INTRODUCTION

The herbicides evaluated in this proposal are Glyphosate and Triclopyr Ester. Forest managers frequently make decisions regarding the use of herbicides on forested lands. Decisions are based not only on the effectiveness of these tools, but also on an understanding of the risks associated with their use. The following documentation describes these risks.

PROPOSED USE OF PESTICIDES

This analysis covers the use of the forestry labeled herbicide glyphosate to site prepare areas to be planted with wildlife plot mixtures, native grass stands, and pollinator plots in 75 existing wildlife openings; and to implement no-till planting methods as a preferred method on site prepared areas within portions of the 75 existing wildlife openings. The proposed herbicide treatment would also help control/eradicate non-native invasive plants (NNIP) species occurring in the wildlife openings. There are approximately 222 acres of wildlife openings in the project area ranging from 0.2 to 23 acres with an average of approximately 2.95 acres in size. Of the 222 acres, approximately 154 acres are wildlife openings in the Beaver Creek Wildlife Management Area.

It is also proposed to chemically treat NNIP species within 100 feet of the wildlife openings on an additional 286 acres, using spot treatments of glyphosate or triclopyr ester; as well as in a 22 acre wooded grassland restoration area. Proposed herbicide treatments would be done according to label directions for the target species. Herbicide would be applied directly on the target plant(s) through directed foliar application (maximum 2% solution of glyphosate or triclopyr ester), basal stem (maximum 20% solution-triclopyr ester), or cut stump treatment (maximum 20% solution-glyphosate).

Basic assumptions for all treatments:

- All herbicide application would be consistent with label directions.
- Worker Protection Standards shall be followed;
- Herbicide Use Guidelines (attached) shall be followed;
Draft Risk Assessment – Greenwood Vegetation Management Project
Broadcast Application-Glyphosate, Directed Foliar Application-Glyphosate, Cut stump Application-Glyphosate, Directed Foliar application-Triclopyr ester, Streamline Application-Triclopyr ester.

- All applicable standards outlined in the **Land and Resource Management Plan for the Daniel Boone National Forest** (LRMP) shall be followed.
- Based on monitoring results and the presence or absence of NNIP, follow up treatments could be necessary for some NNIP.

**Glyphosate for site preparation in wildlife openings**

- A low toxicity glyphosate product (e.g. Rodeo) would be applied as a ground broadcast spray in a 2% solution in water (8 ounces per 3-gallons of mix), A surfactant is needed for foliar applications, and one that is labeled for aquatic use (e.g. Agri-Dex Spray Adjuvant (Helena)) would be used (0.5%). Studies conducted by the US Fish & Wildlife Service identified it as a very low toxicity surfactant that is less liable to cause harm to frogs and other amphibians ([http://www.ncsu.edu/goingnative/glyphosateuse.pdf](http://www.ncsu.edu/goingnative/glyphosateuse.pdf)).

**Wildlife plots** would be prepared and are expected to last anywhere from a year to 5 years. The portion of the wildlife opening to be planted with wildlife plot mixes, would be prepared by treating the existing ground cover. This would be accomplished with a broadcast application of glyphosate (maximum 2% solution) using ground-based application equipment.

**Native Grass Stand openings** in need of supplemental seeding of Native Grass mixtures would be site prepared with herbicide (glyphosate-maximum 2% solution) using ground-based application equipment, and planted with a no-till grass drill the same year.

**Pollinator mixtures** the areas would be site prepared with herbicide (glyphosate-maximum 2% solution) and planted with native wildflower mixtures to benefit pollinators. Some native wildflower mixtures may be planted along with native warm season grasses in the native grass stand openings.

**Glyphosate or Triclopyr Ester for NNIP Control/Eradication within 100 feet of wildlife openings.**

- The herbicides glyphosate and triclopyr ester (e.g. Garlon 4) would be used for control/eradication of NNIP within 100 feet of wildlife openings.
- Most of the herbicide application for NNIP control/eradication would be accomplished with a low toxicity glyphosate product (e.g. Rodeo) applied as a directed foliar spray in a 2% solution in water (8 ounces per 3-gallon mix), sprayed directly onto NNIP species where they occur. Since a surfactant is needed for directed foliar applications, one that is labeled for aquatic use (e.g. Agri-Dex Spray Adjuvant (Helena)) would be used (0.5%). Studies conducted by the US Fish & Wildlife Service identified it as a very low toxicity surfactant that is less liable to cause harm to frogs and other amphibians. ([http://www.ncsu.edu/goingnative/glyphosateuse.pdf](http://www.ncsu.edu/goingnative/glyphosateuse.pdf))
- For the NNIP Japanese honeysuckle, Multiflora rose, and Autumn Olive, on the stems that are too tall for a foliar application, the stems would be cut and immediately treated by a cut stump application of glyphosate herbicide as a 20% solution (2.5 quarts per 3-gallon mix), before fruit set.
- The NNIP species Sericea lespedeza (Lespedeza cuneata) and Korean clover (Kummerowia stipulacea) would be treated with a directed foliar application of triclopyr ester (July to September). Triclopyr ester
Draft Risk Assessment – Greenwood Vegetation Management Project

Broadcast Application-Glyphosate, Directed Foliar Application-Glyphosate, Cut stump Application-Glyphosate, Directed Foliar application-Triclopyr ester, Streamline Application-Triclopyr ester.

may be foliarly applied by diluting with water as a 2% solution (8 ounces per 3 gallon mix). A non-ionic surfactant (e.g. Agri-dex), is recommended for foliar applications, and would be added at 0.5% of the total solution (2 ounces per 3 gallon mix) in accordance with label guidelines. The equipment used in all proposed directed foliar applications would be ground-based application equipment (e.g. backpack sprayers, garden sprayers, or a pistol-grip handgun attached to a skid sprayer).

- Directed foliar applications would occur when environmental conditions limit spray drift. Directed foliar applications of glyphosate or triclopyr formulations would be applied to the foliage of NNIP species, to the point where leaves are thoroughly wetted but not dripping. Directed foliar applications would be applied in a 2% solution on NNIP species and would not exceed maximum application rates of chemical per unit area prescribed by the label. Cut surface treatment applications would utilize hand-held spray bottles.

- For basal stem treatment applications, triclopyr ester would be mixed with a commercially available basal oil spray diluent (e.g. JLB Oil Plus) in a 20% solution (26 oz triclopyr ester per 102 oz of basal oil). A directed straight stream spray would be applied to selected stems in a 2 to 3-inch wide band on one side of stems that are 1-3” dbh, and to two sides of stems that are 3-5” dbh. The spray would be directed at thin juvenile bark that is 12 to 24 inches above ground. The triclopyr ester would be applied using ground-based application equipment (e.g. backpack sprayers, garden sprayers). Triclopyr ester application would not exceed maximum application rates of chemical per unit area prescribed by the label. Spray would be applied to ensure a good “wrap” of the target stem.

**APPLICABLE LRMP STANDARDS**

DB-VEG-8. Herbicides would be applied at the lowest rate effective in meeting project objectives and according to the guidelines for protecting human\(^1\) and wildlife\(^2\) health. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health.

DB-VEG-9. Monitor weather and suspend project if temperature, humidity, or wind becomes unfavorable according to Table 4 below, (page 2-25, LRMP):

**Table 4 - Weather criteria for herbicide treatment at ground level**

<table>
<thead>
<tr>
<th>Ground:</th>
<th>Temperatures</th>
<th>Humidity</th>
<th>Wind (at Target)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) NRC 1983

\(^2\) EPA 1986
4

<table>
<thead>
<tr>
<th></th>
<th>Higher Than (°F)</th>
<th>Less Than (%)</th>
<th>Greater Than (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand (cut surface)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Hand (other)</td>
<td>98</td>
<td>20%</td>
<td>15</td>
</tr>
</tbody>
</table>

DB-VEG-10. Use only nozzles that produce large droplets (mean droplet size of 50 microns or greater) or streams of herbicide. Nozzles that produce fine droplets may be used only for hand treatment, where distance from nozzle to target does not exceed 8 feet, (page 2-25, LRMP).

DB-VEG-11. Areas treated with herbicides are to be clearly posted with notice signs to warn visitors of the treatment, (page 2-25, LRMP).

