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Managing Pines for Profit and Wildlife

Virginia Department of Game and Inland Fisheries

Wildlife Information Publication

This publication series of the Virginia Department of Game and Inland Fisheries is intended to provide non-technical information on wildlife-related topics. Subjects include life history information, habitat management techniques, and wildlife management plans.

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Virginia Department of Game and Inland Fisheries
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About the Cover:
[background] Loblolly pines are the heart of Virginia's reforestation programs (photo Dept. of Forestry); [top insert photo], cutovers treated with Best Management Practices like these Streamside Management Zones provide excellent habitat for numerous early succession wildlife species (photo David Coffman, DGIF); [middle insert photo}, thinned pines maintained with prescribed burning combine financial return and excellent wildlife habitat for the landowner (photo David Coffman, DGIF); [bottom insert photo], populations of early-succession wildlife like bobwhite quail are supported by the vegetation of young pine plantations and can reach excellent numbers in later plantation stages when properly managed (photo Lloyd Hill).

Managing Pines for Profit and Wildlife

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A loblolly pine rotation begins with site preparation — creating a seed bed for the new seedlings. Prescribed burning creates excellent habitat for early-succession species like bobwhite quail by removing old logging debris, recycling nutrients for the new seedlings, opening up ground-level cover and stimulating production of their favorite foods.
(Photo David Coffman, DGIF)

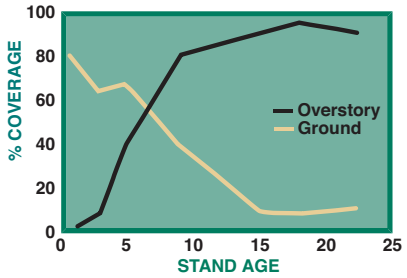
Some of the most pressing wildlife problems in Virginia, and throughout the Southeast, are declines in populations of early-successional[1] wildlife species. For example, since the mid-1960's, Virginia's bobwhite quail population declined an estimated 70%. Simultaneously, populations of at least 18 species using similar habitats plummeted — brown thrashers, yellow-breasted chats, catbirds, field sparrows, loggerhead shrikes and cottontail rabbits to name a few. What brought about these declines and what can be done to reverse them?

Farming modernization, changes in types of farming, changes in timber management strategies, and suburbanization of once rural areas all played a role. Ultimately, habitat loss was the governing factor. Networks of small family and tenant farms once created ideal environments for quail and their cohabitants. Double cropping was unheard of. Small fields and tractors were the norm. Managing brushy fencelines, ditches and roadbanks was more difficult as modern pesticides had not been perfected. Folks managed fewer cattle less intensively and relied on native forage species.

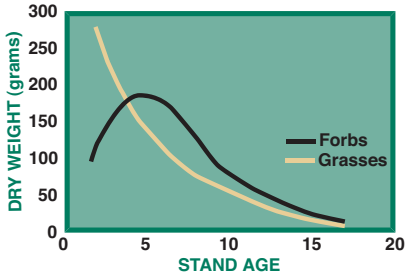
Economics and human population growth have largely ended these favorable conditions. In most cases today, active management is required to maintain and increase early-successional wildlife populations. Our world is far different from the world of 1935, or even 1965. It is not likely that we will ever revert to those conditions. Wildlife managers must now develop solutions practical in a modern, economically driven world.

[1]Early-successional species are those inhabiting brush/scrub/grassland communities that are in progression from bare ground to mature woodland.

In the first five to seven years of a new plantation, the young pines and herbaceous growth offer habitat for a host of early-successional wildlife species like pine warblers, field sparrows, and bobwhites.
(Photo Dwight Dyke)



% Vegetative Coverage of Overstory and Ground Layers in Various Aged Loblolly Pine Plantations — As loblolly pines grow older, their crowns (canopy) begin to intercept an increasing amount of sunlight. Eventually very little sunlight reaches the forest floor. Ground-level and understory plants decline with the decreasing sunlight. A pulpwood pine thinning at year 15 to 20 will restore a better balance of understory plants, greatly benefitting numerous wildlife species.



