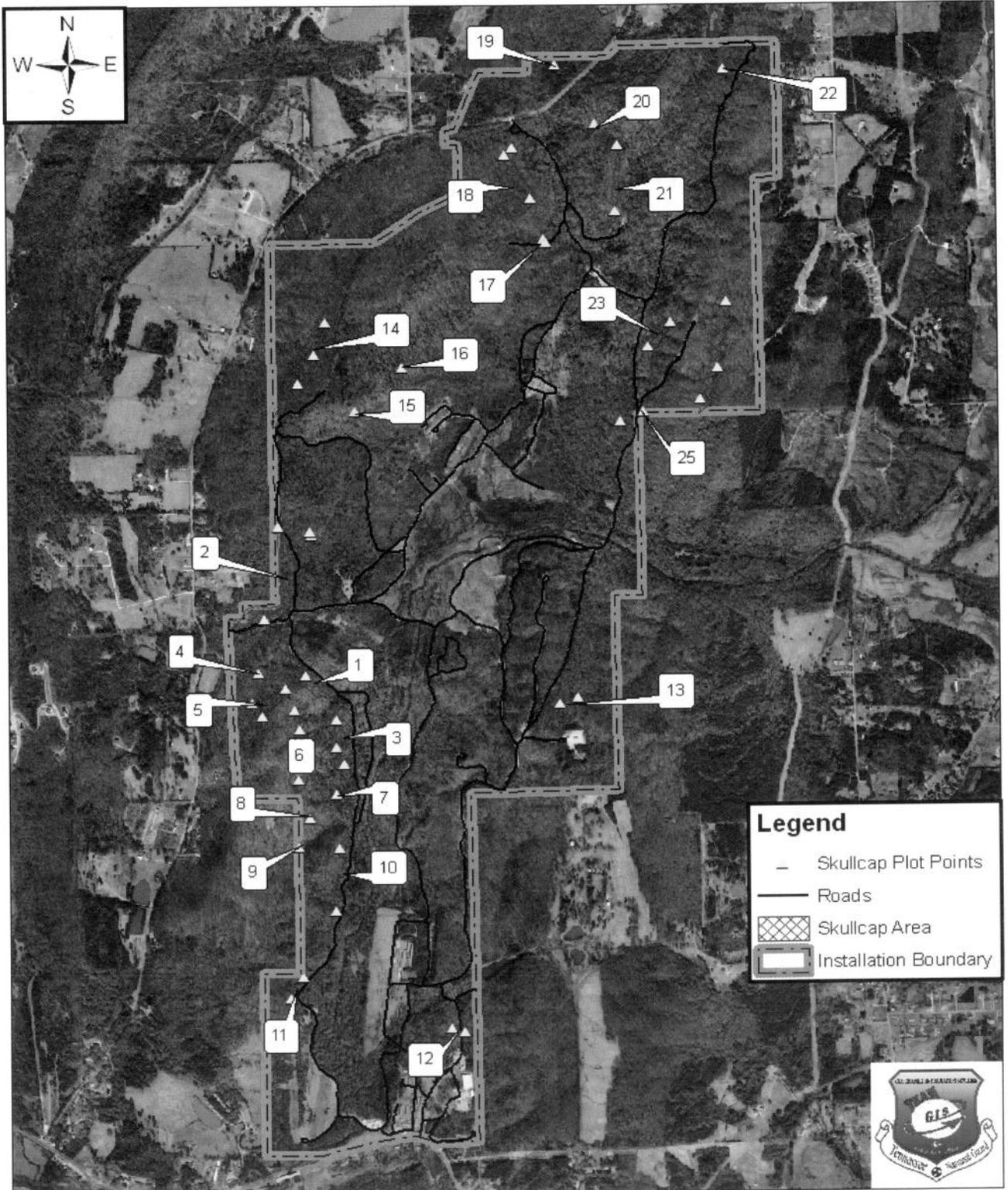
Herbivores can pose a threat to large-flowered skullcap. A number of individual plants have been found that were browsed during the monitoring program. White-tail deer are presumed responsible, however, browsing does not appear to kill the plant, but limits flowering as the buds are typically on the portion that is eaten. White-tailed deer are not currently controlled at VTS-C and there is no hunting on the training site. The TNARNG will coordinate with the Service to determine if monitoring results indicate that deer are significantly impacting the skullcap, and a program should be developed to limit the numbers of deer (TNARNG 2008).

Feral hogs are a more substantial danger to the plant. Disturbance indicative of hog rooting has been found within skullcap groups. It is presumed that hogs will feed on the perennial root of the skullcap and, therefore, could substantially impact the skullcap population. Feral hog numbers on the training site have been controlled in the past through professional removal. The TNARNG will coordinate with the Service to determine acceptable levels of hog damage and a threshold for initiating hog reduction efforts (TNARNG 2008).

Invasive Pest Plants Control

Invasive exotic plants are a problem at VTS-C and some skullcap management groups contain invasive plants. The principal problem species include Japanese honeysuckle (*Lonicera japonica*) and Chinese privet (*Ligustrum sinense*). At this time, the infestations do not appear to seriously impact the skullcap, but over time this status may change (TNARNG 2008).

Figure 2 Management Groups



Herbicide use will be strictly controlled in the vicinity of skullcap management groups. Only chemicals that are not soil active and are unlikely to translocate will be applied to IPP within 50-ft of a skullcap management group. Applications will be restricted to late fall after the skullcap is dormant, and application methods will be utilized that minimize the risk of chemical drift. Additional monitoring will track any changes to treated skullcap management groups, and the methodology will be revised if there appears to be any damage to the skullcap. Where IPP threaten the skullcap, careful application of herbicides will allow improvement of the skullcap habitat. Management groups 12, 18, 19, 23, and 24 are currently threatened by privet and honeysuckle. Monitoring of management groups treated for IPP will allow the identification of any detrimental effects that herbicide use might have on skullcap, and a determination of whether the beneficial effects to the skullcap justify the expense and effort of focused IPP control.

Herbicide treatment of IPP within large-flowered skullcap groups carries some risk for the protected plants from chemical drift and translocation. Careful choice of herbicide and treatment methods will minimize the hazard. As a precaution, initial treatments will only cover one-half of any IPP infested management group. Any herbicide damage to large-flowered skullcap in these groups will require a revision of methods prior to any further chemical IPP control efforts within the management groups.

TNARNG will ensure that environmental personnel with appropriate pesticide applicator certification will apply all herbicides and that applications will be made during the late fall or early winter after the skullcap has become dormant. Privet will be managed primarily by cut-stump method with application of Garlon 3A or a glyphosate herbicide with small privet plants (under 1 m tall) treated by foliar application of glyphosate. Japanese honeysuckle will be treated with foliar application of Garlon or a glyphosate herbicide. No more than half of a skullcap management group will be treated in the first year. Control and treatment plots will be established within each skullcap management group, skullcap will be mapped in the study plots in the spring prior to treatment and reassessed the following spring, if initial results indicate little damage to the skullcap from the herbicide applications, the IPP treatments may be expanded to include all threatened skullcap management groups. Monitoring of skullcap response will continue for at least two years following the last herbicide application (TNARNG 2008).

2. Recovery/Conservation/Environmental Stewardship Measures Incorporated Into the Proposed Action

To investigate management alternatives and impacts on large-flowered skullcap, three research projects are proposed: transplanting of individual skullcap plants, assessing fire impacts, and monitoring the influence of chemical and manual control of invasive pest plants. These projects will expand our understanding of management options and population dynamics for this species and may eventually contribute to the recovery of the species.

Transplanting

Certain management groups are threatened by required or anticipated training site construction and other activities. There are security requirements for a fence and a 25-ft cleared buffer to surround the entire training site. Several management groups (2, 9, 14, and 24) lie along this

boundary and will be affected by clearing. Other groups (17 and part of 18) fall in areas that will potentially be impacted by proposed range construction. TNARNG will transplant individuals from threatened groups to other areas on VTS-C where effects of training are not expected to occur. An adaptive management approach will be used for the transplant effort. Initial transplants will occur using the preliminary protocol below. Information gathered from the initial efforts, in coordination with the Service, will be used to update the protocol to maximize success.

Preliminary Protocol:

- Plants will be transplanted into the best available habitat within the same training site; i.e., group 9 plants will stay in the southwest cluster of management groups, group 17 plants will stay within the 18-20-21 area.
- Appropriate habitat will be identified within 750 ft of the existing group, out of danger of the construction or clearing project.
- Transplant sites will be as similar as possible to the original habitat in terms of slope, aspect, elevation, soil series, canopy cover.
- No more than ½ of a group's plants will be moved initially. A mix of flowering adults and non-flowering juveniles will be moved. Plants will not be taken from within existing monitoring plots in the initial test.
- Plants will be marked with flags during flowering season.
 - o Plants will be dug up either after seed set (July) and maintained in a greenhouse over winter or after initiation of dormancy (October) and transplanted immediately.
- As much soil as is feasible to transport will be dug up with each plant to preserve fine roots and mycorrhizal associations.
- Plants will be watered at transplanting to settle the soil, but will be subject to natural conditions after that.
- Transplant sites will be marked and individual plants mapped to allow monitoring of individual success.
- If the initial transplant success is reasonable, the remainder of the plants that are threatened by immediate military development will be relocated using the most successful methods.
- Plants will be monitored for at least 3 years.

Because efforts to transplant can be complicated by natural factors such as weather, soils and predation, TNARNG will not depend solely on transplant success to maintain the skullcap population on VTS-C. In a redundant effort to maintain the population of large-flowered

skullcap on the training site, arrangements will be made for the greenhouse propagation of new plants, to replace plants that are displaced by construction and training. Propagated plants will be outplanted into training site locations chosen in coordination with the Service (TNARNG 2008).

Fire Impact Research

Prescribed burning is a tool that will be utilized for natural resources management on VTS-C. Currently, there is a limited understanding of the impacts of fire on large-flowered skullcap. It would be useful to know whether the skullcap can withstand occasional burning or whether all management groups within a burn area will always require protection. The fire impact study will involve five skullcap management groups that may result in the death of individual plants. Skullcap response to fire will be monitored and in the worst case scenario, between 50 and 100% of these plants could be killed in the first fire, resulting in the termination of the experiment. It is anticipated, however, that fire will not significantly damage management groups and may improve seed germination and recruitment (TNARNG 2008).

Preliminary Protocol:

- Large concentrations of large-flowered skullcap will be protected from prescribed fire, either by complete restriction on burning (training area 2 and populations within SMZs such as management group 24) or by construction of a temporary fire break surrounding the group with at least 50 feet of buffer.
- Certain groups will be allowed to burn on the rotation schedule recommended in INRMP, Annex 3, Prescribed Burn Plan, for fuel control in the hardwood forests of the site.
- Groups 15 and 16 fall within the tank range target area which is subject to burning every 2-4 years; groups 12, 17, and 19 will be burned on a 5-7 year rotation.
- All skullcap-impacting burns will be cool, dormant season burns.
- Pre- and post-burn sampling will assess fire weather, fire behavior, flame temperature, litter consumption and impacts on vegetation.
- Data from the permanent monitoring plots will be used to assess skullcap recovery in the years following the burn, relative to pre-burn levels. If response to the initial fire is bad (more than 50% loss of plants), the fire study will be discontinued and all management groups will be protected with plowed firebreaks in all future prescribed burn events.

Monitoring

A monitoring protocol has been developed and implemented. Plants that are transplanted, nursery grown or that are within burned areas will be monitored. The monitoring protocol is based on 10-meter radius circular plots. Forty-six of these plots have been established within the 26 management groups (Figure 2) with at least one plot in each management group. The plots are not randomly located but are placed subjectively in areas known to contain skullcap plants. The plot centers are permanently marked and recorded via GPS for repeat sampling. Monitoring is conducted during the flowering season for the large-flowered skullcap which begins in

mid-May and runs into June with the peak usually in the end of May. Within each monitoring plot, the following information is recorded: each individual large-flowered skullcap plant is identified and characterized in terms of number of stems, flowering/nonflowering, browse or insect damage indications, adult or juvenile. The distance and bearing from the center point of the plot to each plant is measured, allowing mapping of plant locations. In addition, a habitat description, associated plant species, threats, and evidence of disturbance are noted for each plot (TNARNG 2008).

FY2008 was the fifth year of data collection following this protocol (Table 1, p. 15). With significant fluctuations in the plant counts in 2007 and 2008, possibly due to drought, the monitoring program will be continued for several more years to track population dynamics. Results from each year of monitoring will be compiled and comparisons made as multiple years' data become available. After a period of five years of monitoring, the trends at each monitoring plot will be evident. At that time, the monitoring protocol will be evaluated and modified, if needed.

II. STATUS OF THE SPECIES/CRITICAL HABITAT

1. Species/Critical Habitat Description

The large-flowered skullcap, (*Scutellaria montana*), is a member of the mint family (Lamiaceae) that was listed as an endangered species on June 20, 1986 (U.S. Fish and Wildlife Service 1986). It is a perennial herb that grows to a height of 30 to 50 centimeters (U.S. Fish and Wildlife Service 1994). The stems are erect and square, and the leaves are lanceolate to ovate, 5 to 8 centimeters long, 3 to 5 centimeters wide, with crenate to serrate margins and hairs on both surfaces. The inflorescence is a terminal raceme with or without paired lateral racemes at the base, and the flowers are relatively large, 2.6 to 3.5 centimeters long and are blue and white in color (U.S. Fish and Wildlife Service 1994).

The Service reclassified large-flowered skullcap from endangered to threatened status in 2002, at which time there were 84 occurrences of the species distributed among 48 populations (U.S. Fish and Wildlife Service 2002). Of these 48 populations, 22 were protected through ownership by conservation organizations, county parks, historic sites, or Federal land; 11 of these protected populations were deemed self-sustaining.

Habitat of large-flowered skullcap has been described as rocky, submesic to xeric, well-drained, slightly acidic slope, ravine and stream bottom forest in the Ridge and Valley and the Cumberland Plateau provinces of northwestern Georgia, southeastern Tennessee, and probably northeastern Alabama (U.S. Fish and Wildlife Service 1994). Specific habitat components are thought to consist of a history of natural pine occurrence, canopy dominated by oaks and hickories, a deciduous shrub layer with some evergreen, a moderately dense herb layer consisting of mesic and xeric species, and well-consolidated strata of sandstone and shale with some exposed rock. Data collected on sites where large-flowered skullcap occurs indicates that it is a mid- to late-successional species (U.S. Fish and Wildlife Service 1994).

Large-flowered skullcap releases nutlets from late June through early July. Nutlets overwinter and germination begins the following year in late March. Flowers appear from mid-May through early June, are pollinated primarily by bees, and fall from the plant one to two days after pollination. The reproductive potential of large-flowered skullcap is low; observers have found that only 10 to 40 percent of flowers produce fruit. Reasons for variation in fruiting as well as conditions needed for germination and dispersal, are unknown (U.S. Fish and Wildlife Service 1994).

2. Life History, Ecology, Population Dynamics, and Threats to the Species

Throughout the range of large-flowered skullcap, numerous entities contribute to monitoring including Tennessee Department of Environment and Conservation-Division of Natural Areas (TDEC-DNA), Tennessee Valley Authority (TVA), National Park Service (NPS), Georgia Department of Natural Resources (GDNR), Tennessee Aquarium, TNARNG, and the Service. In recent years, TVA and Tennessee Aquarium have organized annual meetings for the purpose of sharing information and coordinating monitoring activities among these groups. Monitoring methods used have varied over time and across agencies, but TDEC initiated a standardized approach to monitoring in 2004.

Large-flowered skullcap will be considered for delisting when there are 15 adequately protected and managed self-sustaining populations. Populations must be distributed throughout the range and must be maintained for 10 years. A population will be considered adequately protected when it is legally protected and all needed active management is provided. A population will be considered “self-sustaining” if monitoring data support the conclusion that it is reproducing successfully and is stable or increasing in size. The minimum number of individuals necessary for a self-sustaining population should be considered to be at least 100 until otherwise determined by demographic studies.

Skullcap is known from southern Tennessee and northwestern Georgia (Figure 3). According to data provided by TDEC-DNA (D. Lincicome, email dated August 21, 2008), there currently are 155 extant large-flowered skullcap element occurrences (EOs) in Tennessee; however, the number of populations that these occurrences are distributed among has not been evaluated. In Georgia, there are 52 extant EOs (K. Morris, GDNR, email dated August 18, 2008). Element occurrences are the fundamental unit of information tracked by the Natural Heritage methodology and are defined as “an area of land and/or water in which a species or natural community is, or was, present” (NatureServe 2004). An analysis of the EOs throughout the range of large-flowered skullcap is necessary in order to delineate populations and assess whether they are protected and self-sustaining. Unless new criteria are developed, this analysis should be based on the definitions that the Service used when it reclassified the species (U.S. Fish and Wildlife Service 2002): (1) a population is an occurrence that is generally at least 0.5 mile from other occurrences, taking into account the position of occurrences with respect to physical barriers (ridges, highways, etc.), contiguous habitat (e.g., two or more occurrences deemed part of a single population could be one mile apart on the same ridge or slope), and richness or diversity of the occurrence, and (2) a population is considered self-sustaining, or viable, if it has a minimum of 100 individuals. Due to the number of new EO’s it is likely that the criteria for delisting large-flowered skullcap have been met, this analysis of population

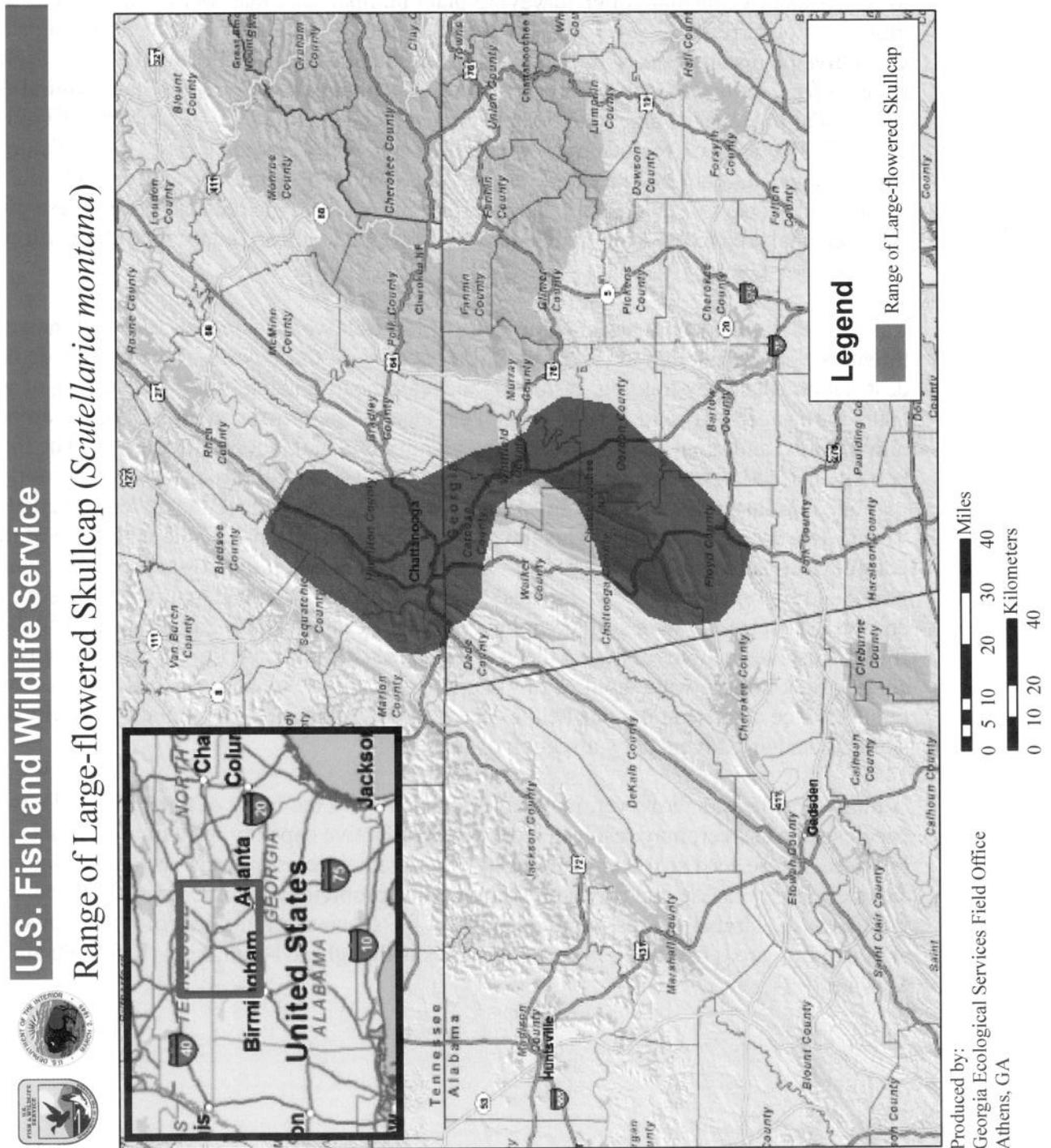
numbers, viability, and protection status must be completed before we can determine whether the species should be considered recovered. The status of large-flowered skullcap is considered stable throughout its range.

The State of Tennessee initiated a monitoring program for large-flowered skullcap in 2004, and has now established 36, 10-meter radius circular plots in locations where the species was found to be reasonably abundant after surveying plant numbers and distribution throughout each monitored occurrence (TVA 2005; TDEC-DNA 2008). Total numbers of flowering and vegetative plants are tracked in each plot. Areas targeted for monitoring included Tennessee River Gorge, Prentice Cooper Forest, North Chickamauga Creek Gorge State Natural Area (SNA), Falling Water Falls State Natural Area, Rock Creek Gorge – Cumberland Trail State Park (CTSP), Soddy Creek Gorge – CTSP, Possum Creek Gorge – CTSP, and Chickamauga and Chattanooga National Military Park (CCNMP). The NPS monitors occurrences in the CCNMP and provides data to TDEC-DNA for reporting purposes. Data collected from these plots have not been analyzed to evaluate trends in large-flowered skullcap, but in the future will provide a basis for doing so.

Range wide threats could affect some EO's of large-flowered skullcap, however, none of these threats are severe enough to cause the further decline of the species. Threats include habitat destruction caused by logging, residential development, grazing, wildfire, clearing of wooded areas for pasture, off-road vehicle (ORV) damage, hiking traffic, maintenance or rerouting of hiking trails, and rapid urbanization in the vicinity of Chattanooga, Tennessee. The threat of habitat destruction has recently been heightened owing to a rapidly growing, but poorly regulated, industry associated with surface rock mining to produce the material marketed as "Tennessee mountain stone". This threat could be especially problematic because of the complexities surrounding conveyance through deeds of mineral and surface rights, which are often held by separate entities. Because of the severance of these legal rights, persons and public entities that currently own surface rights on properties that harbor large-flowered skullcap could find themselves unable to protect the species and its habitat from the destruction caused by surface rock mining when holders of mineral rights choose to exercise those rights. Such a circumstance occurred on lands held by the State of Tennessee that contain large-flowered skullcap and are traversed by a section of the CTSP.

A number of factors, however, may have contributed to the rarity of the species. Browsing, by species such as deer, may result in reduced reproductive capacity of individual plants if they are browsed before seed set. Competition by other plant species may also be a contributory factor. Japanese honeysuckle and privet are known to be problems for some large-flowered skullcap populations. Timber harvest might also affect the species; recruitment of large-flowered skullcap into areas disturbed by such activities is thought to be unlikely (U.S. Fish and Wildlife Service 1994).

Figure 3. Range of the Large-flowered Skullcap (*Scutellaria montana*)



III. ENVIRONMENTAL BASELINE

Status of the Species Within the Action Area

Surveys conducted late in 2002 at TNARNG's VTS-C produced 60 discrete clusters of large-flowered skullcap that contained a total of 1,581 plants, which were grouped into 26 skullcap management groups based on habitat similarity and geographic proximity (Figure 2). The 2002 data was a comprehensive survey of all plants, all subsequent data was extrapolated from monitoring plots. Therefore, for the purpose of this opinion, data from 2002 has been used because they are the most comprehensive data available. Data in Table 1 appear to indicate that the number of skullcap may be declining at VTS-C. The decline is likely a natural fluctuation due to drought conditions on site, because the TNARNG has not altered the natural habitat and natural processes are still intact.

The only large-flowered skullcap occurrences monitored in Georgia are those at TNARNG's Volunteer Training Site, Catoosa County (VTS-C). The data in Table 1 demonstrate the importance of long-term monitoring programs for establishing population trends and examining them for cyclical patterns of variability and responses to environmental conditions. For example, the declining trend in numbers of plants observed that began in 2007 could be attributable to effects from severe drought conditions that occurred in northwest Georgia during this period (SpecPro, Inc. 2008). It will be vital to continue long-term monitoring of all populations to determine whether the effects of this drought, which extended into the Tennessee portion of the range of large-flowered skullcap, and other factors will result in sustained reductions in population sizes. The potential for sustained demographic reductions could have implications for maintaining genetic diversity within large-flowered skullcap populations, and ultimately the species as a whole. Cruzan (2001) interpreted patterns of genetic variation among populations of different sizes as evidence of recent changes in the abundance of this species, noting that large populations consistently had high levels of genetic variation, whereas smaller populations displayed greater variability in this regard. Genetic variation was diminished in some small populations, and Cruzan (2001) concluded that these patterns of variance in large-flowered skullcap provided evidence that the species is generally in the process of demographic decline, because substantial loss of genetic diversity would tend to be expected in small populations only if they were reduced in size for extended periods of time (Cruzan 2001).

Table 1. Counts of all large-flowered skullcap plants within 46, 10-meter radius circular monitoring plots from TNARNG's VTS-C for the period 2004-2008.

Year	Min	Max	Average	Total
2004 ¹	4	112	24	1,121
2005 ²	4	116	32	1,475
2006 ³	6	131	39	1,799
2007 ⁴	0	79	18	827
2008 ³	1	30	8	355

¹Science Applications International Corporations (SAIC) (2006); ²SAIC (2006); ³unpublished data provided by TNARNG; ⁴SpecPro, Inc.

IV. EFFECTS OF THE ACTION

1. Direct Effects

Potential impacts of the INRMP were evaluated using 2002 data.

Training Activities

Although training activities on the VTS-C have the potential for adverse impacts to the large-flowered skullcap, measures implemented by TNARNG should eliminate training related destruction of skullcap. Due to the topography of the region and the forested condition of most of the site, vehicular traffic is restricted to established roads and trails and to prepared open maneuver areas, thus avoiding known large-flowered skullcap groups. The potential for impacts from foot traffic has been largely eliminated and is considered discountable. All known large-flowered skullcap groups are posted with signs restricting entry during the growing season (vehicular traffic is prohibited at all times), and training maps display the skullcap locations as off-limits, so there is limited threat to the plants from soldiers on foot. Bivouac sites experience high foot traffic, as well as, vehicular disturbance immediately off-road, but such training areas are situated at a distance from known skullcap groups to avoid disturbance. Range operations hold little threat to the protected plants on the existing live-fire and non-live-fire ranges (range maintenance, is discussed below). TNARNG training operations are not likely to adversely affect the large-flowered skullcap.

Training Site Maintenance and Improvement Projects

Training site maintenance and improvement involves a wide variety of actions; most will have little effect on the large-flowered skullcap, but certain construction projects may have a substantial impact on the large-flowered skullcap on VTS-C. Maintenance of range facilities and grounds has little influence on the skullcap, which are generally not located in close proximity to these heavily-managed portions of the training site. The use of prescribed fire to maintain the target area of the tank range has affected management groups 15 and 16 in the past; these two groups are now protected by a fire break and will remain protected until the prescribed fire experiment is initiated (see prescribed burning below).

Road maintenance has the potential to impact those management groups located directly beside the major roads; however, all groups have been marked, and training site personnel avoid altering the road shoulder in the vicinity of the large-flowered skullcap. No impacts are expected from road maintenance.

Construction in the cantonment area will be located well away from group 12 and so there will be no impact on the large-flowered skullcap. Reclamation of an old roadway across the northern edge of the training site is anticipated. The roadway will be routed around management groups 20 and 21, and will have no direct impact on the skullcap.

Table 2 Summary of Effects

Management Group	Training Area	Total Number Plants ¹	Anticipated activities	Cluster # ²	Estimated # impacted plants ³	Approximate area impacted (acres)	Probable impacts
1	C-2	108					
2	C-5	67	boundary	cluster 51	11	0.282	likely destroyed
3	C-2	99					No effect
4	C-2	8					No effect
5	C-2	28					No effect
6	C-2	199					No effect
7	C-2	6					No effect
8	C-2	12	boundary	cluster 22	12	0.084	edge effect
9	C-2	9	boundary	cluster 23	9	0.208	likely destroyed
10	C-2	142					No effect
11	C-2	69	boundary	cluster 24	11	0.371	likely destroyed
12	Cantonment	22	prescribed fire		11	0.466	burned 5-7 yr rotation
13	C-3	77					No effect
14	C-6/C-5	165	boundary	cluster 31	8	0.043	likely destroyed
15	C-5	5	prescribed fire		5	0.053	burned 2-4 yr rotation
16	C-7	14	prescribed fire		14	0.048	burned 2-4 yr rotation
17	C-7	69	prescribed fire		69	2.826	burned 5-7 yr rotation
			range	cluster 47	12	0.188	edge effect
			range	cluster 49	4	0.012	likely destroyed
18	C-6/C-7	69	range	cluster 48	16	0.086	edge effect
19	C-8	26	prescribed fire		26	0.167	burned 5-7 yr rotation
			boundary	cluster 54	10	0.080	likely destroyed
			boundary	cluster 54	16	0.080	edge effect
20	C-9	20					No effect

21	C-9	53					No effect
22	C-10	14					No effect
23	C-10	56					No effect
24	C-10	209	boundary	plot 24-3	10	0.046	likely destroyed
25	C-10	9	boundary	cluster 55	9	0.047	likely destroyed
26	C-4	14					No effect
		1569	Total plants in 2002		211		total expected impact *
		70 acres	approx. area in mgmt. groups		72	1.089	likely destroyed by boundary clearing
					56	0.438	edge effect from clearing
					125	3.560	burn effects

¹ Number of plants is based on 2002 full census of large-flowered skullcap.
² Cluster # is based on 2002 census.
³ # impacted plants is estimated based on the location of impact relative to the 2002 "clusters."
* Total expected impact does not equal the sum of column F because management groups 17 and 19 include plants counted twice - for range or boundary and for fire.

Although several management groups (17, 18, 19 and 20) are located in the vicinity of the Land Navigation Course in the north-central portion of the training site, they are posted and mapped, and no vegetation removal will occur within 50 ft of group edges. No direct impact on the large-flowered skullcap is anticipated due to operation or maintenance of the Land Navigation Course.

Security requirements include complete fencing around military installation boundaries. At this time the VTS-C perimeter is only partially enclosed. Fencing efforts will impact several management groups (2, 9, 11, 14, 19, 24, and 25) that abut or straddle the boundary. In order to minimize impact on these plants, all fence building activities will occur during the dormant season. Due to the terrain of the training site, erection of the fence will be done manually, with minimal disturbance to the soil. Transport of the equipment to the boundary is typically via ATV. Pathways are marked in advance by the Environmental office if there are any nearby skullcap management groups to be avoided. There is potential for damage to individual plants that lie directly on the fenceline, however the actual footprint of the fence is small, therefore, there should be minimal peripheral impact from the construction of the security fence.

Security requirements also dictate that 25-ft line-of-sight clearance be maintained on either side of the boundary fence. This clearing of trees and routine mowing will significantly impact management group 2 and will somewhat impact other groups, including 9, 14, 24, 25, and

possibly 8, 11, and 19. The degree of impact will be dictated by the number of plants within that 25-ft buffer. Clearing of the trees will vastly alter the habitat. In addition, the process of cutting the timber and clearing the lower vegetation will probably damage many of the large-flowered skullcap plants in that strip. TNARNG anticipates eventual loss of all skullcap plants within 30-ft of the fenceline after the clearing is completed; TNARNG estimates as many as 72 plants will be lost (see likely destroyed, Table 2).

In order to offset this loss, the TNARNG will tally the number of plants that fall within this hazard zone prior to any clearing. A nursery (the Atlanta Botanical Garden or other repository acceptable to the Service) will be contracted to propagate large-flowered skullcap from the VTS-C population (if possible, from the threatened management groups). When ready, the nursery stock will be out-planted to an appropriate location on the VTS-C, as determined from soil, slope/aspect, and vegetative characteristics, that is not subject to immediate military need. The goal will be 75% replacement of plants lost to fenceline clearing. Although nursery-propagated skullcap plants will be used as replacements for the loss associated with the fenceline clearing and the new range complex, the TNARNG will utilize some of the lost individuals for the transplant experiment as described.

Construction of a new range complex is proposed to begin in 2010. Three ranges will be established in the north-central portion of the training site in the vicinity of large-flowered skullcap management groups 17 and 18. These ranges will not directly impact any known large-flowered skullcap; however, the support facilities for the MRFR and the Zero Range may impinge upon skullcap group 17. Grading for the access road and the support facilities at the Zero Range will destroy 69 skullcaps on 2.8 acres (see likely destroyed, Table 2) from management group 17. Management group 17 will retain 75% of its original plants after construction. Management group 18 (94 plants) will be thoroughly marked and completely avoided with all construction and earth-moving efforts.

As with other projects, TNARNG will offset the loss of plants from management group 17. Large-flowered skullcap will be nursery propagated to replace the individuals lost, with a goal of at least 75% successful replacement. The replacement plants will be out-planted to the west of the management group, if appropriate habitat is available. If not, they will be planted in appropriate habitat in another part of the training site.