DB-VEG-13. No soil-active herbicide will be applied within 30 feet of the dripline of non-target vegetation specifically designated for retention (e.g. roost trees, inclusions, adjacent stands) within or next to treated area, (page 2-25, LRMP).

DB-VEG-14. Do not apply triclopyr within 60 feet of known occupied gray, Virginia big-eared, or Indiana bat hibernacula or known maternity tree, (page 2-25, LRMP).

DB-VEG-16.- No broadcast treatment using herbicide is to be applied within 60 feet of any known PETS plant species, (page 2-25, LRMP).

DB-VEG-17. No soil-active herbicide is to be applied within 60 feet of any known PETS plant species, (page 2-25, LRMP).

DB-VEG-18. Application equipment, empty herbicide containers, clothing worn during treatment, and skin are not to be cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers, (page 2-25, LRMP).

DB-VEG-19. No herbicide shall be applied within 30 horizontal feet of lakes, wetlands, perennial or intermittent springs (seeps) and streams. However, herbicides approved for aquatic use may be used when such treatment is required to control invasive plants, (page 2-25, LRMP).

DB-VEG-20. Necessary buffer zone areas must be designated before making herbicide treatments so applicators can easily recognize and avoid the buffer area, (page 2-26, LRMP).

DB-VEG-21. Herbicide mixing, loading, or cleaning areas in the field are not to be located within 200 feet of private land, open water or wells, or other sensitive areas, (page 2-26, LRMP).

MORE ABOUT DB-VEG-8
The USDA Forest Service, Southern Region standard for acceptable level of risk requires a Margin of Safety (MOS) > 100 or Hazard Quotient (HQ) < 1.0. A hazard quotient is the ratio of the potential exposure to a substance and the level at which no adverse effects are expected. If the Hazard Quotient is calculated to be less than 1, then no adverse health effects are expected as a result of exposure. If the Hazard Quotient is greater than 1, then adverse health effects are possible. The Hazard Quotient cannot be translated to a probability that adverse health effects would occur. It is especially important to note that a Hazard Quotient exceeding 1 does not necessarily mean that adverse effects would occur.

### ABOUT THE RISK ASSESSMENT

The risks for Glyphosate and Triclopyr ester are enumerated in the HQ format. The specific EXCEL spreadsheet file used for the HQ projection is FS Worksheet Maker Version 6.00.13.xlsm. The EXCEL spreadsheet file has been developed as a companion tool for the Human Health and Ecological Risk Assessments (HERA) prepared for these herbicides. In this Risk Assessment for the Greenwood Vegetation Management Project, the process of risk assessment is used to evaluate quantitatively the probability (i.e. risk) that pesticide use might pose harm to humans or other species in the environment. It is the same assessment process used for regulation of allowable residues of pesticides in food, as well as safety evaluations of medicines, cosmetics, and other chemicals. Relevant information from the applicable HERA is incorporated into environmental analysis documents prepared for project proposals using pesticides. The analysis is used to guide decision-making and to disclose to the public potential environmental effects (FHP 2011).

The Forest Service contracted with Syracuse Environmental Research Associates, Inc. (SERA) for a series of pesticide risk assessments (SERA 2011c) that could be used nationally. These national risk assessments are generic or baseline risk assessments that constitute a summary of the best available science. Additional information on the preparation of these risk assessments can be found in the SERA TP 11-23-01-012, ATT-3 and SERA MD-2011-01b document at http://www.sera-inc.com/images/SERA_MD-2011-01b.pdf. This document was prepared November 11, 2011 with minor editorial modifications on February 11, 2012. Risk assessment worksheets are models that are designed to disclose effects from a variety of circumstances, some of which may not have anything in common with the proposal. A hazard quotient that is greater than 1.0 does not automatically indicate inconsistency with LRMP Standard DB-VEG-8. Rather, a hazard quotient that is

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3 Risk is defined as the likelihood that an effect (injury, disease, death or environmental damage) may result from a specific set of circumstances. It can be expressed in quantitative or qualitative terms. While all human activities carry some degree of risk, some risks are known with a relatively high degree of accuracy, because data have been collected on the historical occurrence of related problems (i.e. lung cancer caused by smoking, auto accidents caused by alcohol impairment, and fatalities resulting from airplane travel). For several reasons, risks associated with activities including exposure to chemicals such as pesticides cannot be so readily determined. The process of risk assessment helps evaluate the risks resulting from these situations.
greater than one is a “red flag” that receives further consideration and explanation by the specialist. The probability of occurrence must be taken into consideration along with the fact that the proposal incorporates protective measures not considered in the models, such as following label direction, implementing LRMP Standards, and implementing project specific design criteria. In most cases, risk is further reduced because the probability of exposure is much less from what is presented in the national risk assessment. Thus, a rational interpretation of the data is necessary in a risk management discussion for individual hazard quotients that exceed 1.0.

SERA also developed models (SERA 2011) to allow forest managers to evaluate the human health and ecological risks. The model for a particular pesticide consists of a series of worksheets presented in Microsoft EXCEL format (FS WorksheetMaker Version 6.00.13, last modified on 2/23/2014). Specific parameters, such as application rate or method, are entered into a software application, which then computes the risk of the particular project proposal. The resulting hazard quotients are summarized and discussed in this report.

The spreadsheets that summarize the HQs within each Excel workbook are the following:

- **E02**: Hazard Quotients for workers
- **E04**: Hazard Quotients for the general public
- **G02a**: Hazard Quotients for terrestrial mammals
- **G02b**: Hazard Quotients for the Birds
- **G03**: Hazard Quotients for aquatic species
- **G08b**: Hazard quotients for insects

In accordance with modeling protocol expressed in each Excel spreadsheet (Worksheet “General Notes”) application rates will be expressed in pounds acid equivalent (a.e.) per acre. Risk assessment worksheets present hazard quotients at three levels of exposure: Central, Lower, and Upper. **The “central” level has been used for evaluating risk for this proposal and is the best representation of worker risk when all proper personal protective equipment (PPE) is utilized.** Proper PPE consists of long sleeves, long pants, boots with socks, gloves, and eye protection. The “Upper” level in the worksheets presents a combination of all possible worst-case assumptions within the scenario; it is presented only as a highly improbable reference or a worst-case evaluation.

**SOLUTIONS & RATES OF APPLICATION THAT APPLY TO THE BROADCAST APPLICATION OF GLYPHOSATE HERBICIDE FOR SITE PREPARATION IN WILDLIFE OPENINGS.**

In portions of 75 wildlife openings, glyphosate (e.g. Rodeo) is proposed to site prepare areas for wildlife plot mixtures, native grass stands, and pollinator plant species. The following mixture is proposed:

Broadcast application (ground based):
In the proposed action, broadcast application of a 2% solution of glyphosate with surfactant (0.5%) is planned in portions of 75 wildlife openings. The broadcast application mixture would be 2% glyphosate (e.g. Rodeo), 1% non-ionic surfactant (e.g. Agri-dex), and 97% water. Thus, for every 1 gallon (128 oz.) of mix, there are 2.6 oz. of glyphosate, 0.64 oz. of surfactant, and 124.1 oz. of water.

Assumptions:
Assumption: The Rodeo label states: “For ground broadcast application, unless otherwise specified, apply the rates of Rodeo and surfactant recommended for broadcast application in a spray volume of 3 to 30 gallons of water per acre.” The national risk assessment for Glyphosate is based on a unit application rate of 1.0 lb a.e./acre. This will serve as the central level of exposure for purposes of this risk assessment. The ground broadcast application spray volume would be:

\[
1.0 \text{ lb a.e./acre} \div 4 \text{ lb a.e./gal} = 0.25 \text{ gal Rodeo/acre}
\]

\[
0.25 \text{ gal Rodeo/acre} \times 128 \text{ oz./gal} = 32 \text{ oz. Rodeo/acre}
\]

\[
32 \text{ oz.} \div 2.56 \text{ oz/gal} = 12.5 \text{ gallons/acre (Rodeo and Agri-dex in water solution)}
\]

This is within the spray volume range prescribed by the label.

Hazard quotients were calculated using the estimated application rate above (12.5 gallons/acre of spray solution, 1 lb a.e./acre) for the ground broadcast application of glyphosate.

