

WEST VIRGINIA

Enhancing Wildlife Habitat

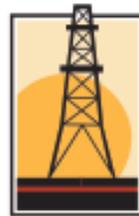
ON OIL AND GAS INFRASTRUCTURE



www.wvdnr.gov

Enhancing Wildlife Habitat on Oil and Gas Infrastructure

Developed in cooperation with:



Preface

West Virginia has been blessed with an abundance of natural resources, many of which have been used for over a century to fuel this country. Early on, extraction of these resources lead to significant surface impacts that left landowners and the public greatly challenged. In the early 1980s, a group of concerned state agency personnel and industry representatives developed a guide to lessen those impacts to the surface and the wildlife that inhabit it. Since then, large expanses of habitat have matured, been changed, or been eliminated entirely. These changes have reduced the abundance of early successional habitat not only in West Virginia but throughout the entire region, causing significant declines in numerous species of wildlife that depend on it. The purpose of this handbook is to incorporate lessons learned from the last thirty years of restoration with available native seed mixes, non-native invasive species management (NNIS) as well as a number of habitat management activities which will provide and/or enhance early successional habitat associated with pipelines, well sites, and access roads.

“Enhancing Wildlife Habitat on Oil and Gas Infrastructure” is a non-regulatory guide for landowners, producers, and regulating agencies offering alternative practices which can enhance early successional habitat. Implementation of alternatives provided in this guide, along with those mandated by State and Federal regulations, will result in a positive improvement for many species of wildlife reliant on early successional habitat.

Introduction

As our need for energy continues to grow, the footprint of oil and gas exploration and development will likely increase. The purpose of this manual is to offer ecologically-viable alternatives to landowners, industry, Non-Governmental Organizations (NGO), and state agency personnel in development and implementation of wildlife habitat reclamation associated with oil and gas activities. The Guiding Principles of this guide are to:

1. Strongly encourage early coordination and planning with affected parties (landowners, developers, natural resource agencies) to ensure proper communication resulting in a more successful project outcome.
2. Provide a list of contacts for landowners and energy developers for technical assistance in wildlife enhancement planning on project sites.
3. Provide information for selection and implementation of wildlife habitat alternatives available.
4. Provide a narrative description and photo/illustrations of management alternatives.

GETTING STARTED

Oil and gas development activities will undoubtedly impact wildlife and their habitats across the landscape. Knowing there will be both positive and negative impacts from oil

and gas development, we must work together to maximize the positive impacts and take steps to lessen the negative. This begins with proper planning prior to any onset of ground disturbance.

Landowner Assistance

Before we go any further, know that landowners are not alone in this process. They can and should contact a professional wildlife biologist, forester, or landowner assistance personnel for technical assistance during the planning process (Table 1). Not only can these agencies provide technical assistance, but it is important that the U.S. Fish and Wildlife Service and the West Virginia Division of Natural Resources determine that large land disturbance activities not significantly impact endangered or threatened species. Long linear herbaceous openings can provide much needed turkey and grouse brood habitat and benefit a variety of early successional habitat species; however, it can negatively impact other species such as forest interior birds and poor dispersers such as salamanders. In addition, large land disturbances can negatively impact critical habitats required by some species for survival.

Planning requires a little time but can provide a valuable communication link between landowners, developers and government agencies. Because wildlife conservation and enhancing wildlife habitat can be common goals shared by landowners, government agencies, conservation organizations and corporations alike, all these parties must work together to reach these common goals. Using an inclusive approach during the planning phase can help generate local support, streamline coordinated efforts and make projects more efficient and cost effective. For assistance in generating a collaborative approach, contact the WVDEP Basin Coordinator at 304-926-0499 ext. 1038 or Toll Free 800-654-5227.