Non-Woody Biomass of Understory Plants in Various Aged Loblolly Pine Plantations — The herbaceous plants of a pine stand are valuable to wildlife as food and cover. They also play an important role in maintaining water quality by reducing erosion and holding nutrients on the site. Grasses are most abundant early and decline as the amount of sunlight reaching ground level declines. Forbs (broadleaf, non-woody plants) increase for 5-7 years, but also decline as sunlight diminishes.

One step the Virginia Dept. of Game and Inland Fisheries is taking to address early-successional species declines is the implementation of the Bobwhite Quail Management Plan (Wildlife Information Publication 96-1). Though titled the Bobwhite Quail Management Plan, the practices carried out as part of this plan help all early-successional wildlife. This plan focuses on promoting management practical on today's landscape. With such dramatic declines in populations, only large-scale, landscape level management practices have a chance at reversing the declines.

One landscape level strategy outlined in Virginia's quail plan concentrates on getting the most for early-successional wildlife out of the Old Dominion's pine plantations. These lands represent nearly 10% (1.5 million acres) of the state's timberland. During the five years preceding the most recent inventory, planted pine acreage increased 25 percent. Concentrated in Virginia's eastern third, an area of extraordinary quail habitat potential, these pine plantations lie waiting to provide a boon for species in trouble.

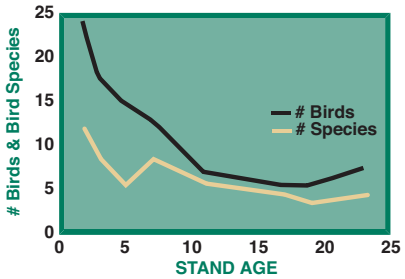
With a few minor adjustments in timber management strategies, you can help reverse the declines in early-successional wildlife species. There are basically five decisions landowners must make when managing pine 1) how to prepare a site for replanting, 2) what planting density should be used, 3) how to release the pines from competition, 4) how to thin the stands when they reach proper age/size, and 5) how to manage the stand after thinning. ALL these decisions have impacts on wildlife populations.

Site Preparation

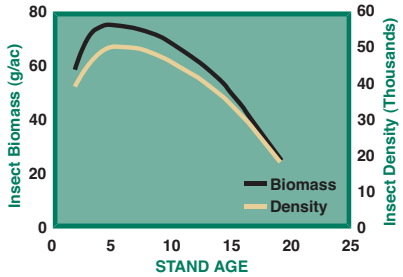
The first decision involves site preparation after harvest. A landowner must decide how to treat a site before planting. The best scenario for quail and other wildlife is preparation by burning. Alone, burning can accomplish a great deal, but is enhanced by soil disturbance techniques such as pre-burn drum chopping, or windrowing. During the first few years after site preparation, these sites will produce an abundance of forage. Legumes will be common. Grasses won't be too thick and insects will be readily available to turkey, quail, songbirds and their young.

Why are insects important? Recent studies demonstrated that quail chicks not getting an adequate supply of insects in their diet grew poorly, developed feathers slowly and had low survival rates. The same is true for turkey poults and all songbirds. Insects are critical! Insects make up 95% of a quail chick's diet its first two weeks of life. It is not difficult then, to see why hens will move their broods long distances to find good, insect-rich brood

For five to seven years young pine plantations offer quail nesting and brood rearing cover. Quail chicks need overhead cover but vegetation must be open at ground level so they can stalk and catch insects easily.
(Photo Melissa McGaw, N.C. Wildlife Resources Commission)



Average Number of Birds and Bird Species in Various Aged Loblolly Pine Plantations — The number of birds and the diversity of bird species in loblolly pine plantations is greatest in young stands and declines as canopy closure occurs. This is directly tied to a decline in understory vegetation density. A thinning (age 15-20) would markedly increase the number of birds using the stand.



Biomass and Density of Insects in Various Aged Loblolly Pine Plantations — Young birds need an abundant supply of insects to thrive and survive. Insect abundance in loblolly pine plantations increases initially but begins to decline as canopy closure occurs. This is directly related to the decline of lush herbaceous growth in the stand.

habitat. A quail or turkey manager's goal is to minimize these movements by providing an ample supply of well distributed brood-rearing cover.