Prescribed Burning

Prescribed burning is a useful tool for land management, but the resilience of large-flowered skullcap to various fire regimes is not well-known. Most burning at VTS-C will be conducted in the grassland areas; thus, posing no threat to the skullcap. However, longer-interval burns will be conducted within forest stands as needed to lower fuel loads and minimize wildfire risks. The majority of large-flowered skullcap management groups will be protected from these burns by firebreaks installed at least 50 ft outside the edge of the group, and Training Area 2 will not be subject to any prescribed burns due to the extensive skullcap presence, pending results from fire impact research.

As part of range maintenance (described above) will be subject to regular fire, this will be incorporated into the prescribed fire experiment. The initiation of the prescribed fire experiment could destroy plants in groups 15 and 16 (5 and 14 respectively, see burned 2-4 yr rotation, Table 2) occupying 0.1 acres. Additional skullcap management groups (12, 17, and 19) will be subjected to the scheduled prescribed burns for experimental purposes. These five management groups include 125 plants on 3.56 acres (see burned 5-7 yr rotation, Table 2). If post-burn sampling indicates a mortality rate of 50% or higher, the burn study will be discontinued. Some loss of large-flowered skullcap plants is anticipated as a result of the experimental prescribed fire evaluation, but will be limited by the constraints of the experimental design. The effect of fire on skullcap has not been evaluated and may benefit the population by eliminating woody competition and exposing mineral soil for seed germination. Although fire is not expected to wipeout all plants and may in fact turn out to be beneficial, the effects are not known, therefore, this Opinion considers the worst case scenario with all 125 plants within the burn areas being destroyed.

Wildlife Control

Herbivores can pose a threat to large-flowered skullcap. Through the monitoring program, a number of individual plants have been found that have been browsed. It is presumed that white-tail deer are responsible. Browsing does not appear to kill the plant but limits flowering as the flower buds are typically on the portion that is eaten. If monitoring results indicate that deer are significantly impacting the skullcap, as determined through coordination between the Service and TNARNG, a program will be developed to limit the numbers of deer.

Feral hogs are a more substantial danger to the plant. It is presumed that hogs will feed on the perennial root of the skullcap and, therefore, could substantially impact the skullcap population. If hog sightings or damage increase above acceptable levels, as determined through coordination between the Service and TNARNG, a project will be initiated to reduce their numbers (TNARNG 2008).

Invasive Pest Plants Control

Weed control is necessary at VTS-C, especially for invasive exotic plants. In areas where such pest plants threaten the skullcap, careful application of herbicides will allow improvement of the skullcap habitat and the opportunity to monitor the impact of invasives and release from invasives. The treatment protocol will include provisos such as no herbicide application to skullcap. Management groups 12, 18, 19, 23, and 24 are currently threatened by privet and Japanese honeysuckle. Careful monitoring of the groups treated for invasive pest plants will allow the identification of any detrimental effects that herbicide use might have on large-flowered skullcap and a determination of whether the beneficial effects for the skullcap justify the expense and effort of focused IPP control.

Herbicide treatment of invasive pest plants within large-flowered skullcap groups carries some risk for the protected plants from chemical drift and translocation. Careful choice of herbicide and treatment methods will minimize the hazard. As a precaution, initial treatments will only cover half of any IPP infested management group. Any herbicide damage to large-flowered skullcap in these groups will require a revision of methods prior to any further chemical IPP control efforts within the management groups. If IPP can be controlled in the vicinity of the

large-flowered skullcap, it will be a beneficial impact. No detrimental impacts are expected from the careful application of chemical weed control at VTS-C.

Transplanting

Where the implementation of this INRMP is expected to destroy skullcap, the TNARNG will transplant individuals from threatened groups to other areas on the training site where effects of training are not expected to occur. A total of 72 plants from skullcap management groups 2, 9, 11, 14, 17, 19, 24, and 25 (see, likely destroyed, Table 2) will be transplanted. An adaptive management approach will be used for the transplant effort. Because efforts to transplant can be complicated by natural factors such as weather, soils and predation, TNARNG will not depend on solely on transplant success to maintain the skullcap population on VTS-C. If a large number of plants are to be displaced by any given project, arrangements will be made for the greenhouse propagation of new plants, which will be outplanted into training site locations chosen in coordination with the Service.

Monitoring

Results from each year of monitoring will be compiled and comparisons made as multiple years' data become available. After a period of five years of monitoring, the trends at each monitoring plot (increasing, decreasing, minimal change) will be evident. At that time, the monitoring protocol will be evaluated and modified, if needed.

2. Indirect Effects

Roads are known corridors for the spread of invasive plant species (Forman et al. 2003), as disturbed soil and the maintenance of open, sunny conditions create favorable conditions where invasive species can establish and spread into the forest interior (Fraver 1994). Fraver (1994) investigated the edge effects associated with agriculturally-maintained openings (similar to maintained right-of-ways for roads) on mixed hardwood forests in North Carolina. He observed that effects influencing vegetative cover, species richness, and presence of exotic species infiltrated into forest interiors up to 60 meters (197 feet) in response to changes in microclimate and increased incidence of sunlight, depending on slope aspect. Of exotic species found along forest edges, two species (Japanese honeysuckle and Chinese privet) were most pervasive. Significant differences in Japanese honeysuckle abundance were observed up to 10 (32.8 feet) and 60 meters (197 feet) from maintained edges on north and south-facing slopes, respectively.

Aside from the direct loss associated with clearing ground for the range and associated construction, there is the potential for loss of skullcap plants to excess competition that may arise when the forest cover just beyond management group 17 (12 plants) and 18 (16 plants) is removed (Table 2). Additionally, skullcap management group 8 and 19 could have 12 and 16 plants affected by edge effect (Table 2). To minimize this impact, TNARNG will plant evergreen tree species (eastern red cedar, shortleaf pine, and/or Virginia pine) along the edges of cleared areas that lie within 30 feet of a large-flowered skullcap group. The goal is to provide a dense edge to minimize increased sunlight intrusion into what had been forest interior.

General Natural Resources Management

There is the potential for a flush of growth by IPP such as privet and honeysuckle following the opening of the canopy by timber harvest. It is anticipated that the 50-ft undisturbed buffer will help minimize such a threat to the large-flowered skullcap; however, IPP presence will continue to be monitored in conjunction with the annual rare, threatened or endangered monitoring, and specific control efforts will be initiated if needed.

3. Interrelated and Interdependent Actions

Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions are actions having no independent utility apart from the proposed action. The Service is not aware of any interrelated or interdependent actions associated with the project.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Reasonably certain to occur means that permits, grants, contracts, authority, obligations of expenditures, etc. have been initiated. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service cannot identify cumulative effects in the defined action area.

VI. CONCLUSION

Overall, the projects identified in this INRMP will affect the large-flowered skullcap. While many of the impacts will be positive, a small number of projects will result in loss of plants. Implementation of this plan will destroy 72 plants, 125 will be affected by burning and 56 will be affected by edge effect; however, some plants are affected by burning and edge effect. Therefore, a total of 211 individual skullcap plants on 4.6 acres will be adversely affected (Table 2). Many of these plants will be transplanted and additional nursery grown plants will be outplanted to ensure that impacts are unlikely to significantly diminish the skullcap population.

After reviewing the current status of the large flowered-skullcap, environmental baseline in the action area, effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of this species. No critical habitat has been designated for this species; therefore, none will be affected.

We reached this opinion based on the occurrence of at least 207 global EO's of large-flowered skullcap and the fact that proposed projects will affect 211 stems on a little more than 4.6 acres (Table 2). VTS-C will retain almost 64 acres of occupied habitat with 1358 stems remaining. Although threats and impacts continue to burden sites harboring large-flowered skullcap, the baseline status for this species has improved since its listings under the Act due to: (1) the discovery of new EO's and/or expansion of existing EO's; (2) changes in management practices

that benefit the species; and (3) permanent protection of sites as public nature preserves (11 of the 15 sites needed to delist).

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally-listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law. Large-flowered skullcap is provided accessory, yet limited, protection under the Georgia Wildflower Protection Act (Ga. Code Ann. § 12-6-170 to -176), under which act these species are also designated as endangered. The Georgia Wildflower Protection Act prohibits removal of State-designated threatened and endangered species from State-owned lands and charges GDNR with regulating the sale of plants designated as protected under this law.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

During the extensive informal consultation period for this project, TNARNG incorporated many conservation measures into the proposed action. TNARNG included extensive recovery and conservation measures (monitoring, fire research, invasive plant control and wildlife control) that would likely provide long-lasting, beneficial improvements to the global baseline of the species.

The Service commends TNARNG for the progressive approach it has taken towards the furtherance of recovery mandates under section 7(a)(1) of the Act and the preservation of

biodiversity. The protection of the habitat for large-flowered skullcap, throughout VTS-C, is an exceptional and, in Georgia, an unparalleled example of how rare ecosystems can be preserved and enhanced through rare species conservation. TNARNG has met or exceeded all expectations of the Service for its treatment of this project.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the biological assessment and supporting consultation materials. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) new information reveals effects of the TNARNG action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the TNARNG action is modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action.

The above findings and recommendations constitute the report of the Department of the Interior. Please contact staff biologist Jimmy Rickard at 706-613-9493, ext. 223 if you require additional information.

Sincerely,



Sandra S. Tucker
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File

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Annex 2

**FOREST MANAGEMENT PLAN
VTS-CATOOSA**

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1.0 INTRODUCTION

The forestlands of VTS-C were inventoried in 2005. A management plan was then developed based on forest health and timber management needs. This plan has been modified to include military needs and plans. It presents the recommended forestry management prescriptions for the forest stands occurring within the Cantonment Area and each of the 10 training areas that comprise VTS-Catoosa (see Figure A2.1). Details of timber volumes and other stand characteristics are available in the Forest Inventory (Thompson Engineering 2006).

Individual forestry management prescriptions are provided for the forest stands occurring within each training area. The forest management prescriptions are generally focused on actions that would enhance the quality and economic value of the forestry resources on VTS-Catoosa. The use of prescribed fire is also addressed for each forest stand. Recommendations for prescribed burning are almost always restricted to burns that would be directed toward reducing excessive accumulations of fuels to reduce wildfire risks and, in most cases, would be conducted infrequently on a 6-year rotation, unless otherwise specified. Annex 3 should be referred to for information on the weather guidelines that should be considered when conducting prescribed burns and for the management objectives that are to be accomplished by burning.

2.0 LARGE-FLOWERED SKULLCAP

The presence of the large-flowered skullcap (*Scutellaria montana*) on VTS-Catoosa will influence timber management operations performed on the installation. The large-flowered skullcap is designated by the U.S. Fish and Wildlife Service as a threatened herbaceous perennial plant that occurs in mature oak-pine forests. While the large-flowered skullcap can benefit from selective thinning of the forest canopy, it does not compete well with the explosive growth of understory plants that is typically encouraged following timber harvests. Populations of the large-flowered skullcap have been found at a number of locations on VTS-Catoosa (Figure A2.1). Since the forested habitat favored by the plant is prevalent throughout most of the installation, all forestry management operations should consider that the plant may be present whenever a timber management action is being planned within any of the 10 training areas. Skullcap management groups and a 50 foot buffer surrounding them will be withheld from any timber sales that occur on the training site, and harvests in the vicinity of skullcap groups will be timed to avoid the growing season for the plant. Logging and skidding equipment will not travel through skullcap management groups at any time.

3.0 FOREST INVENTORY

The forest inventory for VTS-Catoosa was conducted in April 2005 by personnel with the Forest Management Group, Inc., located in Hattiesburg, Mississippi. The forest inventory was developed using the established training areas and Cantonment Area to serve as the basic forestry management units. Figure A2.1 shows the locations of the Cantonment Area and the 10 training areas that make up the VTS-Catoosa.

The forest resources occurring within the forestry management units were inventoried. Each management unit was subdivided as appropriate into individual forest stands based on the sharing of common characteristics that served to define each stand. Among the parameters considered to delineate the forest stands were species composition, age, size, condition, etc. Delineation of the stands was accomplished by both the use of aerial imagery and ground observations of the different timber types and ages. A

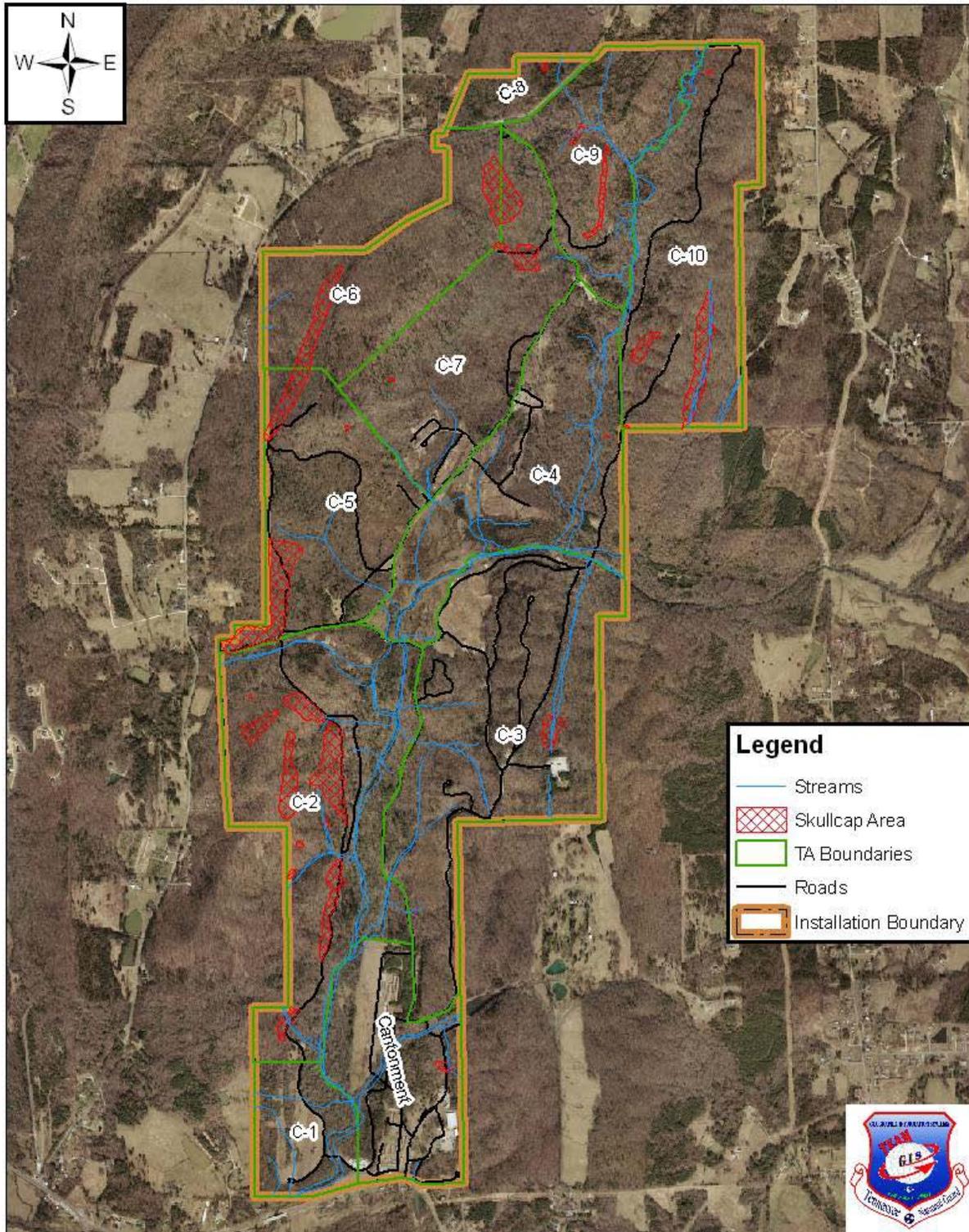


Figure A2.1: Training areas and large-flowered skullcap occurrences on VTS-Catoosa.

consistent forest stand numbering system was used throughout the inventory to identify each stand based on the major land features and forest types that characterized each stand.

The forest inventory provides the volumes of sawtimber (in tons and board feet) and pulpwood (in tons and cords) that was available within each stand at the time the inventory was performed in April 2005. The sawtimber is apportioned between pine, pine poles, CNS (chip-n-saw: pine timber that can yield both 2x4s and chips), spruce pine, red oak, white oak, hickory, poplar, cedar, ash, walnut, and miscellaneous hardwood (i.e., all other hardwood species that may be present). The pulpwood is apportioned between pine and hardwoods. The timber volume data is presented on both a per acre basis and as a total per stand for each product class.

The forest inventory also provides supplementary information to better understand the major characteristics of each stand. That information includes:

- Dominant and co-dominant tree species occurring within each stand
- Average basal area and DBH of trees within each stand on a per acre basis
- Average number of snags per acre
- The minimum and maximum age of the trees
- A general assessment of the overall health of the stand
- An evaluation of the current condition of the stand
- General remarks on other major characteristics of the stand where appropriate and useful.

The forest inventory determined that a total of 1,313 acres of VTS-Catoosa was covered in forests at the time the forest inventory was conducted in April 2005. Table A2.1 presents summary volume data for the inventoried timber products on a per acre basis and for the entire installation.

Table A2.1: Forest Product Volume Summary for VTS-Catoosa Based on the April 2005 Forest Inventory (from Thompson Engineering, et al. 2006).

Timber Product	Per Acre		Installation Total	
	Tons	Board feet	Tons	Board feet
<i>Sawtimber</i>				
Pine	5	640.1	6,837	875,273
Pole	0.1	6.4	137	8,751
CNS	1.9	198.8	2,598	266,370
Cedar	0	4.4	0	6,017
Red Oak	10.7	1485.4	14,631	2,031,136
Hickory	2.9	358.2	3,965	489,803
White Oak	7.2	941.7	9,845	1,287,681
Ash	1.1	148.2	1504	202,649
Poplar	4.8	650.9	6,564	890,041
Walnut	0.2	23.6	273	32,271
Misc. Hardwood	2.6	322.4	3,555	440,850
<i>Pulpwood</i>				
Pine	0.6	0.2	820	273
Hardwood	19.5	7.2	36,664	9,845

The Forest Inventory also revealed that the overall average diameter at breast height (DBH) of trees on the entire installation was 11.7 inches and that the installation had an average basal area of 78.1 square feet per acre. The forest stands on VTS-Catoosa are typically dominated by red oaks and white oaks, with a substantial amount of pine being present in some stands. Yellow poplar is also a co-dominant species in some stands and hickory in others. Most stands were characterized by trees ranging from 20-40 years old, but some had trees approaching 70 years in age, while a few stands were dominated by young trees. While the overall health of the forest stands was observed to be good during the April 2005 Forest Inventory, evidence of a past infestation of Southern pine beetles was present based on damage to the pine timber. In addition, frequent hot fires within the Impact Area shared between Training Areas 5 and 7 have resulted in a significant amount of timber damage in the forest stands occurring within these areas.

Army guidance requires all installations with a forestry program to keep their forest inventories current (i.e., not older than 10 years) when such forests are essential to the mission and/or capable of commercial use. Since the existing forest inventory for VTS-Catoosa was conducted in April 2005, the forest resources should be re-inventoried no later than 2015. The inventory intensity should be appropriate at that time to reflect the planned use of the forest and for monitoring the long-term health and sustainability of the forest. In addition to determining the volume of merchantable forest products available on the installation in 2015, the inventory should be directed at evaluating the overall health and characteristics of the forest community and to assessing the effectiveness of the forest management prescriptions that have been implemented during the intervening 10-year period.

4.0 FOREST MANAGEMENT GUIDELINES

Based on the results of the 2005 forest inventory, the health of most of the VTS-Catoosa forest stands is judged to be good to excellent, although a number of the stands showing signs of having experienced past fires that were too hot and caused some damage to the trunks.

VTS-Catoosa forests will be managed on approximately an 80 year rotation. Forest management for the training site will consist of both even-aged and uneven-aged techniques for improving forest health, modifying stands to meet objectives, and regenerating stands when needed.

Generally no more than 60 acres per year will be harvested on the training site. The priority for management will be:

1. Mission needs
2. Fire damaged stands
3. Oldest stands

Final harvests will generally be small clearcuts or large group selection cuts (2-10 acres) as required by topography and accessibility. Openings of at least 2 acres are most effective for encouraging oak regeneration. Openings will be placed at sites containing sufficient advance regeneration of appropriate size when possible. No more than 30% of a stand acreage will fall within the cleared areas in a group selection harvest. The remainder of the stand may be lightly thinned at the same time to release desirable hardwood species.

Some stands will require pre-commercial thinning or mid-story removal to improve growth of the dominant/co-dominant trees or to encourage advance regeneration of desirable species. This will be done as funding allows, on no more than 60 acres per year. The shelterwood-burn method of regeneration will be applied experimentally as feasible (see Annex 3 of the INRMP).

In all harvest activities, there will be no timber removal within 100 feet of creeks. A 100 ft buffer will also be maintained along property boundaries except for the 20 ft security line of site clearing required along the fence-line itself.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer.

4.1 Forest Management Objectives

The individual forestry management recommendations were based upon a consideration of the following broad management objectives developed for the overall forest community occurring on VTS-Catoosa.

- Provide appropriate vegetation cover for training needs as determined by mission requirements.
- Maintain a healthy forest ecosystem appropriate to the region through even and uneven aged management techniques. Forest values to be protected or improved are:
 - Soil conservation and stream quality protection
 - Wildlife habitat
 - Biodiversity
 - Timber and forest products
- Control invasive pest plants (IPP) for the health of the forest.
- Use prescribed fire only as necessary for fuel reduction or to meet military mission needs, unless deemed appropriate to regeneration efforts. Hardwood stands should be burned no more often than every six years.
 - The shelterwood-burn method of hardwood regeneration may be experimentally applied to a stand within training area 10 on a 5-year test case to determine the potential of this method to produce a regenerated oak-dominated forest while enhancing the military mission (see Annex 3).

4.2 Timber Harvest Operations

The periodic harvest of timber is the major measure used to manage forestry resources. The principle purpose of the forest management program on the VTS-Catoosa is to support military mission and ecosystem management goals, while optimizing the forest resource and its associated forest products and benefits. Timber harvest decisions are not to be directed solely to generate revenue.

Timber harvests must be consistent with the military mission and comply with federal laws and policies, including avoiding adverse impacts on sensitive species and cultural resources. Prerequisites for timber harvests include the following:

- A current and approved Forest Management Plan that is normally included in an INRMP.
- National Environmental Policy Act documentation
- Comply with applicable laws
- Be a fiscally sound investment

- Capable of ecosystem sustainability
- Comply with installation safety restrictions
- Consider potential effects on significant archeological resources and historic properties.

The process for conducting a timber sale on VTS-C will start several months prior to harvest time:

- A stand-specific harvest plan will be developed in accordance with this plan (January)
- A Record of Environmental Consideration will be prepared for the harvest plan to satisfy NEPA requirements
- The harvest plan and REC will be sent to the USFWS field office for consideration (before March 1)
- The harvest plan and REC will be sent to the GA SHPO for consideration (before March 1)
- The harvest plan and REC must be submitted to NGB with a Timber Report of Availability (ROA) (by May 30 prior to the fiscal year in which the harvest is planned)

4.3 Pest Management

Trees are susceptible to periodic infestations of insects and fungi that have the potential to result in serious damage to an installation's forest resources and overall landscape. This can result in the diminishment in the quality of the training landscape; economic loss of potential merchantable timber; modification of habitat conditions within the forest ecosystem that could influence wildlife populations; and an increased risk of wildfire. While such infestations are a natural phenomenon, actions may be required on occasion to prevent the spread of the infecting vector and/or remove damaged and diseased trees.

The U.S. Forest Service (USFS) is responsible for protecting forests from insects and disease in cooperation with the owners of forest lands. The Department of Defense (DoD) and the U.S. Department of Agriculture entered into a Memorandum of Agreement (MOA) in 1990 to conduct forest insect and disease suppression on lands administered by the DoD. Under the MOA, the USFS provides technical assistance and funds to provide foliage protection, reduce specific insect and disease populations, reduce risk of artificial spread to uninfested areas, and to prevent tree mortality.

Army installations may receive funds from the USFS for forest pest suppression projects under the terms of the MOA. Installations wanting to receive pest management funding should have a biological assessment of the forest resources in question conducted by the local USFS staff. The biological assessment should recommend the type of technical assistance required and management actions that could be pursued to address the pest problem. This could include population monitoring, surveys, biological evaluations, determination of trends and projected damage, and consideration of environmental and economic impacts. Approximately one year is required before funds are received for approved requests. The USFS funds are provided to the installations through Army channels to the proponent organizations for distribution to the appropriate installations. In the case of the TNARNG, pest management funds are received from the NGB.

The 2005 Forest Inventory revealed that a substantial amount of the pine timber on VTS-Catoosa had been damaged and/or destroyed by an infestation of southern pine beetles that occurred around two years or more ago. Such infestations are cyclic and should be expected to recur in the future at approximately seven-year intervals depending upon weather conditions. Since pines are a major component of the VTS-Catoosa's mixed pine hardwood forest, periodic monitoring should be performed to identify localized outbreaks of southern pine beetles on the installation in the early stages of development, as well as the occurrence of regional infestations. The Georgia Forestry Commission conducts regular aerial surveys to

identify outbreaks and provides that information to landowners. The best time of the year to obtain that information is during the hot summer when the symptoms of infestations are most apparent in the tree canopy from the air. This information should be obtained from the Georgia Forestry Commission's local offices (Scott Griffin, Forest Health Forester, Gainesville, Georgia, 770-538-2666 or Lee Kelley, Area Forester, Lafayette, Georgia, 706-638-5557) each year and a plan developed as needed to remove the infected trees.

Beavers have also been identified as a potential pest that can adversely impact VTS-Catoosa's timber resources. Beaver activity is primarily restricted to the lower reaches of the tributary streams that drain into Tiger Creek. For the most part, beavers seem to be most active in Broom Branch that flows through Training Areas 4, 9, and 10 before joining Tiger Creek. Besides damaging trees, beaver impoundments can restrict access and cause physical damage to roads. Beaver were removed from the training site in 2006 through an MOA with the USDA Animal Damage Control Office in Georgia. The level of beaver activity on the installation should be monitored annually to assess whether such activity is increasing, remaining stable, or declining.

4.4 Salvage of Disaster Damaged Trees

Natural weather phenomena such as tornadoes and ice storms can have a severe impact on forests. For example, large swaths of trees can be uprooted and/or their trunks broken above the ground by tornadoes, while large ice storms can create extensive alterations in the forest canopy by damaging limbs and small branches. If the damage to trees is significant and widespread, individual trees can be weakened and become more susceptible to disease and parasites in the years following the weather event. That damage can reduce growth rates and possibly even result in the death of individual trees.

If the damaged trees represent a significant economic loss or if the physical aftermath creates a safety hazard, impediment to training, or threat of insect infestation, it may prove prudent to undertake salvage operations in an attempt to recover as much of the lost volume and value of the damaged timber as possible. Salvage actions must be pursued relatively quickly following the disaster to prevent the deterioration in the quality of the damaged wood so as to recover as much economic value as possible. Even though prompt action is needed, the environmental evaluation requirements are typically not waived. In the event a salvage harvest is deemed necessary, TNARNG will coordinate with USACE to conduct the necessary environmental review and emergency harvest procedures.

5.0 ENVIRONMENTAL CONSIDERATIONS IN FOREST MANAGEMENT

All timber sales must be consistent with all applicable environmental laws and regulations. Experience has shown that cultural resources (i.e., historic and/or archaeological) and endangered and threatened species issues have the greatest potential to affect forestry management operations, including timber sales.

5.1 Cultural Resources

Forest management activities must not negatively impact cultural resources on the VTS-C. Several aspects of timber management have the potential to affect cultural resources, including timber harvest operations, site preparation and planting, and prescribed fire. A Phase I survey of VTS-C conducted in 1997 identified 20 archaeological sites and 17 historic architectural resources on the installation (Stanyard et al. 1998). These sites are identified in the TNARNG GIS system and will be incorporated into forest management planning. All efforts will be made to minimize any impacts on known cultural resources.

The eleven sites considered eligible for inclusion on the national Register of Historic Places will be excluded from ground-disturbing activities unless full consultation with the Georgia State Historic Preservation Officer (SHPO) has been conducted for the project. Such activities include, but are not limited to, the construction of plowed fire breaks (see Annex 3 for the “no plow zones”), the use of dozers or other heavy equipment to clear stumps and logging slash, and the use of mechanical planting equipment. Historic structures and cemeteries will be protected from damage during forestry activities by maintaining a 50 foot buffer zone surrounding them.

This plan will be submitted for review by the Georgia SHPO prior to implementation. In addition, the SHPO will be contacted for comments on the annual report of timber availability submitted each year for timber sale planning. Other forestry projects which have the potential to impact known cultural resources on the VTS-C will be coordinated with the SHPO as appropriate.

5.2 Sensitive Species

Chapter 3 of the INRMP contains information on sensitive species occurring or having the potential to occur on the installation. The federal listed threatened large-flowered skullcap (*Scutellaria montana*) exists at a number of well marked locations in the oak-pine forests on the installation. The federal listed endangered gray bat (*Myotis grisescens*) has been captured feeding over Tiger Creek on the training site. In addition, seven species of fish that are listed to be of concern to the State of Georgia have been found in the streams on the installation. A number of other species of concern (see Section 3.9 in Chapter 3) have been reported from Catoosa County, but have not yet been observed on VTS-Catoosa.

Timber management activities will be limited in those areas where large-flowered skullcap occurs. Known large-flowered skullcap groups will be reserved from timber sales with an additional 50’ buffer surrounding the group well-posted prior to any nearby timber sale – no trees will be harvested within the protected area, nor will any equipment be allowed to pass through these areas. Timber harvests within stands that contain or are adjacent to known skullcap groups will be conducted during the fall or winter when the plant is dormant to minimize any accidental damage. Large-flowered skullcap groups will be protected from prescribed burning (see Annex 3 for more details). Ground disturbing activities such as the construction of plowed fire breaks, the traverse of heavy equipment, and log skidding will not be allowed in the known large-flowered skullcap locations.

The gray bat has only been found foraging on VTS-C; no roost sites have been located on site. Therefore, impacts from timber management will be minimal, and protection of waterways and riparian areas through the Streamside Management Zone best management practices (see Section 5.3 below) will ensure the maintenance of foraging habitat quality.

Any activities which may impact federal threatened or endangered species require consultation with the USFWS. Annex 1, the Rare Species Management Plan, contains the biological assessment of the potential impacts of the INRMP on the large-flowered skullcap. The TNARNG will initiate formal consultation with the USFWS prior to the implementation of this plan.

All efforts will be made to protect state listed species from detrimental impacts from forest management activities, as well. In the event any are discovered on the training site, the TNARNG will consult with the Georgia Department of Natural Resources, Wildlife Resources Division, to determine any needed modifications to this forest management plan for the protection of such species.

5.3 Forestry Best Management Practices

Protection of watersheds and water quality during forest management activities can be a significant concern. Forestry practices can generate nonpoint source (NPS) pollution including sediment, organic matter, pesticides, nutrients, and elevated water temperatures. Removal of or damage to vegetative cover can increase runoff and erosion. Eight of the 10 training areas on the VTS-C include portions of Tiger Creek or its tributaries within their limits. Only Training Areas 6 and 8 do not contain any part of the stream system.

Tiger Creek and its tributary streams are protected by the State of Georgia through their designation as secondary trout waters. To maintain high water quality conditions appropriate to trout habitat, a relatively contiguous tree canopy cover over trout streams is important in providing shade from excessive solar radiation heating, and suspended sediment concentrations should be at low levels. As a result, trout streams require additional protection from timber harvest operations along their immediate stream banks if they are to continue to support trout populations. A Streamside Management Zone (SMZ) of 50 feet on both sides of designated trout streams and tributaries is required for protection by State of Georgia regulations. There will be no timber harvested within this SMZ on the VTS-C.

Forestry Best Management Practices (BMPs) have been developed to reduce the adverse effects of forest operations on ecosystems and to protect water quality. A BMP is a practice or combination of practices considered to be the most effective means of preventing or reducing the amount of pollution by nonpoint sources to a level compatible with water quality goals and protecting fish and wildlife populations and habitats. BMPs will be applied to all timber management activities on the VTS-C.

Both Tennessee and Georgia forestry offices have developed BMPs for forestry operations:

<http://www.state.tn.us/agriculture/forestry/bmpmanual.html> and

<http://www.gfc.state.ga.us/ForestManagement/documents/GeorgiaForestryBMPManual.pdf>. The recommendations differ very little between the states. The following synthesis of the state BMPs (Table A2.2) will guide forestry activities on VTS-C. BMP training and technical guidance is available from the Georgia Forestry Commission district office (District 1, Rome, GA, 478-751-3465. Further assistance can be requested from the Catoosa County forester (Gary McGinnis, 706-295-6021), the District 1 water quality forester (Carl Melear, 706-295-6021), or the State Water Quality Coordinator (478-751-3498).

Table A2.2: Forestry Best Management Practices for VTS-Catoosa.

Forestry Practice	Activity/Resource	BMPs
Planning		Locate log landings before planning road system.
		Streamside Management Zone (SMZ) planning should be done before beginning timber harvest.
		Plan site preparation before starting work to ensure best treatment is implemented.
Forest Roads	Locating Roads	Identify laws, regulations, and/or ordinances applying to road construction and maintenance.
		Use soil surveys and topographic maps to develop plan.
		Locate control points on maps prior to design
		Evaluate condition of existing roads and only construct new roads when necessary.
		Minimize the number, length, and width of access roads.
		Locate roads outside of Stream Management Zones and sensitive areas.