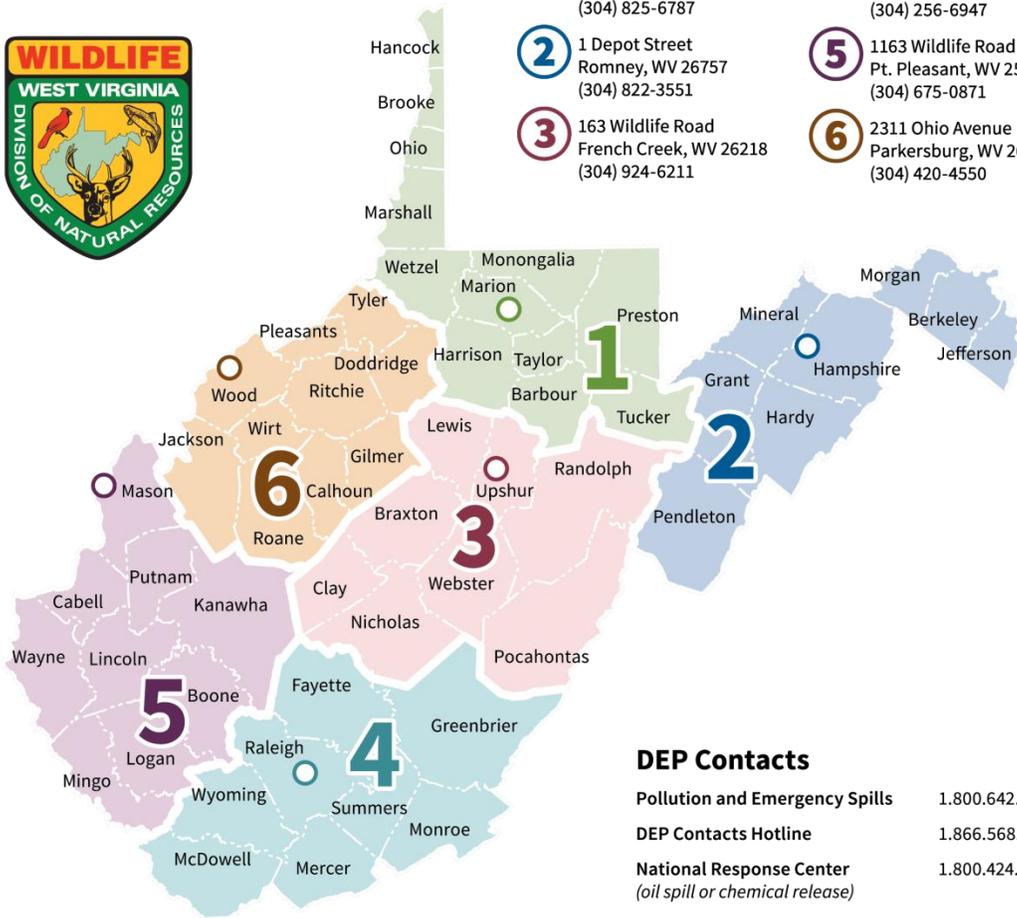
Table 1. Contact Information for Technical Assistance

Agency/Group	Assistance	Website	Contact Number
WV Division of Natural Resources	Habitat assistance, Wildlife Management Assistance	http://www.wvdnr.gov/	See District Map, Page 4
WV Division of Forestry	Landowner Assistance Program, Invasive Species Control, Clements Tree Nursery	http://www.wvforestry.com/	See Table 2.
US Fish and Wildlife Service	Threatened and Endangered Species	http://www.fws.gov/westvirginiafieldoffice/	304-636-6586
US Army Corps of Engineers	Water and Fill Permits	http://www.lrh.usace.army.mil/Missions/Regulatory.aspx http://www.lrp.usace.army.mil/Missions/Regulatory.aspx	Huntington: 304-399-5211 Toll Free: 866-502-2570 Pittsburgh: 412-395-7155

Table 1. Contact Information for Technical Assistance, Continued

Agency/Group	Assistance	Website	Contact Number
WV Department of Environmental Protection	Oil and Gas Permitting, Inspectors	http://www.dep.wv.gov/oil-and-gas/Pages/default.aspx	304-926-0499
WV Department of Environmental Protection: Oil and Gas	Pollution/Spills		1-800-642-3074
WV Conservation Agency	Conservation Districts, Planting material, Ag Equipment Rental	http://www.wvca.us/	304-558-2204
WVU Extension Service	Wildlife Habitat Enhancement, Resource Assistance	http://anr.ext.wvu.edu/	304-293-2990
WVU Extension Service Soil Testing	Soil Test and Analysis	http://plantandsoil.wvu.edu/research_areas/soil_testing_lab	304-293-5375
NRCS	Conservation Practices	http://www.wv.nrcs.usda.gov/	304-284-4839
Appalachian Hardwood Center	Timber Resource Management	http://ahc.wvu.edu/	304-293-9417
Ruffed Grouse Society	Conservation Practices	www.ruffedgrousesociety.org	
National Wild Turkey Federation	Conservation Practices	www.nwtf.org	

District Offices



DEP Contacts

Pollution and Emergency Spills	1.800.642.3074
DEP Contacts Hotline	1.866.568.6649
National Response Center (oil spill or chemical release)	1.800.424.8802

WVDNR Districts, office addresses and phone numbers.

Developing a Plan

It is very important for landowners to develop a management plan outlining their objective(s) for all parties involved with the development process. Components of an effective management plan include, but are not limited to: 1) landowner goals and objectives, 2) property or resource inventory, 3) habitat improvement recommendations, 4) schedule for conducting management recommendations, and 5) detailed records and evaluation of management activities.

Landowners should first determine their objectives by selecting a wildlife species i.e., deer and turkey, or guild of species i.e., early successional specialists to be favored during the reclamation process. This selection will guide habitat enhancement alternatives during reclamation. Next, it is important to identify the existing resources and their locations that may be impacted by development. Resources include spring seeps, streams, wetlands/vernal pools as well as any unique vegetation types i.e., stands of apple or crabapple, as well as critical habitats i.e., cave openings on their property or neighboring properties. Knowing landowner objectives and the location of

unique features will aid in guiding the location of well pads or pipeline rights of way. Proper planning prior to disturbance will aid in determining land clearing, reclamation, re-vegetation and site-maintenance activities that follow initial disturbance. Always keep records of when management activities were conducted and evaluate the impacts of those activities on habitat and wildlife species.