Excellent quail and turkey brood habitat was once provided by idle cropland. But very little idle cropland exists today. In fact, fallowed cropland has declined over 65% in our state since 1925. It is interesting that quail populations have declined at a rate similar to our loss of fallow land. What has replaced these lands? In many cases, cut-over timber stands in early-regeneration fill the idle land void. Though not perfect, young cut-overs are the last stronghold for many of our early successional wildlife species.

Planting Density

Decision number two involves planting density. How many trees per acre (TPA) are enough? At one time, foresters recommended as many as 1000 TPA. Seedling survival was poorer in those days. Also, seedling stock did not have today's quality. By planting so many trees, landowners felt they were insuring a good stand. As seedling quality changed and foresters became more knowledgeable concerning seedling survival, they realized much lower planting densities were viable. They also realized that pines compete with themselves. There is a point beyond which additional planted seedlings actually reduce profit.

Today, 550 TPA is a common planting density. For wildlife, even lower densities are better. Densities of 435 – 450 TPA (10 x 10 and 8 x 12 spacing) at planting can generate great income. The lower densities are better for wildlife because they allow more sunlight to reach ground level, producing more forage and cover. Additionally, they will not reach canopy closure as soon as densely planted pines, increasing the number of years cut-overs remain useful to wildlife populations. Lower planting densities also help insure that thinning is not delayed as a result of the slow growth that over-crowding produces. This translates not only to a quicker monetary return, but a quicker return to good wildlife habitat.

Another place wildlife can benefit at planting time is along cut-over/crop field edges. Rather than plant trees on the entire area, leave unplanted margins 25' to 50' wide along field edges and manage these as field borders, with periodic discing. Sowing such areas to a mixture of legumes like partridge pea and Korean and kobe lespedeza will enhance their value to early-successional wildlife. The same prescription is suitable along haul roads and on log decks.

Overstocked stands can be precommercially thinned to enhance profit and wildlife values.
(Photo Pat Keyser)

In eastern Virginia, where loblolly pine grows naturally, many thousands of seedlings can "volunteer" into planted pines. This creates such a dense stand that little wildlife habitat is available, and any real hope of financial benefits is lost. To correct this problem, the stand can be thinned at four to six years of age using industrial weedeaters with sawheads. This is referred to as "pre-commercial" thinning because trees being removed are not yet of merchantable size. While the practice is expensive, studies have shown that it more than pays for itself when used in heavily stocked stands. It also creates a great deal of wildlife habitat at a time when it would have been otherwise unavailable.

Another technique that can be used to accomplish a pre-commercial thinning is to use a small bulldozer to take out 8' to 10' strips of trees in alternating rows. This is less desirable than selecting for individual trees with industrial weedeaters, but much better than doing nothing.

Young pine plantations provide habitat for early-successional wildlife until they reach crown closure (the tops grow together). This happens rapidly in heavily stocked stands like this, but can be prolonged without impacting economic returns by planting at lower densities (450 trees/acre).
(Photo DOF)

Release From Competition

Another major decision landowners must make is how pines should be released from hardwood competition. Today's trend is toward chemical release only 1 to 2 years after planting. If you want to release relatively soon after planting, use a legume-friendly chemical such as Arsenal®. Though Arsenal® will knock out most hardwood competition and some grass competition, it will not harm many legumes. If you desire to use a broader spectrum chemical application, such as an Arsenal® and Accord® mixture, understand the Accord® will take out more of the legume component. If you use this mixture, it would be best for wildlife to wait 4 to 5 years post-planting before releasing. You will be taking out the legume vegetation component, but it will be at a time when shading would begin to accomplish this naturally. One management note: due to the abundance of blackberry growth often found when using Arsenal® alone, it may be better to delay spraying and use the Arsenal® and Accord® mixture.