Forestry Practice	Activity/Resource	BMPs	
		Avoid locating roads at the confluence of streams.	
		Locate new access roads on high ground on sides of ridges for drainage.	
		Locate new access roads on southern and western sides of ridges to expose roadbed to sunlight.	
		Minimize stream crossings. When that is not possible, crossings should be constructed at right angles to the stream.	
		Locate roads on upper slopes near ridge crests to promote drainage, but avoid the top of ridges.	
		Permanent Roads – Follow natural contours and keep grade below 10 percent. Install water control structures properly.	
		Temporary Roads – Follow natural contours. Allow grades to run up to 25 percent for short distances provided water control structures are properly installed.	
		Conduct site reconnaissance to verify site conditions.	
	Constructing Roads	Complete construction several weeks in advance of use by logging traffic to allow road bed time to settle.	
		Construct access roads only wide enough to safely handle equipment to minimize soil disturbance.	
		Schedule construction during favorable weather.	
		Maximize sunlight exposure along roadsides for drainage.	
		Install appropriate dips, turnouts, and water bars to control drainage from the road surface. The number and design should be determined by the prevailing slope of the road segments involved.	
		Stabilize exposed soil on shoulders.	
		Runoff from roads should not directly discharge into streams.	
		Minimize runoff at stream crossings.	
		Push cleared trees and brush to downhill side of road to assist in trapping sediment.	
		Maximize sunlight exposure to road surface.	
		Revegetate exposed soils in potential problem areas that could generate sediment.	
		Road Maintenance	Keep roads free from obstructions and logging debris.
	Maintain points of ingress from paved roads to prevent mud and debris from being carried onto roads.		
	Minimize grading and reshaping on hilly terrain unless necessary.		
	Keep dips, water bars and water turnouts open		
	Road Retirement	Construct water bars or other drainage structures immediately after active logging has ceased.	
		If logging will be delayed, construct temporary drainage and erosion control structures.	
		Remove temporary fills, bridges, culverts, and pole fords.	
		Remove sediment and debris from dips, ditches, and culverts.	
		Use mulch and/or seed with lime and fertilizer to prevent soil erosion.	
		Periodically inspect retired roads.	
	Streamside Management Zones (SMZs)	SMZs	Mark SMZ boundary prior to harvest.
			SMZ width should be a minimum of 100 feet for Tiger Creek and its tributaries: 50 feet on either side of the stream.
			No harvest is allowed within the 50-foot SMZ.
Maintain integrity of stream banks.			

Forestry Practice	Activity/Resource	BMPs	
		Minimize exposure of mineral soils by spreading logging slash and using it to drive over.	
		Minimize soil exposure and compaction to protect ground vegetation.	
		Do not use stream channels as roadways for equipment.	
		Avoid equipment operation within SMZ.	
		Avoid skidding within drains during wet conditions.	
		Avoid locating roads in drains except when necessary for crossings.	
		Do not empty road runoff into drains.	
Stream crossings	Stream crossings	Avoid or minimize stream crossings. When that is not possible, crossings should be constructed at right angles.	
		Locate crossings on straightest stream sections.	
		Avoid locating crossings at confluence of streams.	
		The road fill shall be bridged, culverted, or otherwise designed to prevent restriction of flood flows.	
		Borrow shall be obtained from upland sources.	
		Fill shall be stabilized and maintained to prevent erosion.	
		Minimize disturbance to stream during construction.	
		Design to minimize disruption of movement of aquatic life.	
		Approaches should be graveled and should rise away from streams at a gentle grade (<3 percent) to minimize erosion.	
		Stabilize approaches with rocks if necessary.	
		Install broad-based dips and wing ditch turnouts to turn water off roads before entering stream.	
		Temporary bridges should be favored over culverts or fords for temporary crossings.	
		Minimum encroachment into SMZs when aligning and constructing stream crossings.	
	Fords		Use fords for haul roads only, not for skid trails.
			Locate fords where stream banks are low.
			Fords should have a solid bottom.
			Where necessary, use gravel to establish low water crossing. Material should not significantly impound stream flow or impede fish passage or cause erosive currents.
			Remove temporary crossings from channel when operations completed.
	Culverts		Use culverts for watersheds less than 300 acres
			Permanent culverts should be sized to accommodate 25-year, 24-hour storm flows.
			Temporary culverts will accommodate 2-year, 24-hour storm flows, but must be removed after completion of logging.
			Install culverts in a manner that minimizes disturbance of stream. Stabilize fill material with riprap and/or vegetation.
			Place at least 15 inches of fill over the culvert so that the culvert becomes the high spot in the stream crossing so flood flows run around the culvert.
			Inspect culverts periodically to ensure they are free of blockages.
			Install culverts on grade with bottom of channel to allow movement of aquatic life.
	Bridges		Use bridges for watersheds of 300 acres or more.
			Locate bridges across narrow points of stream and on firm soils.

Forestry Practice	Activity/Resource	BMPs	
		Protect banks from sloughing during construction.	
		Remove temporary bridges.	
		Do not cover bridges with soil.	
		Use temporary bridges for skid trails to prevent equipment and logs from entering stream channels.	
Timber harvesting	Landings or log decks	Locate landings outside of SMZs and away from streams and sensitive areas.	
		Minimize number of landings.	
		Minimize size of landings.	
		Locate landings uphill and skid up to them.	
		Locate landings in a stable and well-drained area away from gullies.	
		Slope lands 2-5 percent to allow for drainage.	
		Stabilize and revegetate landings after use if they pose a potential water quality problem.	
		Install drainage and sediment control structures to divert runoff.	
	Skid trails	Minimize number of skid trails by using existing trails.	
		Skid uphill to log landings.	
		Locate skid trails on slopes up to 15 percent. Steeper slopes can be used for short distances if water control/drainage structures are provided.	
		Have periodic breaks in grade to help disperse surface flow.	
		Runoff from skid trails should not discharge into a stream.	
		Control runoff by varying trail grade, water bars, wing ditches and/or sediment control structures.	
		Minimize number of stream crossings.	
		Avoid skidding across streams, drains, and sensitive areas. However, if that is necessary, skid at right angles.	
		Use temporary bridges or spans instead of culverts for crossing structures.	
		Use logs as fill over temporary culverts instead of fill dirt.	
		Do not use fords to skid across streams.	
		Do not operate equipment in streams.	
		Avoid skidding directly up or down hill, but follow contours or "zigzag" if possible.	
		Use low ground pressure tires on skidders when available and concentrate skidding as much as possible on a few primary skid trails to minimize site disturbance and soil compaction.	
		After completing logging, remove temporary bridges and culverts, sediment and debris from dips, ditches, and culverts, and revegetate problem areas.	
		Use mulch and/or seed with appropriate amounts of lime and fertilizer when needed to prevent soil erosion.	
		Avoid ruts that risk channeling water into a stream.	
		Retire trails as soon as possible.	
		Logging Debris	Trees should not be felled in or across streams.
			Pull treetops far enough from waterways to prevent them from being washed in during high water.
	Do not drag trees and tops through a stream channel.		
	Do not remove stumps and roots from stream banks.		
	Servicing and Maintaining Equipment		Wash and service any equipment away from any area that may create a water quality problem.
			Dispose of oils and lubricants in their containers and other

Forestry Practice	Activity/Resource	BMPs
		wastes in accordance with applicable regulations.
		Remove all used tires, batteries, oil cans, and trash from site when logging operations are completed.
		Prevent oil and fuel spills. Prevent debris and fuels/lubricants from entering drains from where they could be washed by runoff into streams.
		If a spill occurs, clean up all spilled materials and contaminated soils and dispose of both properly. Notify the Georgia Environmental Protection Division of spill incident.
Site Preparation for Tree Planting	Mechanical	Choose site preparation method that will expose and disturb as little bare soil as possible. Use the minimum intensity for treatment.
		Establish SMZs to minimize sediment entering streams.
		Carry out all mechanical site preparation operations and tree planting along the contour of the land.
		Slopes over 30 percent should use only hand tools and be hand planted and not be subjected to mechanical site preparation.
		Leave logging debris and other litter scattered over erosion problem areas.
	Chemical	Establish SMZs.
		Favor chemical methods over mechanical methods on steep slopes and erodible soils to control undesirable vegetation.
		Follow all EPA label instructions
		Never apply pesticides directly to water except when registered for application over water.
		Establish SMZ to minimize chemicals entering streams.
		Avoid use of chemicals in or near sensitive areas.
		Consider weather conditions and equipment capabilities to avoid herbicide drift.
		Calibrate spray equipment to apply chemicals uniformly and in correct quantities.
		Prevent chemical leaks from equipment and check equipment.
		Mix and load chemicals outside of SMZs and other sensitive areas.
		Rinse spray equipment and discharge rinse water only in areas that are part of the application site. Never rinse tanks or sprayers in or near streams
		Dispose of chemical containers according to label instructions.
		Report all spills to the Georgia Environmental Protection Division.
	Prescribed Fire	Locate windrows well away from drains to prevent materials from being washed into streams.
		Construct firelines on the contour in advance of prescribed burning.
Avoid high intensity fires in SMZs.		
Plow firelines only as deep and wide as necessary to control the spread of the prescribed fire and to minimize soil disturbance.		
Construct water bars and wing ditches at appropriate intervals on firelines to turn water into adjacent undisturbed areas.		
Reforestation		Hand plant on slopes >21 percent.
		Machine plant on the contour between 5 and 20 percent slope.
Fertilization		Determine appropriate amounts and types of fertilizer needed before application.

Forestry Practice	Activity/Resource	BMPs
		Consider weather conditions and equipment capabilities to avoid drift into SMZs.
		Conduct all on-site fertilizer handling away from waterbodies, wells, ditches, and sensitive areas.
		Clean up and/or contain all fertilizer spills immediately.
		Dispose of fertilizer containers and/or excess fertilizer according to applicable governmental regulations and label requirements.

Sources: “Georgia’s Best Management Practices for Forestry” (January 1999), Georgia Forestry Commission and “Guide to Forestry: Best Management Practices in Tennessee (2003), Tennessee Department of Agriculture, Division of Forestry

5.4 Monitoring and Inspections

Monitoring is a key element in ecosystem management. Army forest managers are required to balance increasing demands for resource use, such as military training, forest product sales, biodiversity conservation, and, where applicable, recreation use of military lands. The VTS-C forestry program should be periodically monitored to: (1) assess whether or not forest management objectives are being met; and (2) detect trends in forest health and condition in response to the forest management actions proposed in this plan.

Forestry program monitoring on the VTS-C will include:

- The progress of each timber sale will be monitored to ensure that the harvest is being conducted in accordance with the terms of the contract. Monitoring will be coordinated with the USACE’s Mobile District if the timber sale is administered by the USACE. At the conclusion of the timber harvest, a final inspection of the site will be conducted jointly by the USACE and the TNARNG to assure the cut was conducted in accordance with the contract stipulations to allow release of the buyers’ bond.
- Effective management requires feedback on the results of the management activities. The necessary assessment may be conducted specifically for the forestry program or as a part of another program area. The VTS-C forests will be monitored annually to assess:
 - Whether the overall condition of the forest is meeting military mission requirements
 - The effects of training activities on forest resources
 - Response to forest management activities
 - Wildlife habitat quality
 - Influence of forest management on sensitive species
 - Impacts on cultural resources
 - Erosion problems related to timber management practices and the success of repair efforts
 - Any areas affected by disease or insect infestations (particularly southern pine beetles during summer months)
 - Storm or other natural damage
 - Beaver activity
 - Invasive pest plant problems
 - Fuel loads on the forest floor and the risk for wildfires
 - Areas for inclusion in future timber ROAs
 - Emergency harvests needs

- The baseline forest inventory was conducted for VTS-Catoosa in 2005. Forest resources should be re-inventoried in 2015. If that work is to be accomplished by contract, adequate advance time should be allowed to prepare the scope of work and to award the contract by that timeframe. The 2015 inventory should include a specific task requiring a comparison of the forest condition in 2015 with the results of the 2005 inventory to determine the direction the installation's forest is headed; how effective management measures have been in assuring a quality forest is provided; and identifying adjustments in the long-term management goals in the installation's forest management program.

6.0 MANAGEMENT PRESCRIPTIONS

The following stand descriptions and management prescriptions are based on the 2005 forest inventory. Timber harvests will typically involve thinning the stands to encourage improved growth rather than clearcutting a stand, unless mission needs require a cleared site. Recommendations for the use of prescribed fire are also included; full burn prescriptions are found in the prescribed fire section of the Wildland Fire Management Plan in Annex 3 of the INRMP. There will be no harvesting or prescribed fire within the 50' SMZs bordering Tiger Creek and its tributaries. In addition, there will be no harvesting of timber within any large-flowered skullcap management groups or a 50' buffer surrounding each. Skullcap groups will also be protected from prescribed burning, with the exception of a potential research study, discussed in more detail in Annex 3 and Annex 1.

6.1 Cantonment Area

The 106-acre Cantonment Area is the management center for VTS-Catoosa and contains most of the building infrastructure occurring on the installation. A portion of the southern boundary borders State Highway 2 which provides the primary access onto the installation. The Cantonment Area is dominated by two large open areas, one of which contains the installation's buildings and the other is the range complex. The open areas contribute to the fragmentation of the two forest stands occurring within the Cantonment Area.

Stand Description

Stand cc01 is a mature upland pine and hardwood forest. This highly fragmented 63-acre stand is divided into four units. The stand is dominated by pine and miscellaneous hardwoods, with a mix of oaks, hickory, and poplar. Ages of the trees range from 20 to 50 years. The overall health of the stand is excellent.

Stand cc02 is a 1.9-acre pre-merchantable natural pine stand. The stand is 3 to 5 years old. The overall health of the stand is excellent.

Forest Management Prescription

Stand cc01. Section (a) (17 ac west of the KD range) will be thinned as needed for training use, leaving the 50 ft SMZ along Tiger Creek unharvested. Hardwood trees 20 inches DBH and larger will be selectively removed to make the area traversable. A few small (<1 ac) clearings may be created by taking groups of trees without regard to the size limit.

Section (b) (5 ac west of the road to the southern creek crossing) will not be harvested to ensure sufficient buffer for Tiger Creek.

Section (c) (35 acres north of the barracks, office, and shop complex) will be thinned by small group selection for training and construction needs and to create a patchwork of age classes. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality unless intended to remain clear for training or construction. No more than 30% of the section acreage will be harvested in groups. The remainder may be lightly thinned to release desirable hardwood trees. A 50 ft SMZ along all creeks will not be harvested, and a 50 ft unharvested buffer will surround the large-flowered skullcap management group.

Section (d) (6 ac south east of the developed area) will be left unharvested as a visual buffer from the road.

Prescribed burning can be done in this stand every 6 years for fuel reduction. No burning will be conducted in the portion of the stand bordering Tiger Creek or within the large-flowered skullcap group.

Stand cc02. This stand will be allowed to grow and self-thin for the immediate future. There will be no prescribed burning due to density of the young trees.

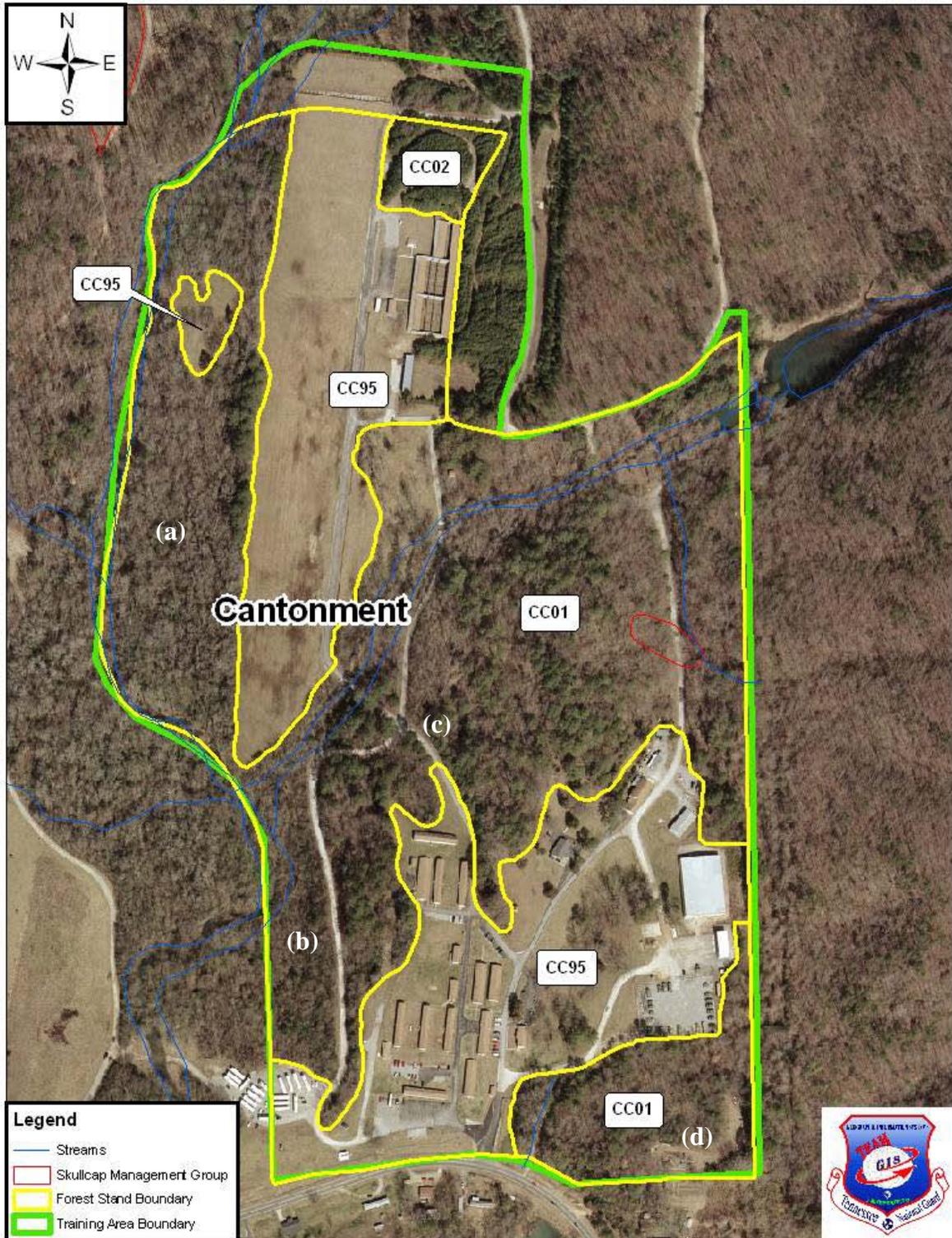


Figure A2.2: Forest stands in the Cantonment Area of VTS-Catoosa.

6.2 Training Area 1

Training Area 1 is a 57-acre tract located along the southern boundary of the installation and immediately to the west of the Cantonment Area. State Highway 2 parallels the southern border of this training area. Training Area 1 contains some of the installation's small arms firing ranges which are essentially located within a large central open area that is surrounded by the two forest stands occurring within this training area. Large portions of the training area fall into "stand" c0195 which identifies the non-forested areas which do not have stand prescriptions.

Stand Description

Stand c0101 is a 22.7-acre immature pine and hardwood forest. Unlike much of VTS-Catoosa, the stand occurs on flat land and is characterized by wet, heavy soils. The stand is dominated by poplar and pine, with a mix of hickory, walnut, and oaks. The trees range in age from 5 to 15 years old. Although the overall health of the stand is good, conditions are expected to decline within the next ten years without management.

Stand c0110 is a narrow 6-acre mature bottomland pine and hardwood forest that is located within the flood plain of Tiger Creek. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and a few large pines. The trees range in age from 30 to 70 year old. The overall health of the stand is good, but will decline without management.

Forest Management Prescription

Stand c0101. This stand will be thinned by removing all trees that are not in the dominant or co-dominant crown class. Some of the co-dominants may also be removed to allow more room for growth by the remaining trees. The goal will be for the tree crowns not to touch each other on at least 3 sides. This will allow room for the remaining trees to grow, plus aide in training. Prescribed burning can be done once every 4 years for fuel reduction. No burning will be undertaken before thinning is completed.

Stand c0110. This stand will be thinned by removing trees that are 20 inches DBH and larger and selectively releasing desirable hardwood trees if needed. This will allow room for the remaining trees to grow, plus aide in training. The 50-foot Stream Management Zone will be clearly demarcated in that portion of the stand that borders Tiger Creek and there will be no harvesting within the SMZ. Prescribed burning can be done once every 4 years for fuel reduction. No burning should be undertaken before thinning is completed.



Figure A1.3: Forest stands in Training Area 1.

6.3 Training Area 2

Training Area 2 is a heavily forested elongated 256-acre tract. This is the second largest training area occurring on VTS-Catoosa. Tiger Creek flows along the entire eastern boundary of the training area. Two forest stands occur within the training area, along with three small scattered open areas.

Stand Descriptions

Stand c0201 is a 182.3-acre mature upland pine and hardwood forest characterized by steep, rolling hills. The stand is dominated by red oak and white oak, with a mix of hickory, ash, poplar, walnut, and a few pines. Most of pines were killed by southern pine beetles in the past. The trees range in age from 20 to 60 years old. The overall health of the stand is good. However, the health of the stand will decline in the next five years without management. A high percentage of the large-flowered skullcap population on the training site occurs within this stand.

Stand c0202 is a 66-acre immature upland pine and hardwood forest, located in the floodplain of Tiger Creek. The stand is dominated by red oak and poplar, with a mix of hickory, white oak, walnut, and a few large pines. The trees range in age from 20 to 50 year old. The overall health of the stand is excellent, but is expected to decline in the next ten years without management.

Forest Management Prescription

Stand c0201. Section (a) (90 ac west of the road and north of the tributary) will not be harvested due to the predominance of large-flowered skullcap in the area.

Sections (b) (35 ac west of the road and south of the tributary) and (c) (47 ac east of the road) will be subject to small group selections to create a patchwork of age classes. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder of each section may be lightly thinned to release desirable hardwood trees. The two sections will not be harvested in the same year. There will be no harvesting in the 50 ft SMZs along the Tiger Creek and its tributaries.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer. There will be no prescribed burning in this stand until the susceptibility of large-flowered skullcap to fire is determined.

Stand c0202. Sections (a) (32 ac west of Tiger Creek) and (b) (34 ac east of Tiger Creek) will be thinned by removing all trees that are not in the dominant or co-dominant crown class. Some of the co-dominants may be removed to allow more room to improve growing conditions for those trees that would not be removed during the thinning operation. The goal would be for the tree crowns not to touch each other on at least 3 sides. This will allow room for the remaining trees to grow, plus aid in training. There will be no harvesting within the SMZ along Tiger Creek.

Prescribed burning can be done once every 4 years for fuel reduction. No burning should be undertaken before thinning is completed.

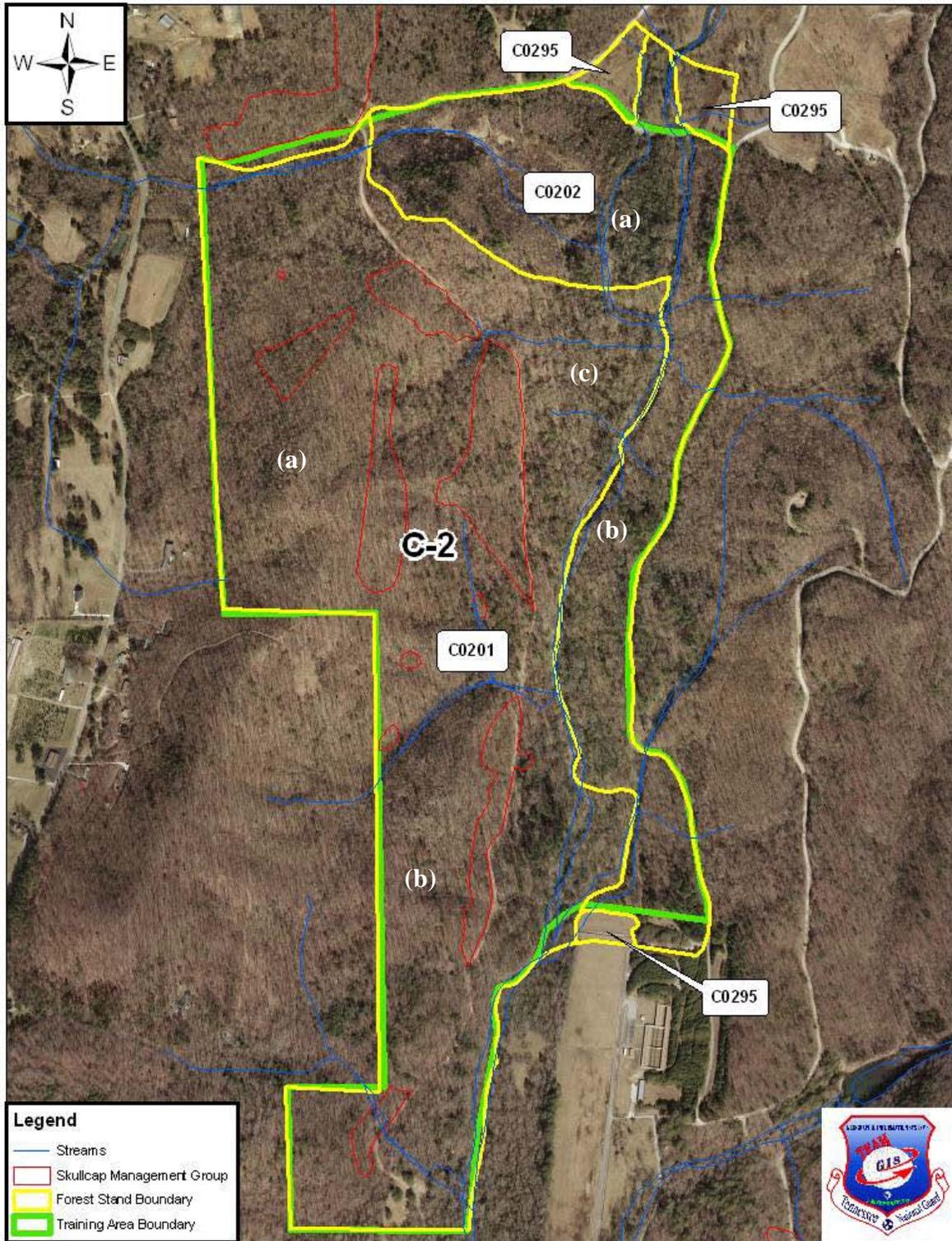


Figure A2.4: Forest stands in Training Area 2.

6.4 Training Area 3

The 277-acre Training Area 3 is the largest of the training areas comprising VTS-C. The training area is characterized by a diverse assemblage of habitat types. Training activities have greatly influenced the juxtaposition of the forest stands with open areas and an extensive internal road network. Four different forest stands are divided into various sub-units by the mixture of habitats.

Stand Description

Stand c0301 is an immature upland pine and hardwood forest that occurs on steep, rolling hills. Totalling 115.4 acres, the stand is broken into two large separated units, with the northernmost unit being somewhat larger. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and a few pines that still remain following a past problem with Southern pine beetles. The trees range from 20 to 50 years old. The overall health of the stand is excellent.

Stand c0302 is 42.5-acre immature upland pine and hardwood forest located in steep, rolling hills. The stand is divided into two units by a hardwood drain that flanks a tributary flowing into Tiger Creek. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and a few pines that remain from a past southern pine beetle infestation. The trees range from 10 to 20 years old.

Stand c0303 is 6.43-acre area of pre-merchantable pines that appear to have naturally regenerated within an open area that was formerly associated with the Cantonment Area and has since been abandoned. The stand is estimated to be 3 to 5 years old. The overall health of the stand is excellent.

Stand c0310 is a 12.8-acre immature upland pine and hardwood forest located within steep, rolling hills. The stand is associated with the lower elevations along and almost evenly divided between two tributary streams that drain into Tiger Creek. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and a few pines that remain from a past infestation by southern pine beetles. The trees range from 20 to 50 years old. The current overall health of the stand is excellent.

Forest Management Prescription

Stand c0301. This stand will require thinning in the future. This stand will be re-assessed in the next inventory and a thinning prescription developed at that time. No burning should be conducted before thinning is completed.

Stand c0302. No forestry actions will be taken in stand c0302 during the next 10 years. At the next inventory, the condition of the stand should be reconsidered and appropriate management measures identified at that time. Prescribed burning can be done once every 4 years for fuel reduction.

Stand c0303. This stand will be allowed to grow and self-thin for the immediate future. There will be no prescribed burning due to density of the young trees.

Stand c0310. This stand falls almost entirely within the SMZ; therefore, there will be no timber harvest or prescribed burning in this stand.

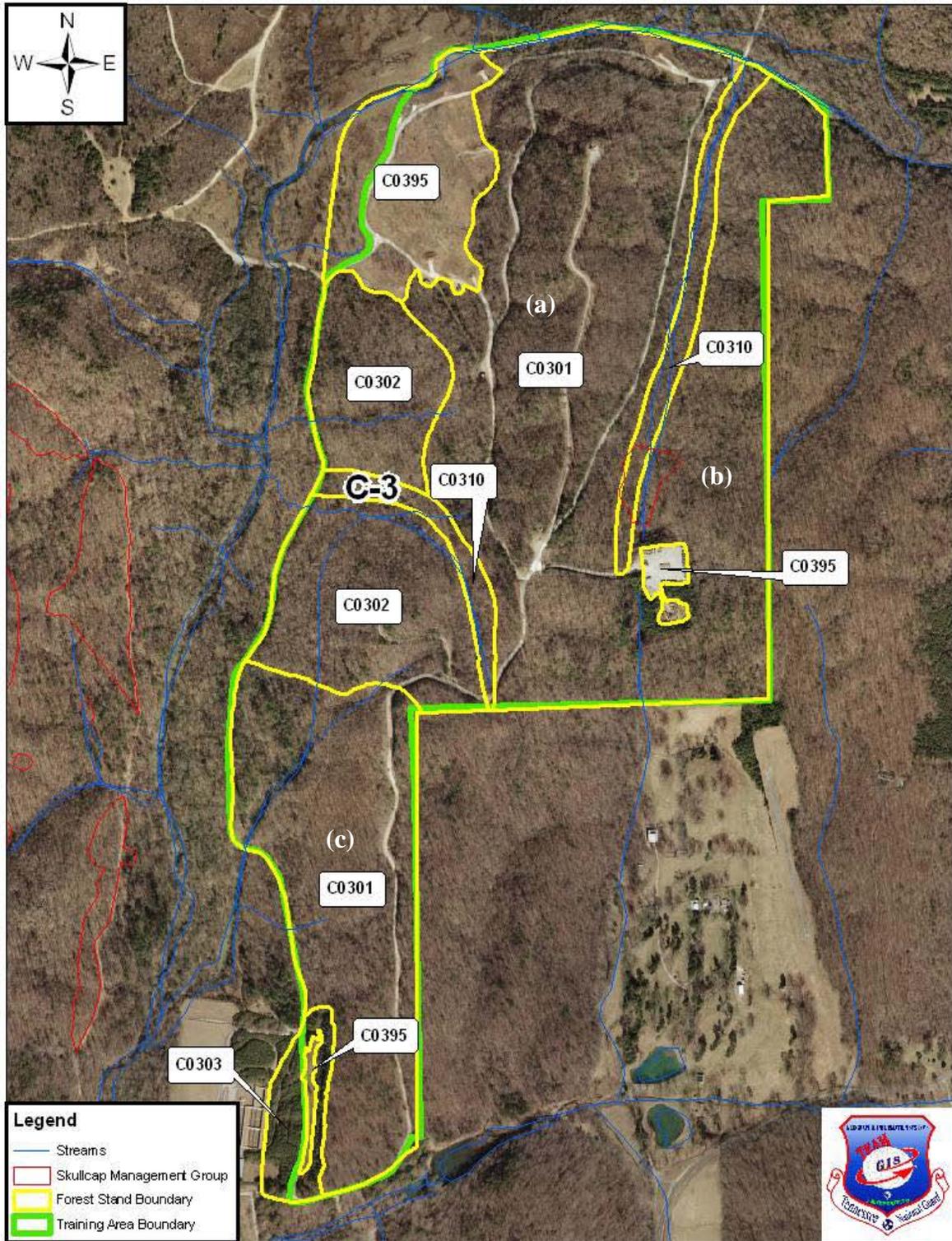


Figure A2.5: Forest stands in Training Area 3.

6.5 Training Area 4

The 173-acre Training Area 4 is also characterized by a mixture of forest conditions and habitat types. Tiger Creek flows along the southern boundary of the training area, while Broom Branch flows near the western boundary before joining Tiger Creek. In addition, an extensive open area is associated with the firing points, the installation Impact Area, and the line-of-sight in between. Three forest stands were identified in the training area.

Stand Description

Stand c0401 is an 88-acre immature pine and hardwood forest that contains very few pines. The stand is divided into eastern and western units by the presence of Broom Branch that flows through the training area. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and pine. The trees range in age from 20 to 50 years old. The overall health of the stand is considered to be excellent.

Stand c0402 is a 28.4 acre young oak and pine stand occurring on rolling hills. This stand has developed from past cuttings that removed most of the pines. There is some scattered pine regeneration in the stand. This stand is of excellent health, with trees ranging in age from 10 to 25 years old.

Stand c0410 is a narrow, elongated 10.3-acre immature pine and hardwood forest exhibiting similar characteristics as Stand c0401. However, since Stand c0410 is located at the lower elevations flanking Broom Branch, for the purposes of this Forest Management Plan it has been determined to be a Streamside Management Zone in which forestry measures should be pursued with extreme caution.

Forest Management Prescriptions

Stand c0401. Section (a) (45 ac west of the drainage) and (b) (33 ac east of the drainage) will be subject to small group selections to create a patchwork of age classes. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder of each section may be lightly thinned to release desirable hardwood trees. The two sections will not be harvested in the same year.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer.

Prescribed burning can be done once every 6 years for fuel reduction. No burning should be undertaken before thinning is completed.

Stand c0402. Approximately 12 acres at the southern end of this stand may be cleared for mission related activities. The remainder of the stand will be left to develop and re-assessed after the next inventory.

Prescribed burning can be done once every 6 years for fuel reduction.

Stand c0410. This stand falls almost entirely within the SMZ; therefore, there will be no timber harvest or prescribed burning in this stand.

