DOE/EA-1012: Final EA

Final
Environmental Assessment
for
Vegetation Control along Transmission Line Rights-of-Way

Prepared for
Southwestern Power Administration
U.S. Department of Energy

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1.0 Purpose and Need for Action

Southwestern Power Administration (Southwestern), a division of the U.S. Department of Energy, accesses transmission lines within their rights-of-way (ROW) for the purpose of line and structure maintenance and emergency response. The most significant impediment to structure maintenance and emergency response is the growth of woody vegetation (trees & shrubs) within the ROW. The primary goal of vegetation control is to minimize woody vegetation growth while increasing the growth of herbaceous vegetation (grasses) within the ROW. The purpose of this environmental assessment (EA) is to evaluate the alternatives available for controlling woody vegetation growth within the ROW.

Southwestern maintains approximately 1,380 miles (2,220 kilometers) of transmission line ROW in Oklahoma, Arkansas, and Missouri crossing private and government-owned lands. The ROW is typically 100 feet (30.48 meters) wide and covers approximately 12.12 acres (4.90 hectares) per mile. Southwestern generally controls vegetation in forest and overgrown shrubland. Areas used for pastureland and farming require little to no vegetation control. Based on Southwestern's observations of the land use along the ROW and past ROW clearing operations, Southwestern maintenance personnel have estimated that approximately 700 miles of ROW (1,120 kilometers) require vegetation control.

Southwestern has been using mechanical methods to control vegetation. The mechanical methods have often resulted in a long term increase in stem counts and the establishment of a dense woody cover. As a result of these effects, mechanical methods have required extensive reclearing efforts every three years and limited annual reclearing (brush-hogging) of controlled areas for localized line maintenance. Reductions in staff and budgetary resources require Southwestern to identify more efficient methods of controlling vegetation within the ROW. Based on these concerns, Southwestern is evaluating a number of alternative methods for vegetation control within the ROW. The alternatives evaluated for controlling vegetation in the ROW include: (1) mechanical/manual control (no action), (2) fire control, (3) biological control, and (4) a combination of mechanical/manual and herbicide control (proposed action). The herbicides suitable for use in the last alternative were evaluated to determine the potential impacts to the environment. Southwestern proposes to implement the selected vegetation control method beginning in Spring 1995.

An Environmental Impact Statement (EIS) evaluating similar vegetation control alternatives was prepared by the U.S. Department of Agriculture (USDA), National Forest

Service for use in National Forest lands in Oklahoma and Arkansas. Alternative evaluations and issues of concern discussed in this EA often reference information contained in the USDA EIS.

Prior to implementing the selected vegetation control alternative, Southwestern must determine whether the selected alternative poses a significant impact to the environment. This determination is aided through the review of the EA. The EA was developed with input from federal and state agencies, public organizations and individuals, and experts familiar with the various alternatives and their impacts. This input was solicited during the scoping process, when these groups were identified and informed of Southwestern's intent to prepare the EA. These groups were given the opportunity to provide the document manager with information on the alternatives under evaluation or to suggest other reasonable alternatives.

The scoping process consisted of the notification of federal and state agencies with interest in the project, public notification published in local newspapers (near the study area), and direct contact with various experts familiar with relevant portions of the EA. Significant issues concerning impacts to human health and the environment were raised during the scoping process including: air quality; water quality; wetlands; vegetation; wildlife; threatened and endangered species; archaeological, cultural, and historical resources; and recreation and aesthetics. In addition, issues concerning the transportation and storage of herbicides and the potential effects of accidents and spills were raised.

In the event that the selected alternative does not pose a significant impact to the environment, a Finding of No Significant Impact (FONSI) would be issued by Southwestern. If a FONSI is not issued, an EIS may be developed.

2.0 Description of the Alternatives

Southwestern maintains the ROW under a legal easement that allows the cutting, trimming, mowing or removal of vegetation that interferes with operations and maintenance of the ROW. Potential alternatives for vegetation control from the scoping process and the USDA EIS include: manual and mechanical (no action), herbicide, fire, and biological vegetation control. Each of these alternative methods are used by private landowners and public agencies for the purpose of vegetation control. The alternatives were evaluated against the rights granted by the easements. In addition, comments received from interested persons, organizations, and governmental agencies were reviewed and considered by the preparation team. Two alternatives, fire control and biological control, were considered but eliminated because they (1) eliminate both desirable and undesirable vegetation, (2) present unacceptably high risks (uncontrolled fires), (3) are not specifically permitted under the terms of Southwestern's easement, or (4) require more resources than are available. The no action alternative, manual and mechanical vegetation control (status quo), and the proposed action, the selective use of herbicides in addition to manual and mechanical vegetation control, were evaluated in greater detail.

2.1 Alternative 1 - No Action

The no action alternative continues the use of mechanical and manual methods to control vegetation. The mechanical method currently used by Southwestern is a tractor-mounted brush hog and a truck-mounted boom-tip saw that clears the vegetation. The manual methods used by Southwestern include chain saws and brush saws. Resprouting of forbs, woody shrubs, or other undesirable plants is usually numerous and vigorous and causes competition with grasses. As a result of resprouting, Southwestern performs an extensive reclearing effort every three years and limited annual reclearing of certain areas.

The brush hog mowing tool cuts, chops, or shreds vegetation near the land surface and allows mulching of vegetation and onsite nutrient recycling. This tool is most effective on vegetation 3 inches (7.6 centimeters) or less in diameter.[1] Brush hogging the ROW may incidentally impact desirable vegetation by cutting plants below the growing point. These impacts may occur prior to seed dispersal, which may inhibit grasses from

[1]U.S. Department of Agriculture, Forest Service, Southern Region, "Final Environmental Impact Statement for Vegetation Management in the Ozark/Ouachita Mountains", Management Bulletin R8-MB, March 1990, pp. II-22, II-27.

spreading throughout the ROW. Southwestern uses this method to maintain the majority of the ROW.

The boom-tip saws are used to cut encroaching tree limbs along the sides of the ROW. Southwestern uses this tool to selectively control tree limbs growing into the ROW, while allowing the live tree to remain.

The manual methods using a chain saw and brush saw are used to control vegetation larger than 3 inches (7.6 centimeters) in diameter, including dense shrub growths, tree limbs, and large trees.[1] These manual methods are initially effective on woody vegetation; however, resprouting from the stumps or other exposed woody vegetation is common. Southwestern uses this method to control larger trees and along slopes too steep for the tractor-mounted brush hog.

2.2 Alternative 2 - Proposed Action

The proposed action includes combining herbicide application with mechanical and manual methods to control undesirable vegetation along the ROW. Discussions on the proposed action in this report are confined to the addition of different methods of herbicide treatment to the established vegetation control methods. The current mechanical and manual vegetation control methods that would be used in conjunction with the selective use of herbicides are discussed in Section 2.1.

With the use of herbicides, woody vegetation would be controlled while promoting the growth of desirable grasses. Herbicide application methods would include a combination of Cut-Surface Treatments, Basal Application, and Foliar Spray Application depending on the season of the year and species controlled. Trees would be primarily controlled using Cut-Surface Treatments and Basal Application. Dense brush would be primarily controlled using Foliar Spray Application.

The combination of herbicides with mechanical and manual methods would reduce the maintenance requirements of the ROW for Southwestern. Southwestern has estimated that the initial herbicide application would eliminate approximately 75-80% of the broadleaf shrub and tree species. The second application would control any broadleaf shrub and tree species that were not controlled in the initial application and any vegetation that has sprouted since the initial application. After the second application, Southwestern has estimated that subsequent applications would be needed every 5 to 6 years depending on species resistance and growth patterns.

Herbicides would be applied using one, or a combination of the following methods: (1) a power-driven vehicle-mounted mechanical sprayer, (2) backpack sprayers, (3)

pressurized sprayers, and/or (4) squirt bottles. The vehicle-mounted mechanical sprayer contains a 200-gallon (757-liter) tank and a 25-foot (7.6-meter) radiarc spray head. This 200-gallon (757-liter) tank would be refilled with water from a 500-gallon (1892.7-liter) polyethylene tank. This refill water is mixed with herbicide in the 200-gallon (757-liter) sprayer tank. The mechanical sprayer allows the herbicide to be sprayed onto the woody vegetation to approximately 6 feet (1.88 meters) above land surface. Herbicide would be applied using the mechanical sprayer at pressures not to exceed 50 pounds per square inch (345 kilo Pascals) to minimize spray fines. Application using the mechanical sprayer would not occur when wind gusts exceed 10 to 12 miles per hour (16 to 19 kilometers per hour), the temperature is above 98 degrees Fahrenheit (37 degrees Celcius), and the humidity is less than 20%. The backpack sprayers, pressurized sprayers, and squirt bottles are standard items and can be manually adjusted to deliver the amount of herbicide needed.