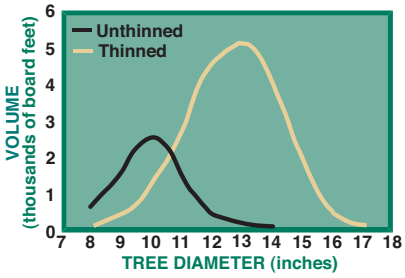
For some, huntability of a cut-over may be a concern. Thick blackberry growth impedes hunter access and can be a painful experience for hunting dogs. Using Escort® in a chemical treatment mixture will further reduce blackberry growth. However, total elimination of blackberry should not be a goal. Having a few blackberry "tangles" provides great rabbit and quail escape cover.

While the use of herbicides to control hardwood brush has been with us about as long as pine plantations themselves, new trends in herbicide use have developed over recent years. Chemicals are now being used to kill grasses, weeds and legumes in pine plantations. This may help the seedlings grow, but it eliminates virtually all wildlife habitat value. Any attempt at total competition control will adversely affect wildlife. With no grass, no lespedeza, no blackberries and few weeds, these sites produce few insects, little fall and winter food and poor cover. Such management may make sense to corporate landowners or private landowners with economics as the top priority, but landowners who place importance on wildlife should avoid total vegetation control.

(Photo Stan Warner, DOF)

Competing woody growth, mainly fast-growing hardwoods like sweetgum and red maple, reduces economic returns. Many landowners carry out an herbicide "release" treatment. This may remove many valuable wildlife food and cover plants. To minimize this impact, herbicide release treatments should be made within two years of the planting or just prior to crown closure.
(Photo DOF)

Total Vegetation Control is sometimes used in pine forestry. It maximizes growth by removing most competition. Careful planning and application of these practices is vital to prevent soil erosion and minimize harmful effects on wildlife. Gullying and a lack of wildlife food and cover may result otherwise.
(Photo Steve Capel)



Comparison of Volume Per Acre of a Thinned and Unthinned Loblolly Pine Stand at Age 45 — Loblolly pines that remain unthinned become stunted. As a result, an unthinned stand declines in productivity and economic worth. Thinning a pine stand dramatically increases the growth rate of the remaining pines — increasing both the diameter and volume of timber in a stand at maturity.

Thinning

The fourth major decision is how to thin a pine stand. Thinning a pine stand in mid-rotation (between 16 and 20 years post-planting) will increase the quantity of future harvested sawtimber. This is just the expression of reducing pine to pine competition. On most first thinning operations in Virginia, trees are thinned by a process termed 50% operator select. This usually takes a stand down to 200 to 225 TPA. At these densities, little canopy opening exists, therefore very little sunlight hits the forest floor, few herbaceous plants grow, few insects are produced and usefulness for quail, turkey and deer is limited.

As a general rule, to achieve benefits for wildlife under a forest canopy, sunlight should strike at least 50% of the ground at noon. To accomplish this, pine stands must be thinned to 175 or fewer TPA. An ideal compromise is to thin to 150 TPA. Understand that this yields fewer but larger, higher value sawlogs in the future. It also yields more pulpwood at present. Thinning to this level (150 TPA) sets the stage for a potential wildlife bounty.

Even if thinning to a lower density is not judged feasible on an entire plantation, much can be gained for wildlife by thinning heavily along field edges, road corridors and around stand openings. This "edge" habitat often yields the greatest dividend for wildlife, acre for acre.

By thinning to 150 TPA, much more of the forest floor receives sunlight. Half the ingredients are in place, but just like a chicken seasoning missing a certain spice, something more is required to complete the perfect taste. How you manage the stand after thinning is what really makes or breaks the deal.