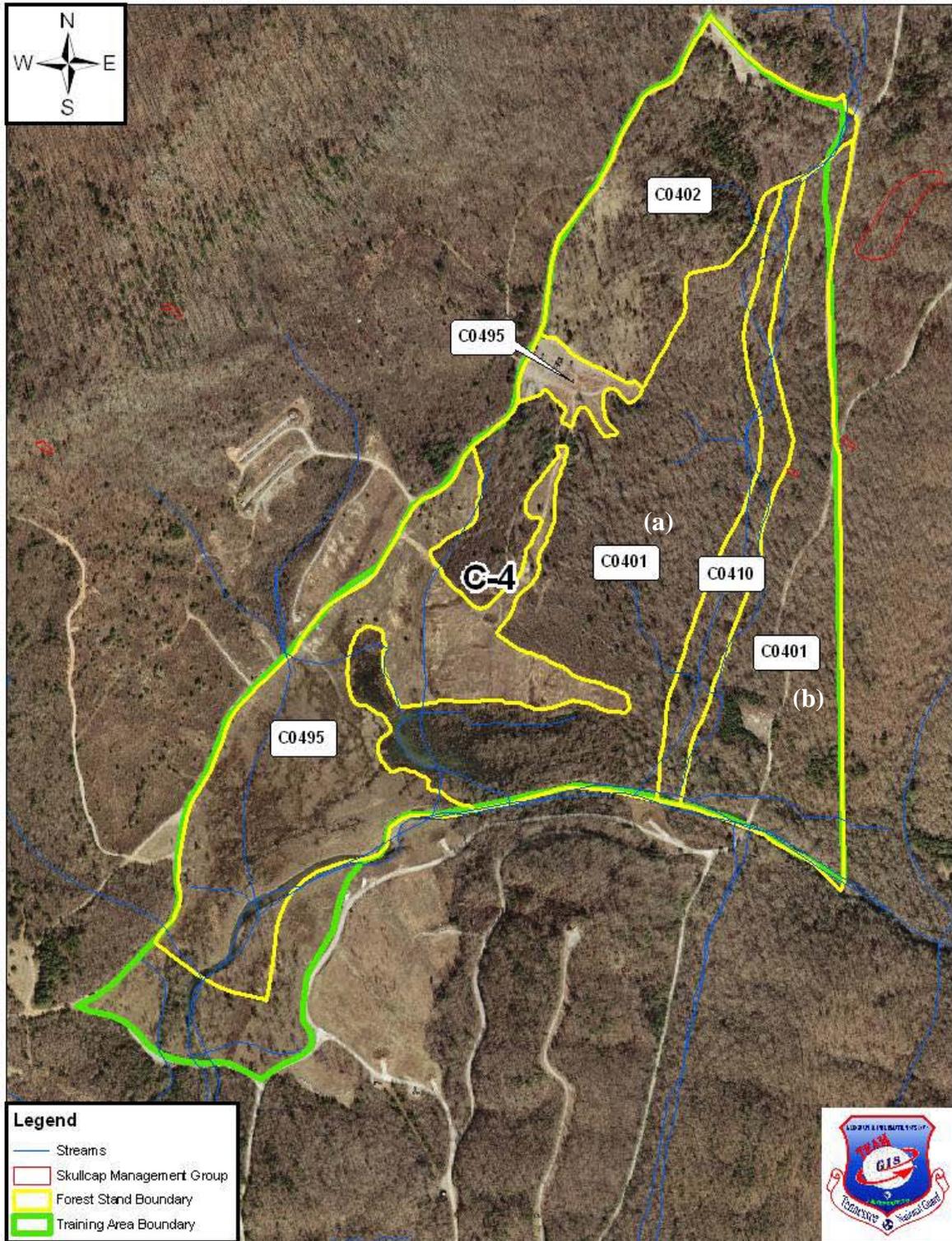


Figure A2.6: Forest stands in Training Area 4.

6.6 Training Area 5

Training Area 5 is 145 acres in size and is essentially completely covered in forest with the exception of a small open area along its southeastern margin. Three different forest stands have been identified in this training area. Some evidence of fire damage is shown in the forested areas occurring along the eastern boundary of the training area. The fires have originated from annual controlled burns and wildfires that have initiated from military firing operations.

Stand Descriptions

Stand c0501 is a 17.1-acre mature upland pine and hardwood forest. The stand is dominated by red oak, with a mix of hickory, white oak, poplar, walnut, and a few pines. The trees range in age from 30 to 70 years old. The overall health of the stand is good. A portion of a large-flowered skullcap management group occurs in this stand.

Stand c0502 is a 95.7-acre immature pine and hardwood forest. The stand is dominated by red oak and pine, with a mix of hickory, poplar, walnut, and white oak. The trees range from 10 to 40 years old. The overall health of the stand is excellent, but is expected to decline during the next ten years without any management. There is some evidence of fire damage along the eastern boundary of this stand.

Stand c0503 is a 31.6-acre mature upland pine and hardwood forest. The stand is dominated by pines and cedar, with a mix of hickory, white oak, and poplar. The trees range in age from 30 to 70 years old. The overall health of the stand is poor due to poor site index and rocky ground conditions. An extensive large-flowered skullcap management group occurs at the southern end of this stand.

Forest Management Prescriptions

Stand c0501. No harvest will be conducted at this time. Selective cutting will be considered after the next inventory. Prescribed burning can be conducted once every 6 years for fuel reduction purposes.

Stand c0502. Sections (a) (50 ac north of tank trail) and (b) (40 ac south of tank trail) will be thinned by removing all trees that are not in the dominant or co-dominant crown class. Some of the co-dominants may also be removed to allow more room for the remaining trees to grow, plus aide in training. The goal would be for the tree crowns not to touch each other on at least 3 sides.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer.

Prescribed burning can be done once every 6 years for fuel reduction. No burning should be undertaken before thinning is completed.

Stand c0503. Due to the rocky ground and poor site conditions, there are few viable forestry management options to improve the quality of the forest stand occurring on this site. No management actions will be taken at this time; the stand will be reconsidered after the next Forest Inventory is conducted. Prescribed burning can be conducted once every 6 years for fuel reduction purposes. The skullcap management group will be protected from prescribed fire with a temporary firebreak placed outside the 50' buffer.

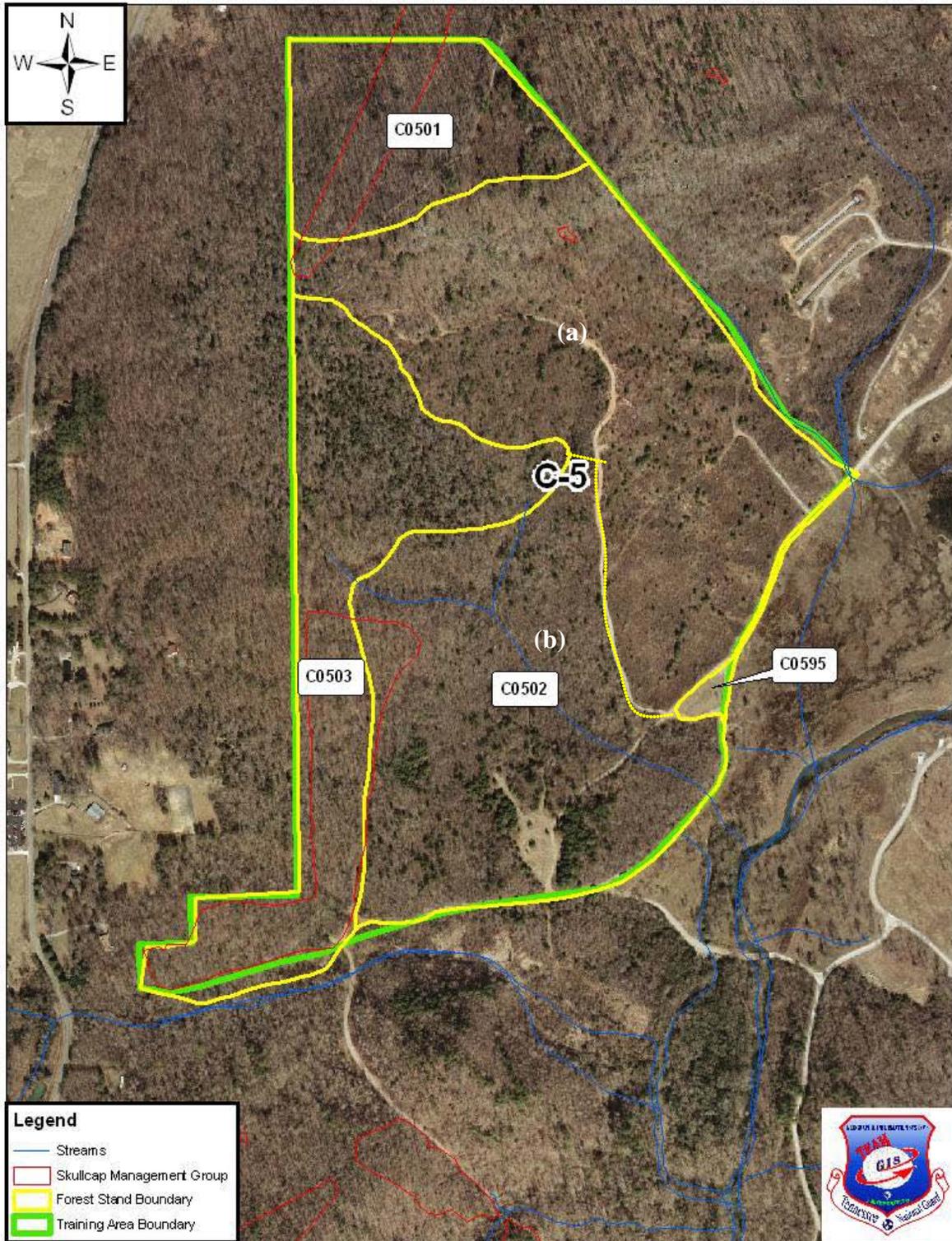


Figure A1.7: Forest stands in Training Area 5.

6.7 Training Area 6

Training Area 6 is a 129-acre tract located along the northwestern boundary of VTS-Catoosa. This training area includes the summit of Sand Mountain which represents the most rugged terrain occurring on the installation. The site is completely covered by a single forest stand.

Stand Description

Stand c0601 is a mature upland pine and hardwood forest that is dominated by red oak with a mix of hickory, white oak, poplar, walnut, and a few pines. The trees range in age from 30 to 70 years old. The overall health of the stand is good. A large skullcap management group is located on the west-facing slope of Sand Mountain, and a portion of another group occurs on the northeast edge of the stand.

Forest Management Prescription

Stand 0601 is divided into three sections (a: 50 ac to the west, b: 44 ac in the center, and c: 37 ac to the west). All three will be subject to small group selections to create a patchwork of age classes. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder of each section may be lightly thinned to release desirable hardwood trees. The sections will not be harvested in the same year.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer.

Prescribed burning can be done once every 6 years for fuel reduction. The skullcap management group will be protected from prescribed fire with a temporary firebreak placed outside the 50' buffer.

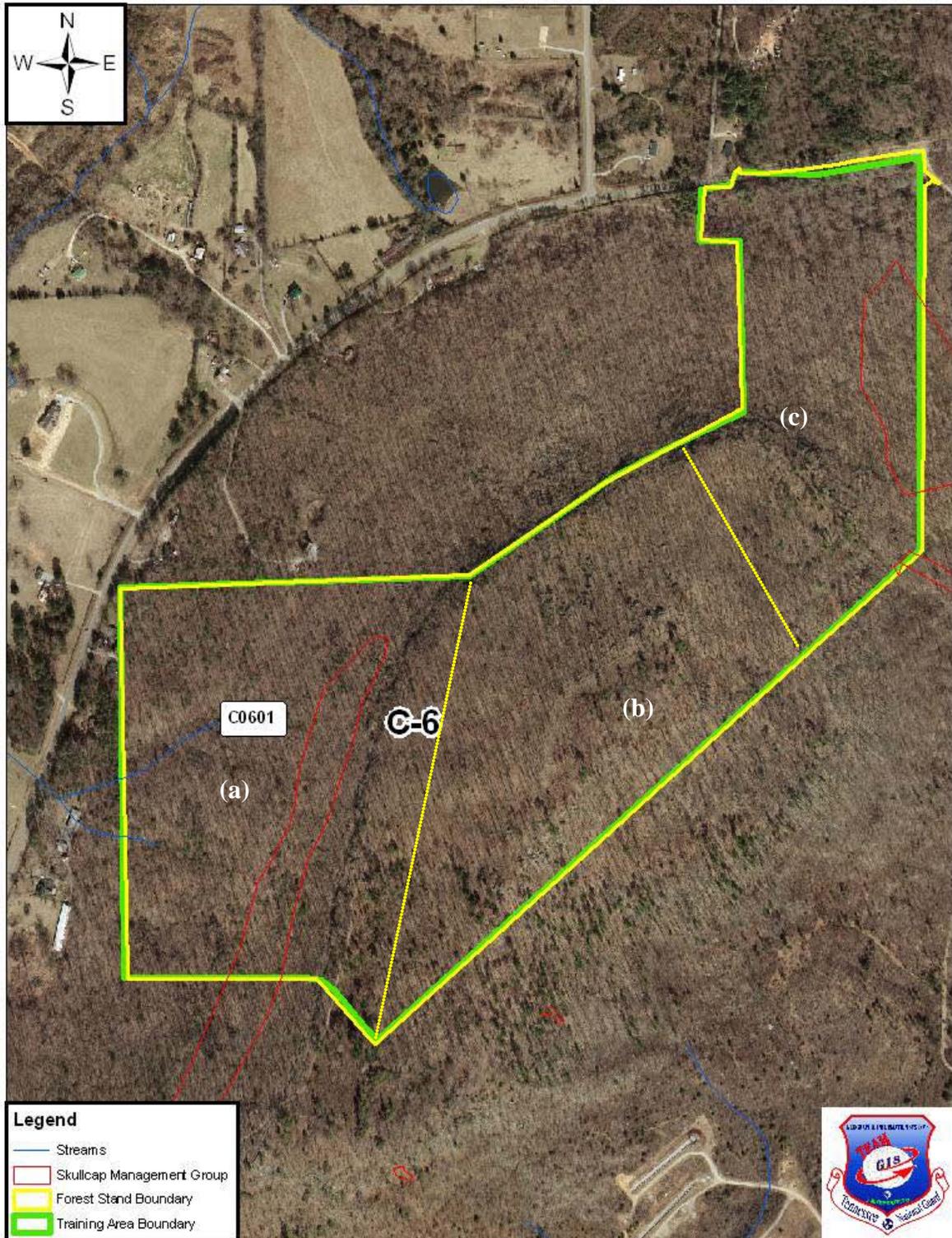


Figure A2.8: Forest stands in Training Area 6.

6.8 Training Area 7

Training Area 7 consists of 154 acres. This site contains most of the Impact Area for military firing exercises. Two forest stands occur within the training area, along with a small acreage of open lands occurring along the southeastern boundary of the area.

Stand Description

Stand c0701 is a mature upland pine and hardwood forest that is located on the very steep and rocky terrain of Sand Mountain. The stand exists as two separated units. The stand is dominated by red oak and white oak, with a mix of hickory, poplar, walnut, and a very few pines. The trees range in age from 20 to 60 years old. The overall health of the stand is excellent. The stand exhibits signs of fire damage resulting from wildfires ignited by military firing exercises and/or by controlled burns. The fire damage has resulted in major damage to the hardwood species and allowed erosion of the soil to occur. Two large-flowered skullcap management groups occur in the northeastern portion of this stand.

Stand c0702 is a contiguous 106.6-acre area of immature pine and hardwood forest, containing areas in which significant pine and hardwood regeneration has occurred. The trees range from 10 to 30 years old. The stand has experienced past hot fires and wind damage that has reduced the condition of the stand.

Forest Management Prescription

Stand c0701. Section (a) (8 ac) in the west will be subject to small group selections at the same time as Stand c0601 (b) to create a patchwork of age classes. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder may be lightly thinned to release desirable trees. Due to the prevalence of fire in this portion of the training site, pine species will be maintained whenever possible

Section (b) (32 ac) in the east will be subject to small group selections. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder may be lightly thinned to release desirable trees. Due to the prevalence of fire in this portion of the training site, pine species will be maintained whenever possible.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer.

Prescribed burning can be done once every 6 years for fuel reduction.

Stand c0702. This stand will be left alone for the immediate future. Fire, both accidental and intentional, will continue to influence the conditions. Following the next inventory the stand will be reassessed. If expansion of the target area is required, areas of the stand will be cleared of damaged forest vegetation and maintained in an open state..

Prescribed burning can be done once every 6 years for fuel reduction.

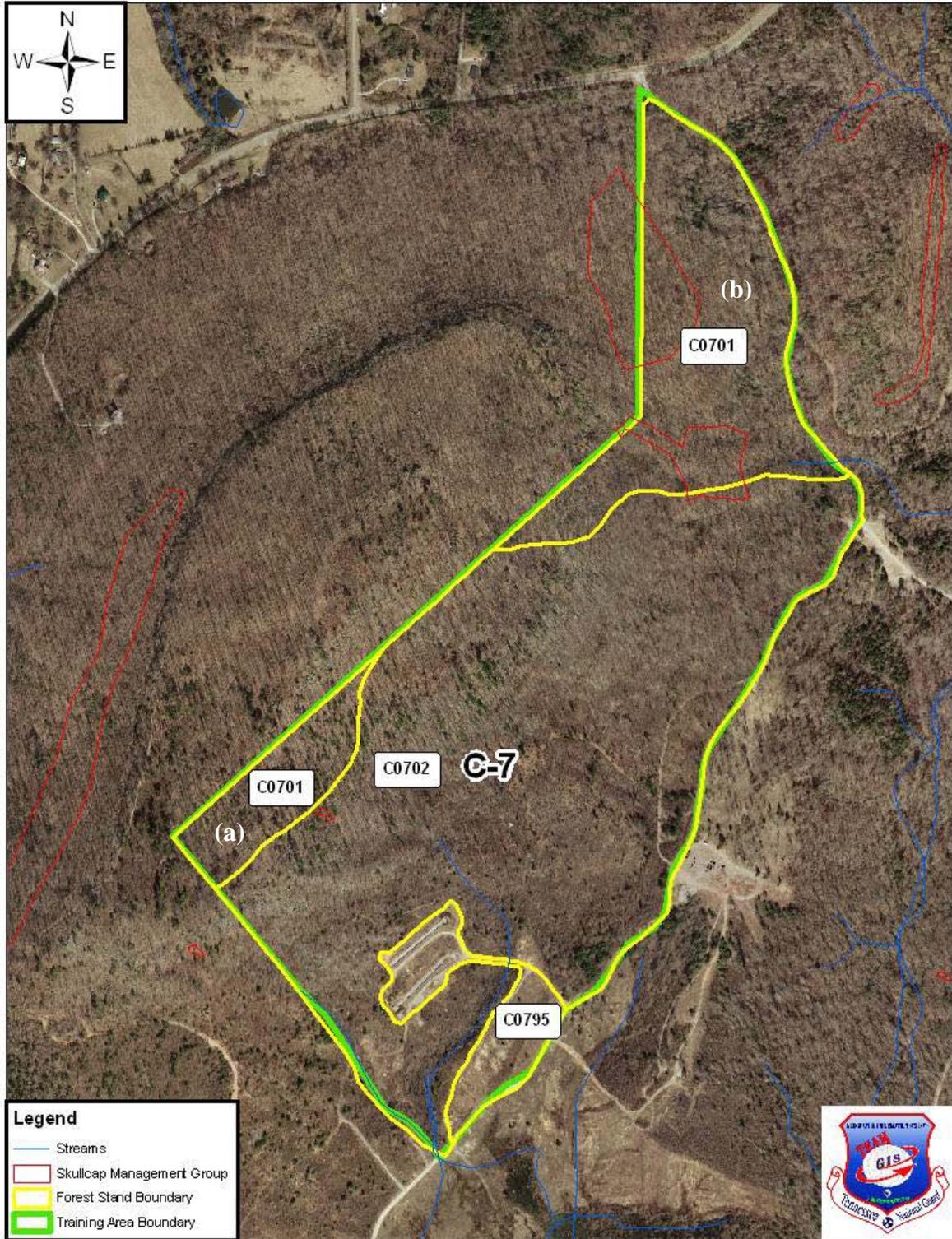


Figure A2.9: Forest stands in Training Area 7.

6.9 Training Area 8

Training Area 8 consists of a small 24.8-acre tract on the extreme northwestern boundary of the installation that is forested over its entire area. This area supports a single forest stand and a small cluster of large-flowered skullcap.

Stand Description

Stand c0801 is a mature upland pine and hardwood forest. The stand is dominated by white oak and hickory, with a mix of red oak, poplar, walnut, and a very few pines. The trees range in age from 30 to 60 years old. The overall health of the stand is excellent and there is good hardwood regeneration present.

Forest Management Prescriptions

Stand c0801 will be subject to small group selections. Areas to be harvested will be chosen on the basis of advance regeneration and seed tree quality. No more than 30% of the section acreage will be harvested in groups. The remainder of each section may be lightly thinned to release desirable hardwood trees.

Harvest activities will be limited in the vicinity of skullcap management groups. Harvest operations must be scheduled for the fall or winter when the plants are dormant. No vehicles, skidders included, may pass through a management group at any time, and soil disturbance must be minimized. There will be a 50' buffer surrounding the skullcap group; no timber will be cut within the management groups or the buffer zone. Tops and limbs will not be left within a management group or buffer zone.

Prescribed burning can be done once every 6 years for fuel reduction. The skullcap management group will be protected from prescribed fire with a temporary firebreak placed outside the 50' buffer.

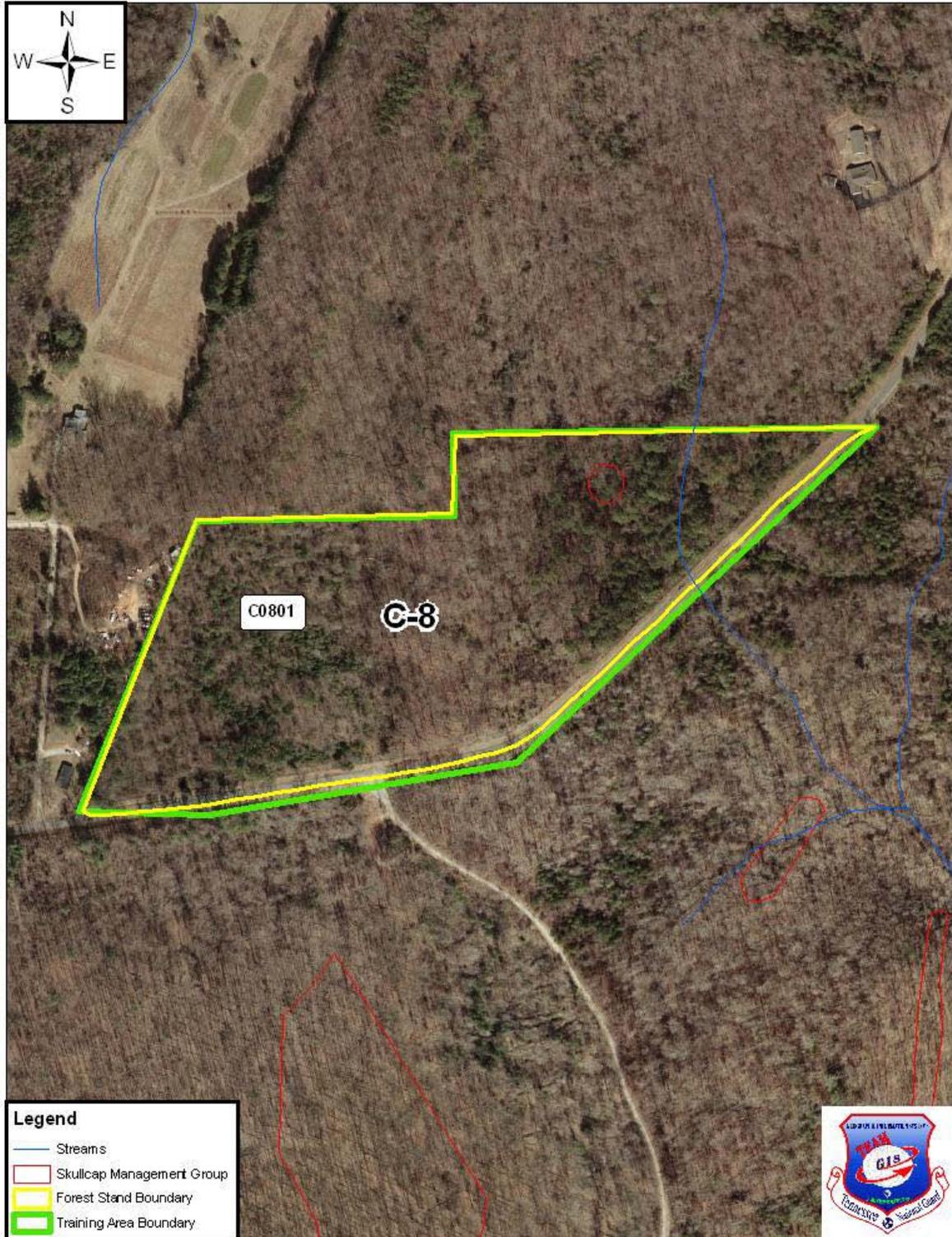


Figure A2.10: Forest stands in Training Area 8.

6.10 Training Area 9

Training Area 9 is a 112-acre tract located along the northern boundary of the installation. This training area is mostly forested, with Broom Branch (a major tributary to Tiger Creek) flowing along its eastern boundary. A beaver pond occurs within the stream. Two forest stands were identified in the training area.

Stand Description

Stand c0901 is a 96.3-acre contiguous area of immature sawtimber. The stand is dominated by poplar, oaks, hickory, pines, and miscellaneous hardwoods. Hardwood saplings and some mature pines and hardwood are scattered throughout the stand. This area was harvested during the past 20 years. The overall health of the stand is excellent, although evidence of damage from beaver-induced flooding is present at the lowermost elevations along Broom Branch. Large-flowered skullcap management groups are present in the southern portion of this stand.

Stand c0910 is a narrow 13.1-acre mature hardwood sawtimber stand stretched along either bank of the tributary streams occurring within the stand. This stand was not harvested when the adjacent Stand c0901 was. The overall health of the stand is judged to be excellent although evidence of beaver damage is present.

Forest Management Prescription

Stand c0901. The trees in this stand will be allowed to continue to grow for the immediate future. The stand will be reassessed following the next inventory when it may be due to be thinned of trees that are not in the dominant or co-dominant crown class in the next management cycle.

No prescribed burning should be pursued before the thinning is completed.

Stand c0910. Due to the intimate association of the tributary streams to Tiger Creek with Stand c0910, there are limited forest management options. No harvesting will be conducted in this stand.

No prescribed burning should be pursued before the thinning is completed.

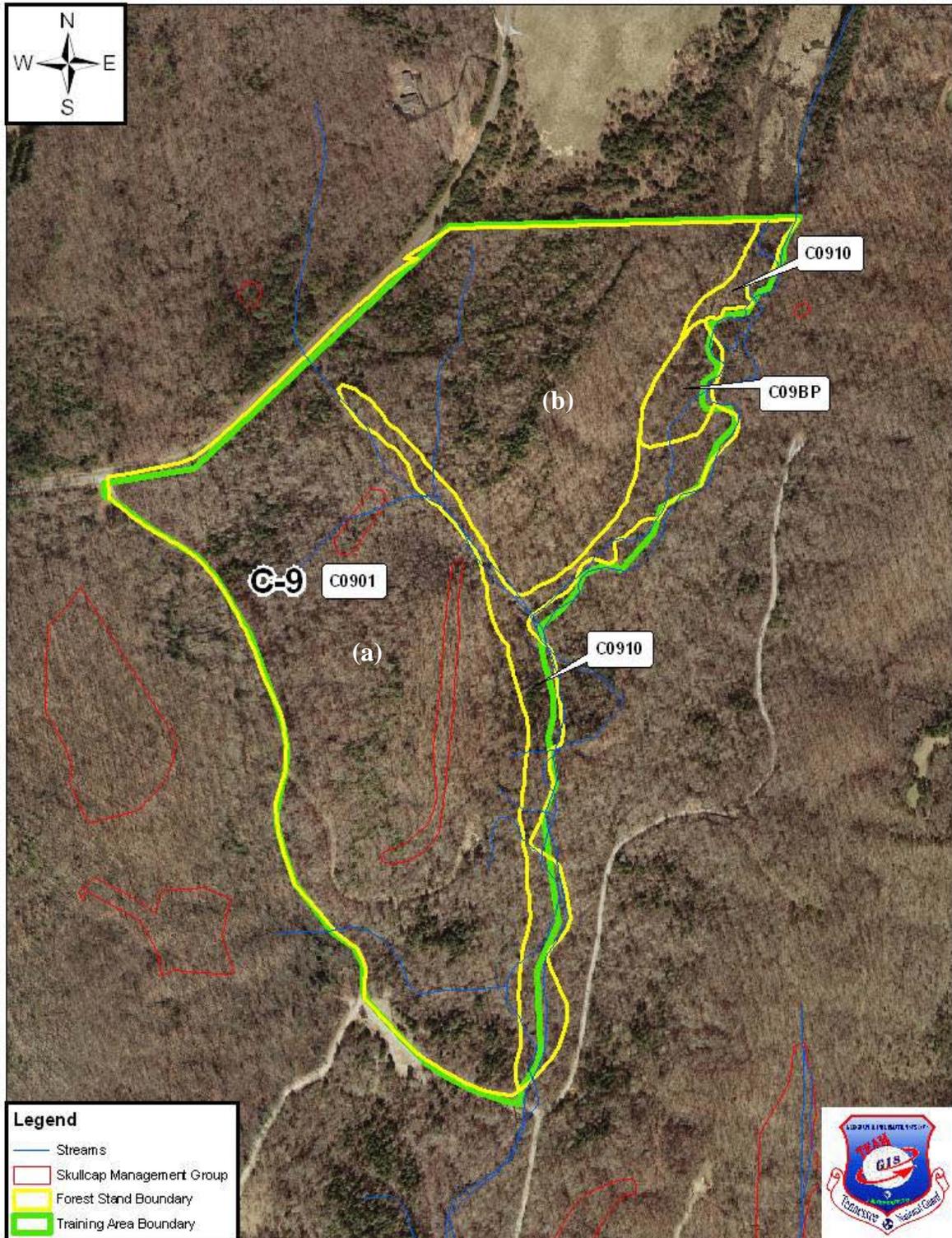


Figure A2.11: Forest stands in Training Area 9.

6.11 Training Area 10

Training Area 10 is located along the northeastern boundary of the installation. This 178-acre area also borders Broom Creek to the west. The site contains three forest stands and portions of streams that are tributaries to Tiger Creek.

Stand Description

Stand c1001 is a 123.8-acre mature upland pine and hardwood forest that occurs on steep rolling hills. The stand is predominantly red oak and white oak, with a mix of hickory, poplar, walnut, and a few pines that remain from a past infestation of southern pine beetles. The trees range in age range from 20 to 50 years old. The overall health of the stand is excellent. Several small skullcap management groups are located within this stand.

Stand c1002 is a 35.1-acre immature sawtimber stand of poplar, oaks, hickory, pines, and miscellaneous hardwoods. Hardwood saplings with some mature pines and hardwoods are scattered throughout the stand. This area was harvested within the past 20 years. The overall health is excellent for the stand.

Stand c1010 is a 15.2-acre mature hardwood sawtimber stand. The stand is relatively narrow and is divided between two units, both of which are associated with tributary streams. The overall health of the stand is excellent, with the age of the trees ranging from 25 to 50 years old. The southern unit of this stand is largely occupied by a large-flowered skullcap group.

Forest Management Prescription

Stand c1001. This stand will be left alone until the next inventory when it will be reassessed. This is the likely location for an experimental application of the shelterwood – burn method of hardwood regeneration, which will be addressed following the 2015 inventory.

No prescribed burning should be conducted at this time.

Stand c1002. This stand will be thinned by removing all trees that are not in the dominant or co-dominant crown class. Some of the co-dominants may also be removed to allow more room for the remaining trees to grow, plus aide in training. The goal would be for the tree crowns not to touch each other on at least 3 sides.

Prescribed burning can be done once every 6 years for fuel reduction. No burning should be undertaken before thinning is completed.

Stand c1010. Due to the close association of Stand c1010 with the tributary streams and the large-flowered skullcap management group, there will be no timber harvest activities or prescribed burning in this stand.