Nine herbicides were initially evaluated to assist mechanical vegetation control methods including Accord, Arsenal, Escort, Garlon 3A, Garlon 4, Krenite-UT, Spike-80W, Tordon-K, and Tordon 101M. The characteristics of each herbicide are depicted in two matrices developed during the scoping process. The Application Matrix, Table 1, depicts each herbicide's characteristics of physiological and biochemical behavior, target vegetation, habitat usage, application method, soil persistence, degradation mechanisms, and relative cost. The Impact Matrix, Table 2, depicts the ability of each herbicide to effect air quality, surface water quality, groundwater quality, wetlands, vegetation, aquatic life, wildlife, threatened and endangered species, cultural resources, recreation and aesthetics, and human health effects.

These nine herbicides were then evaluated against a herbicide selection criteria developed by Southwestern. Southwestern has determined that herbicides proposed for use in vegetation control along ROW must meet all of the following herbicide selection criteria:

1) active on deciduous vegetation,
2) able to use in both terrestrial and wetland habitats,
3) exhibits a half-life in soil of 60 days or less,
4) exhibits high soil adsorption,
5) exhibit a low likelihood to migrate to surface water or leach to groundwater,
6) exhibit a non- or low- oral toxicity to wildlife, and
7) not exhibit toxicological effects on human internal organs.

Based on the results of this evaluation three herbicides, Accord, Garlon 3A, and Garlon 4, meet all of the herbicide selection criteria and could be used by Southwestern to assist manual and mechanical vegetation control. Prior to application, these herbicides would be diluted with water. Occasionally, herbicides would be diluted with either mineral oil, diesel oil, kerosene, limonene, or a surfactant when used in conjunction with the cut stump or basal application methods. A coloring agent may be added to the mixture to aid the applicator in determining the area covered.

2.2.1 Cut-Surface Treatments

Cut-surface treatments are used to eliminate undesirable trees. Tree injection, frill or girdle, and cut-stump treatments are the most commonly used cut-surface treatments. These methods could be applied during any season including the dormant season. However, the proposed herbicides are most efficient when applied during the growing season. Some herbicides are better applied during the late summer and fall. Free-bleeding species, such as red maple, would not be treated during the spring sap rise, as the sap would push the herbicide out of the injection points. Herbicide would not be applied to frozen trees.

Tree Injection Method (Hack and Squirt) - This method includes exposing the cambium of the target tree and then injecting herbicide into the wound. A hatchet and squirt bottle are often the tools used in this method. The wound would angle downward through the bark into the sapwood. The herbicide would be applied when the hatchet is removed.[2,3] This method would be used to control larger trees in the ROW, and to control saplings and trees located within wetland areas in the ROW.

Frill or Girdle Method - This method involves cutting completely around the tree trunk into the sapwood with an ax, hatchet, or chainsaw. The cuts would be completely wetted with herbicide using a squirt bottle or pressurized spray unit. The wood chips produced during the cutting would not be removed, rather remain attached to the tree trunk to aid in containing the herbicide within the wounds.[2,3] This method would be used to control larger trees in the ROW, and to control saplings and trees located within wetland areas in the ROW.

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[2]Ibid, pp. 2 - 8.

[3]Williamson, Max, "Selective Herbicide Applications for Low Impact Vegetation Management of Right-of-Ways, Southern United States, undated.

Cut Stump Method - This method is used on freshly cut or older stumps of any size to prevent resprouting. The cambial area (approximately the outer 1 inch (2.54 centimeters) of the stump) would be wetted with herbicide using either a pressurized backpack sprayer or vehicle mounted radiarc head sprayer. The herbicide would be applied to smooth level stumps free of bark tears, sawdust, or other debris. If a delay of more than 2 hours between cutting and herbicide application occurs, the effectiveness of the herbicide can be reduced; therefore, an oil additive would be added to the herbicide mixture as a cambium treatment.[2,3] This method would be used to control vegetation after mowing with a tractor-mounted brush hog using the mechanical sprayer and to stumps with a backpack sprayer.

2.2.2 Basal Application

Basal applications are used for selective control of undesirable saplings and brush. Under this method, herbicide in an oil-based diluent would be applied directly onto the bark encircling the lower 12 to 24 inches (0.31 to 0.61 meter) of the target stems until thoroughly wet, but not to the point of runoff. The herbicide mixture would be applied with a backpack sprayer and spray gun or wand. This method allows for selective stem removal while desirable plants are left unharmed.[2,3] Basal applications could be applied during any season; however, application during the dormant season is preferred because the stem bases are easily accessible.

2.2.3 Foliar Spray Application

Foliar Spray Application is used for individual plant treatments and to selectively control undesirable woody vegetation. Under this method, herbicide would be applied directly onto the target foliage in a uniform spray generating large spray droplets using the mechanical sprayer, backpack sprayers, or pressurized sprayers. Foliar Spray Application would be applied when vegetation is fully leaved, green, and growing.[2,3] Early season application would be made after full leaf-out of the species to be controlled is obtained; late season application would be made prior to the appearance of fall colors.

2.2.4 Cumulative Actions

Cumulative actions are actions resulting from or associated with the proposed alternative that do not specifically affect the goals of the proposed alternative. Cumulative actions associated with the proposed action include waste generated, herbicide containment, and access development.

2.2.4.1 Waste Generated

Wastes generated during the proposed alternative include herbicide product containers, spray tips, and personal protection equipment. Herbicide product containers would be triple rinsed with water, punctured, and disposed of in a sanitary landfill or by any other method indicated on the manufacturer's label. Spray tips would be triple rinsed and disposed of in a sanitary landfill or by any other method indicated on the manufacturer's label. Personal protection equipment would either be rinsed and disposed of in a sanitary landfill or washed and reused. The rinse water generated in cleaning containers and spray tips would be applied in the treated areas.

There would be no excess herbicide mixture remaining onsite after each day because any excess herbicide mixture would be applied within the ROW before Southwestern personnel leave the site.

2.2.4.2 Herbicide Containment

Product herbicide would be delivered to the site in either 2.5-gallon (9.46-liter) or 55-gallon (208.19-liter) containers. The herbicide would normally be diluted with water. Occasionally, herbicides would be diluted with either mineral oil, diesel oil, kerosene, limonene, or a surfactant. Surfactants and/or dyes may also be added to the herbicide depending on the method of application. Non-water diluents would be transported to the site in small (less than 5-gallon (18.93-liter)) containers and would be poured into the hand or backpack sprayers as necessary. The herbicide dilution would occur within the ROW.

In case of a rupture or other release of a herbicide container, the remainder of mixed herbicide would be applied to the target area until the container was empty. Leaking herbicide containers would not be transported off of the ROW until no herbicide remained in the container. If an uncontrollable rupture or other release of a herbicide or non-water diluent container did occur, Southwestern personnel would contain any liquids within the ROW.

To further reduce the risk of release, no product herbicide, diluted herbicide, or non-water diluents would remain in non-contained areas within the ROW without Southwestern personnel supervision.

2.2.4.3 Access Development

Access roads into the ROW do not exist in many areas. While some portions of ROW may be accessible at points where the ROW crosses existing roads, many areas

would need to be accessed through private properties. Access through private property would be maintained with permission of the specific landowner.

Access to target areas within the ROW exists through existing jeep trails or would be developed as the machinery travels over forbs and grasses. The access to the target areas would be the final area treated once personnel and machinery have exited the treated area. The use of this access reduces the threat of personnel and machinery contacting treated areas and transporting the herbicide offsite.

2.2.5 Future Activities

In the future, development of new herbicides could occur. The characteristics and potential impacts of new herbicides proposed for use would be compared to the subjects listed in Tables 1 and 2. Selection of new herbicides would be limited to herbicides meeting the herbicide selection criteria, as discussed in section 2.2.

In addition, modifications to the existing ROW, such as additional ROW acquired or developed by Southwestern, could occur. Modifications that occur within the three Physiographic Provinces described in the Environmental Setting, section 3.0, would not need to be evaluated with respect to potential impacts from herbicide application. The potential impacts upon the environment and human health in these three Physiographic Provinces has been conducted in this EA; however, the presence of protected streams, karst geology, threatened and endangered species, and archaeological, historical, or cultural resources would need to be identified and mitigated following the practices identified in this EA.