**RISK ANALYSIS – GROUND BROADCAST APPLICATION OF GLYPHOSATE**

For the central level of exposure, data found in the Glyphosate Ground Broadcast Foliar for Site Preparation in Wildlife Openings.xlsm worksheets E02, E04, G02a, and G08b indicate a very low to negligible risk for:

- Workers
- The General Public
- Terrestrial Mammals
- Insects

This applies at all points in the application chain from loading and mixing, transportation and application.

For the central level of exposure, five scenarios in the Glyphosate Ground Broadcast Foliar for Site Preparation in Wildlife Openings.xlsm worksheets G02b, G03, return an HQ of 1 or greater.

The five scenarios that return an HQ of 1 or greater are:

**Scenario #1 – Chronic/Longer Term Exposure to Small Bird (Passerine) Eating Contaminated Short Grass**
The HQ = 1 for contaminated short grass and refers to a small perching bird repeatedly eating short grass contaminated by a direct spray of glyphosate solution over a long period of time (months or years).

**Site Specific Circumstances and Design Criteria**

This scenario is designed to demonstrate a “worst case” scenario for purposes of the risk assessment, and should be regarded as extreme and to the point of limited plausibility (unlikely to happen). In scenario #1, it is highly unlikely that an individual bird would continuously eat short grass that has been contaminated by a direct spray of glyphosate over a long period of time (months or years). It is plausible that an individual bird could eat some short grass that has just been sprayed with glyphosate, however, this type of acute exposure gives an HQ of only 0.2. The preferred diet of passerines is primarily insects, seeds, fruits (berries), or worms; not short grass. A small perching bird would have much more palatable food to choose from and would be unlikely to choose short grass to eat. An individual bird is not going to fly around looking for areas that have just been sprayed with glyphosate to eat short grass. For these reasons the HQ for a chronic/longer term exposure to a small bird (passerine) eating contaminated short grass is less than 1.0.

**Scenarios #2, 3, 4, and 5 – Accidental acute exposure to sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae.**

The [HQs] are as follows:

- Fish (Sensitive) [7]
- Invertebrates (Sensitive) [1.3]
- Macrophyte (Sensitive) [44]
- Algae (Sensitive) [16]

The Hazard Quotients [HQs] for scenarios 2, 3, 4, and 5 refer to an acute (one time) contact with the 2% solution of the herbicide Glyphosate, in a spill scenario. This scenario assumes a spill of 100 gallons of pre-mixed solution of the herbicide directly into a water body 1000m² in size and 1m in depth. Large spills into small water bodies such as this would likely have an adverse effect on sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae.

**Site Specific Circumstances and Design Criteria** – The scenarios described above are designed to demonstrate “worst case” scenarios for purposes of the risk assessment. They are regarded as extreme and to the point of limited plausibility (unlikely to happen). The HQs greater than 1.0 shown above are dependent on a chain of several assumed conditions; if any one condition is unfulfilled, HQs would reduce to 1.0 or below. A 100-gallon spill would require involvement of a fully loaded transport (nurse/supply) vehicle with 100 gallons of pre-mixed solution of Glyphosate. This supply vehicle would have to be directly at the water body (pond) and either involved in a wreck or overturned. The supply vehicle in this case typically carries two fifty gallon tanks. It is assumed that both of the tanks would be ruptured during the incident and that nearly every gallon would enter the water body. **There would not be a fully loaded transport (nurse/supply) vehicle carrying 100 gallons of**
pre-mixed glyphosate solution. Hazard Quotients for accidental scenarios, while they provide additional information, are not applicable to the proposed activities. That is, the Forest Service does not propose to have accidents. Strict adherence to LRMP Standards DB-VEG-18, 19, 20 & 21 (design criteria) would decrease or negate the chances for herbicide entering water, as these standards require designation of a buffer zone, prohibit mixing or loading herbicides and cleaning equipment within 200 feet of open water or wells and prohibit application of herbicide within 30 horizontal feet of streams, seeps, springs, wetlands, lakes or ponds. The hazard quotients produced in the risk assessment are based on a very extreme scenario that is at the limits of plausibility. For these reasons the HQs for an accidental acute exposure to sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae would be reduced to less than 1.0.

**SOLUTIONS & RATES OF APPLICATION (GLYPHOSATE) THAT APPLY TO THE PROPOSED ACTION FOR CONTROL OF NON-NATIVE INVASIVE PLANTS (NNIP) WITHIN 100 FEET OF WILDLIFE OPENINGS AND IN THE PROPOSED PINE WOODLAND ESTABLISHMENT AREA.**

In the proposed action, the herbicide Glyphosate is proposed to spot treat NNIP to control/eradicate NNIP within 100 feet of wildlife openings on 286 acres, and in a pine woodland establishment area of 22 acres. Proposed herbicide treatments would be done according to label directions for the target species. The majority of glyphosate application for NNIP control/eradication would be accomplished with a low toxicity glyphosate herbicide (e.g. Rodeo) applied as a directed foliar spray in a 2% solution in water (8 ounces per 3-gallon mix) sprayed directly onto NNIP species where they occur. Since a surfactant is needed for foliar applications, one that is labeled for aquatic use (e.g. Agri-Dex Spray Adjuvant (Helena)) would be used (0.5% in solution). Studies conducted by the US Fish & Wildlife Service identified it as a very low toxicity surfactant that is less liable to cause harm to frogs and other amphibians. The directed foliar spray mixture would be 2% Glyphosate (e.g., Rodeo), 0.5% surfactant (e.g., Agri-dex), and 97.5% water. Thus, for every 1 gallon (128 oz.) of mix, there would be 2.6 oz. of Glyphosate, 0.64 oz. of surfactant, and 124.8 oz. of water.

For NNIP species that are too tall for a foliar application (above shoulder height, e.g. Multiflora rose, Autumn Olive), the stems would be cut and immediately treated by a cut stump application of glyphosate herbicide as a 20% solution (2.5 quarts per 3-gallon mix). Thus, for every 1 gallon (128 oz.) of mix, there would be 25.6 oz. of Glyphosate, and 102.4 oz. of water.

**Assumptions:**

- The equipment used in all proposed directed foliar applications would be ground-based application equipment (e.g. backpack sprayers, garden sprayers, or a pistol-grip handgun attached to a skid sprayer).
- Assuming that 10% of an acre would be treated through directed foliar spot applications to NNIP where they exist at an application rate of 1 lb. a.e./acre of the herbicide solution, the maximum application rate of Glyphosate solution on a per acre basis would be **0.1 lb. a.e./acre**:

This will serve as the central level of exposure for purposes of this risk assessment. The directed foliar spot application spray volume would be:

- 0.1lb a.e./acre ÷ 4 lb a.e./gal = 0.025 gal Rodeo/acre
Draft Risk Assessment – Greenwood Vegetation Management Project

Broadcast Application-Glyphosate, Directed Foliar Application-Glyphosate, Cut stump Application-Glyphosate, Directed Foliar application-Triclopyr ester, Streamline Application-Triclopyr ester.

- 0.025 gal Rodeo/acre X 128 oz./gal = 3.2 oz. Rodeo/acre
- 3.2 oz./acre ÷ 2.56 oz/gal = 1.25 gallons/acre (Rodeo and Agri-dex in water solution)
- So, 1.25 gallons/acre would be the estimated amount of the non-selective herbicide Glyphosate (2% solution) that would be applied on a per acre basis. For purposes of the risk assessment this will be used as the “central” application rate.