Aerial photographs can be used to locate and identify natural and man-made features such as forest types, land use, water sources, roads, rights of ways, buildings and other features. Topographical maps can be used to determine physical features such as elevation, roads, water sources and other land characteristics. County soil surveys provide a description and map of soil types including soil suitability and productivity ratings for growing timber, producing wildlife habitat and other land uses. Landowners can use various field guides to help identify wildlife, trees, shrubs and other herbaceous vegetation. A digital camera/cell phone can be used to document wildlife habitat conditions before and after management practices. It is quite simple to download or “snip” aerial photography that is freely available on the internet i.e., Google Earth, USDA FSA. We often paste the photography into Power Point and insert the pictures we have taken on top of it with arrows pointing to their location. Similarly, physical features i.e., wetland creation and vegetation enhancement methods such as planting layouts along with general notes stipulating seeding mixtures, rates, mulch, timing etc., can be inserted as text boxes. For those not wanting to embrace a computer, simply obtaining a topographic map and identifying feature locations and the activities mentioned above will suffice.

What Happens Next

Once a site is selected for development, roads will be constructed to the site and the well pad will be cleared and leveled. Topsoil should be removed and stored on site and reapplied once the reclamation process begins. Well pad sites vary in size but are generally one to five acres. Developers must follow West Virginia regulations for reclamation requirements. Landowners and developers may also agree on special considerations for reclamation. This needs to be determined and written into the lease. This is where a written plan is especially important. The development process may also include construction of access roads and pipeline infrastructure. The well pad and pipeline rights of way will result in long linear strips of permanent early successional habitats.

BRIEF DESCRIPTION OF THE PROCESS

Timber Removal

In forested environments, standing trees will be removed from the well pad location and the pipeline right of way. In most cases landowners receive reimbursement for the trees removed. Consider harvesting these for timber, pulpwood, or firewood. If trees are pushed to the side or just felled in place, consider establishing log piles or windrows for

wildlife cover and denning or resting sites. Landowners should contact the West Virginia Division of Forestry to insure conservation of timber resources (Table 2). Landowners can also contact the Appalachian Hardwood Center at West Virginia University for assistance (Table 1).

Table 2. Contact Information for WV Division of Forestry

Office	Address	City	Phone Number
State Headquarters	7 Players Club Drive	Charleston, WV	304-558-2788
Region 1 Headquarters Farmington	1106 Railroad Street	Farmington, WV	304-825-6983
Region 1 Romney	1 Depot Street	Romney, WV	304-822-4512
Region 2 Headquarters Beckley	330 Harper Park Drive, Suite J	Beckley, WV	304-256-6775
Region 3 Milton	878 E. Main Street	Milton, WV	304-743-6186
Region 3 Elizabeth	25 Schoolview Street	Elizabeth, WV	304-275-0261

Well Pad and Pipeline Development

During site construction, topsoil is removed and stockpiled on site for reapplication during restoration. Current practice is to re-seed the topsoil with a basic mix including quick growing cover vegetation in order to reduce erosion and stabilize the soil. This is not always the same seed mix that will be applied during restoration. A different seed mix may be used to meet restoration preferences agreed upon by the landowner and operator.

Native trees, shrubs and groundcover can be planted around well pads/sites as part of the restoration process, per landowner’s discretion and which does not impede site operation. While seed mixes and shrubs can be immediately applied and planted during restoration, trees are not planted until sufficient ground cover has been established to prevent erosion. Tree planting may take place several months to a year after initial seeding to provide ample time for establishment of groundcover to prevent erosion. There is no minimum distance from the edge of a well pad for trees and shrubs to be planted, as long as there is no interference with the ability to service the wells on site. Vegetation which is a hindrance to activities at the restored well pad will be scaled back as necessary during regular well servicing and tending visits.

During restoration, the disturbed area will be re-topsoiled and re-contoured to be as close to pre-development conditions as possible. After restoration, the Limit of Disturbance is reduced to the boundary of the well pad. All erosion and sedimentation controls (Silt-soxx, sediment ponds, etc.) are removed during restoration.



A wide variety of sediment and erosion control materials and products are available to minimize the effects of precipitation before vegetation can be established.

RECLAMATION

Keep in mind, the primary goal and requirements of site reclamation are to prevent soil erosion. Site reclamation or re-vegetation may take place in two phases; temporary seeding and permanent seeding. During the site construction and reclamation process, sites may be temporarily reclaimed to prevent erosion. In most cases, this does not represent the final reclamation, but in some cases temporary seeding may become the final or permanent vegetation. However, in most cases there will be a permanent seeding process that will establish the long-term vegetation on site.