Table 1
Application Matrix

Herbicide	Physiological & Biochemical Behavior	Target Vegetation	Habitat Usage	Application Method	Soil Persistence	Degradation Mechanisms	Relative Cost (1-9, 1 being highest)	Remarks
Accord[a,b,c] (41.5% Glyphosate)	Inhibits protein synthesis	All vegetation, non-selective	Terrestrial Wetland Aquatic	Cut-Surface Basal Foliar Spray	60-day half-life. High soil adsorption.	Soil microbes	3	Widely used.
Arsenal[a,d] (28.7% Imazapyr)	Inhibits cell growth and plant DNA synthesis	Deciduous vegetation, non-selective	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	3-month to 2-year activity period. High soil adsorption.	Photodegraded	9	Widely used. Not active on coniferous trees.
Escort[a,e] (60% Metsulfuron)	Inhibits cell division	All vegetation, non-selective	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	1 to 6-week half-life. Limited soil adsorption.	Soil microbes, chemical hydrolysis	8	12-hour Worker Re-entry Restriction.
Garlon 3A[a,b,f] (44.4% Triclopyr amine)	Inhibits normal growth processes	Deciduous broadleaf vegetation, selective	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	30 to 46-day half-life. High soil adsorption.	Soil microbes, photodegraded	1	Widely used. Selectively encourages the growth of grasses.
Garlon 4[a,b,g] (61.6% Triclopyr ester)	Inhibits normal growth processes	Deciduous broadleaf vegetation, selective	Terrestrial Wetland	Cut-Surface Basal (mixed with oil)	30 to 46-day half-life. High soil adsorption.	Soil microbes, photodegraded	2	Widely used. Selectively encourages the growth of grasses.
Krenite-UT[a,b,h] (41.5% Fosamine)	Prevents bud growth	Deciduous broadleaf vegetation, selective. Works during subsequent growing season.	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	1-week half-life. Moderate soil adsorption.	Soil microbes	7	Prevents "brown out" by effecting bud development in subsequent growing seasons.

Table 1
Application Matrix

Herbicide	Physiological & Biochemical Behavior	Target Vegetation	Habitat Usage	Application Method	Soil Persistence	Degradation Mechanisms	Relative Cost (1-9, 1 being highest)	Remarks
Spike-80W[a,b,i] (80% Tebuthiuron)	Inhibits photosynthesis	All vegetation, non-selective	Terrestrial Wetland	Soil Spray by Hand Only	12 to 15-month half-life. Soil sterilant. Limited soil adsorption.	Soil microbes	6	Takes up to 3 years to be effective. Active within 6 feet of area sprayed.
Tordon-K[a,b,j] (24.4% Picloram)	Inhibits plant growth	Broadleaf vegetation	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	1-month half-life. Low soil adsorption.	Soil microbes, photodegraded	4	Mild skin irritant to workers.
Tordon 101M[a,b,k] (10.2% Picloram, 39.6% 2,4-D)	Inhibits plant growth	Broadleaf vegetation	Terrestrial Wetland	Cut-Surface Basal Foliar Spray	1-month half-life Low soil adsorption.	Soil microbes	4	Combustible at 35C.

[a]Weed Science Society of North America, Herbicide Handbook, 1989.
[b]U.S. Department of Agriculture, Forest Service, Pesticide Background Statements, Volume 1 - Herbicides, Agricultural Handbook No. 633, August 1984.
[c]Monsanto Corporation, Speciment Label for Accord, 1992.
[d]American Cyanamid Company, Specimen Label for Arsenal, 1992.
[e]E.I. Dupont de Nemours and Co., Specimen Label for Escort, 1993.
[f]Dow Elanco, Specimen Label for Garlon 3A, 1993.
[g]Dow Elanco, Specimen Label for Garlon 4, 1993.
[h]E.I. DuPont de Nemours and Co., Specimen Label for Krenite-UT, 1993.
[i]Dow Elanco, Specimen Label for Spike 80W, 1992.
[j]Dow Elanco, Specimen Label for Tordon-K, 1992.
[k]Dow Elanco, Specimen Label for Tordon 101M, 1992.

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects
No Action											
Manual or Mechanical Control	Dust from cutting operations.	Erosion of treated areas may cause increased turbidity.	No Impacts.	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Potential injury from mower blades. Secondary impacts from habitat loss.	Impacts to life from increased sediment. Decrease in dissolved oxygen.	Cutting or damage of plants. Nest disruption.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary loss of berry picking areas.	Injury from airborne vegetation.
Proposed Action											
Accord	Application method minimizes mist drift.	Halflife of 2 weeks in water.[b,c] Registered by EPA for use in water.[c] Erosion of treated areas may cause increased turbidity.	Low likelihood to leach to ground water based on soil adsorption.[b]	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Slight eye irritation in rabbits.[a,b] Low oral toxicity.[a,b]	Non-toxic to fish. Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Potential effects from inhalation during application.

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects
Arsenal	Application method minimizes mist drift.	Restricted from use in surface water.[d] Erosion of treated areas may cause increased turbidity.	Moderate likelihood to leach to ground water based on long activity period.[a]	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Mild skin and eye irritant.[a,d] Non-toxic.	Non-toxic to fish and inverts.[d] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Mild skin and eye irritant during application.
Escort	Application method minimizes mist drift.	Restricted from use in surface water.[e] Erosion of treated areas may cause increased turbidity.	Moderate likelihood to leach to ground water based on limited soil adsorption and short half-life.[a]	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Eye and skin irritant, low oral toxicity.[b,e]	Non-toxic to fish.[b] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Potential effects from inhalation during application, skin and eye irritant.

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects
Garlon 3A	Application method minimizes mist drift.	Restricted from use in surface water.[f] Halflife of 3 hours.[b,f] Erosion of treated areas may cause increased turbidity.	Low likelihood to leach to ground water based on soil adsorption.[b]	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Low oral toxicity.[b,f]	Non-toxic to fish.[b,f] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Potential effects from inhalation during application, eye and skin irritant.
Garlon 4	Application method minimizes mist drift.	Restricted from use in surface water. Halflife of 12 to 24 hours.[b,g] Erosion of treated areas may cause increased turbidity.	Low likelihood to leach to ground water based on soil adsorption.[b]	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Low oral toxicity.[b,g]	Highly toxic to fish.[b,g] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Potential effects from inhalation during application, eye and skin irritant.

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects
Krenite-UT	Application method minimizes mist drift.	Restricted from use in surface water.[h] Can persist for over 8 weeks[a,b] Erosion of treated areas may cause increased turbidity.	Low likelihood to leach to ground water based on soil adsorption and short half-life.	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Short-term loss of woody vegetation. Does not affect grasses. Change in habitat type.	Mild skin, eye, and inhalation irritant to mammals. Non to slightly toxic to wildlife.[b,h]	Non-toxic to fish and inverts.[b] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. No "brown out".	Mild skin, eye, and inhalation toxicity.
Spike-80W	Application method minimizes mist drift.	Restricted from use in surface water.[i] Erosion of treated areas may cause increased turbidity.	High likelihood to leach to ground water based on limited soil adsorption and long half-life.	Short-term loss of most vegetation. Change in habitat type. High threat to non-target vegetation.	Short-term loss of most vegetation. Change in habitat type.	Slight toxicity to invertebrates; low toxicity to mammals.[b,i] Mild skin, eye, and inhalation irritant to mammals.[b,i] Decreases growth.	Slightly toxic to fish and inverts.[b,i] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Mild skin, eye, and inhalation toxicity.