- Cut stump applications would utilize hand-held spray bottles.
- A 1 gallon 20% solution of Glyphosate herbicide would be 25.6 oz. of Glyphosate and 102.4 oz. of water.
- The estimated amount of herbicide that would be applied per cut stump application is 0.33 oz. of mixed chemical in solution (3 squirts from a hand-held spray bottle into a graduated dose cup is approximately 0.33 oz).
- Assuming that one applies 0.33 ounces of the mixed chemical in solution per stump, then:
  If 1 stump = 0.33 ounces (in solution)
  Then x stumps = 128 ounces (in solution)
  0.33(x) = 128 oz./gal
  (X) = 128 ÷ 0.33 = 388 stumps.
- So with 1 gallon of a 20% solution of Glyphosate solution one could treat 388 NNIS stumps. So, 1 gallon of the 20% Glyphosate solution would be more than enough mix to treat any Autumn Olive, Multiflora Rose, or Japanese Honeysuckle that are too tall for a direct foliar application with a cut stump application on several acres. These 3 species are known to occur within 100 feet of wildlife openings and in the 22 acres proposed for pine woodland restoration.
- Assuming stumps occupied an estimated 10% of an acre, the application rate for cut stump application on a per acre basis using an application rate of 1 lb. a.e./1 acre, but only treating 10% of an acre, would be an estimated 0.1 lb.a.e./acre:
  0.1 lb a.e./acre ÷ 4 lb a.e./gal = 0.025 gal Rodeo/acre
  0.025 gal Rodeo/acre X 128 oz./gal = 3.2 oz. Rodeo/acre
  3.2 oz./acre ÷ 25.6 oz/gal = 0.125 gallons/acre (Rodeo and Agri-dex in water solution)

- Cut stump applications are examples of non-contiguous applications in which the pesticide is applied to small areas (stumps). Worksheet Maker does not directly accommodate these types of application methods. Worksheet Maker suggests using one of the broadcast application methods—e.g., backpack for cut stump, and then adjust the application rate. Thus, the two different application rates for the two different type applications were added together to give a total of 0.2 lb. a.e./acre and 1.375 gal mix/acre.
- The 0.2 lb. a.e./acre application rate for directed foliar and cut stump applications (expressed in pounds acid equivalent/acre) was used in estimating the spray volumes that would be applied per acre (1.375 gal mix/acre) and serves as the “central” level of exposure for purposes of this risk assessment. Hazard
Risk assessment worksheets present hazard quotients at three levels of exposure: Central, Lower, and Upper. The “central” level has been used for evaluating risk for this proposal and is the best representation of worker risk when all proper personal protective equipment (PPE) is utilized. Proper PPE consists of long sleeves and pants, shoes with socks, gloves and eye protection. The “Upper” level found in the .xlsm worksheets presents a combination of all possible worst-case assumptions within the scenario; it is presented only as a highly improbable reference or a worst-case evaluation.

**RISK ANALYSIS – GLYPHOSATE FOR CONTROL OF NON-NATIVE INVASIVE PLANTS (NNIP) WITHIN 100 FEET OF WILDLIFE OPENINGS AND IN THE PROPOSED PINE WOODLAND ESTABLISHMENT AREA.**

For the central level of exposure, data found in the *Directed Foliar and Cut Stump Application of Glyphosate for Control of NNIP.xlsm* worksheets E02, E04, G02a, G02b and G08b indicate a very low to negligible risk for:

- Workers
- The General Public
- Terrestrial Mammals
- Birds
- Insects

This applies at all points in the application chain from loading and mixing, transportation and application.

**CENTRAL HAZARD QUOTIENTS GREATER THAN 1.0 – GLYPHOSATE FOR CONTROL OF NON-NATIVE INVASIVE PLANTS (NNIP) WITHIN 100 FEET OF WILDLIFE OPENINGS AND IN THE PROPOSED PINE WOODLAND ESTABLISHMENT AREA.**

Four scenarios in *Directed Foliar and Cut Stump Application of Glyphosate for Control of NNIS.xlsm worksheet* G03 return an HQ > 1

Scenarios #1, 2, 3, 4 – Accidental acute exposure to sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae.

The [HQs] are as follows:

- Fish (Sensitive) [13]
- Invertebrates (Sensitive) [2]
- Macrophyte (Sensitive) [78]
- Algae (Sensitive) [28]
The Hazard Quotients [HQs] for scenarios 1, 2, 3, and 4 refer to an acute (one time) contact with the 2% solution of the herbicide Glyphosate, in a spill scenario. This scenario assumes a spill of 100 gallons of pre-mixed solution of the herbicide directly into a water body 1000m² in size and 1m in depth. Large spills into small water bodies such as this would likely have an adverse effect on sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae.

Site Specific Circumstances and Design Criteria – The scenario described above is designed to demonstrate “worst case” scenarios for purposes of the risk assessment. It should be regarded as extreme and to the point of limited plausibility (unlikely to happen). The HQs greater than 1.0 shown above are dependent on a chain of several assumed conditions; if any one condition is unfulfilled, HQs would reduce to 1.0 or below. A 100-gallon spill would require involvement of a fully loaded transport (nurse/supply) vehicle with 100 gallons of pre-mixed solution of Glyphosate. This supply vehicle would have to be directly at a water body (pond) and either involved in a wreck or overturned. The supply vehicle in this case typically carries two fifty gallon tanks. It is assumed that both of the tanks would be ruptured during the incident and that nearly every gallon would enter the water body. **There would not be a fully loaded transport (nurse/supply) vehicle carrying 100 gallons of pre-mixed glyphosate solution, so this scenario is inapplicable to the proposed action.** Hazard Quotients for accidental scenarios, while they provide additional information, are not applicable to the proposed activities. That is, the Forest Service does not propose to have accidents. Strict adherence to LRMP Standards DB-VEG-18, 19, 20 & 21 (design criteria) would decrease or negate the chances for herbicide entering water, as these standards require designation of a buffer zone, prohibit mixing or loading herbicides and cleaning equipment within 200 feet of open water or wells and prohibit application of herbicide within 30 horizontal feet of streams, seeps, springs, wetlands, lakes or ponds. The hazard quotients produced in the risk assessment are based on a very extreme scenario that is at the limits of plausibility. For these reasons the HQs for an accidental acute exposure to sensitive fish, sensitive invertebrates, sensitive macrophytes, and sensitive algae would be reduced to less than 1.0.

**SOLUTIONS & RATES OF APPLICATION (TRICLOPYR ESTER) THAT APPLY TO THE PROPOSED ACTION FOR DIRECTED FOLIAR APPLICATION TO THE NNIP SPECIES SERICEA LESPEDEZA AND KOREAN CLOVER.**

In Alternative 2, the herbicide Triclopyr ester is proposed for control/eradication of the NNIP Sericea lespedeza and Korean Clover within 100 feet of wildlife openings on 286 acres, and in a pine woodland establishment area of 22 acres. Control methods for these two species call for thoroughly wetting all leaves with triclopyr ester with a surfactant (July to September) as a 2% solution (8 ounces per 3-gallon mix) and only sprayed directly onto the NNIP where they occur.

The directed foliar spray mixture would be 2% Triclopyr ester (e.g., Garlon 4), 0.5% surfactant (e.g., Agri-dex), and 97% water. Thus, for every 1 gallon (128 oz.) of mix, there are 2.6 oz. of Triclopyr ester, 0.64 oz. of surfactant, and 124.1 oz. of water.

**Assumptions:**
The equipment used in all proposed directed foliar applications would be low volume backpack or garden sprayers.

Assuming that 10% of an acre would be treated through directed foliar spot applications to NNIP where they exist at an application rate of 1 lb. a.e./acre of the herbicide solution, the maximum application rate of triclopyr ester solution on a per acre basis would be **0.1 lb. a.e./acre**.

This will serve as the central level of exposure for purposes of this risk assessment. The directed foliar spot application spray volume would be:

- $0.1\text{lb a.e./acre} \div 4 \text{ lb a.e./gal} = 0.025 \text{ gal triclopyr ester/acre}$
- $0.025 \text{ gal triclopyr ester/acre} \times 128 \text{ oz./gal} = 3.2 \text{ oz. triclopyr ester/acre}$
- $3.2 \text{ oz./acre} \div 2.56 \text{ oz/gal} = 1.25 \text{ gallons/acre}$ (Triclopyr ester and Agri-dex in water solution)

So, 1.25 gallons/acre would be the estimated amount of the non-selective herbicide Triclopyr ester (2% solution) that would be applied on a per acre basis. For purposes of the risk assessment this will be used as the “central” application rate.