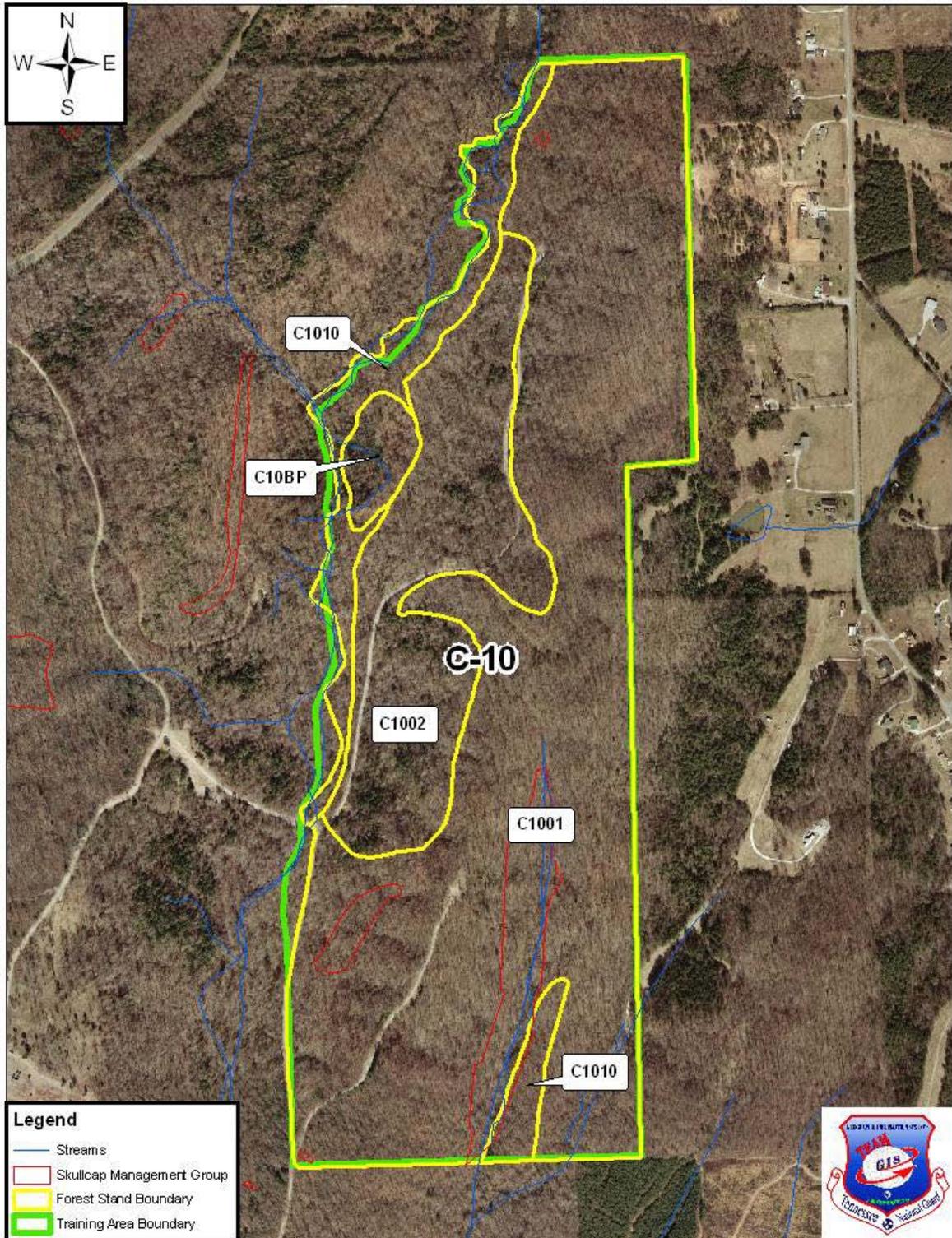


Figure A2.12: Forest stands in Training Area 10.

7.0 IMPLEMENTATION SCHEDULE

A total of 25 individual forest stands have been designated on VTS-Catoosa. Some stands have been further divided into management units of 50 acres or less. Stand designations indicate site (C), training area (05), stand (01), and unit (a): C0501(a).

In general, the overall health of the installation's forest resources is considered to be relatively good, with the exception of portions of Training Areas 5 and 7. These two areas contain the installation Impact Area that has experienced frequent periodic fires that have resulted in damage to the timber. Due to the age and density of trees occurring over most of the installation, it appears that a sizable timber harvest took place some time around 20+ years ago.

Generally, stands totaling less than 50 acres will be harvested in any one year. This figure indicates total stand acreage; actual cleared acres will be much lower for group selection cuts. In addition, many stands contain large-flowered skullcap management groups which are not subject to timber harvest, thereby further lowering the impacted acreage.

Table A2.3 lists stands in order of the priority of treatment for the next 12 years; stand-specific management actions are planned for 19 of the stands during this time period. The recommended order of work summarized in Table A2.3 would be scattered over the installation's training areas in any given year (Figure A2.13) to avoid concentrating forestry operations in a single portion of the installation, while contributing to the creation of a long term mosaic of differing habitat conditions.

This schedule is subject to change based on military mission needs and updated forest inventory data. A resurvey of the VTS-C forest stands is scheduled for 2015. This plan and the harvest priority will be revised as dictated by the results of the new inventory.

Table A2.3: Timber stand harvest priority for VTS-Catoosa.

Training Area	Stand &Section	Acres	Primary Management Action
01	C0101	23	Thin everything below dominant/co-dominant
02	C0202 (a)	32	Thin everything below dominant/co-dominant
08	C0801 *	25	Group selection and thin
Cantonment	CC01 (c) *	35	Group selection and thin
05	C0502 (a) *	50	Thin everything below dominant/co-dominant
07	C0701 (b) *	32	Group section and thin
02	C0202 (b)	31	Thin everything below dominant/co-dominant
06	C0601 (c) *	37	Group selection and thin
04	C0401 (b) *	31	Group selection and thin
Cantonment	CC01 (a)	17	Selectively thin trees above 20" dbh
01	C0110 **	6	Selectively thin trees above 20" dbh
05	C0502 (b) *	40	Thin everything below dominant/co-dominant
02	C0201 (b) *	35	Group selection and thin
06	C0601 (a) *	50	Group selection and thin
04	C0401 (a)	33	Group selection and thin
02	C0201 (c) *	47	Group selection and thin
10	C1002	35	Thin everything below dominant/co-dominant
06	C0601 (b)	44	Group selection and thin
07	C0701 (a)	8	Group selection and thin

* Harvesting will be limited to outside the large-flowered skullcap management groups and surrounding 50' buffer. Acreages to be cut are overestimated in this table.

** Riparian stands will only be thinned outside the 50' SMZ on each side of the stream.

Annex 3

Wildland Fire Management Plan

VTS-Catoosa

Tennessee Army National Guard

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1.0 INTRODUCTION

This Wildland Fire Management Plan (WFMP) has been developed in accordance with the 2002 Department of Army (DA) Wildland Fire Policy Guidance. It presents the standards by which the VTS-Catoosa wildland fire control and prescribed burning programs will be conducted. This plan is a component of the Integrated Natural Resources Management Plan (INRMP) for the training site and is especially linked to the Forest Management Plan annex to the INRMP.

This plan shall be in compliance with:

- Army Regulation (AR) 420-90, 10 Sep 97, Fire and Emergency Services
- AR 200-1, 28 Sep 2007, Environmental Protection and Enhancement
- DOD Instruction 6055.6, 10 Oct 00, DoD Fire and Emergency Services Program
- Army Memorandum, 04 Sep 2002, Army Wildland Fire Policy Guidance

1.1 Goals and Objectives

Fire management policy for VTS-Catoosa was developed to support the following goals:

- Provide for the safety of fire crews on every wildland fire management activity.
- Reduce wildfire potential on the training site and suppress undesired wildfires to protect lives, property, and natural and cultural resources in a cost-effective manner.
- Utilize prescribed fire to maintain and improve the usability of the training site to support all aspects of the military mission.
- Utilize prescribed fire to effectively protect and enhance valuable natural resources and to implement ecosystem management goals and objectives.

1.2 Key Definitions

Wildland. An area in which development is essentially nonexistent, except for roads, railroads, power lines and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Fire. Any non-structure fire occurring in the wildland that is not meeting management objectives and thus requires a suppression response.

Wildland Fire Use. The application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in pre-defined designated areas outlined in Fire Management Plans.

Wildfire. An unplanned, unwanted wildland fire, including unauthorized human caused fires, naturally occurring wildland fires, and escaped prescribed fires, where the objective is to put out the fire.

Prescribed Fire. Controlled, purposeful application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

1.3 Location and Physical Features

The VTS-Catoosa consists of 1,628 acres in the northwestern portion of Georgia in Catoosa County, approximately 5 miles south of the Tennessee-Georgia border. The VTS-Catoosa is located approximately 90 miles northwest of Atlanta, Georgia, and approximately 20 miles southeast of Chattanooga, Tennessee. Georgia State Highway 2 borders the installation on the south, and Salem Valley Road provides access to the northern boundary. The VTS-Catoosa is approximately 16,000 feet at its maximum length (north-south) and around 6,625 feet at its maximum width (east-west).

The closest town is Ringgold, Georgia, the county seat of Catoosa County, which is located approximately two miles west of the VTS-Catoosa along I-75 between Atlanta and Chattanooga. The VTS-Catoosa was originally used as the Fort Oglethorpe Rifle Range and Training Site between 1910 and 1946. Fort Oglethorpe was closed immediately after World War II and placed under the jurisdiction of the U.S. Army Corps of Engineers (USACE). Since 1960, the Tennessee Army National Guard (TNARNG) has operated the VTS-Catoosa under a license from the USACE.

The VTS-Catoosa is comprised of a relatively small Cantonment Area and 10 designated training areas. Topographic relief across the site is significant, with an elevation change from approximately 755 feet above mean sea level (msl) along the creek system that bisects the training site to over 1,200 feet above msl on the northeast-southwest running ridges on either side of the stream valley. Slopes on the training site range from 0% to 53%.

Approximately 1,300 acres of the VTS-Catoosa is forested, principally with mixed hardwood species. Managed grasslands cover about 80 acres on the small weapons ranges and tank range. There is no unexploded ordinance on the VTS-Catoosa.

2.0 PROGRAM OVERVIEW

2.1 Organizational Structure and Responsibilities

The wildland fire program on VTS-Catoosa will operate in accordance with DA Memo (4 Sep 2002), "Army Wildland Fire Policy Guidance," and the DA "Sustainable Range/Installation Environmental Activities Matrix" (2 Sep 2005) for funding. The Adjutant General (TAG) as commander of the TNARNG is directly responsible for the operation and maintenance of the Volunteer Training Sites, including implementation of this WFMP. TAG delegates fire-related duties among environmental and training site staffs.

The Wildland Fire Program Manager for the TNARNG is the Natural Resources Manager (NRM) in the Environmental Office. The NRM is responsible for preparing and maintaining this WFMP. The NRM also ensures that firefighters are trained to National Wildfire Coordinating Group (NWCG) Firefighter Type 2 standards, at a minimum, maintaining training records and scheduling training as needed.

VTS-Catoosa Range Control is responsible for immediate wildland fire control response on the training site. There is a verbal MOA for firefighting support in place with the Georgia Forestry Commission (GFC), which is located within a few miles of the training site. A unified command will be set up with the GFC and any qualified VTS-Catoosa personnel in the event that the GFC is called in to help control a wildland fire that is beyond the capabilities of the training site staff. Catoosa County also has six volunteer fire departments (VFDs). Ringgold VFD would respond to any structural fires on the training site.

Prescribed fire activities on the VTS-Catoosa are cooperative actions conducted by training site personnel and the Georgia Forestry Commission. A GFC forester acts as burn boss for all prescribed burns on the training site. Environmental personnel also participate in prescribed burns conducted for ecosystem management goals.

2.2 Interagency Cooperation and Mutual Aid Agreements

There is a verbal MOA in place with the Georgia Forestry Commission, which is located near VTS-Catoosa. The GFC conducts the prescribed burns and controls any wildland fires that are too large for the VTS-Catoosa personnel to handle.

2.3 Personnel

VTS-Catoosa currently has 4 trained wildland firefighters (FFT2). Additional firefighters may be requested from other TNARNG facilities to aid in prescribed burning. The GFC County Forester acts as the burn boss for all prescribed burns, as no training site personnel have yet received prescribed fire training.

2.4 Available Equipment

The VTS-Catoosa maintains a cache of fire equipment for wildland fire suppression and prescribed burning (Table A3.1). In addition, personal protective equipment (PPE) conforming to National Fire Protection Act (NFPA) 1977 (Standard on Protective Clothing and Equipment for Wildland Fire Fighting) is maintained for all trained personnel on site. Each firefighter is outfitted with:

- Nomex pants
- Nomex shirt
- Firefighting helmet
- Leather gloves
- Goggles
- Fire shelter
- Pack for gear
- Leather boots are required, but are provided by the individuals.

Table A3.1: Available fire equipment at VTS-Catoosa.

Fire rake	8
Pulaski axe	4
Shovels	5
Drip cans	2
5 gal Backpack sprayer - metal	1

Collapsible backpack sprayer	2
500 gal Fire Trailer + pump + 500' hose	1
Hydro-seeder 800 gal water capacity + 100' hose	1
Trailer-type pressure washer 300 gal + 25' hose	1
D-7 dozer	1
120-G grader	2
Gyro-track with brush grinder	1
245 Massey tractor	1
6400 JD tractor	2
4720 JD tractor with dump bucket	1
New Holland back hoe	1
24-C skid loader	2
Track hoe	1
GMC 4WD diesel pickup truck	4
6' scraper	1
6' box blade	1
10' bush hog	1
7' bush hog	1
Disc harrow	1
100 gal spray tank	1

2.5 Funding Requirements

The funding responsibilities for wildland fire are defined in the DA Sustainable Range/ Installation Environmental Activities Matrix (2 Sep 2005). Wildland fire expenses are primarily the responsibility of the Facilities/Real Property Division. Funding for WFMP implementation, wildland fire prevention, fuels management for hazard reduction, wildland fire suppression, prescribed burning, firebreak construction and maintenance, and other wildland fire management is an installation operations and maintenance responsibility.

Integrated Training Area Management funds may be utilized for prescribed burning intended to improve training facilities/environments, as well as for construction and maintenance of fire breaks or other fuel removal directly associated with training-induced fire hazard on ranges and training areas.

Environmental funds may be utilized for prescribed burning that has a specific ecosystem management or rare, threatened, and endangered species management objective as presented in the INRMP and for wildland fire management activities conducted for the purpose of compliance with environmental laws and regulations. Forestry reserve account funds may be requested for fire-related projects that will improve forest health or timber management concerns on the facility.

The funds available will be used to continue the training of the on-site resources and maintain a cache of personal protective equipment and wildfire tools. The VTS-Catoosa personnel should use appropriate management response in all incidents which will maintain a cost efficient program.

2.6 Public Relations

When involved with any fire application, VTS-Catoosa personnel should always consult with the Georgia Forestry Commission and should also consider contacting the local VFDs. At the minimum the main

Ringgold VFD should be contacted. The surrounding public should be made aware of any smoke issues that may arise and could cause any health issues.

2.7 Environmental Review

Implementation of this Integrated Wildland Fire Management Plan requires an assessment of the environmental effects as required by AR 200-1, *Environmental Protection and Enhancement*, and the National Environmental Policy Act of 1969. This assessment will be completed before implementation of the plan, in conjunction with the Environmental Analysis (EA) for the Integrated Natural Resources Management Plan for the VTS-Catoosa.

3.0 SAFETY AND EMERGENCY OPERATIONS

All emergency operations go through Range Control and will be handled through the 911 dispatch. The Range Control Officer will function as the Incident Commander for small scale fire suppression. If a wildfire is beyond the capabilities of the on-site staff, Incident Command will be turned over to the Georgia Forestry Commission or Ringgold VFD representative, as appropriate to the nature of the outside aid required.

The on-site Incident Commander will ensure all firefighter and public safety precautions are taken and are the highest priority in all operations. Except in the event of a threat to human life, no wildland fire situation will require placing a firefighter or equipment in extreme danger.

Before fire suppression or prescribed fire activities are initiated, the Incident Commander (or burn boss, in the case of prescribed burning) will go over the plan of operation with all personnel directly participating and ensure all personnel have at least the minimum PPE required.

All TNARNG personnel involved in wildland fire activities will receive appropriate training for their tasks (see Section 3.2). Firefighters will be issued a Fireline Handbook NWCG Handbook (3 PMS-410/NFES 0065) and the Incident Response Pocket Guide (PMS-461/NFES 1077). Each firefighter will be knowledgeable and review the 10 Standard Fire Orders and the 18 Watchout situations. No emergency situation will be approached without the proper safety mitigations in place with the use of Lookouts, Communications, Escape Routes and Safety Zones (LCES).

All safety gear will comply with NFPA 1977 Standard on Protective Clothing and Equipment for Wildland Fire Fighting. This standard specifies the minimum design, performance, testing, and certification requirements for items of wildland fire fighting protective clothing and equipment, including protective garments, helmets, gloves, footwear, goggles, chain saw protectors, and load carrying equipment.

The VTS-Catoosa does not contain any unexploded ordinance.

3.1 Risk Assessment Process

Safety of TNARNG personnel, firefighters, civilians, and neighbors is of paramount importance in all wildland fire actions. Risk assessment for all emergency response situations will follow the five step process outlined below (from the Incident Response Pocket Guide PMS-461/NFES 1077). Situational awareness must be maintained throughout the changeable conditions of a wildland fire activity and re-assessment conducted whenever there is a significant alteration of circumstances.

3.1.1 The Risk Management Process

Step 1. Situational Awareness

- Gather information
 - Objective(s)
 - Previous fire behavior
 - Communication
 - Weather forecast
 - Who's in charge?
- Any local factors
 - Scout the fire/incident

Step 2. Hazard Assessment

- Estimate potential fire behavior hazards
 - Look Up / Down / Around indicators
- Identify tactical hazards
 - Watch Outs
- What other safety hazards exist?
- Consider severity vs. probability

Step 3. Hazard Control

- Firefighting Orders and LCES Checklist – MANDATORY
 - Anchor point
 - Downhill checklist (if applicable)
- What other controls are necessary?

Step 4. Decision Point

- Are controls in place for identified hazards?
 - NO: Reassess situation YES: Next question
- Are selected tactics based on expected fire behavior?
 - NO: Reassess situation YES: Next question
- Have instructions been given and understood?
 - NO: Reassess situation YES: Initiate action

Step 5: Evaluate

- Personnel: Low experience level with local factors?
 - Distracted from primary tasks?
 - Fatigue or stress reaction?
 - Hazardous attitude?
- The Situation: What is changing?
 - Are strategy and tactics working?

3.1.2 Prescribed Burning Risk Assessment

The above Risk Management Process will be applied during prescribed fire activities. Prescribed burning will not be conducted under any of the following conditions, as based on the Fire Weather information from the Georgia Forestry Commission (<http://weather.gfc.state.ga.us>):

- A predicted temperature greater than 85° F
- A predicted wind speed greater than 18 mph at the 20' level
- A predicted relative humidity less than 25%

- An atmosphere with Red Flag conditions issued by GFC or USDA-FS
- Inadequate personnel or equipment available to manage the prescribed burn

3.1.3 Fire Danger Rating and Burning Index

Fire danger (Table A3.2) rating is a classification based on the Burning Index and is available from the Georgia Forestry Commission fire weather system. Fire danger rating will be routinely checked during fire season, as it provides guidance of importance both for prescribed burn activities and also for military training. Prescribed burns will generally be conducted at low fire danger rating, or occasionally moderate. Pyrotechnic devices and live fire training will be limited in accordance with the recommendations in the table below:

Table A3.2: Fire Danger Rating.

Fire Danger Rating and Color Code	Burning Index (BI)	Description	Recommended Military Considerations
(1) Low (Green)	0-20	Fuels do not ignite readily from small firebrands. Most prescribed burns are conducted in this range.	None.
(2) Moderate (Blue)	21-40	Fires are not likely to become serious and control is relatively easy. Fires burning in these conditions generally represent the limit of control for direct attack methods.	None.
(3) High (Yellow)	41-60	Fires may become serious and their control difficult unless they are attacked successfully while small. Machine methods are usually necessary or indirect attack should be used.	Recommend firing pyrotechnics into open drums; altering firing times to hours with lower fire danger.
(4) Very High (Orange)	61-79	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. The prospects for direct control by any means are poor at this intensity.	No pyrotechnics or tracer rounds allowed, except with written authorization from Range Control.
(5) Extreme (Red)	80+	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. The heat load on people within 30 feet of the fire is dangerous.	No pyrotechnics or tracer rounds allowed.

3.2 Personnel Training and Certification

Training will adhere to the standards set by NWCG as described in PMS-310 (<http://www.nwcg.gov/pms/docs/docs.htm>). All firefighters need to obtain the basic Firefighter Type 2 (FFT2) qualifications (S130/190 classes) and will need to attend an annual fireline safety refresher provided on-site or off.

The Natural Resource Manager (NRM) for TNARNG, is responsible for maintaining and tracking the training records for VTS-Catoosa personnel. The NRM will keep track of the training being offered close to the installation and inform training site personnel of its availability. VTS-Catoosa should look for opportunities to train with the Georgia Forestry Commission.

3.3 Physical Fitness Standards

Based on the conditions and terrain encountered in wildland fire situations on the VTS-Catoosa, the moderate level fitness standard is considered sufficient for TNARNG wildland firefighters. The field test will be administered by the Natural Resources Manager and/or the Environmental Program Manager according to the standards in PMS-307/NFES 1109, Work Capacity Test Administrator's Guide (2003). All TNARNG personnel with current firefighter training will be required to pass the test prior to the end of FY2009. New personnel with fire suppression or prescribed fire duties will be tested prior to their first fire activities (unless they already have their Red Card).

4.0 FIRE FACTORS

4.1 Fire History

No significant wildfires have occurred on the training site. All wildfires have been associated with military activities such as firing blanks or tracer rounds. Each fire has been less than one acre in size and has been extinguished by on-site staff.

4.2 Mission Considerations

The mission of the VTS-Catoosa is to support unit requirements for maneuver, range operations, equipment use, and other combat readiness training. These training activities occur within the developed Cantonment Area, the small arms ranges, and throughout the maneuver areas which comprise 96% of the training site. The VTS-Catoosa facilities are used to conduct small arms range firing, maneuvering, and combined arms training including field bivouac; tracked and wheeled vehicle operations on all military roads and developed major trails; mounted and dismounted maneuvers; and weapons firing. Off-road maneuvers are performed within designated open terrain areas and in designated fringe areas (concealment parking sites) within 100 feet of specified roads and trails within the maneuver areas. Over 80% of training site utilization is by military users; use by non-military entities is generally restricted to the small arms firing ranges.

This WFMP supports the military mission of the VTS-Catoosa by providing for timely wildfire response, thus minimizing training downtime and facility loss to wildfires. The prescribed burn program provides a cost effective method of maintaining and expanding open training areas such as ranges and controls fuel buildup to minimize wildfire intensity.

Potential negative impacts of the wildland fire program include smoke impacts and interruption of training activities. Care in scheduling burns to accommodate the training calendar will minimize all effects on training activities. Wildfire control downrange will require a range shutdown, which could lead to loss of training time. Smoke management will be addressed through the guidelines provided in this plan.

4.3 Natural and Cultural Resources Considerations

Fire management may have beneficial or negative impacts on both the natural and cultural resources of a site, and both can represent constraints on the fire program, especially prescribed burning.

4.3.1 Cultural Resources

Development of firebreaks is the greatest fire-related threat to Cultural Resources on VTS-Catoosa. No new permanent firebreaks (off existing roads and trails) will be developed without consultation with the Georgia State Historic Preservation Officer (SHPO). Temporary plow line firebreaks may be constructed in those portions of the training site which have been surveyed and identified as free of significant archaeological or historical resources.

A Phase I survey of VTS-Catoosa conducted in 1997 identified 20 archaeological sites and 17 historic architectural resources on the installation. The historical architectural sites are located within the Cantonment Area; the archaeological sites are scattered across the training site. These sites are considered “no plow” zones, and are included on Figure A3.1 with the natural resource sites that are also protected from the fire plow. Fire control in “no plow” zones will depend on existing firebreaks or methods that do not disturb the soil.

One family cemetery is located on the VTS-Catoosa (the cultural zone in the northeast corner of the training site). It is fenced and will be protected from wildfire and prescribed burns.

4.3.2 Natural Resources

- One federally listed threatened plant species (large-flowered skullcap (*Scutellaria montana*)) occurs at multiple locations across VTS-Catoosa. The occurrences of this plant are identified as “management groups” and have been marked in the field and recorded on the installation GIS. The large-flowered skullcap areas are “no plow” zones, as indicated on Figure A3.1. Vehicles are not allowed within the management groups, and earth disturbance is prohibited. Large-flowered skullcap management groups will be protected from wildfire as possible using existing firebreaks, plowed breaks at least 50 feet outside of group boundaries, or control methods that do not disturb the soil.

The impact of fire on large-flowered skullcap is relatively unknown. It is possible that a “cool” prescribed fire applied early in the spring could assist in reducing competition from other herbaceous ground cover plants and exotic invasive plant species without damaging the protected plant. The TNARNG has proposed a study to investigate the susceptibility of large-flowered skullcap to light burning. Formal consultation with the U.S. Fish and Wildlife Service (USFWS) must be completed prior to any experimental burning of the skullcap. Until that time, all known large-flowered skullcap occurrences will be protected from prescribed fire by a temporary fireline constructed at least 50 feet outside of the posted boundaries of the management group. Any research activities will impact only specific management groups (see Annex 1); all other groups will continue to be protected from prescribed fire, as well as from wildfire.

- The gray bat (*Myotis grisescens*) is the only federally listed animal species that has been observed on VTS-Catoosa. No roosting sites have been found on the training site, and the species has only been documented foraging over Tiger Creek. Appropriate care of streamside management zones in the development of firebreaks and limiting fire within the riparian areas should ensure minimal impact on the gray bat on VTS-Catoosa. If a roost site is ever found on the training site, the immediate area and a sufficient buffer surrounding it will be removed from the burn program.

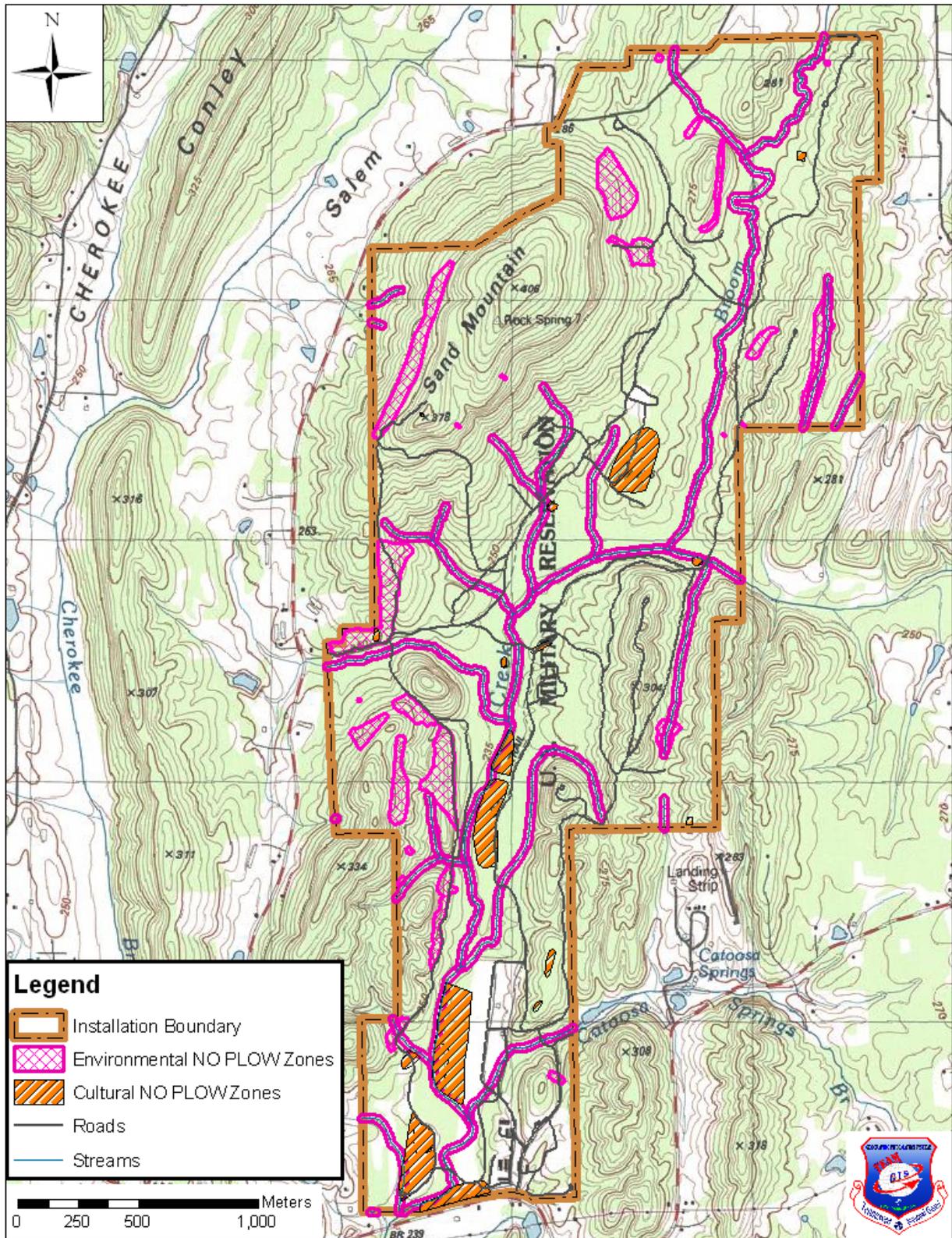


Figure A3.1: No-Plow Zones on VTS-Catoosa due to significant natural and/or cultural resources.

- The VTS-Catoosa contains 11.6 miles of intermittent or flowing streams. Two of these, Tiger Creek and Broom Branch, are recognized by the state of Georgia as secondary trout streams. To protect water quality, the 50 foot Streamside Management Zone on each side of the streams will be a no-plow zone. Firebreaks within riparian corridors must be designed in coordination with the NRM and will be outside of the 50 foot SMZ (Figure A3.1). Prescribed burning within riparian areas will be limited and subject to careful planning to ensure streambanks are not denuded of vegetation.
- The topography of the VTS-Catoosa makes the site prone to soil erosion. In order to minimize erosion problems on firebreaks, water control structures to manage surface water movement will be installed during firebreak construction. Permanent fire lines will have water control structures maintained. Temporary firelines will be rehabilitated as soon as practicable after any fire. Existing barriers such as roads and trails will be used whenever possible to reduce the need for fire line construction and to minimize resource impacts.

4.4 Fire Regime

The fire regime classification system is used to characterize the personality of a fire in a given vegetation type, including the frequency that the fire visits the landscape, the type of pattern created, and the ecological effects. The following natural fire regimes are arranged along a temporal gradient, from the most frequent to the least frequent fire return interval. The definitions below are from the General Technical Report, Rocky Mountain Research Station #87 (GTR-RMRS-87).

Fire Regime Frequency Effect to Dominant Vegetation:

Fire Regime I	0-35 years	Low Severity
Fire Regime II	0-35 years	Stand Replacement
Fire Regime III	35-100+ years	Mixed Severity
Fire Regime IV	35-100+ years	Stand Replacement
Fire Regime V	200+ years	Stand Replacement

Fire Regime I: Fires in the under-story fire regime generally do not kill the dominant vegetation or substantially change its structure. Approximately 80 percent or more of the above ground dominant vegetation survives fire. The under-story fire regime occurs primarily in southern pine and oak-hickory forests, including the upland hardwood forest types found at VTS-Catoosa. Fire is a natural maintenance disturbance for these types of stands, and is used to maintain and regenerate oak-hickory for timber stand improvement and wildlife stand improvement concerns.

4.5 Fuel Types

Wildland fuels are classified by diameter:

- less than 0.25” 1-hour fuel
- 0.25”-1” 10-hour fuel
- 1-3” 100-hour fuel
- 3-8” 1000 hour fuel

VTS-Catoosa is considered to be over 90% forested. The training site consists of the following fuel models (Figure A3-2). Each group has an approximate acreage that occurs on site and gives a general description of the fuel and the fire behavior typically seen with the given fuels.

4.5.1 Grass Group

These fuels are seen on approximately 80 acres on VTS-Catoosa. Grasses are generally associated with weeds, ferns and other seasonal plants. During the growing season, they are green with high moisture content. They act as barriers to fire when green rather than as a carrier of fire. As the season advances, they cure and when fully mature, all but the roots will die and dry out. When dry, they have the fastest rate of spread of any fuel. The loading, however, is low and the fire will not be as intense. The intensity of these fires will be closely associated with the rate of spread. Slow moving fires in grass fuel will have very low intensity but high winds can change it to a very fast moving fire of moderate intensity. Moisture content closely follows daily weather changes. It is very sensitive to changes in relative humidity and wind.

- **Fuel Model 1** (1-foot deep) Fire spread is governed by the fine herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area. Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that meet the above area constraint. Annual and perennial grasses are included in this fuel model.
=> Regularly mowed ranges and lawns on the VTS-Catoosa.
- **Fuel Model 3** (2.5 feet deep) Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. The fire may be driven into the upper heights of the grass stand by the wind and cross over standing water. Stands are tall, averaging about 3 feet, but considerable variation may occur. Approximately one-third or more of the stand is considered dead or cured and maintains the fire.
=> Range areas on the VTS-Catoosa that are maintained by occasional bush-hogging.

4.5.2 Shrub Group

These fuels are not seen very frequently on VTS-Catoosa and only make up approximately 200 acres. Red cedar can be a very volatile fuel, especially during a drought or given a significant amount of grasses under and between trees. The volume of available fuel will continue to increase until the crowns begin to close, shading out the weeds and grasses. As this occurs, a smaller percentage of the total fuel loading becomes available to most fires due to the height of the crowns and less “ladder” fuel to carry the fire into them. The fuel available to most fires will generally be the understory fuels that are on the surface.

- **Fuel Model 4** (6 feet deep) Fire intensity and fast spreading fires involve the foliage and live and dead fine woody materials in the crowns of a nearly continuous secondary over-story. Besides flammable foliage, there is dead woody material in the stand that significantly contributes to the fire intensity. Heights of stands, qualifying for this model, vary with local conditions. There may be also a deep litter layer that confounds suppression efforts. Red cedar is considered in this group.
=> One redcedar-dominated stand on the south slope of Sand Mountain.
- **Fuel Model 6** (2.5 feet deep) Fires carry through the shrub layer where the foliage is more flammable than Fuel Model 5, but require moderate winds (>8 mi/h) at mid-flame height. Fire will drop to the ground at low wind speeds or openings in the stand. Shrubs are older, but not as tall as shrub types of Model 4, nor do they contain as much fuel as Model 4. This model covers a broad range of shrub conditions. Typical examples include intermediate stands of chamise, chaparral, oak brush, low pocosins, Alaskan spruce taiga, and shrub tundra. Cured hardwood slash can be considered.
=> No typical stands present; timber harvest slash could result in similar fire activity.