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects
Tordon K	Application method minimizes mist drift.	Restricted from use in surface water.[j] Erosion of treated areas may cause increased turbidity.	High likelihood to leach to ground water based on low soil adsorption.[b]	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Low oral toxicity. Eye and skin irritant.[b,j] Increase in tumor development.[b]	Slightly toxic to fish.[b,j] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Severe eye irritation, skin irritation and skin burn, repeated exposure may cause liver effects.[b,j]
Tordon 101M	Application method minimizes mist drift.	Restricted from use in surface water.[k] Erosion of treated areas may cause increased turbidity.	High likelihood to leach to ground water based on low soil adsorption.[b]	Short-term loss of most vegetation. Change in habitat type.	Short-term loss of most vegetation. Change in habitat type.	Toxic. Eye and skin irritant.[b,k] Increase in tumor development.[b] Potential teratogen.[b]	Slightly toxic to fish.[b,j] Prevent algae growth, large scale use may affect aquatic life by reducing food sources.	Herbicide will not be used near T&E species. No Impact.	No impact. No sub-surface areas are disturbed.	Better access to ROW. Temporary "brown out".	Severe eye irritation, skin irritation and skin burn, repeated exposure may cause liver effects.[b,k]

Table 2
Impact Matrix

Method	Air Quality	Surface Water Quality	Ground Water Quality	Wetlands	Vegetation	Wildlife	Aquatic Life	T&E Species	Cultural Resources	Recreation & Aesthetics	Human Health Effects

[a]Weed Control Society of North America, Herbicide Handbook, 1993.
[b]U.S. Department of Agriculture, Forest Service, Pesticide Background Statements, Volume 1 - Herbicides, Agricultural Handbook No. 633, August 1984.
[c]Monsanto Corporation, Specimen Label and MSDS for Accord, 1992.
[d]American Cyanamid Company, Specimen Label and MSDS for Arsenal, 1992.
[e]E.I. Dupont de Nemours and Co., Specimen Label and MSDS for Escort, 1993.
[f]Dow Elanco, Specimen Label and MSDS for Garlon 3A, 1993.
[g]Dow Elanco, Specimen Label and MSDS for Garlon 4, 1993.
[h]E.I. DuPont de Nemours and Co., Specimen Label and MSDS for Krenite-UT, 1993.
[i]Dow Elanco, Specimen Label and MSDS for Spike 80W, 1992.
[j]Dow Elanco, Specimen Label and MSDS for Tordon-K, 1992.
[k]Dow Elanco, Specimen Label and MSDS for Tordon 101M, 1992.

2.3 Alternatives Considered but Eliminated

2.3.1 Vegetation Control with Fire

Prescribed fire would be the planned use of fire. It is used to reduce hazardous forest fuels, prepare sites for seeding or planting, rejuvenate wildlife and range forage species, maintain fire-dependent species and ecosystems, control insects and diseases, manage wilderness, and manage threatened and endangered species and their habitats. There are six commonly used techniques to dispense fire including backing fires, strip-head fires, flanking fires, spot fires, ring fires, and slash pile or windrow fires. The three common ignition tools include the traditional ground-based hand-held drip torch, and the aerial ignition systems of the helitorch and plastic sphere dispenser. The success of vegetation control using fire is dependent upon plant characteristics, fire type and behavior, topography, wind speed, temperature, length of exposure, and season of the year.[4]

This alternative was not further considered because: (1) it impacts all vegetation, (2) there is a high potential for uncontrolled fires, and (3) it requires more resources than are available. The use of fire for vegetation control will impact all vegetation in the ROW, leaving the soil exposed and susceptible to erosion. Fire would be especially difficult to control since flames, heat, or burning airborne material may cause wildfires outside of the ROW. The use of fire would require the construction of fire breaks throughout the ROW and the mobilization of additional Southwestern and local response personnel.

2.3.2 Biological Control

Biological control uses living organisms to suppress, inhibit, control, or eliminate growth of herbaceous and woody vegetation. Grazing within the ROW by domestic livestock was evaluated because other potential methods of biological control, such as microbial agents, plant pathogens, and insect, are in the experimental development stages. The effectiveness of grazing for vegetation control depends on the area size, amount of control needed, types and amounts of herbaceous and woody species present, and feeding selectivity of animals used.[5]

This alternative was not further considered because: (1) it damages most vegetation, (2) restrictive measures would need to be constructed along the ROW, and (3) it requires more resources than are available. Biological vegetation control would leave the soil

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[4]U.S. Department of Agriculture, Forest Service, Southern Region, "Final Environmental Impact Statement for Vegetation Management in the Ozark/Ouachita Mountains", Management Bulletin R8-MB, March 1990, pp. II-19, IV-30.

[5]Ibid, pp. II-39, II-40.

exposed and susceptible to erosion. In addition, the trampling of soil and vegetation by grazing animals would increase soil erosion. The construction of restrictive measures to contain grazing animals within the ROW would also restrict landowner activities. Biological control would be resource intensive, requiring resources not currently available to Southwestern such as herd health managers and agricultural experts.

3.0 Environmental Setting

The Environmental Setting is a general description of the area that the ROW passes through and may be affected by the no action and the proposed action alternatives. The ROW passes through the Central Lowland, Ozark Plateau, and Mississippi Alluvial Plain Physiographic Provinces. The Central Lowland Province is characterized by numerous wide, flat valleys incised by rivers. The Ozark Plateau Province is characterized by deep, narrow valleys with sharp ridges. The Mississippi Alluvial Plain Province is a relatively flat area, that is well drained and contains excellent farmland.[6]

3.1 Air Quality

Air flow and quality are dominated by changing air masses and storm systems. In the Ozark region, air flow and quality are dominated by migrating, frequently changing air masses during the dormant season and an Atlantic high-pressure system, whose clockwise movement pulls in tropical air from the Gulf of Mexico during the growing season. Prevailing winds in the region are typically from the northwest from October to March, and from the southwest from April to September.[7]

Regionally, air quality is generally good in winter and spring when changing weather patterns keep the atmosphere mixed. Occasional stagnation periods in summer and fall cause natural and manmade pollutants to accumulate. Stagnation is worsened in valleys, where pollutants are contained by surrounding hills and downslope air flows. The ROW passes through nonattainment areas where air quality is well within U.S. Environmental Protection Agency standards.[8,9,10]

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[6]Lapedes, Daniel N., Editor, McGraw-Hill Encyclopedia of the Geological Sciences, 4th edition. New York: McGraw-Hill, Inc. 1977.

[7]U.S. Department of Agriculture, Forest Service, Southern Region, "Final Environmental Impact Statement for Vegetation Management in the Ozark/Ouachita Mountains", Management Bulletin R8-MB, March 1990, pp. III-18.

[8]Missouri Department of Natural Resources (MDNR), Division of Environmental Quality, Air Pollution Control Program Report, 1992.

[9]Oklahoma Department of Environmental Quality (ODEQ), Air Quality Service, Oklahoma 1992 Air Quality Report, 1992.

[10]U.S. Environmental Protection Agency, Aerometric Information Retrieval System, Air Quality Subsystem for Arkansas, provided by the Arkansas Department of Pollution Control and Ecology, August 11, 1994.

3.2 Water Quality

The humid climate of the region produces abundant precipitation. Precipitation can either generate overland flow and runoff into surface waters or infiltrate into the soil and recharge groundwater. Evaporation and evapotranspiration (uptake of water by vegetation) can have a significant effect on runoff and infiltration depending on the local geographic conditions, soil permeability, soil thickness, and geology.

3.2.1 Surface Water

The ROW crosses numerous perennial and intermittent streams, natural lakes, manmade lakes, and reservoirs. Most perennial streams in the study area are fed by intermittent streams, springs, and natural lakes. Many of the watersheds fed by the perennial streams are used as sources for public drinking water. Surface water quality is excellent in most streams except during major storms, when runoff from mines, farms, roads, and construction sites contribute runoff materials to the surface water. Localized contamination often occurs near urban areas, industrialized centers, agricultural chemical use areas, and waste sites. In the Salem and Springfield portions of the Ozark Plateau, limestone and dolomite produce a neutral pH surface water high in dissolved minerals. Elsewhere in the Ozark Plateau, sandstone and novaculite produce neutral pH surface water low in dissolved minerals.[11,12,13,14]

The ROW crosses several state-designated scenic rivers including one in Oklahoma (Big Lee's Creek) and eight in Arkansas (Kings River, Spring River, Mulberry River, Strawberry River, Eleven Point River, North Fork Illinois Bayou, Middle Fork Illinois Bayou, and Big Piney Creek). The ROW also crosses Buffalo National River in Arkansas, a federally-designated wild and scenic river.

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[11]U.S. Department of Agriculture, Forest Service, Southern Region, "Final Environmental Impact Statement for Vegetation Management in the Ozark/Ouachita Mountains", Management Bulletin R8-MB, March 1990, pp. III-16.

[12]U.S. Geological Survey, Water Resources Data - Arkansas, Water Year 1993, Water Data Report AR-93-1, March 1994.

[13]U.S. Geological Survey, Water Resources Data - Missouri, Water Year 1993, Water Data Report MO-93-1, April 1994.

[14]U.S. Geological Survey, Water Resources Data - Oklahoma, Water Year 1993, Water Data Reports OK-93-1 and OK-93-2, May 1994.

3.2.2 Aquatic Life

The diverse aquatic habitats of the region support many species of fish, reptiles, amphibians, mollusks, and aquatic insects. The basic habitat types are lotic (standing water such as lakes and ponds) and lentic (flowing water such as streams).