Remember the overall goal of site reclamation is soil stabilization. Therefore, options are limited on certain slopes and soil types. Reclamation on these sites must follow erosion and sediment control guidelines. However, wildlife-friendly options are available and in some cases will meet or exceed mandated guidelines. Landowners should determine reseeding mixes prior to the lease agreement to ensure the correct seed mixes are used during reclamation.

Soil Sampling

Soil type and fertility drives what will grow best on a site. Therefore, before applying seed or re-vegetating a site, sample and test soils to determine the status of soil nutrient levels and soil pH. Results of soil sampling will determine recommended application of lime and appropriate fertilizers for the desired plants. The WVU Extension Service Soils Testing Laboratory in Morgantown provides soil fertility analysis free of charge to West Virginia residents. Landowners should check with their local Extension Office or WVU Extension Service soil testing lab (Table 1) to ensure that samples are representatively collected, prepared and shipped in the proper manner. In general, soil samples should

be collected in late summer or fall and submitted to the soil testing lab well before results are needed for the field preparation and planting. On average, allow at least a two week turn around for soil samples.



Soil samples should be collected from a variety of locations across the site, dried and mixed together in a clean container prior to an overall sample being taken and submitted which insures that the whole area is represented.

Seedbed preparation

One of the greatest limitations to plant growth on reclaimed areas is soil compaction. Heavy rubber tired and tracked vehicles used in land clearing, grading and construction activities compact the soil profile inhibiting root penetration. Shallow rooted plants are unable to bind the soil to a significant depth which weakens their erosion-stopping potential and ability to survive periods of drought or stress. Soil compaction can be eliminated by ripping or discing the soil profile prior to planting which will also increase rainfall infiltration, reducing runoff. This may not be appropriate in all situations due to too steep a slope or soil stability issues.

Another limitation to plant growth in the Marcellus shale counties are naturally acidic soils. Low pH conditions reduce the nutrient holding capacity of the soil thus reducing plant diversity in some locals and survival/growth in others. The typical solution for low pH is to incorporate lime into the root zone of the future plants. This is best done in the fall as it takes four to six months for the lime to buffer the acid which will make the area suitable for spring planting. Per the results of the soil sampling, lime should be applied at the indicated rate. If possible lime should be either disked/ripped in to the top six inches of the soil column.

WILDLIFE HABITAT ALTERNATIVES

Critical Area Planting

Critical area planting consists of planting vegetation on highly erodible areas. Examples of these types of areas include some woodland and well access roads, dams, well locations, rights of way or steep slopes where vegetation may be difficult to re-establish by normal planting methods. Some seed mixtures may not provide adequate soil stabilization on these critical areas. Keep in mind that soil stabilization and erosion control are the top priority and an erosion control seed mixture may be required in these situations. Vegetation should never replace time-tested engineering techniques such as broad-based dips, water bars, gravel and rock.



In some soil types and certain percent slopes, vegetation by itself is unable to prevent slipping, hard engineering techniques should be employed in these cases.

Seeding

Oil and gas development sites can be enhanced for a variety of early successional wildlife. The following planting recommendations are intended to enhance early successional stage habitat found on well pads and along access roads and pipelines. Other commercial seed mixtures are available. Seed mixtures should be selected for site conditions and intended uses. Selection should be based on factors including: climate, soil conditions and pH, slope, site wetness, species characteristics, disease resistance and the ability to achieve an adequate stand. Use high quality or certified seed mixtures to minimize seeding failure. Check labels to ensure proper planting dates, seeding rates and soil amendments. To further improve soil stabilization and reduce erosion, all tillage operations should be conducted on the contour whenever possible.

After seeding, the area should be protected from impacts such as vehicular and pedestrian traffic, pests, livestock damage, fire, etc. Vegetation damaged by machinery, herbicides or erosion must be repaired promptly. The area must be protected from livestock grazing until vegetation is well established and the soil is stabilized. Remember, soil amendments should be applied as required to maintain ground cover density at the desired level which is dependent on your objectives i.e., steep slopes should have little bare ground, whereas flatter areas can have a greater percent to accommodate turkey and grouse broods if that is an objective. Application of soil amendments should be based on soil test recommendations. In the absence of a soil test, fertilizer (10-20-20) will be applied at a rate of 600 lbs. per acre and lime at a rate of three tons per acre.

Option 1

Perennial, Cool Season, Deer and Turkey Mix, Slopes		
Common Name	Scientific Name	lbs/ac^a
Ladino White Clover ^b	<i>Trifolium repens</i>	8
Red Clover ^b	<i>Trifolium pratense</i>	5
Birdsfoot Trefoil ^b	<i>Lotus corniculatus</i>	8
Orchard Grass	<i>Dactylis glomerata</i>	15
Winter Wheat **	<i>Triticum aestivum</i>	50

**Plant September 1 - October 15 or substitute annual rye for fall planting. If a spring planting is desired, substitute oats at the same rate February 15 - March 15 and retain the other species as listed.