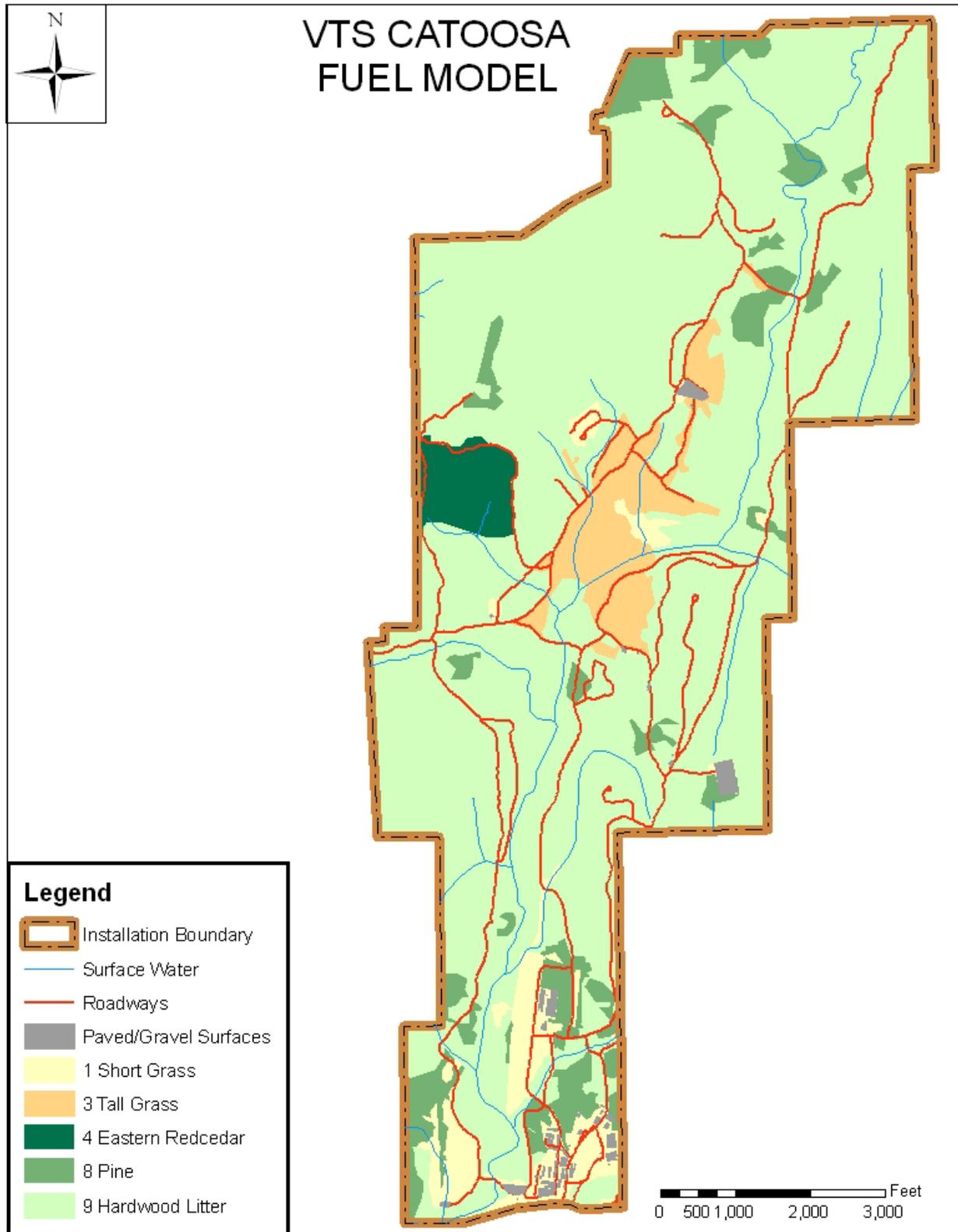


Figure A3.2: Fuel types on the VTS-Catoosa.

4.5.3 Timber Litter Group

These fuels are the majority of what will be seen on-site. Approximately 1,300 acres of VTS-Catoosa is in the timber litter group, and the majority of that falls in fuel model 9. The fuel under most forest stands consists of light to moderate loading of fuel, most of which is compacted on the ground. Fuels of this type are found throughout the Piedmont and Upper Coastal Plain regions of the Southeast. In dense pine stands, the predominant fuel is the matted pine needles. In upland hardwoods, it is compacted hardwood leaves. The amount of brush will vary from almost non-existent to almost solid brush, especially if there is little over-story. This type fuel will generally consist of grasses, pine needles, deciduous shrubs, small saplings, pinecones, twigs and branches. Fires in this type fuel will generally be of low intensity and slow spreading. The surface fuel is compacted and dries out very slowly. Consequently, much of it will not be available. Shrubs and small saplings tend to be more readily available and will add to the intensity where they are present. Most fires will be of rather low intensity and easy to control except during droughts when a larger percent of the fuel will be available. Firefighters can be surprised when this happens if they are not alert because of the increased intensity and rapid spread of the fire.

- **Fuel Model 8** (0.2-foot deep) slow burning ground fires with low flame heights are generally the case, although an occasional “jackpot” or heavy fuel concentration may cause a flare up. Only under severe weather conditions do these fuels pose fire problems. Closed-canopy stands of short needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand.
=> Pine-dominated stands scattered across the training site
- **Fuel Model 9** (0.2 foot deep) Fires run through the surface litter faster than model 8 and have higher flame height. Both long-needle conifer and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are representative, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning activity.
=> The hardwood forests that occur throughout the VTS-Catoosa.

5.0 WILDLAND FIRE CONTROL

Due to its small size, the VTS-Catoosa is not subdivided into fire management zones. Wildfire in all areas outside the Cantonment (where structural firefighters would almost always be needed) will be addressed similarly with the objectives of:

- preserving firefighter and other human safety
- protecting real property
- containing all fires within the training site boundaries
- protecting significant natural and cultural resources
- suppressing or using wildland fire in accordance with military and environmental needs

5.1 Suppression and Prevention

Qualified VTS-Catoosa firefighters respond to all wildland fires on the training site. At no time will the firefighting assets be used for fighting vehicle, fuel, or structure fires without approval from the Installation Commander or the Range Officer. The Catoosa County VFD’s will be contacted through 911.

Under normal circumstances, immediate suppression will be the goal of wildland fire response on VTS-Catoosa. Occasionally, an accidental fire within an open grassland area may be allowed to burn the entirety of a range or fire unit which is due for prescribed burning in that FY.

Wildfire prevention on the VTS-Catoosa encompasses the involvement of the following activities. First, all units will be briefed prior to the start of any exercises on what the fire potential for that day will be and any restrictions on use of pyrotechnics and/or tracers. All personnel will understand how fires are reported through range control and who will be responding that day. All firebreaks will be maintained in a functional manner. The use of prescribed burning will keep fuels loads down.

5.2 Detection

All personnel using or working on VTS-Catoosa are responsible for detecting and reporting wildfires. All wildfires must be reported to Range Control.

5.3 Dispatch Procedures

VTS-Catoosa Range Control is responsible for wildland firefighting activities on the training site. There is a verbal MOA in place with the Georgia Forestry Commission, which is located within miles of the training site. Catoosa County has six volunteer fire departments (VFD's) on-site. A unified command will be set up with the VFD's and any qualified VTS-Catoosa personnel.

5.4 Communications Plan

All dispatch runs through range control; the following radio channels will be used.

- Channel 1-Repeater channel
- Channel 2- Car to Car channel (Tactical Channel)

There is cellular phone signal throughout most of VTS-Catoosa that can be used if radio traffic is heavy.

5.5 Extended Attack Procedures

If a fire cannot be contained in the first operational period, the Georgia Forestry Commission will be requested to manage the incident.

5.6 Rehabilitation Needs and Procedures

The Natural Resource Manager (NRM) for TNARNG should evaluate all burned locations and suggest any site rehabilitation measures that may be needed. Rehabilitation costs will be the responsibility of facility maintenance or ITAM budgets

5.7 Records, Reports, and Monitoring

Firefighters call in a fire report to Range Control after every fire. These fire reports should include:

- Incident name
- Date and Time
- Incident Commander
- Location

- Size in Acres
- Fuel Type
- Brief description of the events
- Documented After-Action-Review:
 - What did we set out to do (what was planned)?
 - What actually happened?
 - Why did it happen that way?
 - What should be sustained? What can be improved?

The Range Control Officer will forward copies of these wildfire reports to the Natural Resource Manager for TNARNG who is responsible for maintaining fire records for all wildfires. The NRM will conduct a basic post-burn evaluation of the site to determine the need for rehabilitation and/or further monitoring of fire impact on natural resources.

6.0 PRESCRIBED FIRE MANAGEMENT

Prescribed fire can be used as a land management tool at VTS-Catoosa. However, because of the dominance of hardwood forests throughout much of the installation, prescribed fire should be used selectively and under a limited set of circumstances. The sensitivity of hardwoods to fire necessitates that the burner be experienced in conducting prescribed burns in hardwood forest communities. In view of the preponderance of hardwoods, the following overall burning guidelines were considered in developing the prescribed fire objectives and the recommended prescribed burn program for VTS-Catoosa.

- If burning is done in hardwood stands, the fire should be done 2-6 days after good rainfall and when relative humidity is 40 to 50%.
- Prescribed burns should be directed at reducing excessive fuel loads and should consume only the top layer of litter matter when burning under any type timber.
- Open fields should be burned clean to topsoil, but not so hot as to burn the grass roots.

6.1 Objectives

The following are the primary objectives for the prescribed burning program at VTS-C which are described in more detail below:

- Reduce fuel load and wildfire threat.
- Utilize prescribed fire, as appropriate, to create and maintain conditions as required by the military mission.
- Utilize prescribed fire, as appropriate, to aid in control of invasive plant species.
- Test the use of shelterwood harvest/burn method to regenerate mixed oak-pine forest.

6.1.1 Reduce fuel load and wildfire threat. Fire management activities should concentrate on preventing, managing, and controlling wildfires that originate on the installation, as well as fires that may encroach onto the installation from neighboring properties.

The upland hardwood forests should be burned on a 5- to 7-year interval to reduce fuel loads while minimizing damage to the timber. Burns should be conducted in mid-winter (December – February) under conditions that will produce the coolest fires possible. More frequent burning could damage or

stress the trees. Forests on VTS-Catoosa will be monitored for degradation due to burning, and the burn frequency will be adjusted as necessary to maintain a healthy forest ecosystem.

6.1.2 Create and maintain conditions required by the military mission. Some aspects of the military mission demand conditions other than the closed canopy, mixed hardwood forests native to the training site. Open areas and grasslands may be effectively managed by prescribed burning to control woody species encroachment and to rejuvenate herbaceous and graminoid species. Areas subject to higher fire danger (target sites, ranges) also require more thorough control of fuel loads to minimize wildfire threat.

- The southeast-facing slope of Sand Mountain functions as an impact area and has been routinely burned on a 2-3 year rotation to maintain a clear line-of-sight and to control fuel load in an area subject to training-sparked wildfire. The open nature of the woodland and shrubland of this area is conducive to dense understory growth, which demands on-going prescribed burning to control. Prescribed burns should be conducted every two years in late spring (April) immediately prior to green-up. That timeframe will provide the best opportunity to remove the accumulated vegetative material produced by the previous growing season, while minimizing the period of time the area would be without vegetative cover and thus exposed to erosive forces.
- Grassland areas constitute less than 5% of the total installation area, with the most significant areas occurring in portions of the Cantonment Area and Training Areas 1, 2, 3, 4, and 7. For the most part, the grassland areas are restricted to the firing ranges and are crucial to providing the required line-of-sight for effective military training. Although the open areas have historically been maintained by bushhogging, use of prescribed fire could minimize the frequency of bushhogging required, while promoting the growth of the grasses and other herbaceous plants and better controlling woody successional vegetation.

The application of prescribed fire will be tested in Training Areas 1, 3, and 4 to determine if its use is practical and efficient in contributing to meeting the training needs. These areas will be burned during March and/or April 2010 (before the spring green-up of grasses and woody plants) to remove the accumulated dead organic litter produced during the prior growing season and killed by the preceding winter. The test should evaluate the compatibility of the burns with military activities and also their influence on the timing and frequency of subsequent bushhogging events for the growing season following conduct of the controlled burn. Controlled burns will be conducted at 2-year intervals for at least two cycles and the effects evaluated thereafter.

- Prescribed fire will be applied in established openings within upland hardwood forests at 3-year intervals. The installation desires additional 2- to 4-acre openings for training within the upland forests of Training Area 4 and in the lower, level areas within Training Areas 9 and 10 to better satisfy the training mission needs for bivouac training, camouflage set-ups, and dismounted infantry tactics.

The use of fire alone will not create the openings. However, once the areas are mechanically cleared, fire will be applied to eliminate the slash materials produced by the initial clearing activities, and then periodically applied to prevent the encroachment of woody plants and vines and to maintain the openings in a desired condition. Prescribed fire will be applied on at 3-year intervals and will be performed during late spring. The openings will also be bushhogged periodically during the remainder of the growing season in order to maintain the areas.

6.1.3 Aid in the control of invasive species. Prescribed fire may be used in combination with mechanical and herbicidal methods to control two of the invasive species that are problematic on VTS-C: common privet and Japanese honeysuckle. Care will be taken to avoid the use of prescribed fire in those locations where fire could stimulate the spread of other invasive plant species.

6.1.4 Regenerate native mixed oak-pine forest through shelterwood harvest/burn methods. The results of recent research indicate that low intensity backing fire in mature hardwood stands would probably have little adverse affect on the existing timber and could be used in combination with established forestry management methods to favor regeneration of oaks and oak-pine mixtures over less desirable hardwood species that are particularly sensitive to the effects of fire. Under this approach, an initial shelterwood harvest is made to remove roughly half of the basal area of the overstory in a hardwood stand near the end of its rotation. Logging slash must be kept away from the bases of the residual oaks that are not harvested to minimize damage from fires.

The initial partial harvest is followed by a 3- to 5-year waiting period during which time undesirable species such as yellow-poplar will dominate the advance regeneration pool of young trees. At the end of the waiting period, a relatively hot growing-season prescribed fire is conducted that topkills the seedlings and frees the oaks to replace the fire-sensitive species that are killed. The 3- to 5-year waiting period provides the shelterwood overstory trees that remain from the initial harvest sufficient time to recover from the shock of the logging operations before they are shocked again by the burn. If compatible with mission needs, an experimental application of this method will be applied to an appropriate stand in training area 10.

6.2 Constraints

In addition to minimizing damage to the hardwood timber, prescribed fire on VTS-C must be conducted cautiously with concern for two other major limitations on burning on the training site:

6.2.1 Protection of the waterways. Tiger Creek is designated as a “Secondary Trout Water” because it is capable of supporting trout populations throughout the year. Accordingly, the Georgia Environmental Protection Division regulations require a buffer of 50 horizontal feet be provided on each bank of the stream between the stream bank and any ground disturbing activity. Although controlled burns typically would not be considered to represent a ground disturbing activity, it is recommended that all efforts possible be made to refrain from intentionally burning within 50 feet of the top of the stream bank for both Tiger Creek and Broom Branch so as to maintain the protective vegetative buffer flanking the streams. This 50 foot buffer is also a “no-plow zone” (Figure A3.1); firebreaks should be established further than 50 feet from the stream bank as needed.

6.2.2 Protection of sensitive species. All prescribed fire applications should be conducted with maximum sensitivity to the biological requirements and behavioral patterns of species of special concern that have the potential to occur on VTS-Catoosa.

One federally listed threatened plant species (large-flowered skullcap (*Scutellaria montana*)) occurs at numerous locations across VTS-Catoosa. The occurrences of this plant are identified as “management groups” and have been marked in the field and recorded on the installation GIS. The large-flowered skullcap areas are “no plow” zones, as indicated on Figure A3.1. Vehicles are not allowed within the management groups, and earth disturbance is prohibited. Large-flowered skullcap management groups will be protected from wildfire as possible using existing firebreaks, plowed breaks at least 50 feet outside of group boundaries, or control methods that do not disturb the soil.

The impact of fire on large-flowered skullcap is relatively unknown. It is possible that a “cool” prescribed fire applied early in the spring could assist in reducing competition from other herbaceous ground cover plants and exotic invasive plant species without damaging the protected plant. The TNARNG has proposed a study to investigate the susceptibility of large-flowered skullcap to light burning. Formal consultation with the U.S. Fish and Wildlife Service must be completed prior to any experimental burning of the skullcap. Until that time, all known large-flowered skullcap occurrences will be protected from prescribed fire by a temporary fireline constructed at least 50 feet outside of the posted boundaries of the management group. Training Area 2 will not be subjected to prescribed burning due to the abundance of large-flowered skullcap. Any research activities will impact only specific management groups (see Annex 1 of the INRMP); all other groups will continue to be protected from prescribed fire, as well as from wildfire.

The endangered species gray bat (*Myotis grisescens*) is the only federally listed animal species that has been observed on VTS-C. The gray bat has been captured feeding over Tiger Creek. At this time, no caves or other suitable hibernacula have been located on the training site. Foraging habitat for this species will be protected through the SMZ system – there will be no prescribed fire within 50 feet of either side of any perennial stream on VTS-C. If a roost site is ever found, the immediate area and a sufficient buffer surrounding it will be removed from the burn program.

6.3 Smoke Management and Air Quality

The U.S. Environmental Protection Agency (EPA) monitors specific air quality parameters to determine if a particular area is in attainment with the National Ambient Air Quality Standards (NAAQS). The parameters of interest are ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead. Smoke produced by wildfires contains a number of these pollutants.

Catoosa County experiences air quality problems because of its proximity to Chattanooga, Tennessee. The EPA has designated the region surrounding Chattanooga, including Catoosa County, as a non-attainment area for ground-level ozone and particulate matter. At the time this Plan was prepared, Catoosa County failed to meet the 8-hour ozone standard which requires that the three-year average of the annual fourth-highest daily maximum 8-hour ozone concentration in an area must be less than or equal to 84 ppb. Catoosa County also failed to meet the fine particulate matter standard of 2.5 microns (PM_{2.5}). EPA has adopted two PM_{2.5} standards, known as the 24-hour and annual standards. The 24-hour standard is met in an area when, as averaged over a consecutive three-year period, at least 98 percent of the of the 24-hour average PM_{2.5} concentrations per year at each monitor are less than or equal to 65 micrograms per cubic meter of air. The annual standard is met in an area when, averaged over a consecutive three-year period, the annual PM_{2.5} average concentration is less than or equal to 15 micrograms per cubic meter of air. Fuels, paints, solvents, vegetation, and industrial combustion processes contribute to elevated ozone concentrations. Fine particulate matter (PM_{2.5}) is emitted from vehicle engine combustion and burning of various materials, including prescribed burns and wildfires.

The Georgia Environmental Protection Division (EPD) is responsible for protecting Georgia’s air quality. The EPD has developed regulations governing open burning and has issued an annual ban on open burning between May 1 and September 30. This timeframe corresponds to the traditional annual smog season in Georgia. Citizens and businesses are not allowed to burn yard and land-clearing debris during the burn ban season. Although prescribed burns are considered a type of open burning, EPD regulations exempt prescribed burning of forestlands from the EPD permitting requirements and from the burn ban. The EPD places no special requirements on the conduct of prescribed burns, other than directing burners to obtain Burn Permits from the Georgia Forestry Commission and complying with applicable local burn regulations and ordinances. Despite the open burning ban from May through September, prescribed

burning is allowed during that period provided the Georgia Forestry Commission determines that conditions are not conducive to the formation of ozone.

Although the conduct of prescribed burns are not regulated by the EPD, to avoid potential air quality compliance problems, the area to be burned should be visually inspected prior to the burn to assure that no items that are prohibited from open burning have been abandoned within the site (i.e., tires, oils, paints, vinyl siding, treated woods, etc.). Should such materials be present, they should be removed prior to burning. Further, in light of the air quality problems affecting Catoosa County, current air quality conditions near the training site will be taken into consideration when planning a prescribed burn. Information on air quality, the status of burn bans, and the existence of any other emergency measures that may be in effect to protect air quality can be obtained from the Georgia EPD by calling 404/675-6210 or at <http://www.air.dnr.state.ga.us/airpermit/openburning>. If any special air quality protection measures are in effect, the prescribed burn will be postponed until conditions improve.

Atmospheric conditions should be favorable for smoke to rise into the upper air and away from smoke-sensitive areas such as highways, airports, and urban areas. There are several smoke-sensitive areas at VTS-Catoosa that will warrant consideration during the conduct of every prescribed burn:

- Roads – Highway 2 parallels the southern boundary of VTS-Catoosa. Crossing Tiger Creek, this road passes through the floor of the lower valley within which the installation is located. To the east and west of the installation are County Roads 1286 and 224 (Salem Valley Road), respectively. Both of these roads are located on the floor of their respective valleys and downslope from the boundary of VTS-Catoosa. To the north, Rifle Range Road parallels a portion of the installation's northern boundary. These roads could be affected if atmospheric conditions, particularly in the evening following a burn, resulted in the smoke settling to the lowest elevations of their valleys. Local law enforcement personnel should be informed of an impending prescribed burn so a determination can be made as to whether an officer(s) should be assigned to the area to aid in directing traffic movement should smoke impede visibility on the roads. Consideration should also be given to placing temporary signage during prescribed burns to inform motorists of potential smoke hazard issues.
- Tiger Creek Elementary School is located less than a mile west of the training site on Highway 2.
- Scattered along the roads surrounding the VTS-Catoosa are a number of rural residences. The heaviest Wildland Urban Interface is on the west-northwest and north sides of the training site. All burn activities should consider the potential effects of smoke dispersion on the residents located within these areas.

6.4 Use of Fire Breaks

Fire breaks can consist of established roads, logging trails, cleared lanes used for the sole purpose of controlled burns, utility rights-of-way, and watercourses. Ideally, fire breaks should be capable of supporting groundcover to guard against erosion when not being used to contain fires. Prior to the conduct of a prescribed burn, the fire breaks should be inspected to ensure that they are in the proper condition to contain the fire. Following the burn, the fire breaks should be inspected again to determine if any remedial measures are needed to prevent erosion and other problems from developing.

To ensure that fire breaks are available when needed, a regular maintenance program must be pursued to maintain the fire breaks in a cleared and open condition, with a minimum of undergrowth and low hanging limbs. The best maintenance scenario exists when the fire breaks serve dual or multiple purposes

(i.e., roads, utility rights-of-way, etc.). In such situations, it is possible to distribute maintenance costs to other installation activities instead of having to assign the total costs to the prescribed fire program.

The existing road system provides the basis of the fire break network on the VTS-Catoosa. A perimeter fire break should be developed in conjunction with the security line-of-sight clearing along the boundary fence, as funds are available. Additional fire breaks will be developed to subdivide large areas (e.g., Sand Mountain in training areas 6 and 7); where possible, these fire breaks will function as and be maintained as tank trails. Temporary fire breaks will be cut, as needed, prior to prescribed burns or during wildfire control, in accordance with the no-plow zones (Figure A3.1). These fire breaks will be reclaimed and revegetated as soon as possible following the fire.

6.5 Training and Crew Requirements

Prescribed fire personnel will follow the training set forth in the PMS-310-1 (<http://www.nwcg.gov/pms/docs/docs.htm>). The following positions should be filled during operations:

- Prescribed Fire Crew Members (VTS-Catoosa personnel with FFT2 training)
- Prescribed Fire Burn Boss (1, 2, or 3) depending on complexity (GFC Forester)

6.6 Burn Plans

A site specific burn plan is developed for each prescribed burn on the VTS-Catoosa, containing the elements listed below. The prescribed burn plan format for the TNARNG is located in Section 7.3.

- Burn Objectives
- Acceptable weather and fuel moisture parameters – Spot and General Forecast
- Required personnel and equipment resources
- Burn area map
- Smoke management plan
- Safety considerations
- Pre-burn authorization/notification checklist
- Coordination procedures
- Contingency Plan
- Evaluation and Monitoring plan

6.7 Notification

Agencies and individuals who may play a role in the prescribed burn or may be affected by the burn will be notified prior to the ignition of a prescribed fire.

- The Georgia Forestry Commission, Catoosa County office, will be contacted well in advance to arrange the assistance of a forester to function as a burn boss. In addition, a burn permit will be requested from the GFC county office: 706-935-3162.
- The Catoosa County Volunteer Fire Department will be contacted at 706-935-2001 or fire_fight1070@hotmail.com
- Local law enforcement agencies will be notified so that they can plan for smoke-induced traffic duties, as needed.
 - Catoosa County Sheriff Department 706-935-2323
 - Ringgold Police Department 706-935-3061
 - Georgia State Patrol 706-271-2825

- Temporary signs may be placed along Highway 2 to inform motorists of potential visibility hazards from smoke resulting from the burn.
- A news release may be utilized to inform the public if the planned burn is extensive or located close to the property line.

6.8 Contingencies for an Escaped Burn

Prior to any prescribed burn, a small test fire will be ignited to confirm that the fire will behave in the desired manner. However, if after conducting a successful test fire and igniting the main burn any of the following conditions develop, burning will be stopped and the fire will be plowed under:

- Fire behavior is erratic
- Fire is difficult to control
- Wind shifts or other unforeseen weather conditions develop
- Weather conditions move outside the prescription range
- Smoke is not dispersing as predicted
- Public road or other sensitive area becomes smoked-in
- Burn does not comply with all laws, regulations, and standards
- Large fuels are igniting and burning
- There are not enough personnel to mop-up before dark and the likelihood exists that smoke will settle in a smoke-sensitive area overnight

Under any of these conditions, Range Control will be notified that contingency actions are being taken. If the contingency actions are successful at bringing the project back within the scope of the Prescribed Fire Plan, the project may continue. If contingency actions are not successful by the end of the next burning period, then the prescribed fire will be converted to a wildfire, and TNARNG will request assistance from the Georgia Forestry Commission.

6.9 Monitoring

Three types of post fire monitoring should be conducted to determine if fire management activities are reaching the stated objectives: post operational report, post fire effects monitoring, and burn program objective monitoring.

6.9.1 Post operational reports are an important written record of the burn, enabling future staff to learn from previous activities. They will be completed during and immediately following a prescribed fire activity to address the effectiveness of the overall burn process – the plan, implementation, personnel, and effectiveness at meeting objectives. The post-operational report will include:

- Burn unit information
- Burn dates
- Forecasted weather conditions
- On-site burn day weather conditions
- Crew assignments
- Burn schedule
- Fire narrative
- Immediate post burn effects
- Comparison of post burn effects with unit fire management objective
- Notes and recommendations.

Within this report, several questions should be answered:

- Were the fuel conditions within plan guidelines and were guidelines appropriate?
- Did the burn stay within planned parameters?
- Were the fire lines installed as planned and were they adequate?
- Was the equipment in the plan available and appropriate?
- Did the equipment work?
- Was the crew number, training, and assignments appropriate?
- Did the crew understand what they were doing?
- Were the rate of spread and flame length as predicted in the plan?
- Were public interactions satisfactory?

To answer some of these questions, during the burn, a designated crewmember should be assigned to estimate behavior, establish benchmarks (height and distance), record rate of spread for back, flank, and head fires, record flame heights for back, flank, and head fires stratify for fuel type and topography. Post fire estimates of fire intensity (scorch height and class, char, understory burn severity, and litter consumption), should be recorded after each burn to determine if unit-specific fire management objectives were met. Permanent transects with photo points may be established to monitor and measure tree densities and plant composition. Observations of rare species reaction to fire management will be noted.

6.9.2 Fire effects monitoring will be conducted via a post-burn evaluation of the physical effects of the fire. This monitoring should include data collected during and immediately following the fire, as well as during the first growing season following the fire. Parameters to be evaluated will include tree mortality, midstory kill, pine bark beetle or other pest infestation, erosion problems, and whether overall burn objectives were met. These evaluations are completed and filed with the burn plan.

6.9.3 Burn program objective monitoring will be conducted over a longer time scale in conjunction with the review of INRMP objectives and achievements.

6.10 Prescriptions

The prescriptions below describe the preferred environmental conditions for a burn. Some deviation from these prescriptions in response to specific objectives will be possible on the recommendation of an experienced burn boss, such as the GFC District Forester. The general prescription for prescribed burning in the open grassland areas of VTS-Catoosa is presented in Table A3.3, and the prescription for burning the hardwood forest habitat of the training site is presented in Table A3.4.

Table A3.3. Prescription for controlled burns in grasslands, fields, and forest openings.

Stand Description:	Overstory	None to scattered trees
	Understory	Grasses and low shrubs
	Fuels	1, 3, 6
	Topography	Gentle rolling hills to flat
Weather Range	Surface wind (dir/speed)	North, West, South at 5 – 8 mph
	Transport wind (dir/speed)	Greater than 5 mph
	Mixing height	Greater than 500 m
	Stagnation index	0 – 3 daytime
	Relative humidity	35 – 55 %
	Temperature	High 70°F
		Low 30°F
	Start time	9:30 am (or as soon as permit allows)

Table A3.4. Prescription for controlled burns in upland hardwoods.

Stand Description:	Overstory	Closed canopy mature hardwood stands
	Understory	Open, small areas of brush
	Fuels	8, 9
	Topography	Gentle rolling hills
Weather Range	Surface wind (dir/speed)	North, West, South at 5 – 10 mph
	Transport wind (dir/speed)	Greater than 5 mph
	Mixing height	Greater than 500 m
	Stagnation index	0 – 3 daytime
	Relative humidity	40 – 55 %
	Temperature	High 70°F Low 30°F
	Start time	9:30 am (or as soon as permit allows)

6.11 Schedule

The planned prescribed fire management actions for VTS-Catoosa are presented in Table A3.5. Recommended fire frequency is depicted for all burn units in Figure A3.3. The prescribed fire management measures and their recommended frequency of occurrence are based on the objectives identified in Section 6.1 and correlate to the forest management prescriptions described in the forest management plan (Annex 2 of the INRMP).

The open grasslands of the small weapons ranges and the tank range will be subject to a 2 year fire rotation. Forest stands that are dominated by pine species will be burned on a 3 year rotation, while hardwood stands will only be burned approximately every 6 years. Table A3.6 is subject to minor changes because certain stands will not be burned until a thinning harvest can be completed. Areas with a substantial large-flowered skullcap presence (e.g., most of training area 2) will not be subject to prescribed fire at this time. Select skullcap management groups will be subject to light burning for the purposes of investigating fire impact on this protected species in accordance with the research project discussed in Annex 1 of the INRMP, subject to USFWS approval.

6.12 Test application of shelterwood-burn method to regenerate mixed oak-pine forest

Over 90% of the forest occurring on VTS-Catoosa is classified as hardwood forest. Traditionally, fire has not been used as a management tool in hardwood stands due to the perceived danger to timber quality and value. Recent research, however, has indicated that frequent burning may create an environment in which oaks can have a competitive advantage over other hardwood species. The shelterwood-burn method described by Van Lear et al. (2000) will be applied to a hardwood stand in training area 10 to test whether this technique will encourage greater oak regeneration in place of the dominant yellow poplar. A small stand will be subject to a shelterwood harvest, followed by a prescribed burn, in accordance with the forestland burn prescription, 3-5 years after the timber is cut. When the exact location and timing of this project is determined, Table A3.5 and Figure A3.3 will be modified to include the proposed burn. For more information, see the Forest Management Plan in Annex 2 of the INRMP.

Table A3.5: Burn schedule.

Year	Burn Units						Total Acreage
	2 yr rotation		3 yr rotation		6 yr rotation		
2012	KD Rge (C-3) 4-1	19 37	3-2	41			97
2013	M203 Rge(1-2) 3-8 4-7 7-1	18 26 21 4	7-3 ^*	105			174
2014	KD Range 4-1	19 37	3-3 3-10	21 31	6-2	63	171
2015	M203 range 3-8 4-7 7-1	18 26 21 4	3-2	41	8-1 ^	24	134
2016	KD Range 4-1	19 37	5-2 ^ 7-3 ^*	43 105	6-3 * 7-5 ^*	26 26	256
2017	M203 range 3-8 4-7 7-1	18 26 21 4	3-3 3-10	21 31	5-1 *	83	204
2018	KD Range 4-1	19 37	C-6 3-1 3-2	2 7 41	5-3 * 6-1 * 7-4 ^	18 38 14	176
2019	M203 range 3-8 4-7 7-1	18 26 21 4	5-2 ^ 7-3 ^*	43 105	C-2 ^	21	238
2020	KD Range 4-1	19 37	3-3 3-10	21 31	6-2	63	171
2021	M203 range 3-8 4-7 7-1	18 26 21 4	C-6 3-1 3-2 3-6	2 4 41 51	4-2 8-1 ^	61 24	252
2022	KD Range 4-1	19 37	3-4 3-7 5-2 ^ 7-3 ^*	24 32 43 105	4-4 ^ 4-5	16 11	287

* Significant large-flowered skullcap management group will be protected from fire.

^ Small large-flowered skullcap management group will be subjected to fire for purposes of research.