Lentic habitats contain the greatest diversity of species and are divided into cool and warm water. Cool water streams are generally found in the Ozark Plateau and support various fish species including brown and rainbow trout (*Salmo trutta* and *S. gairdneri*), smallmouth bass (*Micropterus dolomieui*), and darters (*Etheostoma spp.*). Warm water streams are generally found in the Mississippi Alluvial Plain and the Central Lowlands. These streams support various fish species including largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), and minnows (*Notropis spp.*). One of the basic food sources for all of these fish are aquatic invertebrates including mayflies (Order Ephemeroptera), stoneflies (Order Plecoptera), caddisflies (Order Trichoptera), crayfish (Order Decapoda), worms (Phylum Annelida), and mussels (Order Mollusca). Generally, these invertebrates are very sensitive to water quality changes.[15,16,17]

Lotic habitats are often fed or drained by lentic habitats thereby allowing some of the species to migrate and colonize the different habitats; however, in a general description, these two habitats function and support life differently. Fish found in lotic habitats include largemouth bass, walleye (*Stizostedion vitrium*), bluegill sunfish (*Lepomis macrochirus*), and crappie (*Poxomis spp.*). Aquatic invertebrates commonly found within lotic habitats include dragonflies and damselflies (Order Odonata), and zooplankton.[15,16,17]

3.2.3 Groundwater

Groundwater levels in the surficial aquifers generally respond to climatic influences, as continual discharges to streamflow are offset by periodic rainfall. There are also areas within the study area where streams recharge the groundwater in a region. Water levels in these unconfined aquifers are typically highest in the winter and lowest in the summer.

Groundwater found within limestone and dolomite usually contains high levels of calcium carbonate. Groundwater found with the valley deposits of the Mississippi,

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[15]U.S. Department of Agriculture, Forest Service, Southern Region, "Final Environmental Impact Statement for Vegetation Management in the Ozark/Ouachita Mountains", Management Bulletin R8-MB, March 1990, pp. III-16, III-17.

[16]Pennak, Robert W., Ph.D., Fresh-Water Invertebrates of the United States. New York: The Ronald Press Company, 1953.

[17]Wetzel, Robert G. and Gene E. Likens, Limnological Analyses. New York: Springer-Verlag, 2nd edition, 1991.

Arkansas, Red, Ouachita, and White Rivers is often high in iron. Groundwater can be easily impacted in karst terrain through sinkholes, sinking creeks, and caverns.[12,13,14]

Generally the transmission lines in Oklahoma are located within the Central Lowlands Physiographic Province and traverse areas where the surficial geologic deposits are predominantly bedrock formations consisting of shale, and shaly sandstone and to a lesser extent non-karst limestone. In southern Johnston and Atoka counties there exists a sandstone bedrock aquifer which crops out at the land surface. The water table is most typically 20 to 50 feet (6.1 to 15.2 meters) below land surface in this aquifer. Due to the relatively high permeability of this sandstone formation, the infiltration rate of precipitation is expected to be higher than in most areas of Oklahoma. The transmission lines cross the Canadian River, the North Canadian River, and the Arkansas River alluvial valleys. The transmission lines also cross numerous less significant alluvial valleys. The surficial geologic deposits in these areas consist of unconsolidated clay, silt, sand and gravel. These deposits comprise unconfined aquifers with moderate to high permeability whose water table is generally within 10 to 30 feet (3.0 to 9.1 meters) below land surface. Along the transmission line in Cherokee and Adair counties, groundwater in the surficial aquifer in this region exists in fractured and karstified carbonate formations.

All transmission lines in southwest Missouri and northern Arkansas are situated within the Ozark Plateau Physiographic Province except for the lines east of the western one-third of Lawrence County, Arkansas and the western two-thirds of Randolph County, Arkansas. The Ozark Plateau is characterized by an extremely thick sequence of carbonate (limestone and dolomite) bedrock formations. Generally there exists a thick clay rich residual soil overlying the bedrock. Groundwater in the surficial geologic deposits exists in unconfined to semiconfined fractured and karstified bedrock formations.

All transmission lines in Dunklin, New Madrid, Pemiscot, Mississippi, Butler, and Stoddard counties Missouri, and in Craighead, Mississippi, Greene, and Clay Counties, Arkansas, are situated in the Mississippi Alluvial Plain Physiographic Province. The surficial geologic deposits in this region consist of unconsolidated alluvial deposits of clay, silt, sand, and gravel. The surficial aquifer in this area is generally unconfined and groundwater occurs relatively close to the land surface.[18]

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[18]U.S. Environmental Protection Agency, Regional Assessment of Aquifer Vulnerability and Sensitivity in the Conterminous United States, August, 1991.

3.3 Wetlands

Wetlands are transitional lands between terrestrial and aquatic ecosystems, and are characterized by the presence of hydrophytic vegetation, hydric soil, and hydrology. In addition to providing habitats for many plants and animals, wetlands function to improve water quality, control flood waters, and control erosion.[19]

Wetlands have been impacted through agriculture in the United States. Agricultural impacts include drainage and filling, channelization, alteration of wetland hydrology, and the runoff of herbicides, pesticides, fertilizers, and soil into the wetland.[20]

The ROW crosses several types of wetlands, including forested, scrub-shrub, and emergent. Forested wetlands are dominated by woody vegetation greater than 20 feet (6 meters) tall. Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet (6 meters) tall. Emergent wetlands are dominated by erect, rooted, herbaceous hydrophytic vegetation.[19]

3.4 Vegetation

The ROW is a corridor through various ecosystems and plant communities. The ROW passes through agricultural lands, where the ecological succession and vegetation abundance and diversity have been influenced by man. The ROW in these areas are often used for crops or pasture and are represented by vegetation typical of these areas. The ROW also passes through forested areas, where historical ROW mechanical maintenance activities have altered the habitat into more of an oldfield/shrubland habitat. ROW in these areas is generally characterized by a thick growth of low spreading shrubs, forbs, or grasses caused by selectively removing developing trees, and allowing a dense shrub, forb, and grass cover to establish and outcompete invading tree seedlings. Species such as goldenrod (*Solidago spp.*), fescue grass (*Festuca spp.*), huckleberries (*Gaylussacia spp.*), blueberries (*Vaccinium spp.*), sweet fern (*Comptonia peregrina*), greenbrier (*Smilex spp.*), meadowsweet (*Spireau spp.*), and arrowwood (*Viburnum spp.*) are typical of these areas. The edge between the surrounding forest and ROW corridor (an ecotone) is very

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[19]Tiner, Ralph W., Jr., "Classification of Wetland Ecosystems" in Wetlands Ecology and Conservation: Emphasis in Pennsylvania, The Pennsylvania Acedemy of Science, 1989.

[20]Tiner, Ralph W., Jr., "Agricultural Impacts on Wetlands in the Northeastern United States", presented at the National Symposium on Protection of Wetlands from Agricultural Impacts, sponsored by the U.S. Fish and Wildlife Service, April 26-28, 1988.

diverse in vegetation, since it contains species found both within the corridor and the forest.[21]

3.5 Wildlife

The wildlife found within the ROW is influenced by the adjoining land use. The two primary land uses crossed by the ROW include agricultural and forested lands. Wildlife use the ROW for foraging, nesting, and as a travel corridor. Typical species likely to be found within the ROW include various mammals, such as the white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), and white-footed mouse (*Peromyscus leucopus*), various birds, such as the wild turkey (*Meleagris gallopavo*), northern bobwhite quail (*Colinus virginianus*), rufous-sided towhee (*Pipilo erythrophthalmus*) and common yellowthroat (*Geothylpis trichas*), various reptiles, such as the black rat snake (*Elaphe obsoleta*) and copperhead (*Agkistrodon contortrix*), and various amphibians, such as the spotted salamander (*Ambystoma maculatum*).[21] Since the ROW edge is an ecotone between the adjoining land use and the ROW, and usually has more species diversity than either of the adjoining land uses, the ROW is generally high in species diversity and potentially includes species of both land uses.

3.6 Threatened and Endangered Species

The presence of federally- or state-listed threatened and endangered (T&E) species within 0.5 mile (0.8 kilometer) on either side of the ROW was investigated for this study. There are over one hundred federally- or state-listed T&E species within this 1.0 mile (1.6 kilometers) zone along the ROW. The majority of the species are state-listed endangered or rare plants that are not located directly within the ROW. T&E species have been identified as being located within the ROW by either the U.S. Fish and Wildlife Service or the respective state office overseeing T&E species. Southwestern plans to review and update the T&E species locations with respect to the ROW on an annual basis.