Option 2

Perennial, Cool Season, Deer and Turkey Mix		
Common Name	Scientific Name	lbs/ac^a
Ladino White Clover ^b	<i>Trifolium repens</i>	4
Mammoth Red Clover ^b	<i>Trifolium pratense</i>	5
Forage Chicory	<i>Cichorium intybus</i>	2
Winter Wheat **	<i>Triticum aestivum</i>	50

**Plant September 1 - October 15. If a spring planting is desired, substitute oats at the same rate February 15 - March 15 and retain the other species as listed.

- This option can be used on flatter areas where the objective is to have a good vegetative cover for pollinators, structure and insects for turkey/grouse broods and forage for deer.

Option 3

Native Seed Bank Mix

- This option can be used on flatter areas where the objective is to have a natural, old field appearing area the second year after planting. During the first growing season one should expect this to resemble a somewhat “weedy” wheat or oat field. This option creates good vegetative cover for pollinators, structure and insects for turkey/grouse broods and forage for deer.

Common Name	Scientific Name	Inoculant ^b	lbs/ac ^a
Winter Wheat**	<i>Triticum aestivum</i>		50
Crimson Clover	<i>Trifolium incarnatum</i>	Rhizobium leguminosarum biovar <i>trifolii</i> , (inoculant code R)	5

**Plant September 1 - October 15. If a spring planting is desired, substitute oats at the same rate February 15 - March 15. Change the clover to Ladino White Clover at 4 lbs/ac, inoculant code B and add 5# peredovic sunflower (black oil type) to enhance aesthetics.

^aSeeding rate suggested is for Pure Live Seed (PLS) in pounds per acre.

^bHerbaceous legumes must be treated with the appropriate inoculant before seeding

In the past, many, including authors of this bulletin, recommended using a variety of cool season and annual grasses i.e., orchard grass, timothy and annual rye grass in their seed mixes as a necessary ground-cover component. However, results of food habit studies reveals that many of our native wildlife do not eat grass. In addition, grass supports reduced insect populations making it poor brood habitat and it outcompetes preferred native forbs and legumes. Therefore on flatter slopes we removed grass from recommended wildlife seed mix. Because grasses are perceived to be necessary on steeper slopes to minimize soil erosion it is included in some recommended seed mixes.



Clover and chicory mixtures provide excellent brood bugging habitat for grouse and turkey poults as well as high quality forage for deer.

Fruit Tree or Shrub Establishment

Fruit trees (apples, crabapples, pear, etc.) and shrubs (black haw, gray dogwood, etc.) provide shelter, nesting structure and food for many mammals and birds. Given our mature forests, these trees are often lacking from those stands, and energy development projects provide an opportunity to re-establish their presence.

Edge is the area where two vegetation types meet; the cleared land of a well pad or pipeline meeting a standing forest is an abrupt edge. Hard, abrupt vegetation edges can have a negative impact on some wildlife species. This impact can be lessened by either planting low-growing trees or shrubs along the edge or creating a cut-back border within the existing stand of trees (discussed shortly). Planting trees and shrubs along a forest

edge will produce a tapering effect from the tall trees to mid-level tree/shrubs to the herbaceous layer. Consider planting scattered clumps of these fruiting species along the edge of well pads and along pipeline rights of way to soften the forest edge.

Planting trees and shrubs away from access roads, pipelines or lanes will reduce damage to plantings during future activities. Try to use native species where possible and choose locally adapted seedlings or cuttings for best results. Where multiple species are available, consider selecting species that best accommodate the wildlife species or guild for which you are managing. Many plant species are site specific and require specific site characteristics. Therefore, consider drainage class and soil type when making plant species selection. Also, location within the right of way or on the well pad is important to consider when planting species with specific shade tolerances.

Trees/shrubs can be planted in the fall from the time growth stops until the soil is frozen; or in the spring after the soil has thawed until bud break which usually occurs by May 1. Unfortunately, these trees and shrubs are highly favored by deer and often need to be protected in either 5-foot tree shelters or fenced, individually or collectively. In all cases, eliminate the herbaceous competition within a 6-foot diameter of the bole of each tree/shrub with a non-selective, systemic herbicide. If grass is a problem, after herbicide treatment, place and stake a 3-foot diameter Vis-a-por mat to the ground around the newly planted tree. Place a 5-foot tree shelter over the seedling/sapling burying the bottom of it two inches into the soil. This is important as it minimizes the chimney effect the shelter creates which will dry out the tree and will eliminate voles and mice building nests in the bottom of it. These small mammals eat the bark off of the plant material causing the death of the plant. Shelters should be maintained twice a year and repaired as needed. By year five they should be cut their entire length with a knife to free them from the constraints of the tube. If deer are abundant, leave the split tube in place to continue protecting the tree from bucks rubbing their antlers on them. Some have had success with repellents; however, they must be applied according to manufacturer guidelines.