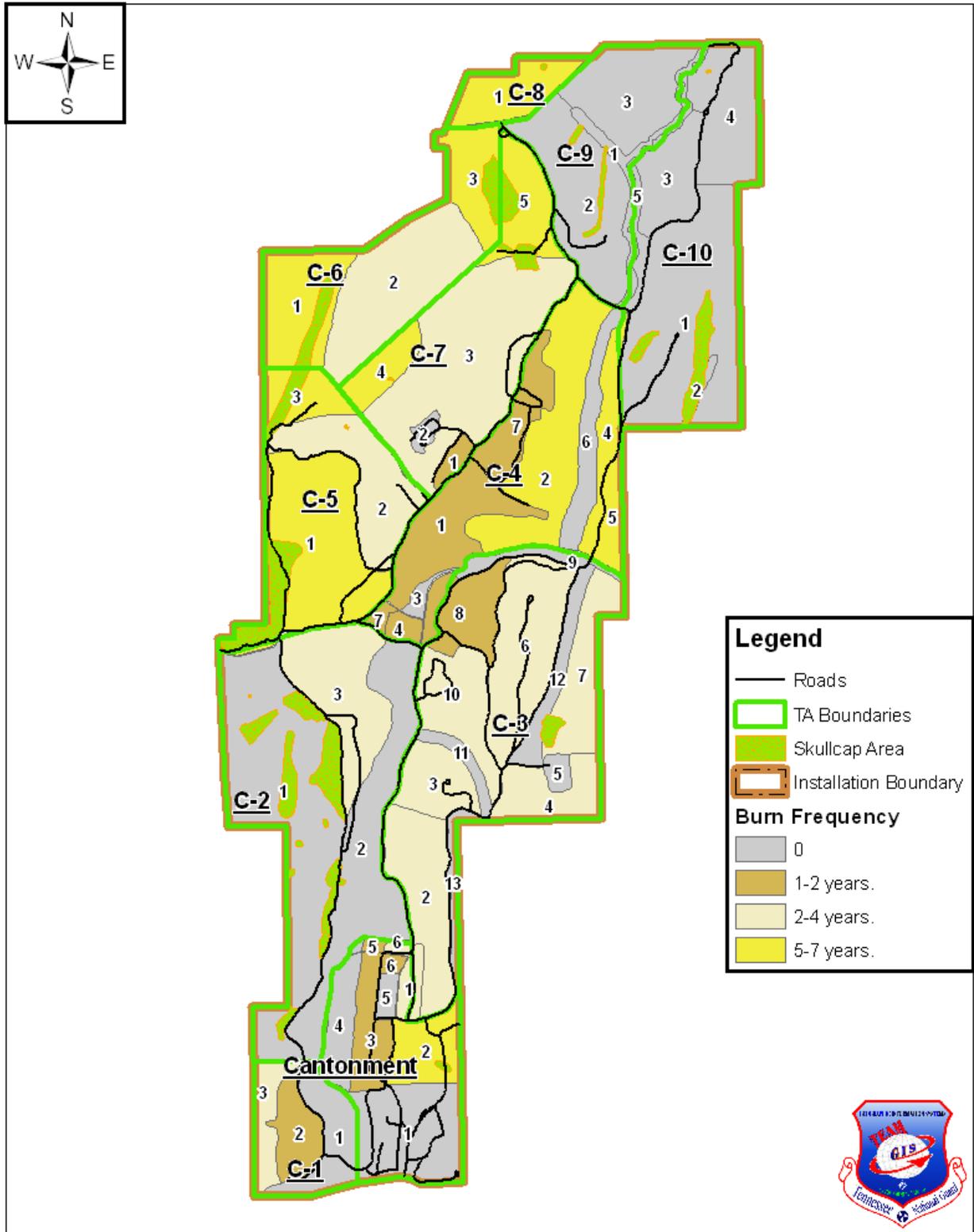


Figure A3.3: Prescribed burn frequency for burn units on VTS-Catoosa.

7.0 ATTACHMENTS

7.1 Reference Materials

Department of Army

Memorandum 4 Sep 2002, Army Wildland Fire Policy Guidance.
2 Sep 2005, Sustainable Range/Installation Environmental Activities Matrix.

Interagency Prescribed Fire – Planning and Implementation Procedures Guide (July 2008)

Available at http://www.nifc.gov/fire_policy/rx/rxfireguide.pdf

NFPA 1977: Standard on Protective Clothing and Equipment for Wildland Fire Fighting (2005 edition)

NWCG Publications – available at <http://www.nwcg.gov/pms/pms.htm>

PMS 307, Work Capacity Test Administrator's Guide (March 2003)
PMS 310-1, Wildland Fire Qualification System Guide (January 2006)
PMS 410-1, Fireline Handbook (March 2004)
PMS 410-1, Appendix B, Fire Behavior (April 2006)
PMS 424, Prescribed Fire Complexity Rating System Guide (January 2004)
PM 461, Incident Response Pocket Guide (January 2006)

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann, and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. USDA Forest Service, Rocky Mountain Research Station.

Thompson Engineering, Forest Management Group, and Aerostar Environmental Services. 2006. Volunteer Training Site – Catoosa Forest Management Plan. Prepared for the TNARNG.

TRC Garrow and Science Applications International Corporation. 2002. Integrated Cultural Resources Management Plan and Environmental Assessment of the Implementation of the Plan, Catoosa Training Center, TNARNG, 2002-2006. Prepared for the TNARNG.

Van Lear, D.H., P.H. Brose, and P.D. Keyser. 2000. Using prescribed fire to regenerate oaks. In: Workshop Proceedings of Fire, People, and the Central Hardwoods Landscape.

Weather Information

Spot Weather Forecast, <http://spot.nws.noaa.gov/cgi-bin/spot/spotmon?site=ffc>
General Forecast, <http://www.srh.noaa.gov/ffc/html/firewx.shtml>
Georgia Fire Weather, <http://weather.gfc.state.ga.us>

7.2 Burn Plan Format

TNARNG PRESCRIBED FIRE PLAN

Facility: _____

Training Area: _____ Burn Unit Number/Name: _____

Fuel Type: _____ Acres: _____

Burn Permit #: _____

Fire Planner(s):

Name: _____

Title: _____

Signature: _____ Date: _____

Name: _____

Title: _____

Signature: _____ Date: _____

Burn Boss:

Name: _____

Title: _____

Signature: _____ Date: _____

Complexity Rating: _____ (Low, Moderate, High)

Approved By:

Signature: _____ Date: _____

A. Pre-Burn Go/No Go Checklist

Has the area (inside and outside the unit) experience unusual drought conditions or does it contain above-normal fuel loadings which were not considered in the prescription development? If YES, go to question below. If NO, continue with Section B.	YES	NO
If YES, have appropriate changes been made to plans for ignition, holding, mop-up, and patrol? If YES, continue with Section B. If NO, stop and consult Fire Manager.		

B. Prior to Crew Briefing:

- Fire Unit is as described in plan
- Copy of burn plan is on site
- Certified Burn Boss present; Permit obtained (#_____)
- Required number personnel present, with required PPE
- Weather forecast obtained & within prescription; Long-range forecast checked for chance of severe weather
- Official & neighbor notifications complete
- Required equipment for holding, weather monitoring, ignition, & suppression is on-site & functioning
- Crew has reviewed equipment
- Planned ignition & containment methods are appropriate for current & predicted conditions
- Planned contingencies & mop-ups are appropriate for current & predicted conditions
- List of emergency phone numbers are in each vehicle
- Off-site contingency resources are operational and available

C. Crew Briefing:

- Prescribed Fire Objectives
- Burn Unit size & boundaries
- Burn unit hazards & safety issues
- Expected weather & fire behavior
- Organization of crew & assignments
- Methods of ignition, holding, mop-up, communications
- Contact with the public; Traffic concerns
- Safety & medical plan
- Location of back-up equipment, supplies, & water
- Contingencies for escaped prescribed fire
- Contingencies for medical emergency

D. Prior to Ignition:

- On-site weather and fuel conditions are within prescription & consistent with forecast
- Test burn conducted; fire & smoke behavior within prescribed parameters.

Burn Boss: _____

Date: _____

1. Burn Objectives

2. Location and Physical Description (Attach map)

A. Site_____ **Training Area**_____

B. Size_____

C. Topography / Slope_____

D. Project Boundary_____

E. Complexity_____

3. Vegetation / Fuels Description

A. On-site Fuels

Vegetation Types	Fuel Models	% of Unit Area	% Slope	Aspect

B. Adjacent Fuels

Vegetation Types	Fuel Models	% of Unit Area	% Slope	Aspect

4. Description of Unique Features

A. Natural:_____

B. Cultural:_____

5. Special considerations (fences, power poles, ...):

6. Prescription

A. Environmental Prescription: _____

B. Fire Behavior Prescription: _____

7. Fuel and Weather Prescription (acceptable ranges)

Fuel Parameters	Prescription MIN/MAX	Forecast* MIN/MAX	Test Fire	Rx Burn
1-Hour Fuel Moisture (%)				
10-Hour Fuel Moisture (%)				
100-Hour Fuel Moisture (%)				
Live Fuel Moisture (%)				
Other (e.g., KBDI, live/dead ratio,...)				
Weather Parameters				
Air Temperature (°F)				
Relative Humidity (%)				
Days Since Rain				
20 ft Wind Speed (mph)				
Wind Direction(s)				
Midflame Windspeed (mph)				
Atmospheric Mixing Height (ft)				
Atmospheric Stability				
Rate of Spread				
Flame Length (ft)				
Scorch Height (ft)				
Probability of Ignition				

*Attach weather forecast.

8. Scheduling

A. Ignition Timeframe / Season(s): _____

B. Projected Duration: _____

C. Constraints: _____

9. Pre-burn Considerations and Weather

A. On-site Considerations: _____

B. Off-site Considerations: _____

C. Method & Frequency for Obtaining Weather and Smoke Management Information:

D. Notifications (List all agencies and neighbors):

Name	Date	Method	Contact Information
Public		Press Release	
Public		Road Signs	
Georgia Forestry Commission		Telephone	706-935-3162
Catoosa County VFD		Telephone	706-935-2001
Catoosa County Sheriff		Telephone	706-935-2323
Ringgold Police Department		Telephone	706-271-2825
Georgia State Patrol		Telephone	706-271-2825

10. Ignition Plan

A. Firing Methods (including Techniques, Sequences, and Patterns): _____

B. Devices: _____

C. Ignition Staffing: _____

11. Holding Plan

A. General Procedures: _____

B. Critical Holding Points: _____

C. Minimum Organization or Capabilities Needed: _____

12. Contingency Plan

A. Trigger Points: _____

B. Actions Needed: _____

C. Additional Resources and Maximum Response Time: _____

D. Secondary Control Lines: _____

E. Backup Water Supply: _____

13. Crew Organization

- **Burn Boss:**
- **Ignition Boss:**
 - **Ignition:**
 - **Ignition:**
- **Holding Boss:**
 - **Holding:**
 - **Holding:**
 - **Holding:**
- **Monitor:**

14. Equipment

Equipment Item	Quantity	Source

15. Fire Details

Ignition Time _____ **Fire Declared Out** _____

Narrative _____

7.3 Post Burn Evaluation

1. Site _____ **Training Area** _____

Burn Date _____

Evaluation Date _____ (immediately following burn)

Re-evaluation Date _____ (follow-up as needed)

2. Amount litter left (immediately after burn) _____ **(inches)**

3. Understory vegetation consumed _____ **(%)**

4. Scorch: % of Area with Crown Scorch

<1/3 _____ **1/3 – 2/3** _____ **2/3+** _____

5. Any spotting / jumpovers? (immediately after burn)

6. Tree Damage (insects, disease, mortality)? _____

7. Understory kill of undesired vegetation (% top-killed) _____

8. Any smoke management violations? (immediately after burn)

9. Any escapes? (immediately after burn)

10. Any complaints? (immediately after burn)

11. Adverse effects?

12. Any restoration needed?

13. Were objectives met (results)?

Immediate Evaluation By: _____ **Date:** _____

Recommendations for future evaluation:

Follow-up Evaluation By: _____ **Date:** _____

7.4 After-Action Review

What did we set out to do? _____

What actually happened? _____

Why did it happen? _____

What are we going to do next time? _____

Which activities should be sustained? _____

What can be improved? _____

Annex 4

INVASIVE PEST PLANT CONTROL

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1.0 INTRODUCTION

1.1 Background

Like most regions of the world today, the VTS-C suffers from infestations of invasive exotic pest plants. The primary problem species on the training site are privet, Japanese honeysuckle, multiflora rose, wintercreeper, princess tree, Nepalese browntop, sericea lespedeza, mimosa, and tree-of-heaven. These problem species are found throughout the training site, but the most significant problems generally occur along the banks of Tiger Creek and its tributaries. Figure A4.1 shows locations of small invasive occurrences; the extensive presence of privet along the creek banks is not depicted. The infestation information included here is based on the 2006 invasive plant species survey by Dynamic Solutions.

This annex provides more detailed information on each of these problem species, including recommended methods of control. It also outlines the plan of attack for controlling these species on the training site, to be implemented as funding allows. It is important to note that complete eradication of widespread invasive plant species is nearly impossible and is cost-prohibitive. Small, confined occurrences may be completely eliminated by prompt, decisive action; however, with well-established populations (e.g., the privet on VTS-C) the only feasible goal is to contain and thin the infestation and hopefully prevent it from spreading further. Both eradication and control will take multiple years of repeated treatment to achieve.

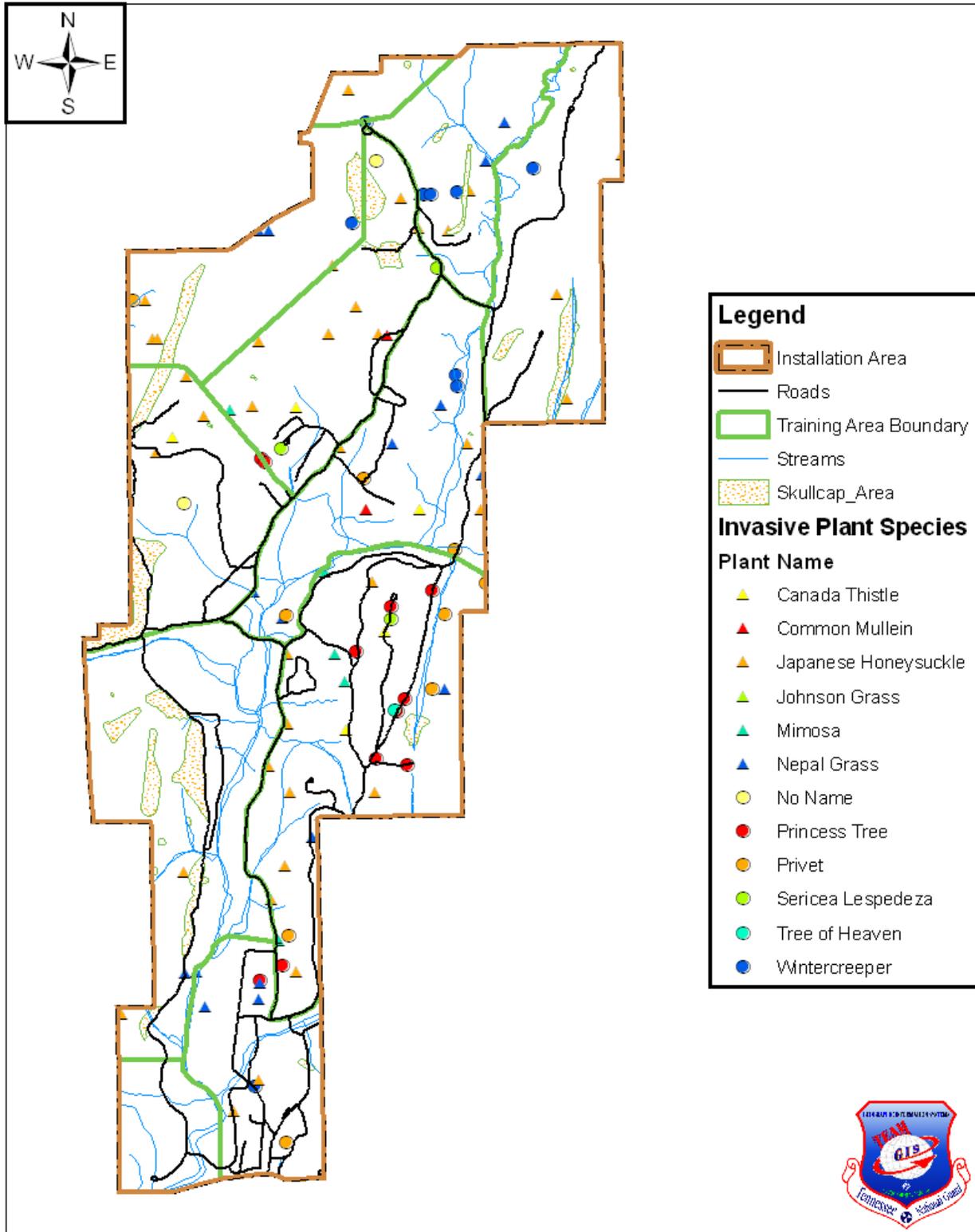


Figure A4.1: Invasive exotic plant occurrences on VTS-Catoosa (small groups and individual plants). From Dynamic Solutions (2006).

The control plan on VTS-C will be a two-tiered approach: first, small occurrences (tree-of-heaven, mimosa, princess tree, wintercreeper, woolly mullein) will be identified and treated on a training area-by-training area basis, and second, the larger infestations (privet, honeysuckle, Nepalese browntop) will be treated on a species basis in manageable sections. The spatial occurrence of the invasive species is described in more detail below. Control methods will typically be a combination of mechanical (cutting, mowing) and chemical (herbicide) and will follow US Forest Service and TN Exotic Pest Plant Council (TN-EPPC) control recommendations (Miller 2003; TN-EPPC 1997).

The presence of the federally listed large-flowered skullcap (*Scutellaria montana*) requires extra caution with the use of herbicides. The 26 management groups in which it occurs are located throughout the training site, though typically not in the areas of heaviest non-native infestation. Care must be taken at all times to ensure this protected species is not harmed by the process of invasive pest plant control. Restrictions on the use of chemicals around the large-flowered skullcap groups are detailed in Section 2.3.

1.2 Objectives

The objective of this plan is to provide effective control of invasive exotic pest plants on the VTS-C, limiting the areas infected by exotics and allowing the native vegetation communities to reestablish themselves.

Important guidelines for the control program:

- The large-flowered skullcap should not be stressed or damaged during any phase of these control efforts;
- Eradication and suppression efforts will be coordinated and scheduled to avoid interference with training events;
- There should be no detrimental environmental impact resulting from this control effort.

1.3 Species Targeted for Suppression

Invasive plant species are successful invaders because they generally grow rapidly, create large amounts of seed, and are thus positioned ecologically to exploit the greater amount of light found on the edges of man-made and natural openings as well as all disturbed areas. The roads and openings of the forested and woodland portion of the VTS-C have provided many places for invasive plant species to seed into and dominate.

The Georgia Exotic Pest Plant Council (GA-EPPC) has developed a List of Non-native Invasive Plants in Georgia (GA-EPPC 2006). This list categorizes plants that pose threats to natural areas in Georgia, but does not include plants that are only problems in agricultural or pastoral systems. The list groups exotic species as:

- Category 1: exotic plants that are a serious problem in Georgia natural areas because they are extensively invading native plant communities and displacing native species;
- Category 1 Alert: exotic plants that are not yet a serious problem but have significant potential to become such;
- Category 2: exotic plants that are a moderate problem through invading native plant communities and displacing native species to a lesser degree than category 1 species;
- Category 3: exotic plants that are a minor problem in Georgia or are not yet known to be a problem in Georgia but are a problem in adjacent states; or
- Category 4: exotic plants that are naturalized in Georgia and generally do not pose a problem in natural areas; also, species that are potentially invasive but in need of further information to make a determination.

The classification of each invasive plant species observed at VTS-C is noted in the list below. The Tennessee Exotic Pest Plant Council (TN-EPPC) has also developed a list of invasive plants and ranked them according to the threat that they pose. The TN-EPPC ranking is included in the table below for consistency with other TNARNG training sites. TN-EPPC recommends that Rank 1 and Rank 2 species be controlled and managed in the early stages of detection when possible.

Table A4.1 is a summary of the invasive species observed at the VTS-C site during the 2006 invasive species survey. It is organized alphabetically by species observed. Abundance of the invasive species in the aggregation was coded Dominant, greater than 50%, Present, 10 to 50 %, and Sparse, less than 10%.

Table A4.1: Invasive exotic plant species observed on VTS-Catoosa (from Dynamic Solutions 2006).

Scientific Name	Common Name	GA-EPPC Category	TN-EPPC Ranking	Abundance at VTS-C
<i>Ailanthus altissima</i>	tree of heaven	1	Rank 1: Severe Threat	Sparse with an isolated location in TA-3
<i>Albizia julibrissin</i>	mimosa	1	Rank 1: Severe Threat	Present in clusters in TA-2, 3, 7, 9, and the Cantonment.
<i>Cirsium arvense</i>	Canada thistle	4	Rank 2: Significant Threat	Present along edges and in openings in TA-3, 4, 5, 7
<i>Euonymus fortunei</i>	wintercreeper	3	Rank 1: Severe Threat	Sparse at several isolated location in TA-5, 9, 10, and the Cantonment. Where observed generally formed 1/3 acre and larger stands dominated by wintercreeper.
<i>Lespedeza cuneata</i>	sericea lespedeza	1	Rank 1: Severe Threat	Present in roads road edges, and openings in TA-2, 3, 5, 7, and the Cantonment
<i>Ligustrum sinense &/or Ligustrum vulgare</i>	privet	1	Rank 1: Severe Threat	Present to dominant in every training area and the Cantonment. Privet population increases as you move south along Broom Branch to Tiger Creek with dense stand along the banks and flood plain of the southern part of Tiger Creek in TA-1, 2, 3, and the Cantonment.
<i>Lonicera japonica</i>	Japanese honeysuckle	1	Rank 1: Severe Threat	Present pervasively in all training areas. Dominant in sunny edges of roads and openings.
<i>Microstegium vimineum</i>	Nepalese browntop; microstegium	1	Rank 1: Severe Threat	Present in all low lying and moist shaded areas in all training areas and the Cantonment.
<i>Paulownia tomentosa</i>	princess tree, royal paulownia	1	Rank 1: Severe Threat	Sparse at isolated locations in TA-3, 7, and the Cantonment.
<i>Rosa multiflora</i>	multiflora rose	1	Rank 1: Severe Threat	Sparsely present in TA-2, 3, 4, and the Cantonment. Multiflora rose is a part of the invasives mix, but generally a minor one at VTS-C.
<i>Sorghum halepense</i>	Johnson Grass	3	Rank 1: Severe Threat	Sparsely present along roads and in openings in TA-1, 2, 3, 5, 9, and 10.
<i>Verbascum thapsus</i>	wooly mullein	4	Rank 2: Significant Threat	Isolated and sparse in TA-7 near tank target pits and one location in TA-4.

2.0 CONTROL PLAN

2.1 Small Infestations

The several small occurrences of tree-of-heaven, mimosa, princess tree, wintercreeper, and wooly mullein will be treated first, with the goal of completely eradicating these species on VTS-C.

Tree-of-heaven and mimosa will be treated at the same time. A crew will travel the road system and trails of the training site during the late summer or mid-winter and treat all individuals of these species that they encounter. Tree-of-heaven has previously been found only in training area 3, but mimosa occurs in clusters in training areas 2, 3, 7, and 9 as well as the cantonment. Large trees will be stem-injected or felled and the stump treated with Garlon 3A. Saplings will be basal-bark treated with Garlon 4. The following summer, a crew will return to treat all sprouts and seedling with a foliar spray of Garlon 4.

Princess tree occurrences may be treated at the same time as the previous two trees. However, the recommended herbicides differ for this species, and so the crew will have to maintain an additional herbicide preparation or else mark the trees and return at another time to treat the princess tree. This species has been noted in training areas 3 and 7 and in the cantonment. Large trees will be stem injected or cut-stump treated with a glyphosate herbicide. Saplings will be basal bark treated with Garlon 4. The following summer, the crew will treat all sprouts and seedlings with a foliar spray of Garlon 4.

Wintercreeper occurs in several patches in the cantonment and training areas 5, 9, and 10. Two of the patches are located very close to large-flowered skullcap groups. The wintercreeper will be treated in late summer to fall with a foliar application of Garlon 4. This will be repeated annually for several years. In August, prior to spraying, the patch should be inspected and all vertical climbing stems and any visible flowering stems will be cut to minimize fruit development.

Wooly mullein was found in a few places in training areas 4 and 7. It will be treated by hand pulling in May-June. Plants will be bagged for disposal, and the areas in which it is occurring will be sown with an appropriate native grass and forb seed mixture. These areas will be scouted and treated annually for several years until the seed bank is exhausted.

2.2 Extensive Infestations

A number of invasive species have become thoroughly established on the VTS-C and are unlikely to ever be completely removed. The goal of this program is to bring those infestations under control, reducing the numbers of exotic plants, rehabilitating native communities that have been affected, and limiting further spread of the invasives. The principle species are privet, Japanese honeysuckle, Nepalese browntop and an open-areas conglomeration of sericea lespedeza, Canada thistle, and Johnson grass.

For each of these species, the control effort will be intensive and require several years of effort. It would be most efficient to have a firm commitment of manpower and funding for at least 3 years' work prior to initiating any control efforts. A single year of effort without follow-up will have little long-term impact on the invasive species and will represent wasted effort and money.

In addition to the control efforts, it will be necessary to be prepared with a plan for reestablishing native vegetation once the invasives have been cleared. Native species restoration plans will be developed individually for areas requiring such. Restoration efforts will utilize all native species and will involve a minimum of soil disturbance.

2.2.1 Privet

Privet occurs in every training area on VTS-C and the cantonment. It is generally most common along the creek banks and becomes more dense as you move south through the training site. Control, therefore, will begin at the northern end of the site. Roadsides, forest openings, and the Broom Branch shoreline will be treated. Individuals less than 5" dbh will be treated with a basal bark spray of Garlon 4. Larger stems will be cut and immediately stump treated with Arsenal AC. This process will be repeated in manageable chunks moving south to take in Tiger Creek and the remainder of the training site. This effort should be conducted in winter. The following late summer, a return visit will be made to treated areas to foliar spray sprouts with Arsenal.

The same program will need to be repeated each winter for several years.

If there are areas of infestation in which little to no desirable vegetation remains, at least 50 feet beyond any creek banks and more than 50 feet from any skullcap management group boundary, a brush cutter or similar equipment may be used to mow down the privet while leaving any other trees and shrubs standing, as possible. This should be conducted in summer when the ground is dry but before seed set. This will be followed up in the fall with broadcast foliar application of Arsenal AC to the sprouts.

2.2.2 Japanese honeysuckle

Japanese honeysuckle is also present throughout the training site. It is typically less overpowering on VTS-C than the privet, but honeysuckle is the species most commonly threatening large-flowered skullcap groups. The first stage of control will be to treat infestations along roads and near skullcap groups. Foliar spray with Garlon 3A will be conducted in the late fall. Care will be taken when spraying near skullcap management groups to ensure that drift is minimized and directed away from the protected species. Areas will be checked the following summer to determine the need for retreatment. Additional infestations of honeysuckle that are documented during the course of other work will be treated the following winter.

2.2.3 Nepalese browntop

Nepalese browntop occurs in low-lying and moist, shaded areas throughout VTS-C. Management will be concentrated along the creeks and drainages, beginning, as with privet, at the northern end of the training site where conditions are somewhat less impacted.

Treatment will consist of foliar application of herbicide: glyphosate where there is little desirable vegetation mixed with the Nepalese browntop. Vantage or Select 2EC (grass-specific post emergent herbicide) will be applied in locations where native herbaceous vegetation is still present. Treatment will be made in early June, with a second application in late July to ensure complete kill. Care will be taken to avoid drift onto the waterways. Infestations on shorelines will be treated with a glyphosate herbicide labeled for aquatic use. Sites will be inspected the following June for new germination. Complete removal will require several years to exhaust the seedbank.

Areas that are accessible and also sufficiently dry may be treated without chemicals by mowing in August. This method requires careful timing to remove the flowers before seed set but late enough to negate the possibility of new flower development. This method will also require several years of repeat treatments to exhaust the seedbank.

Areas that were heavily infested with Nepalese browntop will need to be reseeded or planted with native species to minimize the available space for re-invasion.

2.2.4 Open areas complex

Most open fields and roadsides around the training site are infested with some combination of sericea lespedeza, Johnson grass, and Canada thistle. Control of these species will be undertaken in combination with an effort to restore native grasses where feasible on the training site. Small arms ranges and lawns are typically not appropriate locations for native warm season grasses, due to their tall growth form. Such areas will be maintained with the existing mixtures of fescue, bermudagrass, crabgrass, and similar species. Canada thistle will be spot treated with Garlon 3A when found in these areas. Johnsongrass clumps will be spot treated with glyphosate or Arsenal when found.

Less manicured open areas such as the tank range impact area may be treated for invasive pest plants in preparation for reseeding native warm season grasses (NWSG). The standard site preparation for conversion to NWSG involves a combination of herbicide treatments, mowing, and burning prior to sowing the NWSG seed. Glyphosate or triclopyr herbicides in conjunction with Plateau herbicide are used to control fescue and should control the other exotic species in these areas. Establishment of native grasses requires several years of effort before a good stand is present. Repeated area treatments and spot treatments may be required during this time to control the exotic plant species.

2.3 Environmental Precautions

As noted above, the federally protected large-flowered skullcap occurs in 26 management groups scattered around the training site. This perennial wildflower begins shoot growth in March, blooms in May-June and maintains its aboveground vegetation until late summer. Herbicide use during this active growing season will be carefully controlled in the vicinity of known large-flowered skullcap groups: only stem treatments (basal bark, stem-injection, or cut stump) of invasive plants will be allowed within 50 feet of a skullcap group from March to September. Foliar applications of herbicides within 50 feet of a group may only be made during the fall and winter to minimize the risk of spray reaching an active large-flowered skullcap. No soil active herbicides will be used at anytime within 50 feet of a large-flowered skullcap group.

VTS-C also contains significant waterways in the trout streams Tiger Creek, Broom Branch, and Catoosa Springs Branch. Protecting stream habitat from both chemical pollutants and sedimentation is of utmost importance.

- There will be no herbicide applications to water unless the chemical is labeled for aquatic use
- Within 25 feet of water, only stem treatments will be used to minimize risk of drift
- Foliar treatments will be avoided in any situation where the spray would be carried toward water
- Where possible, dead vegetation will be left standing on the creek banks
- There will be no stump removal on creek banks
- Where creek banks are more than 50% invasive species, revegetation and bank stabilization will be conducted immediately following IPP control

All label requirements will be followed, as will state and DoD pesticide regulations. Only state or DoD certified applicators will apply herbicides for IPP control. Non-certified personnel may help with non-chemical aspects of control, but will be briefed on pesticide safety prior to initiating work.

2.4 Personal Protective Equipment (PPE)

Personnel who handle and/or apply pesticides are required to wear personal protective equipment and clothing designated on the herbicide label IAW the Federal Insecticide, Fungicide, and Rodenticide Act (40 CFR 162), Occupational Safety and Health Standards (29 CFR 1910), and DOD Directive 4150.7.

Such protective devices include masks, respirators, gloves, goggles, and protective clothing necessary for the pest management operations being conducted and the pesticides used. All personnel involved in pesticide operations will utilize, at minimum, the PPE required by the product label.

2.5 Treatment Methods

2.5.1 Cut stump

The cut stump method is a method used for trees and woody shrubs greater than 5" dbh. The tree is cut down, leaving a stump 2 to 6 inches high (excessive stump height can limit the effectiveness of this method). The appropriate herbicide solution is applied to the outer 20% of the freshly cut surface within a few minutes, if possible. (After 2 hours, a basal bark treatment with penetrant will have to be applied.) All stems coming from the base or roots of the plant should be cut and treated at the same time.

The cut stump method is most effective when the plant is actively growing but not during the first flush of spring growth. Therefore, cut stump treatments may be initiated in May and continue through the summer. Cut stump can also be applied during the dormant season.

2.5.2 Stem injection

Stem injection is another method for use on large trees and shrubs. Incision cuts are made downward into the stem, and herbicide is applied into the cut. With hard to control species, the cuts should completely frill the stem. There is less physical effort required for this method as opposed to completely cutting down the tree, but it leaves a dead snag standing, which may or may not be acceptable, depending on the situation.

Like cut stump, stem injection is most effective in late winter or throughout the summer. It should not be utilized during the heavy spring sap flow.

2.5.3 Basal bark spray

The basal bark method is a recommended method for controlling young trees with smooth bark (generally individuals under 5" dbh). A 6 to 12 inch band of herbicide is applied around the circumference of the tree trunk approximately one foot above ground level. The width of the sprayed band depends on the size of the tree and the species' susceptibility to the herbicide. Ester formulations of pesticides are most effective due to their ability to readily pass through tree bark. Esters are volatile and care must be taken to follow the label – avoid ester formulations on hot days because vapor drift can injure nontarget plants. A chemical penetrant should be included in the herbicide mixture.

Basal bark applications are usually made in late winter and early spring, when leaves do not interfere with trunk access. This method is effective during the summer, but much more difficult.

2.5.4 Foliar spray

The foliar spray method can be used for all target species not in close proximity to environmentally sensitive areas. This method is most effective in areas where there is a low density of desirable vegetation. Care must be taken to use appropriate spray equipment with sufficient droplet size to minimize drift to nontarget plants. Handheld sprayers can only treat plants up to about 6' in height. Leaves should be wet thoroughly but not to the point that herbicide runs off and impacts non-target species. Air temperature should be above 65°F to ensure absorption of herbicides.

Foliar sprays should not be used on windy days. Care must be taken to minimize threat to surrounding nontarget vegetation and other sensitive sites (riparian areas).

The foliar spray method only works when the plant has full or near full leaf cover and is most effective from mid-summer to late fall, depending on the target species' life cycle. Evergreen or semi-evergreen species like privet and honeysuckle can be treated in the late fall to winter as long as they retain a significant portion of their leaf cover.

2.6 Herbicides

Table A4.2 reflects the recommended herbicide and standard concentration to use per plant species and the primary method of control. These recommendations must be corroborated with the concentrations approved on each product label. **The label is the law.**

Table A4.2: Herbicide concentrations for use on VTS-C invasive pest plants.