In Arkansas, the ROW crosses two areas where the following T&E species are present: the pink mucket (*Lampsilis abrupta*) and the heart-leaved plantain (*Plantago cordata*).[22] In Missouri, the tradescant aster (*Aster dumosus* var. *strictior*), arrow arum

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[21]Kricher, John C., A Field Guide to Ecology of Eastern Forests, North America (The Peterson Guide Series). New York: Houghton-Mifflin Company, 1988.

[22]Arkansas Natural Heritage Commission, Data Report of Elements of Special Concern along Southwestern Power Administration Line Corridors, in letter to Corry Platt, BLACK & VEATCH Waste Science, Inc., October 19, 1994.

(*Peltandra virginica*), Loesel's twayblade (*Liparis loeselii*), hyssopleaf thoroughwort (*Eupatorium hyssopifolium*), and a sedge (*Carex bromoides*) are the T&E species identified within the ROW. The Missouri bladderpod (*Lesquerella filiformis*), a federally-listed endangered plant has been identified within the 1 mile study zone of the ROW. Also in Missouri, records of swamp rabbit (*Sylvilagus aquaticus*), black-tailed jackrabbit (*Lepus californicus)*, Neosho mucket (*Lampsilis rafinesqueana*), and the Arkansas darter (*Etheostoma cragini*) are listed within the 1 mile study zone of the ROW and may come in contact with activities within the ROW. Subterranean habitats for the Ozark cavefish (*Amblyopsis rosae*) are also crossed by the ROW.[23] In Oklahoma, the following federally-listed T&E species have been documented within the counties that the ROW crosses: bald eagle (*Haliaeetus leucocephalus*), interior least tern (*Sterna antillarum*), and the American burying beetle (*Nicrophorus americanus*). The state endangered longnose darter (*Percina nasuta*) was reported to be present in Big Lee's Creek, which is crossed by the ROW.[24]

3.7 Archaeological, Cultural, and Historical Resources

During the scoping process, the respective state offices overseeing archaeological, cultural, and historical resources indicated that the proposed action would not disturb subsurface features. Therefore, these offices determined that an additional search to identify archaeological, cultural, and historical resources within the ROW was not warranted.

The ROW adjoins the George Washington Carver National Monument in Granby, Missouri.[25] The George Washington Carver National Monument is listed on the National Register of Historic Places, Missouri Register of Historic Places, and Black Register of Historic Places.

3.8 Recreation and Aesthetics

The ROW may be used by neighboring residents for recreational purposes and berry picking. The ROW provides access to undeveloped lands potentially used for hunting, fishing, hiking, or birding/wildlife observation. In addition to the ROW itself being used for recreational purposes, the ROW crosses several publicly-owned lands used for

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[23]Missouri Department of Conservation, Data Report for Southwestern Power Administration, in letter to Corry Platt, BLACK & VEATCH Waste Science, Inc., September 8, 1994.

[24]Oklahoma State University (OSU), Endangered and Threatened Species of Oklahoma, Oklahoma State University Press, 1993.

[25]U.S. Geological Survey, 7.5-Minute Quadrangle Sheet for Granby, Missouri, 1974.

recreation. These recreation areas are used for hunting, fishing, swimming, camping, picnicking, boating, and birding.

Visually, the ROW divides the natural landscape and is easily seen by humans when sightseeing from a mountain top or driving past. The ROW uses large metal towers and double wooden poles to hold the transmission lines above the ground, which are also easily noticeable as they differ significantly from the natural landscape.

4.0 Description of Environmental Impacts

The Description of Environmental Impacts is a description of the known or potential impacts to the Environmental Setting features along the ROW. Table 2, the Impact Matrix provides an overview of the potential impacts of each of the alternatives on the criteria identified during the scoping process. The following contains a summary comparing each alternative to each of the impact criteria identified.

4.1 Air Quality

The brush hogging and mechanical saws used in the no action alternative may create some dust particles. The dust particles created by this method are minimal relative to adjacent land uses such as agriculture.

The Foliar Spray Application method used in the proposed action may result in some drift of droplets of herbicide; however, the droplet size used in the proposed action reduces this likelihood. Under the conditions limiting the use of the Foliar Spray Application, it is unlikely that there would be any drift or volatilization of herbicide, regardless of the herbicide selected.[3]

4.2 Water Quality

4.2.1 Surface Water Quality

The manual and mechanical methods of the no action alternative may remove vegetation down to the soil surface or disturb the soil, creating an erosion potential. Soil particles may be carried by rainfall runoff into nearby streams where it may increase turbidity and result in habitat loss. In addition, vegetative debris may be carried into nearby streams, affecting nutrient loading, which may affect aquatic life.

Of the herbicides evaluated in the proposed action, only Accord is registered for use in surface waters. Accord exhibits a half-life of 2 weeks in surface water with direct sunlight and is subject to microbial degradation. The other herbicides are specifically restricted from use in surface waters. Initial use of herbicides in the ROW may result in increased erosion due to less vegetative cover; however, the promotion of grass growth in the ROW would reduce impacts to surface water, since grasses provide more soil erosion protection than shrubs and trees. To further reduce any impact to surface water, herbicides would not be applied within 15 feet (4.6 meters) of any flowing surface water.

4.2.2 Aquatic Life

The manual and mechanical methods of the no action alternative may remove vegetation down to the soil surface or disturb the soil, creating an erosion potential. Soil particles may be carried in rainfall runoff into nearby streams where it may increase turbidity and result in habitat loss. In addition, vegetative debris may be carried into nearby streams, increasing turbidity and decreasing dissolved oxygen content, which may adversely affect aquatic life.

Of the herbicides meeting the herbicide selection criteria, Accord and Garlon 3A are non-toxic to fish. The remaining herbicide currently meeting the herbicide selection criteria, Garlon 4, is highly toxic to fish; however, to reduce impacts to aquatic life from any of the herbicides, herbicides would not be applied within 15 feet (4.6 meters) of any flowing surface water.

4.2.3 Groundwater Quality

Manual and mechanical vegetation control activities associated with the no action alternative would have no effect on groundwater quality.

The herbicides in the proposed action were evaluated to determine their affinity to adsorb to soil particles. Herbicides that are strongly adsorbed to soil particles are less likely to leach into groundwater. The herbicides meeting the herbicide selection criteria, Accord, Garlon 3A, and Garlon 4, strongly adsorb to soil particles and are not likely to leach to groundwater. Other herbicides evaluated, Spike-80W, Tordon-K, and Tordon 101M, are especially likely to impact groundwater since these leach rapidly; therefore, these herbicides did not meet the selection criteria and are not proposed for use in the proposed action. To further reduce any potential impacts to groundwater, herbicides would not be applied within 15 feet (4.6 meters) of sinkholes, visible fractures in rock outcrops, sinking creeks, and caverns. Areas exhibiting these karst features would be field identified and marked prior to herbicide application.

4.3 Wetlands

Manual and mechanical vegetation control activities associated with the no action alternative will directly impact vegetation in wetland areas. These impacts are short-term since this vegetation grows back between treatments.

All of the herbicides evaluated in this EA could be used in wetlands to control vegetation; however, only Accord is specifically registered by U.S. Environmental Protection Agency (EPA) for that use. Accord, Escort, Spike, and both Tordon herbicides

are non-selective and would control both herbaceous and deciduous vegetative species to which they are applied. Arsenal is selective for deciduous species and would not be effective on coniferous vegetation. The Garlon herbicides and Krenite-UT are selective for broadleaf plant control and would promote the growth of grasses in wetlands. Wetland soils are generally high in organic content and are generally located at the groundwater/surface water interface. The herbicides meeting the herbicide selection criteria, Accord, Garlon 3A, and Garlon 4, adsorb to sediment which limits migration to adjoining surface water or groundwater. Garlon 4 is highly toxic to aquatic life and may impact invertebrate life within the wetland or connected surface waters.

4.4 Vegetation

Manual and mechanical vegetation control activities associated with the no action alternative will directly impact vegetation in treated areas. These impacts are short-term since this vegetation grows back between treatments.

All of the herbicides evaluated in the proposed action will directly impact vegetation. Accord, Escort, Spike, and both Tordon herbicides are non-selective and will control both herbaceous and deciduous vegetative species to which they are applied. Arsenal is selective for deciduous species and would not be effective on coniferous vegetation. The Garlon herbicides and Krenite-UT are selective for broadleaf plant control and will promote the long-term establishment of grasses in treated areas.