The **1.25 gallons/acre** for directed foliar application of Triclopyr ester was used in determining the application rate expressed in pounds acid equivalent (lb. a.e) per acre (**0.1 lb. a.e./acre**), and serves as the “central” level of exposure. Hazard quotients (HQs) were calculated using these estimated application rates for the Triclopyr ester application. Risk assessment worksheets present hazard quotients at three levels of exposure: Central, Lower, and Upper. The “central” level has been used for evaluating risk for this proposal and is the best representation of worker risk when all proper personal protective equipment (PPE) is utilized. Proper PPE consists of long sleeves, pants, boots, gloves and eye protection. The “Upper” level presents a combination of all possible worst-case assumptions within the scenario; it is presented only as a highly improbable reference or a worst-case evaluation.

HQs over 1.0 are discussed below.

**CENTRAL HAZARD QUOTIENTS GREATER THAN 1.0 – DIRECTED FOLIAR APPLICATION TRICLOPYR ESTER**

At the central level of exposure, data found in Directed Foliar Application of Triclopyr ester to NNIP.xlsm worksheets E02, E04, G02a, G02b and G08b indicate a very low to negligible risk for:

- Workers (who aren’t wearing contaminated gloves)
- The General Public
- Terrestrial mammals
- Birds
- Insects

Nine scenarios in Directed Foliar Application of Triclopyr ester to NNIP.xlsm worksheets E02, and G03 return an HQ > 1.
Scenario #1 – Contaminated gloves, 1 hour (worker)

The HQ = 1.5 for this scenario based on a worker wearing contaminated gloves (i.e. chemical is between gloves and skin) for 1 hour.

Site Specific Circumstances and Mitigation – The scenario described above is designed to demonstrate a “worst case” scenario for purposes of the risk assessment. It is regarded as extreme and to the point of limited plausibility (unlikely to happen). This scenario would be mitigated by following the Specimen Label instructions and recommendations. The label requires the use of proper personal protective equipment (PPE), which includes long-sleeved shirt, long pants, and shoes plus socks. According to the label, the proper first aid treatment for a worker who gets herbicide on skin or clothing (e.g. inside their glove) is to immediately discard contaminated clothing and rinse the skin with plenty of water for 15-20 minutes. Fresh gloves and water (from offsite in separate containers) would be readily available to all workers that would be in contact with the herbicide. The Material Safety Data Sheet includes “Gloves and protective clothing as necessary to prevent skin contact”. The use of Rubber, Neoprene rubber, or Nitrile gloves would be recommended. Furthermore, the label for Garlon 4 (Triclopyr ester) requires wearing chemical resistant gloves.

The Forest Service has standard Herbicide Use Guidelines (attached below) that are placed in all herbicide contracts. These guidelines would also mitigate the above scenario. For these reasons the HQ for a worker wearing contaminated gloves is less than 1.0.

Scenarios #2-9 – Accidental Acute Exposure to Fish, Amphibians, Invertebrates, Macrophytes and Algae

The [HQs] are as follows:

Fish (Sensitive) [40], Fish (Tolerant) [5]
Amphibian (Sensitive) [36]
Invertebrate (Sensitive) [81], Invertebrate (Tolerant) [1]
Macrophyte (Sensitive) [85], Macrophyte (Tolerant) [12]
Algae (Sensitive) [2,595], Algae (Tolerant) [4]

The Hazard Quotients [HQs] for scenarios 2-9 refer to an acute (one time) contact with the herbicide Triclopyr ester, in a spill scenario. This scenario assumes a spill of 100 gallons of pre-mixed 2% solution of the herbicide directly into a water body 1000m² in size and 1m in depth. Large spills into small water bodies such as this would likely have an adverse effect on aquatic life.

Site Specific Circumstances and Design Criteria – The scenario described above is designed to demonstrate the “worst case” scenario for purposes of the risk assessment. It should be regarded as extreme and to the point of limited plausibility (unlikely to happen). The HQs greater than 1.0 shown above are dependent on a chain of several assumed conditions; if any one condition is unfulfilled, HQs would reduce to 1.0 or below. A 100-gallon spill would require involvement of a fully loaded transport (nurse/supply) vehicle with 100 gallons of pre-mixed
solution of Triclopyr ester. This supply vehicle would have to be directly at a water body and either involved in a wreck or overturned. The supply vehicle in this case typically carries two fifty gallon tanks. It is assumed that both of the tanks would be ruptured during the incident and that nearly every gallon would enter the water body. For the proposed action, only 1.25 gallons per acre of the triclopyr ester solution would be applied to specific NNIP species only where they occur. **There would not be a fully loaded transport (nurse/supply) vehicle carrying 100 gallons of pre-mixed triclopyr ester solution, so these scenarios are completely inapplicable to the proposed action.** Hazard Quotients for accidental scenarios, while they provide additional information, are not applicable to the proposed activities. That is, the Forest Service does not propose to have accidents. Strict adherence to LRMP Standards DB-VEG-18, 19, 20 & 21 (design criteria) would decrease or negate the chances for herbicide entering water, as these standards require designation of a buffer zone, prohibit mixing or loading herbicides and cleaning equipment within 200 feet of open water or wells and prohibit application of herbicide within 30 horizontal feet of streams, seeps, springs, wetlands, lakes or ponds. The hazard quotients produced in the risk assessment are based on a very extreme scenario that is at the limits of plausibility. For these reasons the HQs for an accidental acute exposure to sensitive and tolerant fish, sensitive amphibians, sensitive and tolerant invertebrates, sensitive and tolerant macrophytes, and sensitive and tolerant algae would be reduced to less than 1.0.

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**SOLUTIONS & RATES OF APPLICATION (TRICLOPYR ESTER) THAT APPLY TO THE PROPOSED ACTION FOR BASAL BARK APPLICATION OF TRICLOPYR ESTER TO SPECIFIC NNIP SPECIES WITHIN 100 FEET OF WILDLIFE OPENINGS AND IN THE 22 ACRE PINE WOODED GRASSLAND ESTABLISHMENT AREA.**

The use of triclopyr ester applied as a basal bark treatment could be used to treat specific NNIP in the project area including Tree-of-Heaven, and Kudzu. Basal bark treatment with Triclopyr ester could also be used as an alternative means of treating Autumn Olive, and Multiflora Rose.

In a basal bark application triclopyr ester (e.g. Garlon 4 or equivalent) would be mixed with an oil diluent (e.g. JLB Oil Plus Improved or equivalent) in a 20% solution. Thus for every gallon of this mix there would be 25.6 oz. of triclopyr ester and 102.4 oz. of basal oil diluent.

Basal bark applications are usually applied with low volume backpack sprayers. Application is to smooth juvenile bark by thoroughly wetting the lower 12 to 20 inches of the trunk, up to 36 inches on large trees (over 8”) to the groundline including the root collar area and any exposed roots. Smaller trees, shrubs, and vines are controlled with less coverage. A flat fan nozzle is best for applying a nice vertical band on the stem.

- Assuming an application rate of 1 lb. a.e./acre:
  - 1.0 lb a.e./acre ÷ 4 lb a.e./gal = 0.25 gal triclopyr ester/acre
  - 0.25 gal triclopyr ester/acre X 128 oz./gal = 32 oz. triclopyr ester /acre
Draft Risk Assessment – Greenwood Vegetation Management Project
Broadcast Application-Glyphosate, Directed Foliar Application-Glyphosate, Cut stump Application-Glyphosate, Directed Foliar application-Triclopyr ester, Streamline Application-Triclopyr ester.

- 32 oz. triclopyr ester/acre ÷ 25.6 oz/gal = 1.25 gallons/acre (Triclopyr ester and basal oil in mixture). So, if you were treating an entire acre at an application rate of 1 lb. a.e./acre you would spray out 1.25 gallons as a basal bark treatment to specific NNIP species over the entire acre to meet an application rate of 1 lb. a.e./acre.
- So, **1.25 gallons/acre** would be the estimated amount of the non-selective herbicide Triclopyr ester (20% mixture) that would be applied on a per acre basis. For purposes of the risk assessment this will be used as the “central” application rate.