Table 3. Common, successfully-planted shrubs with high wildlife food value in WV

Riparian	Scientific Name	Upland	Scientific Name
Silky Dogwood	<i>Cornus amomum</i>	Black Haw	<i>Viburnum prunifolium</i>
Gray Dogwood	<i>Cornus racemosa</i>	Arrowwood	<i>Viburnum dentatum</i>
Speckled Alder	<i>Alnus incana</i>	Gray Dogwood	<i>Cornus racemosa</i>
Deer Berry	<i>Vaccinium stamineum</i>	Washington Hawthorn	<i>Crataegus sp</i>
Buttonbush	<i>Cephalanthus occidentalis</i>	Staghorn Sumac	<i>Shus typhina</i>
Common Elderberry	<i>Sambucus canadensis</i>	Mountain Ash	<i>Sorbus Americana</i>
Arrowwood	<i>Vibrunum dentatum</i>	American Chestnut	<i>Castanea dentate</i>
Nanny Berry	<i>Viburnum lentago</i>	Apple	<i>Malus spp.</i>
Wild Raisin	<i>Viburnum nudum</i>	Crabapple	<i>Malus coronaria</i>



Properly installing and maintaining tree tubes insures highly-palatable trees like this crabapple survive to maturity.

Field Border Cuts/ Daylighting Edges

Field border cuts or daylighting edges consists of harvesting, cutting or deadening trees along the edges of well pads or pipeline rights of way to open the forest canopy and increase sunlight to stimulate vegetation growth in the understory. This practice creates brushy, sapling-stage woody vegetation transition areas between open areas and woodlands. This transition zone provides necessary habitat, including escape cover, feeding areas and nesting cover for numerous wildlife species.

Field border cuts are typically created by using a chainsaw (preferred method) but can be accomplished with basal application of herbicide or by use of heavy equipment such as a bulldozer to open woodland edges. Field border cuts should be 30-50 feet wide and extend along as much of the well pad or right of way edge as possible. Field border cuts along rights of way preferably should be a minimum of 500 feet in length. Width of the border cut can vary throughout its length and does not need to be uniform. However, width is important; narrow border cuts may result in predation on wildlife that utilizes these areas. Border cuts may be established at different times along the field, rights of way, etc. to provide various stages of regrowth. When cutting the borders, leave trees or shrubs that have special wildlife benefit. Species such as apples, dogwood, viburnum and serviceberry, as well as other soft-mast producing trees/shrubs, should be retained. Additionally, exceptional specimens of hard mast species such as oaks and disease-resistant American Beech (it will have smooth, blemish free bark) can be left uncut to provide important food for a variety of wildlife. Leaving the cut, woody debris and slash within the border cut provides additional wildlife cover and tends to provide protection to new sprouts from browsing. As necessary, tree and shrub saplings can be planted in association with border cut establishment for food (e.g., hawthorn and crab apple) and cover (e.g., conifer planting for winter cover) to increase the wildlife benefits of the border cut.



Hard forest edges (L) minimize use of the right of way by many species of wildlife, whereas cut-back borders (R) soften the edge between open areas and forest enhancing both for a wide variety of species.

Brush Piles/ Log Piles

Conservation and maintenance of nesting and escape cover is an important element of habitat management to support small game and early successional stage species populations. When natural cover is limited in wildlife habitat, brush piles may be provided. For cost efficiency, brush piles may be a by-product of other land management activities. Residual logs and limbs produced from timber harvest or removal during the land clearing phase can be piled in strategic locations to provide cover. Brush piles may be constructed as supplemental habitat where the establishment of woody shrubby thickets is not practical or can serve as temporary habitat until permanent, shrubby vegetation becomes established.

Constructing a brush pile begins at the bottom. Place the largest material on the bottom to elevate the base which prevents rotting and enables larger mammals like cottontails to enter the pile. Once a foundation is laid, pile successively smaller layers of branches on top in opposing directions such that the pile is actually built like a log cabin with an eventual tangle of small material on the top to shed precipitation.

Using freshly cut stumps as the base and the tree tops for brush piles can have the added benefit of increasing sprout survival if the pile is placed over the cut stumps. This prevents deer damage to the new sprouts. Brush piles 12- to 18-feet in diameter and three to six feet in height are best in order to enable multiple individuals and species to occupy a single location. Smaller brush piles are acceptable when moderate use is expected and can always be enlarged later as use increases.

Placement should be near feeding areas and along the edges of and within well pads and pipeline rights of way. Avoid the bottoms of drainages and low spots where standing water might render the brush pile useless. Well-constructed brush piles can have a life span of as much as 10 years, and proper placement can promote use by eastern cottontails as well as many different species of songbirds, insects and other animals.