A longterm impact to vegetation from the proposed action is the change of species composition within some areas of the ROW. The control of woody vegetation and respraying every three to six years, as scheduled, would encourage the recolonization of treated areas with grasses, forbs, and broadleaf weed species, creating a diversity of non-woody habitat. This impact is consistent with Southwestern's goal for vegetation control along the ROW. This impact is not significant when compared to the impacts upon the natural vegetative community from agricultural development and highway corridor maintenance, which generally encourage a monotypic species composition and limited habitat.

4.5 Wildlife

Manual and mechanical vegetation control activities associated with the no action alternative may directly impact wildlife by (1) contact with the mower blades and (2) a change in habitat.

All of the herbicides evaluated in the proposed action have some toxicological effects on tested animal species at high experimental doses. The herbicides meeting the herbicide selection criteria would not cause chronic health hazards to wildlife, but may cause skin and eye irritation at high experimental doses. Spike and both Tordon herbicides are associated with increased tumor development, teratogenic effects, and a decrease in growth at high experimental doses; therefore, these herbicides did not meet the herbicide selection criteria and are not proposed for use in the proposed action. The quantity of active ingredient in the diluted herbicide and the application mixture make it unlikely that any wildlife species would be exposed to doses of herbicides high enough to cause direct effects. Indirect effects of herbicide application to wildlife may include loss of habitat for some species and a gain of habitat for others.

A longterm impact to wildlife from the proposed action and the associated change in vegetative species composition is the reduction of woody vegetation habitat used for nesting, foraging, and protective cover. The removal of this habitat and respraying every three to six years, as proposed, would encourage the recolonization of treated areas with grasses, forbs, and broadleaf weed species, creating a diversity of non-woody habitat. The promotion of grasses, forbs, and broadleaf weed species would replace food sources and improve wildlife access along the ROW. Under the no action alternative, the extent of growth and re-establishment of vegetation between cuttings provides a lower quality habitat when compared to adjacent land uses, such as forest; therefore, the reduction of woody vegetation habitat from the proposed action would not have a significant impact to wildlife.

4.6 Threatened and Endangered Species

Threatened and endangered species located within the ROW are minimally impacted by the current vegetation control methods. The mowing and manual cutting of the vegetation within the ROW impacts protected vegetation if the protected vegetation is cut. The current vegetation control method temporarily impacts the habitats of the mobile T&E species not located directly within the ROW because the food sources and habitats available within the ROW are reduced. Additional impacts to T&E animal species include disruption of nests and nesting species.

The herbicides evaluated in the proposed action would not be applied on or near the T&E species. Where the T&E species occur within the ROW, the proposed action would not be used, rather target vegetation in this area would be controlled using the established mechanical and manual vegetation control. The known locations of T&E species would

be field identified and marked to aid the applicator in avoiding these areas during herbicide application. As stated in Section 3.6, Southwestern plans to review and update the known locations of T&E species available from the respective state office annually.

The potential for impact to mobile T&E species was evaluated because these species could come in contact with the treated areas. Based on the estimated concentration of herbicide applied through the Foliar Spray Application method, the concentrations of herbicide present within the treated ROW would not be high enough to cause toxic impacts to the T&E mammalian or avian species.

The Missouri bladder-pod inhabits limestone glades and outcrops and is known to exist in four counties along the ROW. The known and potential Missouri bladder-pod habitats along the ROW would be surveyed and species locations would be marked in the field prior to herbicide application.

Threatened and endangered fish (Neosho mucket, longnose darter, and Arkansas darter) and mussel (pink mucket) could be impacted by Arsenal, Garlon 4, Krenite-UT, Spike-80W, and both Tordon herbicides carried by runoff into an inhabited stream; however, of these herbicides only Garlon 4 meets the herbicide selection criteria and is proposed for use. To reduce potential impacts upon T&E fish, herbicides would not be applied within 15 feet (4.6 meters) of flowing surface water. There is no risk to the federally-threatened Ozark cavefish, from the proposed action, since the herbicides meeting the herbicide selection criteria adsorb highly to soil particles and herbicides would not be applied within 15 feet (4.6 meters) of visible karst features.

The American burying beetle inhabits oak-hickory forests and open grasslands in the area of the ROW. Based on this habitat preference and the habitat created within the ROW, the American burying beetle may use the ROW itself as a habitat. The active ingredients in Accord, Garlon, Krenite-UT, Spike-80W, Tordon-K, and Tordon 101M have been tested on invertebrates, other than the American burying beetle, and found to be generally slight to nontoxic at concentrations greater than the expected application rate; therefore, the application of herbicides in the ROW is not expected to impact this species.[26,27]

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[26]U.S. Department of Agriculture, Forest Service, "Pesticide Background Statements", Volume 1 - Herbicides, Agricultural Handbook No. 633, August 1984,

[27]Forest Pest Management Institute, "Proceedings of the Carnation Creek Herbicide Workshop", Suite Ste. Marie, Ontario, Ministry of Forests, Research Branch, 1989.

4.7 Archaeological, Cultural, and Historical Resources

There is no significant impact upon archaeological, cultural, and historical resources from the current vegetation control. The mechanical vegetation control may disturb surface soil; however, no subsurface disturbances occur from the current vegetation control method.

According to the respective state office overseeing archaeological, cultural, and historical resources, the proposed action would not impact archaeological, cultural, and historical resources, as no subsurface disturbances would occur. If future activities, as described in section 2.2.5, potentially impact archaeological, cultural, and historical resources mitigation measures recommended by the respective state office would be followed.

4.8 Recreation and Aesthetics

There are minimal impacts to recreation from the current vegetation control method. Hiking along the ROW would be temporarily improved along the ROW, as a reduction of dense brush would ease hiking along the ROW. Berry picking and birding/wildlife observation would be temporarily impacted, until regrowth occurs, because the fruit bearing plants would be cut and the wildlife that feed on the fruits would be reduced. Access to hunting, fishing, hiking, berry picking, birding/wildlife observation, swimming, picnicking, boating, and canoeing would be temporarily improved until regrowth occurs.

There are temporary impacts to aesthetics from the current vegetation control method. After mowing of the vegetation, the remains would turn brown and build up along the ROW. The results of the mowing activities would be easily viewed within the ROW after the current vegetation control method during any season of the year.

There would be no significant impacts to recreation from the proposed action. Activities such as hunting, hiking, fishing, swimming, picnicking, boating, and canoeing would not be detrimentally impacted. Access to hunting, fishing, swimming, picnicking, boating and canoeing areas would be beneficially impacted since the lack of brushy vegetation would ease access to these recreational areas. Hiking along the ROW would be improved because of the lack of dense brush blocking the ROW, and improving the ease of travel along the ROW.

Berry picking and birding/wildlife observation would be impacted along the ROW by the proposed action. The destruction of fruit bearing shrubs would halt berry picking within the ROW. Fruit bearing plants attract many birds and other wildlife that people

observe; without the fruit bearing plants the amount of birds and other wildlife attracted to the ROW would decrease as would the number of people observing these animals.

There would be temporary impacts to aesthetics from the proposed action. A brownout would occur after herbicide treatment, as the leafy vegetation would wilt, turn brown, and die. This brownout would be observed by people viewing portions of the ROW from roadsides, scenic overlooks, or mountain tops. The brownout would disrupt the natural landscape during the spring and summer months; however, during the fall season, the brownout would be similar to leaf-off. Long-term aesthetics would improve because grass growth would be promoted along the ROW.

4.9 Human Health Effects

The manual and mechanical methods associated with the no action alternative would have little long-term effect on human health. Short-term effects include injury to workers from flying objects during clearing operations and wounds from sharp machinery.

Risks to humans generally occur during the Foliar Spray Application method, when herbicide may be inhaled or contacted, and during the manual application methods, when herbicide may contact skin. The greatest potential risks to human health is to workers involved in the application. Herbicides that may cause human health effects through inhalation include Accord, Escort, Garlon 3A and Garlon 4. However, the likelihood of exposure through inhalation is unlikely since the droplet size that would be used reduces airborne herbicide mist. Of the herbicides currently meeting the herbicide selection criteria, Garlon 3A and Garlon 4 may cause skin irritation through dermal contact. A less significant potential risk of human health effects is from the ingestion of water contaminated by these herbicides. This impact is mitigated by the restriction of herbicide use in areas exhibiting karst features.

4.10 Transportation Impacts

For both alternatives, machinery and personnel would be transported to and from the site using established and maintained roadways. Access within the ROW exists through existing jeep trails or would be developed as the machinery travels over herbaceous vegetation. This access would be used by Southwestern personnel to access the target areas within the ROW.

There would be no additional transportation impacts from the no action alternative. A potential for motor vehicle accidents during transportation to and from the site does exist for the no action alternative.