- The **1.25 gallons/acre** for basal bark application of Triclopyr ester and 1.0 pounds acid equivalent (lb. a.e) per acre (**1.0 lb. a.e./acre**), serves as the “central” level of exposure. For purposes of this risk assessment these figures will serve as a central level of exposure. Hazard quotients (HQs) were calculated using these estimated application rates for the Triclopyr ester application. Risk assessment worksheets present hazard quotients at three levels of exposure: Central, Lower, and Upper. The “central” level has been used for evaluating risk for this proposal and is the best representation of worker risk when all proper personal protective equipment (PPE) is utilized. Proper PPE consists of long sleeves, pants, shoes with socks, chemical resistant gloves, and eye protection. The “Upper” level presents a combination of all possible worst-case assumptions within the scenario; it is presented only as a highly improbable reference or a worst-case evaluation.

HQs over 1.0 are discussed below.

**CENTRAL HAZARD QUOTIENTS GREATER THAN 1.0 – BASAL BARK APPLICATION TRICLOPYR ESTER**
At the central level of exposure, data found in *Basal Bark Application of Triclopyr ester to NNIP.xlsx* worksheets E02, E04, and G08b indicate a **very low to negligible risk** for:
- **Workers**
- **The General Public**
- **Insects**

Twenty-one scenarios in *Basal Bark Application of Triclopyr ester to NNIP.xlsx* worksheets G02a, G02b and G03 return an HQ > 1

**Scenarios #1, 2, 3, 4-** Contaminated Fruit, Broadleaf Foliage, Tall Grass, Short Grass-Large Mammal (70 kg or 154 lbs.)

Large Mammal [1.8]

The Hazard Quotient [HQ] of 1.8 for scenarios 1-4 refers to an acute (one time) exposure to a large mammal, such as a white-tailed deer, eating contaminated fruit, broadleaf foliage, tall grass, or short grass that has been directly sprayed with a 20% solution of triclopyr ester in basal oil.
It is not part of the proposed action to directly spray tree or shrub fruit, broadleaf foliage, tall grass or short grass with a 20% solution of triclopyr ester in basal oil. The target to be sprayed is the lower portion of woody shrub, vine, and tree stems (2-8” dbh). Application is to smooth juvenile bark by thoroughly wetting the lower 12 to 20 inches of the trunk to the groundline. The basal bark application is an alternative method of treating the NNIP species Autumn olive and Multiflora rose. If the deciding official makes a decision to not treat these two species through basal bark application, then they could be treated with a cut stump application of glyphosate instead.

It is possible that some indirect spray of grass, broadleaf foliage, or tree or shrub fruit could occur, if application occurs during growing season. However, basal bark application can occur anytime during the year, and would be scheduled during the dormant season when green grass, broadleaf foliage, or tree or shrub fruits are not present. The basal bark application would only occur as a spot treatment to basal bark on very specific NNIP species. Basal bark treatment is a very directed application and over spray would be minimal. The HQs >1 in scenarios 1-4 represent worst case exposure assumptions that are extreme and are really inapplicable to a basal bark treatment to very specific NNIP species only where they occur. The worst case exposure assumptions could be considered implausible and unlikely to occur in the field. The scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. A field study by Leslie et al. (1996) suggests that some mammals, such as deer, may avoid treated areas. If larger mammals avoid treated areas, and the proportion of their diet that is contaminated decreases, the consequent HQs would also decrease. It is far-fetched to believe that deer would eat the lower bark of treated trees, shrubs, and vines and that this would comprise 100% of their diet. Deer prefer to feed on forbs. Forbs are not the target of herbicide treatment.

Several factors combine to decrease the level of concern in scenarios 1-4: the target for application is basal bark...not fruit, broadleaf vegetation, or grass. If grass were indirectly sprayed and eaten around a treated tree, shrub, or vine it certainly wouldn’t comprise 100% of a deer’s diet. The treatment could be scheduled in the winter when no broadleaf vegetation, fruit, or green grass is present. Deer may avoid treated areas. For these reasons the HQs for a large mammal eating contaminated fruit, broadleaf foliage, tall grass, or short grass would be less than 1.0

**Scenarios #5 -12** – Scenarios 5-12 all have to do with mammals repeatedly eating contaminated fruit, broadleaf foliage, tall Grass, or short grass contaminated by a direct spray of triclopyr ester over a long period of time (months or years).

The [HQs] are as follows:

**Contaminated Fruit**

400g mammal (Rat) [3]

70kg mammal (Deer) [36]
Contaminated Broadleaf Foliage
400g mammal (Rat) [3]
70kg mammal (Deer) [36]

Contaminated Tall Grass
400g mammal (Rat) [3]
70kg mammal (Deer) [36]

Contaminated Short Grass
400g mammal (Rat) [3]
70kg mammal (Deer) [36]

The HQs >1 in scenarios 5-12 represent worst case exposure assumptions that are extreme and are really inapplicable to a basal bark treatment to very specific NNIP species only where they occur. The worst case exposure assumptions could be considered implausible and unlikely to occur in the field. The scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. A field study by Leslie et al. (1996) suggests that some mammals, such as deer, may avoid treated areas. If larger mammals avoid treated areas, and the proportion of their diet that is contaminated decreases, the consequent HQs would also decrease. It is far-fetched to believe that deer or rats would eat only the lower bark of treated trees, shrubs, and vines and that this would comprise 100% of their diet. Deer prefer to feed on forbs. Forbs are not the target of herbicide treatment. Wild rats are opportunist omnivorous eaters. That means they will eat whatever they can find. In most cases, this includes grains, fruits and vegetables, seeds and nuts and any other edibles they might find. Although rats prefer to eat what they find, they will hunt in occasion, catching bugs and other small animals.

Several factors combine to decrease the level of concern in scenarios 5-12: the target for application is basal bark...not fruit, broadleaf vegetation, or grass. If grass were indirectly sprayed and eaten around a treated tree, shrub, or vine it certainly wouldn’t comprise 100% of a deer or rat’s diet. The treatment would be scheduled in the winter when no broadleaf vegetation, fruit, or green grass is present. Additionally, deer may avoid treated areas. For these reasons the HQs for a deer or rat continuously eating contaminated fruit, broadleaf foliage, tall grass, or short grass would be less than 1.0.

Scenarios 13-20 - The Hazard Quotients [HQs] of 1.9 for scenarios 13-20 refers to a small (10g) or large (4kg) bird continuously eating contaminated fruit, broadleaf foliage, tall grass, or short grass that has been directly sprayed with a 20% solution of triclopyr ester in basal oil. The risk assessment assumes a foliar application of a 20% solution of triclopyr ester in basal oil, and that fruit, broadleaf foliage, and tall and short grass would be directly sprayed. A foliar application of a 20% solution of triclopyr ester in basal oil is not proposed. The
application method proposed would be a basal bark treatment applied to the lower 12 to 20 inches of the trunk of specific NNIP species only where they occur.

The HQs >1 in scenarios 5-12 represent worst case exposure assumptions that are extreme and are really inapplicable to a single basal bark treatment to very specific NNIP species only where they occur. The worst case exposure assumptions could be considered implausible and unlikely to occur in the field, since the scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. A small or large bird is not going to continuously eat the lower bark of NNIP species such as tree-of-heaven, and even if they ate a little grass that has been indirectly sprayed it certainly would not comprise 100% of their diet.

Several factors combine to decrease the level of concern in scenarios 13-20: the target for application is basal bark...not fruit, broadleaf vegetation, or grass. If grass were indirectly sprayed and eaten around a treated tree, shrub, or vine it certainly wouldn’t comprise 100% of a birds diet. The treatment could be scheduled in the winter when no broadleaf vegetation, fruit, or green grass is present. The proposed application method is not a directed foliar application. For these reasons the HQs for a small or large bird continuously eating contaminated fruit, broadleaf foliage, tall grass, or short grass would be less than 1.0.

**Scenario 21 Accidental Acute Exposure to Sensitive Fish**

The [HQ] is as follows:

Fish (Sensitive) [1]

The Hazard Quotient [HQ] for scenario 21 refer to an acute (one time) contact with the herbicide Triclopyr ester, in a spill scenario. This scenario assumes a spill of 100 gallons of pre-mixed solution of the herbicide directly into a water body 1000m² in size and 1m in depth.