Windrowed piles should be constructed in the same manner as standard brush piles with the log cabin-like base and loose material piled as the canopy. If windrowed brush piles for rabbits are to be constructed, they should be at least 25-50-feet long, 10-12-feet wide and at least 4-feet high. Stagger windrows such that they do not block movement corridors and benches.



Constructing the brush pile with large logs on the bottom and smaller material on the top will increase its lifespan and help shed rain and snow while creating protected areas for rabbits and other small mammals.

Living Brush Piles/Green-Tree Cuts

A simple, convenient brush pile may be created by cutting a larger diameter wolf or edge tree and leaving it where it falls. This will allow vines, weeds and briar tangles to grow up in and around the felled crown and create cover and shelter for a variety of animals. Rabbits, white-tailed deer, grouse and many species of songbirds will make use of this type of cover.

Another method is known as the "Living" brush pile. Evergreen trees such as Eastern red cedar, American holly or even deciduous trees may be used. Choose wide-crowned trees that are six to eight feet tall. In the spring of the year, make a cut in the tree with a hand or chainsaw three to four feet above the ground opposite the intended location of the pile. Cut deep enough so that you can push the top over, leaving a connecting strip of bark and wood (hinge) to nourish the tree. Use a stake or stone to tie the top of the tree to the ground. Select trees with grape or honeysuckle vines nearby that will grow and cover the pile. If the trees are cut to fall in a crisscross pattern over each other, a living brush pile is created.

Brush piles of this type are loosely formed and do not give the best protection from severe weather. They can be made denser by using the bases of the cut trees as foundations and piling dead limbs and brush over them. Old piles may need to be rebuilt or have additional material added every five or six years.

Rock Pile

Undoubtedly, many large rocks and boulders will be unearthed and redistributed during well site and pipeline right of way construction here in West Virginia. Relocating these rocks and forming rock piles is another technique used to establish cover for early successional wildlife species. Consider access when establishing rock piles and place them in areas with limited access, are poorly drained, or in close proximity to edges.



Similar to brush piles, rock piles when placed along woodland or wetland edges are used by a variety of wildlife including rabbits and weasels.

Coarse Woody Debris

Clearing forest land for well site establishment and pipeline rights of way will produce residual logs and other woody debris. Leaving large logs as piles or single logs on site to rot will provide valuable cover for various reptiles and amphibians. These large logs should not impede access to the site or lay directly over a buried pipeline.

Stream Crossings

Water quality is an important component not only to your property but all of those downstream as well. Steps to minimize impact to streams and water resources should be taken throughout the development process and every effort should be made to restore or improve any impacted stream.

Natural stream channel design can be used as a cost effective, wildlife-and-fisheries-habitat-enhancing technique to protect or maintain existing utility line crossings or incorporated into new resource crossings. These techniques have been effectively implemented by various resource managers as well as utility companies to enhance wildlife and fisheries habitat while protecting utility lines in stream crossings.

Small Wetland Construction

Small vernal pools or wet areas may be disturbed during construction of well pads and pipeline rights of way. These pools of water, generally less than two feet deep and from 10- to 30-feet across, are used by deer, wild turkey, ducks, frogs and salamanders. Most frogs, toads and salamanders require wetlands for breeding. Small wetlands are also prime real estate for dragonflies, damselflies and fairy shrimp, all which eat mosquito larvae. Research shows that the presence of wetlands can actually control mosquito populations. Those mosquitoes that lay their eggs in the water are quickly consumed by salamander and dragonfly larvae, and the few adult mosquitoes that emerge are quickly captured by tree swallows, purple martins and bats.

One can make a small wetland with little investment that will improve habitat for wildlife and clean water. While building one wetland is good, creating more can be better. Consider building one wetland to keep water year-round and another that will dry in the fall. The permanent water wetland can be a lifesaver for deer in time of drought, and the ephemeral wetland can be a place for frogs, toads and salamanders to thrive.

Wetlands should be built with certain characteristics so that they will require no maintenance. These include dams less than 18 inches high, gentle slopes less than five percent on the front and back sides of the dam, and a spillway at least 12 feet wide that directs overflow down a gradual slope of three percent or less. The reader is urged to read Tom Biebighauser's book: *Wetland Restoration and Construction – A Technical Guide* before building a wetland. Tom has built over a thousand of these and this resource is invaluable. The book clearly explains the steps needed to design and build a wetland that will persist.

Please visit <http://www.wetlandrestorationandtraining.com/> for more information about building wetlands and to view photo albums showing wetlands constructed near roads, rights of way and on mined lands.



Creating small wetlands along energy development openings provides frog and salamander habitat in the summer, catches mast during the fall and feeds turkeys during the winter.