In the proposed action herbicides would be transported to the site in manufacturer's containers, available in either 2.5-gallon (9.46-liter) containers or 55-gallon (208.19-liter) containers. Herbicides would remain in manufacturer's provided containers until mixed with water prior to application. Unused concentrated herbicides would be transported from the site in manufacturer's containers. Diluted herbicides would be transported onsite using a 200-gallon (757.06-liter) tank mounted onto a tractor. No diluted herbicides would be transported offsite because all diluted herbicides would be applied to the ROW prior to removal from the ROW.

A potential exists for motor vehicle accidents to occur while transporting herbicides. No U.S. Department of Transportation placarding is needed on transporting motor vehicles. Absorbent material would be carried with the herbicide to contain any spills resulting from motor vehicle accidents. A copy of the Material Safety Data Sheet (MSDS) for the herbicides and the non-water diluents would be carried with the containers to inform any emergency response personnel of dangers associated with the herbicide.

4.11 Accident Impacts

Potential accident scenarios were identified during the scoping process. There would be a potential for worker injury during the no action alternative. This scenario and associated impacts was discussed in section 4.8.

Three potential accident scenarios were identified in association with the proposed action, including human error in herbicide mixing, application of incorrect mixture, and fire/explosion.

A potential exists for incorrect dilution of herbicide prior to application. The manufacturer's label for each of the herbicides lists a range of recommended dilution rates, depending on the vegetative species needing control. A lower dilution rate would be used for more resistant vegetation. This scenario would pose the greatest threat during the Foliar Spray Application method, as the greatest area is covered by this method. The potential for environmental impacts presented in this report from the three proposed herbicides were evaluated based on the highest concentration of herbicide to be applied by any method according to manufacturer's labels. Any environmental consequences resulting from incorrect dilution would be highly unlikely since Southwestern personnel supervising the application of the herbicide mixture have been formally trained in herbicide handling and application.

A potential exists for applying either the incorrect dilution of herbicide, incorrect herbicide, or applying the herbicides incorrectly. Each of these scenarios would pose negative environmental hazards to a portion of the ROW, if the incorrect action is not within manufacturer's labelled directions. The destruction of desirable vegetation, such as grasses, would increase the time necessary for revegetation and cause a greater risk for erosion. In the case of excess damage to vegetation, Southwestern will mitigate the effected areas. These three scenarios are unlikely since Southwestern personnel supervising the application of the herbicide mixture have been formally trained in herbicide handling and application.

A potential exists for fire and explosion resulting from incorrect storage of the herbicides. Extinguishing agents appropriate for the herbicides used in the proposed action would be carried within Southwestern vehicles transporting or applying the herbicides. A copy of the herbicide MSDS sheets would be carried by Southwestern personnel and transferred to emergency personnel upon any fire or explosion.

4.12 Compliance with other Regulations

4.12.1 Disposal of Excess Herbicide

Southwestern plans to use and accurately mix the amount of herbicide needed to accomplish vegetation control within each section of the ROW. Empty herbicide containers would be triple rinsed and disposed of in a sanitary landfill, following manufacturer's labels. Water from rinsing will be added to the herbicide formulation and applied as normal.

Excess pure herbicides would be stored by Southwestern for future use. In the rare event that pure herbicide would be disposed of, manufacturer's labelled instructions would be followed.

4.12.2 Applicator Certification

Southwestern would have trained personnel supervising the application and mixing of herbicides. Southwestern personnel have been trained by the state of Arkansas in herbicide application. There is currently no certification necessary within the states of Missouri and Oklahoma for landowner herbicide application; therefore, certification of Southwestern personnel within these states is not necessary. Arkansas, Missouri, and Oklahoma do have certification programs for commercial herbicide applicators. In the event that Southwestern would subcontract the herbicide application, the subcontracting firm's field personnel would be required to meet all appropriate local, state, and federal certification requirements.

5.0 List of Preparers and Agencies Consulted

5.1 Preparers

- Corry T. Platt, Black & Veatch Waste Science, Inc., Biologist, principal author
  specialties: terrestrial ecology; aquatic ecology; plant ecology; ornithology; wetlands; habitat requirements; waste handling, disposal, and regulations

- Dane G. Pehrman, Black & Veatch Waste Science, Inc., Biologist, co-author
  specialties: wetland ecology; water quality; ecological health effects; wildlife

- Kevin EuDaly, Black & Veatch Waste Science, Inc., Scientist
  specialties: *human health effects*

- Timothy T. Travers, Black & Veatch Waste Science, Inc., Scientist
  specialties: air quality

- Michael Ferrari, Black & Veatch Waste Science, Inc., Scientist
  specialties: recreation and aesthetics; transportation

- John Field, Black & Veatch Waste Science, Inc., Geologist
  specialties: regional geology and soils

- Robert Orr, Black & Veatch, Geologist
  specialties: NEPA regulatory compliance

- James B. Jennings, Southwestern Power Administration, Office of Maintenance, Special Assistant
  specialties: Project Document Manager

- David Dossett, Southwestern Power Administration, Environmental Protection Specialist
  specialties: NEPA regulatory compliance

- Jerry Murr, Southwestern Power Administration, Maintenance Supervisor
  specialties: herbicide vegetation control; pesticide applicators certification

5.2 Agencies Consulted

The following personnel were contacted to obtain information needed during the preparation of this EA. The individual spoken with, agency representing, and topic(s) discussed are listed below.

Name	Affiliation	Topic(s) Discussed
John Giese	Arkansas Department of Pollution Control & Ecology	Regulations surrounding destruction of wetland vegetation.
Tim Ellison	Arkansas, State Plant Board	Pesticide Applicator Certifications, pesticide application permits.
Cindy Osborne	Arkansas Natural Heritage Program	Threatened and endangered species locations.
Sam Cooke	Arkansas Wildlife Federation	Public concern for herbicide application, herbicide application methods, proposed herbicides.
Ples Spradley	USDA, Arkansas	Regulations surrounding herbicide application.
John Madres	Missouri, Department of Natural Resources, Water Quality Management	Regulations surrounding destruction of wetland vegetation.
Bill Bieffenbach	Missouri Natural Heritage Program	Threatened and endangered species locations; habitat and exact locations of Ozark cavefish; buffer zones.
John Madres	Missouri, Water Quality Branch	Regulations surrounding wetland vegetation.
Paul Brooks	Missouri Dept. of Natural Resources, Air Quality	Herbicide application permits.
Becky Bryan	National Forest Service, Mark Twain National Forest, Missouri	Regulations surrounding herbicide applications, herbicide application permits, Forest Service policies, buffers, sensitive areas.
Paul Ondray & Jim Lea	Missouri Department of Agriculture	Regulations surrounding herbicide application, herbicide application permits.
Ed Fite, III	Oklahoma Scenic Rivers Commission	Buffers surrounding state designated scenic rivers.

Name	Affiliation	Topic(s) Discussed
Derek Smithy	Oklahoma Water Resources Board	Regulations surrounding the destruction of wetland vegetation.
John Hassell	Oklahoma Conservation Commission	Regulations surrounding the destruction of wetland vegetation, anti-degradation regulation.
Sandy Wells & Jim Eigelhardt	Oklahoma Department of Agriculture	Regulations surrounding herbicide applications, herbicide application permits, buffers surrounding threatened & endangered species.
Mark D. Howery	Oklahoma Department of Wildlife Conservation	Threatened and endangered species locations; habitat requirements for the American burying beetle, interior least tern, and longnose darter.
Don Vandersypen	USDA, Soil Conservation Service, Oklahoma	Soil erosion and herbicide application.
Thomas Dominguez	USDA, Soil Conservation Service, Arkansas	Soil erosion and herbicide application.
Russell Mills	USDA, Soil Conservation Service, Missouri	Soil erosion and herbicide application.
Charles M. Scott	USFWS, Ecological Services, Oklahoma Field Office	Threatened and endangered species locations.
Gary D. Frazer	USFWS, Ecological Services, Missouri Field Office	Threatened and endangered species locations; habitat requirements for the Missouri bladderpod.
Dave Purser	National Forest Service, Ozark National Forest, Arkansas	Regulations surrounding herbicide applications, herbicide application permits, Forest Service policies.
Joyce Perser	US Army, Corps of Engineers, Little Rock	Regulations surrounding destruction of wetland vegetation.
John Abley	National Park Service, Buffalo National River, Arkansas	Regulations surrounding herbicide applications, herbicide application permits, buffers, sensitive areas.

Name	Affiliation	Topic(s) Discussed
Tammy Benson	George Washington Carver National Monument, Missouri	Historical designation and preservation listings, uses of land.