Site Specific Circumstances and Design Criteria – The scenario described above is designed to demonstrate the “worst case” scenario for purposes of the risk assessment. It is regarded as extreme and to the point of limited plausibility (unlikely to happen). The HQ of 1.0 shown above is dependent on a chain of several assumed conditions; if any one condition is unfulfilled, the HQ would reduce to below 1.0. A 100-gallon spill would require involvement of a fully loaded transport (nurse/supply) vehicle with 100 gallons of pre-mixed solution of Triclopyr ester. This supply vehicle would have to be directly at a water body (pond) and either involved in a wreck or overturned. The supply vehicle in this case typically carries two fifty gallon tanks. It is assumed that both of the tanks would be ruptured during the incident and that nearly every gallon would enter the water body. There would not be a fully loaded transport (nurse/supply) vehicle carrying 100 gallons of pre-mixed Triclopyr ester, so this scenario is completely inapplicable to the proposed action. Hazard Quotients for accidental scenarios, while they provide additional information, are not applicable to the proposed activities. That is, the Forest Service does not propose to have accidents. Strict adherence to LRMP Standards DB-VEG-18, 19, 20 & 21 (design criteria) would decrease or negate the chances for herbicide entering water, as these standards require designation of a buffer zone, prohibit mixing or loading herbicides and cleaning equipment
within 200 feet of open water or wells and prohibit application of herbicide within 30 horizontal feet of streams, seeps, springs, wetlands, lakes or ponds. The hazard quotients produced in the risk assessment are based on a very extreme scenario that is at the limits of plausibility. For these reasons the HQ for an accidental acute exposure to sensitive fish, would be reduced to less than 1.0.

RISK ASSESSMENT CONCLUSION

The proposed action proposes the use of the forestry labeled herbicide glyphosate (e.g. Rodeo) to site prepare areas to be planted with wildlife plot mixtures, native grass stands, and pollinator plots in 75 existing wildlife openings; and to implement no-till planting methods as a preferred method on site prepared areas within portions of the 75 existing wildlife openings. The proposed herbicide treatment would also help control/eradicate non-native invasive plants (NNIP) species occurring in the wildlife openings. There are approximately 222 acres of wildlife openings in the project area ranging from 0.2 to 23 acres with an average of approximately 2.95 acres in size. Of the 222 acres, approximately 154 acres are wildlife openings in the Beaver Creek Wildlife Management Area.

It is also proposed to chemically treat NNIP species within 100 feet of the wildlife openings on an additional 286 acres, using spot treatments of glyphosate or triclopyr ester; as well as in a 22 acre wooded grassland restoration area. Proposed herbicide treatments would be done according to label directions for the target species. Herbicide would be applied directly on the target plant(s) through directed foliar application (maximum 2% solution of glyphosate or triclopyr ester), basal stem (maximum 20% solution-triclopyr ester), or cut stump treatment (maximum 20% solution-glyphosate).

The hazard quotients (HQs) > 1 from the individual risk assessments for the use of Glyphosate and Triclopyr ester have been discussed above.

For the proposed ground broadcast application of Glyphosate (e.g. Rodeo) for site preparation in wildlife openings five scenarios in the Glyphosate Ground Broadcast Foliar for Site Preparation in Wildlife Openings.xlsx worksheets G02b, G03, return an HQ of 1 or greater. The five scenarios that return an HQ of 1 or greater are: chronic/longer term exposure to small bird (passerine) eating contaminated short grass, accidental acute exposure to sensitive fish, accidental acute exposure to sensitive invertebrates, accidental acute exposure to sensitive macrophytes, and accidental acute exposure to sensitive algae. The worksheets with HQs of 1 or greater for Glyphosate Ground Broadcast Foliar for Site Preparation in Wildlife Openings.xlsx are attached to this risk assessment.

For the proposed use of Glyphosate (e.g. Rodeo) applied as a directed foliar application or cut stump application for control of non-native invasive plants (NNIP) within 100 feet of wildlife openings and in the proposed pine woodland establishment area, four scenarios in Directed Foliar and Cut Stump Application of Glyphosate for Control of NNIS.xlsx worksheet G03 return an HQ > 1. The four scenarios that return an HQ of 1 or greater are: accidental acute exposure to sensitive fish, accidental acute exposure to sensitive invertebrates, accidental acute exposure to sensitive macrophytes, and accidental acute exposure to sensitive algae. The
worksheets with HQs of 1 or greater for Directed Foliar and Cut Stump Application of Glyphosate for Control of NNIS.xlsm are attached to this risk assessment.

For the proposed use of Triclopyr ester (Garlon 4 or equivalent) applied as a directed foliar application for control of specific NNIP species within 100 feet of wildlife openings and in the proposed pine woodland establishment area, nine scenarios in Directed Foliar Application of Triclopyr ester to NNIP.xlsm worksheets E02, and G03 return an HQ > 1. The nine scenarios that return an HQ of 1 or greater are: contaminated gloves, 1 hour (worker), accidental acute exposure to sensitive fish, accidental acute exposure to tolerant fish, accidental acute exposure to sensitive amphibians, accidental acute exposure to sensitive invertebrates, accidental acute exposure to tolerant invertebrates, accidental acute exposure to sensitive macrophytes, accidental acute exposure to tolerant macrophytes, and accidental acute exposure to tolerant algae. The worksheets with HQs of 1 or greater for Directed Foliar Application of Triclopyr ester to NNIP.xlsm are attached to this risk assessment.

For the use of Triclopyr ester (Garlon 4 or equivalent) applied as a basal bark treatment to specific NNIP species only where they occur within 100 feet of wildlife openings and in the proposed pine woodland establishment area, twenty-one scenarios in Basal Bark Application of Triclopyr ester to NNIP.xlsm worksheets G02a, G02b and G03 return an HQ > 1. The twenty-one scenarios that return an HQ of 1 or greater are: non-accidental acute exposure to a large mammal (e.g. deer) eating contaminated fruit, non-accidental acute exposure to a large mammal (e.g. deer) eating contaminated broadleaf foliage, non-accidental acute exposure to a large mammal (e.g. deer) eating contaminated tall grass, non-accidental acute exposure to a large mammal (e.g. deer) eating contaminated short grass, chronic/longer term exposure to a 400g mammal (rat) eating contaminated fruit, chronic/longer term exposure to a 70 kg mammal (deer) eating contaminated fruit, chronic/longer term exposure to a 400g mammal (rat) eating contaminated broadleaf foliage, chronic/longer term exposure to a 70 kg mammal (deer) eating contaminated broadleaf foliage, chronic/longer term exposure to a 400g mammal (rat) eating contaminated tall grass, chronic/longer term exposure to a 70 kg mammal (deer) eating contaminated tall grass, chronic/longer term exposure to a 400g mammal (rat) eating contaminated short grass, chronic/longer term exposure to a 70 kg mammal (deer) eating contaminated short grass, chronic/longer term exposure to a small (10g) bird eating contaminated fruit, chronic/longer term exposure to a small (10g) bird eating contaminated broadleaf foliage, chronic/longer term exposure to a large (4kg) bird eating contaminated short grass, chronic/longer term exposure to a large (4kg) bird eating contaminated tall grass, chronic/longer term exposure to a small (10g) bird eating contaminated tall grass, chronic/longer term exposure to a large (4kg) bird eating contaminated short grass, and an accidental acute exposure (spill) to sensitive fish. The worksheets with HQs of 1 or greater for Basal Bark Application of Triclopyr ester to NNIP.xlsm are attached to this risk assessment.

It is important to understand that for species that are NOT threatened or endangered (T&E), the Forest Service manages for populations rather than individuals. For example, a common species may have thousands of
individuals throughout the forest, making the loss of an individual not at all detrimental to the species as a whole. T & E species, however, are managed on an individual basis. Consultation takes place with the U. S Fish and Wildlife Service, as is required by the Endangered Species Act, in order to determine the effects of projects on federally listed T & E species.

These scenarios have been discussed in the context of the preceding individual herbicide risk assessments. Adherence to labeling requirements on the herbicide label, herbicide use guidelines provided to cooperators and Forest Service personnel, as well as Forest Service standards would mitigate these scenarios into improbable occurrences. Should a spill or non-target application occur, a quick response, as outlined in the Emergency Spill Plan for the Stearns Ranger District would minimize hazards to humans and aquatic wildlife species.