Species	Season	Method	Chemical	Concentration	Additive
Canada thistle	Summer (pre-flower)	Foliar	Garlon 3a	2%	Surfactant
Johnsongrass	Summer	Foliar	Arsenal	Label	Surfactant
Japanese honeysuckle	Late fall	Foliar	Garlon 3A	5%	Surfactant
Nepalese browntop	June & July	Foliar	Glyphosate	2%	Surfactant
	June & July	Foliar	Select	12 oz/ac	Surfactant
Mimosa	Fall/winter	Cut stump	Garlon 3A	Label	
	Fall/winter	Basal bark	Garlon 4	20%	Basal oil + penetrant
	Summer	Sprout – Foliar	Garlon 4	2%	Surfactant
Multiflora rose	April-June	Foliar	Arsenal AC	1%	surfactant
	Fall/winter	Cut stump	Arsenal AC	10%	
	Summer/winter	Basal bark	Garlon 4	20%	Basal oil + penetrant
Princess tree	Fall/winter	Cut stump	Glyphosate	Label	
	Fall/winter	Basal bark	Garlon 4	20%	Basal oil + penetrant
	Summer	Sprout – Foliar	Garlon 4	2%	Surfactant
Privet	Fall/winter	Cut stump	Arsenal AC	10%	Surfactant
	Fall/winter	Basal bark	Garlon 4	20%	Basal oil + penetrant
	Summer	Sprout – Foliar	Arsenal AC	1%	Surfactant
Sericea lespedeza	Summer	Foliar	Garlon 4 or Glyphosate	2% 2%	Surfactant
Tree-of-heaven	Fall/winter	Cut stump	Garlon 3A	Label	
	Fall/winter	Basal bark	Garlon 4	20%	Basal oil + penetrant
	Summer	Sprout – Foliar	Garlon 4	2%	Surfactant
Wintercreeper	August	Hand cut	N/A	N/A	N/A
	Summer/fall	Foliar	Garlon 4	4%	Surfactant
Woolly mullein	May-June	Hand pull	N/A	N/A	N/A

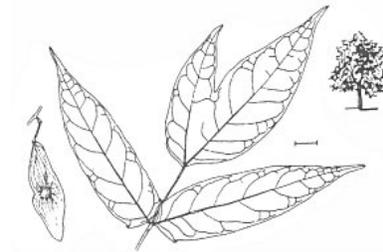
3.0 INVASIVE SPECIES DETAILS

Ailanthus altissima (tree of heaven)

- **Description:** Tree of heaven is a rapidly growing small tree but can reach up to 80 feet in height and 6 feet in diameter. It has pinnately compound leaves that are 1-4 feet in length with 10-41 leaflets. Tree of heaven resembles the sumacs and hickories, but is easily recognized by the glandular, notched base on each leaflet. It is extremely tolerant of poor soil conditions and has been known to grow even in cement cracks. It cannot grow in shaded conditions but thrives in disturbed forests or edges. Dense clonal thickets displace native species and can rapidly take over fields and meadows.
- **Specific Control Prescription:** Small trees may be effectively controlled by hand pulling. Pulling may be done any season. Moist soil facilitates pulling. During growing season, re-inspect pulled sites in 30 days for regrowth from unpulled roots.



Larger trees should be cut at the stump during the growing season. Treat the cut stump immediately with Garlon 3A. As a follow-up when and if stump sprouting occurs, apply Garlon 4 in a 2% solution of herbicide and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species.



Present in Training Area	
3	

***Albizia julibrissin* (mimosa)**

- **Description:** Mimosa is a small tree that is 10 to 50 feet in height, often having multiple trunks. It has delicate looking bi-pinnately compound leaves that resemble ferns. Mimosa has very showy, pink flowers that are fragrant, giving way to small, flat bean-pod like fruits. Mimosa invades any type of disturbed habitat. It is commonly found in old fields, stream banks, and roadsides. Once established, mimosa is difficult to control due to the long-lived seeds and its ability to re-sprout vigorously.



- **Specific Control Prescription:** Small trees may be effectively controlled by hand pulling any time of year. Areas where pulling has been done should be re-inspected during the growing season after 30 days to look for sprouts.

Larger trees should be cut at the stump. Treat the cut stump immediately with Garlon 3A, mixed in accordance with the label.

As a follow-up when and if stump sprouting occurs, apply Garlon 4 in a 2% solution of herbicide and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species.



Present in Training Area	
2	3
7	9
Cantonment	

***Cirsium arvense* (Canada thistle)**

- **Description:** Canada thistle is a tall, erect, spiny herbaceous plant that grows to 4 feet tall. It has an extensive creeping rootstock. The leaves are lance-shaped, irregularly lobed with very prickly margins. The stems are ridged and hairy. The flowers are purple to white and can be up to .5 inch in diameter. The small seeds, called achenes, are 1 to 1.5 inches long and have a feathery structure attached to the base, which lets them float through the air. Canada thistle can invade a variety of open habitats including prairies, savannas, fields, pastures, wet meadows, and open forests. It forms dense stands, which can shade out and displace native vegetation. Once established it spreads rapidly and is difficult to remove.



- **Specific Control Prescription:** Canada thistle control can be achieved through hand cutting, mowing, and controlled burning, and chemical means, depending on the level of infestation and the type of area being managed. Due to its perennial nature, entire plants must be killed in order to prevent regrowth from rootstock. Hand cutting of individual plants or mowing of larger infestations should be conducted prior to seed set and must be repeated until the starch reserves in the roots are exhausted. Because early season burning of Canada thistle can stimulate its growth and flowering, controlled burns should be carried out late in the growing season for best effect.

In natural areas where Canada thistle is interspersed with desirable native plants, utilize a targeted application of a 2% solution of Garlon 3A with surfactant. For extensive infestations in disturbed areas with little desirable vegetation, broad application of this type herbicide may be the most effective method. Repeated applications are usually necessary due to the long life of seeds stored in the soil.



Present in Training Area	
3	4
5	7

***Euonymus fortunei* (wintercreeper)**

- Description: Wintercreeper, also known as climbing euonymus, is an evergreen, clinging vine.

It can form a dense groundcover or shrub to 3 feet in height, or climb 40-70 foot high vertical surfaces with the aid of aerial roots. Dark green, shiny, egg-shaped leaves, from 1 - 2 1/2 inches long, with toothed margins and silvery veins, occur in pairs along the stems. Stems are narrow, minutely warty, and have abundant rootlets or trailing roots. Clusters of inconspicuous green-white flowers are produced on a long stalk from June to July and are followed in the autumn by pinkish to red capsules that split open to expose seeds adorned with a fleshy orange seed coat, or aril.



Clusters of inconspicuous green-white flowers are produced on a long stalk from June to July and are followed in the autumn by pinkish to red capsules that split open to expose seeds adorned with a fleshy orange seed coat, or aril.

- Specific Control Prescription: For small populations, like those observed in TA-A1, individual vines should be pulled up by the roots or cut off at ground level and removed from the area. Follow-up with a foliar application to resprouts; a 4% concentration of Garlon 4 with a surfactant is reported to be effective. Treatment should be in late winter when most native vegetation is dormant and prior to the emergence of spring wildflowers.



Present in Training Area	
3	5
9	10
Cantonment	

***Lespedeza cuneata* (sericea lespedeza)**

- **Description:** Sericea lespedeza is an upright semi-woody forb, 3 to 6 feet in height with one to many slender stems. It has thin, alternate, abundant, three-parted leaves. Flowers are small and whitish-yellow. It is an extremely aggressive invader of open areas, out competing native vegetation. Once it is established is very difficult to remove due to the seed bank, which can remain viable for decades. Native to Asia and introduced into the Unites States in the late 1800s, sericea lespedeza has been widely planted for wildlife habitat, erosion control, and mine reclamation.
- **Specific Control Prescription:** The best control of lespedeza combines both mechanical and chemical treatments. Hand pulling is impractical due to its extensive perennial root system, but mowing plants at the flower bud stage for two to three consecutive years can significantly reduce the vigor of stands as well as control further spread. Mowing followed by an herbicide treatment is likely the most effective option for the successful control.



Herbicide should be applied in mid- to late-summer, July through September. Apply Garlon 4 as a 2% solution. Note that lespedeza and Johnson grass were observed to be growing together and any treatment of one will harm or benefit the other, so plan accordingly.



Present in Training Area	
2	3
5	7
Cantonment	

***Ligustrum sinense* &/or *Ligustrum vulgare* (privet)**

- **Description:** Privet is a thick, semi-evergreen shrub to 30 feet in height. Trunks usually occur as multiple stems with many long, leafy branches attached at near right angles. Leaves are opposite, oval and .5 to 1.5 inches long. White flowers are very abundant and occur at the end of branches in clusters. Fruits ripen to a dark purple to black color and persist into winter. Although several species occur, they are hard to distinguish. It commonly forms dense thickets in the fields or in the understory of forests. It shades and out-competes many native species and, once established, is very difficult to remove.



- **Specific Control Prescription:** Privet has leaves throughout the year in Tennessee and thus can be identified and treated at any time during the year. Small plants may be may be effectively controlled by hand pulling. Plants should be pulled as soon as they are large enough to grasp, but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may re-sprout. Smaller shrubs are usually easy to pull; larger individuals are likely to require mechanical assistance in pulling.



Mowing or other mechanical reduction of plant mass is effective for providing safer spraying access but is not an effective control by itself. Foliar Spraying can be effective for large thickets of privet where risk to non-target species is minimal. Timing applications for late fall or early spring when many native species are dormant will help minimize damage to non-target species. Generally foliar

herbicides offer better control in warmer weather, as plants are growing faster, but privet keeps its leaves which can make it easier to locate when most other plants don not have leaves. To spray, apply a 1% solution of Arsenal AC plus a surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray-drift damage to non-target species.

Present in Training Area	
1	2
3	4
5	6
7	8
9	10
Cantonment	

Larger or un-pullable plants require cutting at ground level with saws. Cutting is most effective when plants have begun to flower to prevent seed production. Re-sprouting is common after treatment. Cutting is an initial control measure, and success will require either an herbicidal control or repeated cutting of re-sprouts.

Treat the cut stump immediately with Arsenal AC applying a 10% solution of herbicide and water to the cut stump. As a follow-up when and if stump sprouting occurs, apply a 1% solution of Arsenal AC plus a surfactant as a foliar spray.

***Lonicera japonica* (Japanese honeysuckle)**

- Description:** Japanese honeysuckle is a perennial vine that climbs by twisting its stems around vertical structures, including limbs and trunks of shrubs and small trees. Leaves are oblong to oval, sometimes lobed, have short stalks, and occur in pairs along the stem. In Tennessee, Japanese honeysuckle leaves often remain attached through the winter. Flowers are tubular, with five fused petals, white to pink, turning yellow with age, very fragrant, and occur in pairs along the stem at leaf junctures. Stems and leaves are sometimes covered with fine, soft hairs. Japanese honeysuckle blooms from late April through July and sometimes into October. Small black fruits are produced in autumn, each containing 2-3 oval to oblong, dark brown seeds about 1/4 inch across.



- Specific Control Prescription:** Mowing and fire are effective at reducing the aboveground mass of plant material, but require herbicide follow-up for effective control of honeysuckle.

Foliar spraying with a 5% solution of Garlon 3A is may be effective for controlling Japanese honeysuckle. Timing applications for late fall or early spring when many native species are dormant will help minimize damage to non-target species. Generally foliar herbicides offer better control in warmer weather, as plants are growing faster, but honeysuckle keeps its leaves, which can make it easier to locate when most other plants do not have leaves.



Present in Training Area	
1	2
3	4
5	6
7	8
9	10
Cantonment	

***Microstegium vimineum* (Japanese grass, Nepalese browntop)**

- Description:** Japanese grass, also known as Nepalese browntop and other names is an annual plant. It has a sprawling habit and grows slowly through the summer months, ultimately reaching heights of 2 to 3 1/2 ft. (6-10 dm.). The leaves are pale green, lance-shaped, asymmetrical, 1-3 in. (3-8 cm.) long, and have a distinctive shiny midrib. Slender stalks of tiny flowers are produced in late summer (August - September). The fruits or achenes mature soon after flowering and the plant dies back completely by late fall.
- Specific Control Prescription:** Mow plants as close to the ground as possible using a weedeater or similar grass-cutting tool. Treatments should be made when plants are in flower and before seeds are produced. Treatments made earlier may result in plants producing new seed heads in the axils of lower leaves.



Herbicide treatments should be made late in the growing season (June-July) but before the plants set seed. Treatments made earlier in the growing season may allow a second cohort of plants to produce seeds. Apply a 2% solution of glyphosate and water plus a 0.5% non-ionic surfactant to thoroughly wet all foliage. Do not spray to the point of runoff. Ambient air temperature should be above 65°F to ensure translocation of the herbicide to the roots. Do not apply if rainfall is expected within two hours following application. Additional treatments are likely to be necessary to exhaust the supply of seed in the soil.



Present in Training Area	
1	2
3	4
5	6
7	8
9	10
Cantonment	

An alternative chemical treatment is to use the grass killer clethodim (Select). Apply 12 oz/ac of Select plus a crop oil concentrate according to the label. Do not spray to the point of runoff. Ambient air temperature should be above 65°F. Do not apply if rainfall is expected within one hour following application.

***Paulownia tomentosa* (Princess tree, royal paulownia)**

- **Description:** Princess tree, also known as royal paulownia or empress tree, is a small to medium sized tree that may reach 30-60 feet in height. The bark is rough, gray-brown, and interlaced with shiny, smooth areas. Stems are olive-brown to dark brown, hairy and markedly flattened at the nodes (where stems and branches meet). Leaves are large, broadly oval to heart-shaped, or sometimes shallowly three-lobed, and noticeably hairy on the lower leaf surfaces. They are arranged in pairs along the stem. Conspicuous upright clusters of showy, pale violet, fragrant flowers open in the spring. The fruit is a dry brown capsule with four compartments that may contain several thousand tiny winged seeds. Capsules mature in autumn when they open to release the seeds and then remain attached all winter, providing a handy identification aid.



- **Specific Control Prescription:** Princess tree can be controlled using a variety of mechanical and chemical controls. Hand pulling may be effective for young seedlings. Plants should be pulled as soon as they are large enough to grasp. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may resprout. Trees can be cut at ground level with power or manual saws. Cutting is most effective when trees have begun to flower to prevent seed production. Because Princess tree spreads by suckering, resprouts are common after cutting. Cutting should be considered an initial control measure that will require either repeated cutting of resprouts or an herbicide treatment.



Princess tree seedlings and small trees can be controlled by applying a 2% solution of Garlon 4 and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce damage from spray drift on non-target species.

Present in Training Area	
3	7
9	10
Cantonment	

The cut stump method can be used with a glyphosate herbicide; see label for concentration. Basal bark applications are also effective on small saplings; utilize Garlon 4 in a 20% solution plus basal oil and penetrant. Girdling is effective on large trees where the use of herbicides is impractical. Using a hatchet, make a cut through the bark encircling the base of the tree, approximately six inches above the ground. Be sure that the cut goes well below the bark. This method will kill the top of the tree but resprouts are common and may require a follow-up treatment with a foliar herbicide.

***Rosa multiflora* (multiflora rose)**

- Description: Multiflora rose is a thorny, perennial shrub with arching stems (canes), and leaves divided into five to eleven sharply toothed leaflets. The base of each leaf stalk bears a pair of fringed bracts. Beginning in May or June, clusters of showy, fragrant, white to pink flowers appear, each about an inch across. Small bright red fruits, or rose hips, develop during the summer, becoming leathery, and remain on the plant through the winter.
- Specific Control Prescription: Mowing/Cutting is appropriate for small initial populations or environmentally sensitive areas where herbicides cannot be used. Repeated mowing or cutting will control the spread of multiflora rose but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible. Hand cutting of established clumps is difficult and time consuming due to the long arching stems and prolific thorns.



Three methods using herbicides are practical for different plant situations. Foliar spray is appropriate for large thickets of multi-flora rose where risk to non-target species is minimal. It is most effective during April to June, around the flowering period. Apply a 1% solution of Arsenal AC thoroughly wetting all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species.



If non-target plants are in close proximity, a 4% solution of glyphosate can be applied May through October to avoid soil contamination.

The cut stump method should be considered when treating individual bushes or where the presence of desirable species precludes foliar application. This treatment remains effective at low temperatures as long as the ground is not frozen. Horizontally cut multiflora rose stems at or near ground level. Immediately apply a 10% solution of Arsenal AC to the cut stump making sure to cover the entire surface.

Present in Training Area	
	2
3	4
Cantonment	

The basal bark method is effective throughout the year as long as the ground is not frozen. Apply a mixture of 20% Garlon 4 plus basal oil to the bark of the shrub to a height of 30-38 cm (12-15 in) from the ground. Thorough wetting is necessary for good control; spray until run-off is noticeable at the ground line.

***Sorghum halepense* (Johnson grass)**

- **Description:** Johnson grass grows as tall as six feet and is a rhizomatous perennial grass that invades open areas throughout the United States. The two-foot long, lanceolate leaves are arranged alternately along a stout, hairless, somewhat upward branching stem. Flowers occur in a loose, spreading, purplish panicle. Johnson grass is adapted to a wide variety of habitats including open forests, old fields, ditches, and wetlands. It spreads aggressively and can form dense colonies, displacing native vegetation and restricting tree seedling establishment.
- **Specific Control Prescription:** Johnson grass reproduces through rhizomes and seeds. It cannot be controlled simply by mowing or cutting. It is recommended that mowing followed by herbicide treatment, several times during the growing season for several seasons, utilizing Arsenal and a surfactant as directed on the label.



Present in Training Area	
1	2
3	5
9	10

***Verbascum thapsus* (wooly mullein)**

- **Description:** Woolly or common mullein is an erect herb. First year mullein plants are low-growing rosettes of bluish gray-green, feltlike leaves that range from 4-12 inches in length and 1-5 inches in width. Mature flowering plants are produced the second year, and grow to 5 to 10 feet in height, including the conspicuous flowering stalk. The five-petaled yellow flowers are arranged in a leafy spike and bloom a few at a time from June-August. Leaves alternate along the flowering stalks and are much larger toward the base of the plant. The tiny seeds are pitted and rough with wavy ridges and deep grooves and can germinate after lying dormant in the soil for several decades.
- **Specific Control Prescription:** Common mullein can be very difficult to eradicate. There are a variety of management methods available, depending on the particular situation. Because mullein seedling emergence is dependent on the presence of bare ground, sowing sites with early successional native grasses or other plants may decrease seed germination and the chance of successful emergence of mullein seedlings.



Mullein plants are easily hand pulled on loose soils due to relatively shallow tap roots. This is an extremely effective method of reducing populations and seed productivity, especially if plant is pulled before seed set. If blooms or seed capsules are present, reproductive structures should be removed, bagged, and properly disposed of in a sanitary landfill. Care should be taken, however, to minimize soil disturbance since loose soil will facilitate mullein seed germination.

Present in Training Area	
4	7



Annex 5

GROUNDS MAINTENANCE – HERBICIDE SPRAY PLAN

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1.0 General Information

Herbicide use for weed control is a necessary part of grounds maintenance on VTS-Catoosa. In order to meet federal and DoD regulations and effectively protect sensitive features of the training site, certain restrictions must be followed:

- Catoosa has a large population of a federally listed threatened plant, the large-flowered skullcap (see Figure A5.1). All herbicide applications will be designed to avoid damage to this protected plant. Skullcap management groups are located within mixed oak forests and are marked with signs. There will be no contract application of herbicide for weed control within **100 feet** of a known large-flowered skullcap group. There will be no application of soil active herbicides within **100 yards** of a skullcap group.
- Only herbicides labeled for aquatic use may be utilized within **50 feet** of creeks, wetlands, or other bodies of water. Roadside spraying of other herbicides must stop **50 feet** prior to all creek crossings and may not be reinitiated until beyond the 50 foot restricted zone.
- The contractor must be licensed with the state of Georgia as a pesticide contractor, and all applicators must have a Georgia commercial applicator license.
- All applications must be recorded on the pesticide control treatment record (see Appendix H) and turned in to the training site personnel. Training site personnel will turn this information in to the TNARNG Pest Management Coordinator. Complete information is necessary; one herbicide per page.
- One goal of management at Catoosa is to minimize chemical pesticide use. Treatments should be made using the minimum application of active ingredient which will **effectively** control the weeds.
- Instructions on the pesticide label will be followed at all times.

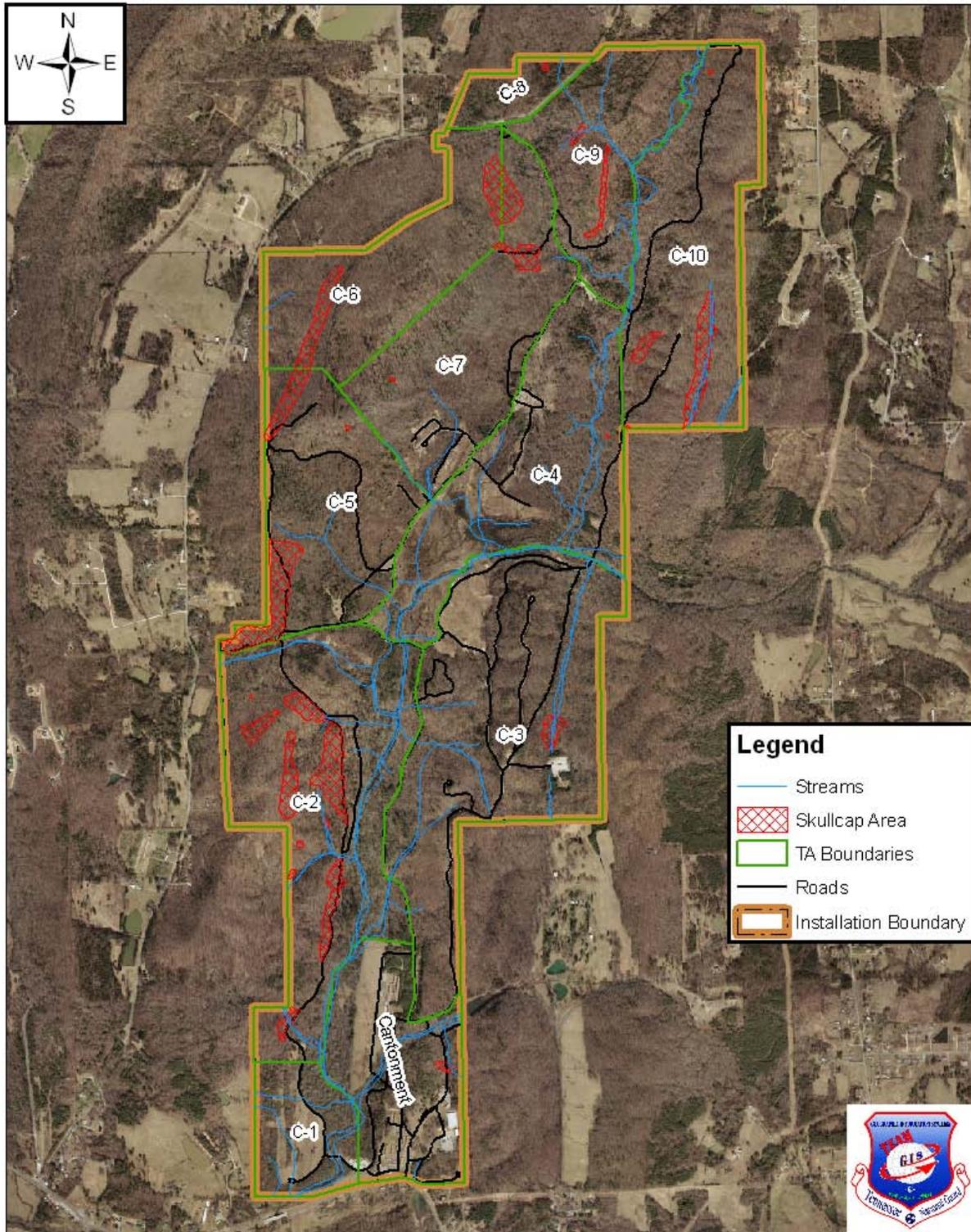


Figure A5.1: Large-flowered skullcap management groups on VTS-Catoosa.

2.0 Limited Herbicide Use Areas

These areas can have only restricted use of herbicides due to their proximity to large-flowered skullcap management groups. The contractor must be made aware of these locations on the ground to ensure that no herbicide is applied too close to the protected plants.

2.1 ASP (Ammunition Storage Point)

There will be NO use of soil-active herbicides in or around the ASP. Roundup or similar glyphosate herbicide may be used to control weeds around the fenceline and around buildings in the ASP. Care will be taken that there is no spray drift downhill to the nearby skullcap population.

2.2 Back gate fence-line

There will be no foliar application of soil-active herbicides along the back fence-line of the training site. Roundup or similar glyphosate herbicide may be used to control herbaceous weeds and vines on the fence. Woody plants encroaching on the fence can be treated with a broadleaf-selective herbicide using a cut-stump or stem injection treatment to minimize transport of the chemical to the soil.

2.3 Roads

Certain stretches of road throughout the training site will be marked with signs indicating proximity of a skullcap patch to the road. There will be NO use of herbicides within those sections of road. All weed control there must be non-chemical (mowing, pulling, or cutting brush).

3.0 Acceptable Chemicals

A list is included (Table A5.1) of the herbicides approved for use on the training site. Contract bids should be based on use of approved chemicals only.

Basic weed control at VTS-C should include:

- A bareground residual herbicide such as Krovar IDF or Oust to be applied once in the early spring as a pre-emergent for vegetation control on parking lots, motorpools, and other graveled areas. The application rate should be appropriate to noncrop areas for broadleaf weed and grass control. If weeds reappear in the treated areas later in the summer, an additional treatment can be scheduled.
- A non-residual contact herbicide such as Roundup or similar glyphosate formulation should be used along fencelines, roads, and edges where minimal mobility in soils is important. Multiple applications may be needed through the growing season
- A broadleaf-specific chemical such as Garlon 3A may be used for brush control along roads or fencelines. Preferred method of application is cut stump or stem injection, but other methods may be acceptable in certain circumstances.
- Garlon 4 or similar product may be used to control brush and sprouts in areas that cannot be easily bushhogged.
- Growth regulators may be used for grasses on the ranges.

Table A5.1: Herbicides for use on Tennessee Army National Guard Properties.

Product Name	Chemical Name	% of A.I.	EPA #
All Vegetation – Bare Ground			
Arsenal	Imazapyr	27.6	241-273
Escort	Metsulfuron	60	352-439
Hyvar XL	Bromacil	21.9	352-346
Krovar IDF	Bromacil	40	352-505
	Diuron	40	
Oust XP	Sulfometuron	75	352-601
Outrider	Sulfosulfuron	75	524-500
Reward Aquatic Herbicide	Diquat dibromide	37.3	100-1091
Round-up Pro	Glyphosate	41	524-475
Round-up Ultra	Glyphosate	41	524-475
Round-up UltraDry	Glyphosate	71.4	524-504
Sahara DG	Imazapyr	7.78	241-372
	Diuron	62.22	
Pre-emergent Herbicide			
Balan 2.5G	Benfluralin	2.5	62179-96
Banvel + 2,4-D	Dicamba	12.4	66330-287
	2,4-D	35.7	
Gordon's Pro Turf & Ornamental Barrier	Dychlobenil	4	2217-675
Surflan A.S.	Oryzalin	40.4	70506-44
MSMA	Monosodium methanearsonate	47.6	19713-42
Pennant (grasses)	S-Metolachor	83.7	100-950
Selective Post-emergent			
MSMA (grasses)	Monosodium methanearsonate	47.6	19713-42
Poast (grasses)	Sethoxydim	18	7969-58
Gordon's Pro Trimec Plus (broadleaf)	Dicamba	1.46	2217-808
	MSMA	18	
	2,4 D	5.83	
	Mecoprop-p	2.93	
Cool Season Grasses			
Plateau	Imazipic-ammonium	23.6	241-365
Plant Growth Regulator			
Cutless 50W	Flurprimidol	50	67690-15
Embark	Mefluidide	28	2217-759
Primo	Cimectacarb	12	100-729

Product Name	Chemical Name	% of A.I.	EPA #
Brush & Forestry			
Accord Site Prep	Glyphosate	41	62719-322
Arsenal	Imazapyr	27.6	241-273
Garlon 3A	Triethylamin triclopyr	44.4	62719-37
Garlon 4	Butoxyethyl triclopyr	61.6	62719-40
Escort	Metsulfuron	60	352-439
Oust XP	Sulfometuron	75	352-601
Round-up Pro	Glyphosate	41	524-475
Tordon K	Picloram	24.4	62719-17
Velpar L	Hexazinone	25	352-392
Velpar ULW	Hexazinone	75	352-450
Aquatic Weeds & Algae			
Aquashade	Acid Blue 9	23.63	33068-1
	Acid Yellow 23	2.39	
Cutrine Ultra Algaecide	Copper	9	8959-53
Reward	Diquat dibromide	37.3	100-1091
Rodeo	Glyphosate	53.8	62719-324
Sonar AS	Fluoridone	41.7	67690-4
2,4-D amine 4	2,4-D	47.3	1381-103

4.0 Prescription by Area

The following guidelines should direct all commercial weed control efforts on the training site. If an area that is not listed requires weed control, contact the Pest Management Coordinator to discuss appropriate actions.

Area 5/Bradley Motor Pool

- Gravel parking lot and around the fence
- Pre-emergent on the gravel lot, careful to avoid drift beyond the edges
- May need to use a contact herbicide to eliminate already established weeds in the gravel
- Glyphosate on the fenceline; broadleaf-selective for persistent vines and brush

ASP

- Around the fence, around the buildings, and gravel area as needed (two applications)
- There will be NO use of soil active herbicides in or around the ASP.
- Glyphosate herbicide may be used to control weeds around the fenceline and buildings and in spot treatments in the gravel in the ASP.
- Care will be taken that there is no spray drift downhill to the nearby skullcap population.

Bradley Firing Points

- Gravel area at each firing point (multiple applications)
- Due to proximity of Tiger Creek, no use of soil-active herbicide
- Apply glyphosate to weeds as they encroach on gravel areas

Cantonment

- Around buildings and along road shoulders
- Glyphosate to control weed encroaching on buildings or road shoulders
- Pre-emergent under gravel in parking areas
- Growth regulator on lawns to minimize mowing requirements

Cemetery

- Gravel area and around the fence
- Pre-emergent on the gravel lot, if needed, careful to avoid drift beyond the edges
- Glyphosate on the fenceline

Front Fence

- Along the road and around the front gate
- Approx. 2 acres
- Glyphosate or broadleaf-selective herbicide as appropriate for control of existing weeds
- Do not apply herbicides within 25 feet of creeks or other surface water

KD Range (gravel)

- Along the roadside around all posts and pit area behind the concrete wall
- Approx. 0.25 acre
- Pre-emergent on graveled areas including the pop-up target pit (behind and below the concrete wall), take care to avoid drift beyond the edge of the gravel

KD Range (turf)

- Entire KD Range
- 8 acres
- Apply growth regulator after first mowing to minimize mowing needs over growing season
- Embark or Primo are acceptable growth regulators

MK 19 Range

- Throughout the cleared zone providing line of sight from the firing point
- Approx. 0.5 acre
- Garlon 4 or similar applied to the sprouts and other brush in the recently cleared area
- Do not spray low-growing ground cover
- Avoid drift to surrounding vegetation

MLRS Staging Area

- Around the edge of the staging area and spot treat the rest of the area as needed
- Pre-emergent for the outer 5-10 feet of the large graveled area, careful to avoid drift beyond edges
- If weeds become problem later in summer, spot treat with contact herbicide

Observation Tower and Tower Road

- Gravel parking area at the tower, around the base of the tower, and center two feet of tower road
- Approx. 0.25 acre + 4000 sq.ft. on road
- Pre-emergent for the gravel parking area and base of tower and also down the center two feet of the road leading to tower
- Broadleaf selective herbicide on road shoulders to minimize brush encroachment

Rear Fence

- Along the road and around the rear gate
- Approx. 4 acres
- There will be no foliar application of soil active herbicides along the back fence-line of the training site. Roundup or similar glyphosate herbicide may be used to control herbaceous weeds and vines on the fence.
- Woody plants encroaching on the fence can be treated with Tordon or Garlon as a cut-stump treatment or a stem injection treatment to minimize transport of the chemical to the soil.
- The 3-6 foot buffer strip should be maintained with broadleaf-selective herbicide to ensure grass cover for soil protection

Roadways

- Approximately 10 miles along the sides of the gravel roads (3 applications)
- Broadleaf selective herbicide on the brush up to 4 feet on either side of the road, except where identified as close to skullcap

Tank Firing Points (Four)

- Around and on top of the firing point
- Approx. 0.5 acre each
- Should be burned in early spring
- Growth regulator on grasses on the mound
- Broadleaf selective herbicide (Tordon or Garlon) may be applied to individual woody plants that germinate on mound (preferably as cut-stump treatment)

Tank Laser Target Pits

- In and around 13 target pits
- 225 sq ft each
- Pre-emergent in gravel of the target pits
- Glyphosate on weeds invading at edges as summer progresses

Tank Target RR Tracks

- All of the gravel area, around both buildings, around both retaining walls, and all of the area in between the two targets
- Pre-emergent in gravel areas along tracks, buildings, and walls, careful to avoid drift beyond edges
- Glyphosate on weeds invading at edges as summer progresses

Two Loading Ramps

- Around both loading ramps in the training area
- Pre-emergent on the gravel, careful to avoid drift beyond edges
- Glyphosate at the edges as vegetation intrudes
- May need to use a contact herbicide to eliminate already established weeds

Urban Assault Course (UAC)

- Gravel parking areas, roads, and training structures
- Pre-emergent on the gravel of parking areas, roads, and training points, no closer than 8" to the edge
- Glyphosate as needed at the edges as vegetation intrudes
- Glyphosate to control weeds around structures as needed

- Broadleaf selective as needed on mowed areas to minimize brush encroachment
- Take care to avoid drift onto skullcap group north of UAC near northern entrance road

50 Cal Range

- 4 pits and gravel area
- Approx. 160 sq ft total
- Pre-emergent under the center gravel, no closer than 8” to the edge
- Glyphosate may be needed at the edges as vegetation intrudes

203 Range

- Gravel parking area, around the observation tower, and all firing points
- Approx. 0.5 acre
- Pre-emergent on the gravel areas, up to edges
- Glyphosate on weeds invading at edges as summer progresses

Point of Contact for pest control questions is:

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