WELL SITE AND RIGHT OF WAY MAINTENANCE

Landowners may choose to improve wildlife habitat on well sites and pipeline rights of way that have already been reclaimed and re-vegetated. Wildlife management techniques mentioned previously can be applied anytime during or after reclamation. Before any management practices are implemented, please check with a gas company representative to ensure safety, site access and to maintain integrity of well and pipeline equipment on site. The following practices can be implemented to create, improve or maintain early successional wildlife habitat on established well site and pipeline rights of way. Where possible, allow vegetation to grow freely and avoid agricultural activities during the peak nesting season (February to September). Occasional disking, herbicide application and burning are beneficial management practices as they promote regeneration of succulent forbs and other preferred vegetation.

Soil Fertility

Remember that soil fertility drives vegetation growth. Consider testing the soil at least once every five years or more often if indicated by periodic inspections of the site to maintain optimal production.

Vegetation Management

Many companies use Integrated Vegetation Management programs (IVM) to manage vegetation on and along their right of way. While these programs incorporate mechanized land clearing (brush hogging), many also use herbicide application as a means of controlling vegetation. Low-volume and ultra-low-volume herbicide application techniques allow for utility vegetation managers to control invasive plant species with lesser amounts of herbicides while reducing competition for native and wildlife-friendly plant species. Selective herbicides used today specifically target plant tissue and have very little to no effect on non-target plant, animal species or water resources. Responsible herbicide application can be conducted in an environmentally-friendly way that controls nonnative and invasive plant species while benefitting wildlife habitat.

Companies and landowners alike that are interested in herbicide application programs for their rights of way or land should contact the West Virginia Department of Agriculture, Regulatory and Environmental Affairs Division, Regulatory Programs at 304-558-2227.

Strip Disking

Strip disking well pads and pipeline rights of way can increase plant diversity and provide wildlife habitat for those species of wildlife that benefit from early successional vegetation and the insects that these communities attract. This practice is conducted with a large, heavy, off-set disc and may be utilized as a maintenance practice for retaining pollinator or terrestrial wildlife habitat. Strip disking involves the purposeful disturbance of the soil to release sod-bound land, reduce litter accumulation, create

bare ground, stimulate germination of desirable seed-producing plants and increase insect populations including pollinators. Strip disking could be used to revitalize rank stands and improve vegetative structure and density. Keep in mind that strip disking may not be appropriate on all slopes or sites. Consider soil erosion and site stabilization before disking a site.

Strip disking is most beneficial when conducted just prior to spring green-up. However, disking may be performed between September and December with good results depending on your objectives. If the existing cover is too dense to allow adequate soil disturbance with a disk, herbicide application, intense flash grazing, haying, plowing, burning or any combination may be used to remove vegetation prior to disking.

Position disked strips in close proximity to adequate cover for the desired species. Disking should be performed in long, linear strips. To prevent soil erosion, disked strips should follow the contour of the land. Thirty-five feet of undisturbed vegetation (i.e. forest riparian buffer, sod, filter strip, etc.) must be left adjacent to water bodies to maintain water quality. The ground should be disked deep enough to destroy the majority of existing vegetation and initially provide additional bare soil for use by ground foraging species. No more than one third of a pipeline right of way, well pad or grassland component should be treated with this practice in any year. Strips should be a minimum of 10 feet in width and no more than 25 feet wide depending on width of right of way. Strip disking should be set up on a rotational basis so that as one or more strips reach brood habitat maturity, other strips are in the beginning or intermediate stages of succession. Depending on the fertility of your land, strips should be set up on a two to three year rotation to maximize wildlife habitat. Immediately following strip disking, fields may be enhanced for wildlife by seeding a variety of herbaceous plants and/or annual plants by broadcasting and culti-packing them onto the exposed strip (Option 1 or 2).

To maintain the diversity and various stages of succession of disking, it may require the periodic application of lime. This should be performed according to recommendations based on a periodic soil test. Nutrients, if required, should be applied outside the primary ground nesting season (March 15 – July 15). The rotation should be maintained and evaluated to determine the effectiveness of providing the desired habitat component(s) and stages of plant succession.

Exotic or Invasive Plant Management

Many non-native plants have been introduced into West Virginia for erosion control, landscaping, horticulture, wildlife foods and as forage crops. Many non-native plants have also been introduced accidentally. In some cases, these non-native plants can outcompete and displace native plants. The disturbance during and after well pad and right of way development presents a perfect opportunity for the spread of non-native invasive plants. Close monitoring is needed to ensure the control and eradication of these invasive plants. For more information on non-native invasive plants found in West Virginia please contact WV Division of Natural Resources or WV Division of Forestry (Table 1 and Table 2).



Non-native invasive species like this Japanese Knotweed can overtake a disturbed site ruining its value to wildlife. Care must be taken to minimize exposure of the site to these during construction and eliminate them if they appear during maintenance activities.

Summary

This publication is not an exhaustive list of options but a good start towards creating better wildlife habitat on oil and gas infrastructure. Remember that assistance is available from many natural resource agencies and groups in West Virginia. All you have to do is call and ask.

Resources

Thomas R. Biebighauser. Wetland Restoration and Construction - A Technical Guide. Upper Susquehanna Coalition, 186 pages, 2011.



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