While the modeling process has revealed a number of scenarios where the risk to non-target species groups or humans would numerically exceed the Hazard Quotients of 1.0, adherence to safety provisions and directions on the herbicide label, implementing LRMP Standards, and implementing project specific design criteria nearly negate these as matters of concern in the applied situation. In most cases, the potential for exposure to non-target organisms is low to negligible. This lack of exposure opportunity, again, is due to the design criteria required for the project, adherence to all herbicide label directions, and adherence to LRMP standards. In the case of accidental spills, a required sequence of highly unlikely events would have to occur for the levels of exposure presented in the scenarios to actually happen.

Forest Service form FS-2100-2 – Pesticide Use Proposal, is an implementation tool for tracking and approving pesticide use consistent with the project decision. It provides the details that the risk assessments are based on. A Pesticide Use Proposal would be completed and approved for each activity or group of activities as implementation progresses.

**HERBICIDE USE GUIDELINES**

**GENERAL**

The following guidelines apply where herbicide would be used.

**LICENSING**

Any cooperator(s) must have a state license for application of herbicide in the State of Kentucky. Prior to herbicide application, they must provide a copy of an herbicide applicator license to the District Silviculturist. If they fail to provide a copy of a license, no herbicide application would take place until someone on the crew provides a State of Kentucky herbicide applicator license. Any Forest Service employee who applies herbicide must be in possession of a Certified Pesticide Applicator card issued by Region 8 before they can apply herbicide, or be supervised, in the field, by a Forest Service employee in possession of this card.
TRAINING OF COOPERATOR/FOREST SERVICE EMPLOYEES

The cooperator/Forest Service is responsible for instructing each of their employees, who would apply herbicides, in the safe and proper method to apply the herbicide in order to protect the employees, the public, and the environment from contamination or injury. The suggested areas of training include but are not limited to:

1. Safe handling of chemicals;
2. Proper application techniques;
3. Use and maintenance of application equipment;
4. Safe transportation, storage, and disposal of containers and chemicals;
5. Emergency first aid in case of personal contamination;
6. Personal hygiene;
7. Clean-up of minor spills and reporting of major spills;

STORAGE OF HERBICIDES

Herbicides used will not be stored or left overnight in cooperator or Forest Service owned vehicles or buildings unless the facilities have been approved by the District Silviculturist. Unused herbicides would be returned to the designated approved storage facility at the end of each workday.

TRANSPORTATION OF HERBICIDES

Cooperator(s) and Forest Service employees are legally responsible for the safe transportation of herbicides after they have received them from the approved storage facility. They shall follow travel routes designated by the District Silviculturist, when transporting herbicides from the public road system to the treatment sites. Transport vehicles shall be parked within the treatment area or an area designated by the District Silviculturist.

Transportation of herbicides used shall be in accordance with label instructions and generally approved and accepted procedures for the safe transportation of herbicides. All cooperator/Forest Service employees should take the following precautions to prevent spills, accidents, injury or theft.

1. Transport herbicides in the cargo compartment of a truck or other vehicle, away from the passenger compartment.
2. No personnel shall ride in the cargo compartment of any vehicle transporting herbicides.
3. All herbicide containers shall be tied down or otherwise constrained in order to prevent the containers from tipping over or breaking and spilling their contents.

4. Herbicides shall not be transported in the same compartment as food and clothing.

5. Any herbicide spilled in or from the transport vehicle shall be cleaned immediately.

6. Herbicides shall not be left unattended in an unlocked vehicle or storage area.

HANDLING AND APPLICATION OF HERBICIDES

A copy of the label/safety data sheet for each herbicide or other chemical being used shall be kept on site at all times. Copies of the label and safety data sheets would be taken to the medical facility, if any crewmember requires medical attention because of using the herbicides or other chemicals. Safety data sheets are available from the Forest Service upon request.

All Cooperator/Forest Service employees shall follow the rules and guidelines shown below:

1. Read and heed the safety information on the herbicide container label and safety data sheet.

2. Wear the designated protective clothing and/or equipment as recommended by the herbicide manufacturer.

3. Keep first aid supplies and a supply of clean water available for use by applicators. This should include soap and eye wash equipment meeting OSHA regulations.

4. Herbicide applicators should not work alone.

5. Only the amount of herbicide required for the day’s work should be transported.

6. Applicators should stand upwind when applying chemicals by spraying, in order to avoid contamination.

7. To avoid splashing or spilling herbicide on the face in eyes, keep the container below eye level when pouring herbicides.

8. Stop work immediately if herbicide is spilled on an employee. If the chemical is exposed to an employee’s eyes, immediately flush out their eyes with clean water. If the chemical is exposed to bare skin, wash any contaminated clothing and dispose of properly. Speed is essential in any of these instances. After cleaning contaminated areas put on clean protective clothing and equipment and clean up the spill. See a physician as appropriate.

9. Keep measuring cups and other equipment clean and properly stored when not in use.
10. Employees should wash their hands carefully before eating, smoking, or relieving themselves.

11. Herbicides shall not be applied within 30 feet of any permanent water source or within 10 feet of any dried streambed.

12. Herbicide shall not be applied or equipment cleaned outside of areas designated by the District Silviculturist.

13. Herbicide mixing, loading, or cleaning areas in the field are not to be located within 200 feet of private land, open water or wells.

14. Application equipment, empty herbicide containers, clothing worn during treatment and skin are not to be cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate, labeled containers.

HERBICIDE SPILLS

The District Silviculturist shall be notified immediately of any herbicide spill or accident. If a spill occurs, every effort shall be made to keep it from contaminating water and other offsite areas. The spill shall be cleaned up as quickly as possible. The appropriate Federal, State, Local government officials shall be notified of any herbicide spill or accident. Herbicide spills shall be handled in accordance with the standard procedures for spill clean-up (40 CFR 117).

EMERGENCY SPILL PLAN

The Cooperator/Forest Service employees should have a copy of the Emergency Spill Plan, as provided by the Forest Service, before commencing work on the project.

DISPOSAL OF HERBICIDE CONTAINERS

All empty herbicide containers shall be returned to the Forest Service for disposal by the Forest Service.

CLEANING OF HERBICIDE CONTAINERS

Empty herbicide containers shall be triple-rinsed at the work site using clean water. Rinse water shall be spread on the work site away from streams and on an area already treated. Triple rinsing is defined as filling the container at least 1/10 full of clean water, replacing the container lid/cap, shaking vigorously for at least 15 seconds and immediately pouring the contents from the container. This process is repeated three (3) times for each container. Note: Clean rinse water must be carried to the site separate from drinking water.

POLLUTION PROTECTION FOR STREAMS, LAKES, AND RESERVOIRS
The Cooperator/Forest Service employees shall take every precaution necessary to prevent pollution of any stream, lake, or reservoir, located in or near the work site, from basal oil, herbicide, or harmful materials. All stream channels shall be kept free of debris.

Herbicides shall not be applied within 30 feet of any permanent water source or within 10 feet of any dried streambed.

WORKER PROTECTION STANDARDS-HERBICIDE APPLICATION

GENERAL INFORMATION

Herbicide workers would be required to follow the requirements of the Worker Protection Standards (Volume 10, Number 1 A, 1994 Reference Guide, EPA's Worker Protection Standards), which include wearing the following personal protective clothing and equipment; long-sleeved shirt; long pants; shoes/boots and socks; chemical resistant gloves; goggles.

REFERENCES


Draft Risk Assessment – Greenwood Vegetation Management Project
Broadcast Application-Glyphosate, Directed Foliar Application-Glyphosate, Cut stump Application-Glyphosate, Directed Foliar application-Triclopyr ester, Streamline Application-Triclopyr ester.

FS Worksheet Maker Version 6.00.13.xlsxm.

Glyphosate Ground Broadcast Foliar for Site Preparation in Wildlife Openings.xlsxm worksheets
Directed Foliar and Cut Stump Application of Glyphosate for Control of NNIS.xlsxm worksheets
Directed Foliar Application of Triclopyr ester to NNIP.xlsxm worksheets
Basal Bark Application of Triclopyr ester to NNIP.xlsxm worksheets

Websites

http://www.ncsu.edu/goingnative/glyphosateuse.pdf

Pesticide risk assessment, Syracuse Environmental Research Associates, Inc. Home