(Photo DOF)

Loblolly pine plantations reach thinning age for the pulpwood markets in Virginia between ages 16 and 20. From canopy closure (about age 8 – 10) until they are thinned, very little sunlight reaches the forest floor. As a result, there is sparse vegetation for most wildlife species during this period. A thinning down to 150 – 175 trees per acre permits adequate sunlight to reach the forest floor, allows wildlife food and cover to flourish, and still retains adequate pines for profitable chip'n'saw or sawlog production. (Photo David Coffman, DGIF)

The Effect of Thinning

BACKGROUND - A Hypothetical Virginia Case Study

Consider a Virginia tree farm located in the Piedmont or Coastal Plain which is average in site quality. After harvest this tract is burned, planted and released with herbicide at an overall cost of $175 per acre. The site was planted with 550 trees per acre of second generation, improved loblolly seedlings with a resultant site index of 65 (base age 25). Annual costs are $2 per acre for property tax and $5 per acre for management expenses. The stand will be thinned at age 20 to three stocking densities of approximately 200, 150, and 100 residual trees per acre, respectively. This reflects the effects of potential trade-offs between financial returns from timber production and increased open space for quail and other wildlife. The stand will be harvested at age 30. Prices for pine pulpwood (5"– 8" d.b.h.), chip-n-saw (9"–12" d.b.h.), and pine sawtimber (13" d.b.h. and up) are $19, $60 and $109 per cord, respectively. Prices are from *Timber Mart-South* for first quarter 1998, for the Piedmont and Coastal Plain regions of Virginia. Projected yields are taken from PCWTHIN, growth and yield software developed at Virginia Tech from a Virginia data base. Inflation is assumed to be two percent, and real price appreciation (price change over inflation) is assumed to be two per-cent. The results that can be expected from this case are shown in Table 1.

FINANCIAL RETURNS

The results are compared among a no-thin alternative and thinning at the three stocking densities to analyze the effects on returns. The choice of a 30-year rotation is arbitrary to facilitate the comparison of the alternatives; however, it is close to what might be selected by a typical Virginia landowner under similar circumstances. In practice, silvicultural treatments such as thinning and fertilization will often extend or shorten an optimum rotation (i.e., investment length). The results are examined before-tax, in current terms (with inflation), using internal rate of return (IRR), net present value (NPV) at eight percent, and land expectation at eight percent. NPV results are one rotation of 30-years. Land expectation values give results for an infinite number of rotations.

The financial returns for the various alternatives are remarkably similar (Table 1). The IRR for the thinned stands is slightly higher than for an unthinned stand under the assumed conditions. Similarly, the NPV for thinned stands is higher than for the unthinned alternative, but the margin of gain is small. A landowner should include other benefits to be gained from thinning before making a final decision. Because the financial results from different thinning intensities are similar, a landowner may thin more heavily to promote food for quail and other wildlife with a minimum sacrifice in financial outcomes.

Financial gains from thinning result mainly from promoting leave trees in the stand into larger diameter classes which result in higher prices per unit for solid wood products. The products possible from a timber stand — pulpwood, chip-n-saw, and sawtimber — vary by initial stocking, timing and severity of thinnings, and site index. Financial returns are also affected by the differentials among the various products which are governed by the local market.

Table 1. Financial returns for loblolly pine on a 30-year rotation under four thinning regimes, per acre.

Thinning regime – residual stocking, trees per acre (#)	IRR, before-tax (%)	NPV @ 6%, before-tax ($)	Land expectation value @ 6%, before-tax ($)
No-thin	13.1	688	764
200	13.6	735	816
150	13.8	766	851
100	13.8	760	845

Properly thinning loblolly pines is vital to the long-term vitality of the stand and to a landowner's economic returns. Standard "operator-select" thinning in Virginia usually takes stands down to 200–225 trees per acre. This stops just short of the level best suited for wildlife. Thinning to 150–175 TPA maintains economic returns and provides for wildlife.

(Photo David Coffman, DGIF)

Prescribed Burning

The fifth decision is how to manage a stand after the first thinning. Often, no management occurs after thinning operations. The one key ingredient to promoting wildlife, controlled understory burning, is missing. Once fuel loads have declined to safe levels (usually one to two years following a thinning), all thinned acres should be burned. From this point on, burning ⅓ of the existing acreage per year will maintain good hardwood control and high quality wildlife habitat. Any spring gobbler hunter worthy of
toting a gun, quail hunter deserving of owning a dog, or deer hunter worth the weight of a tree stand step doesn't have to be told how beneficial understory burning is to wildlife. This is the spice that stimulates herbaceous growth, particularly legumes. This is the ingredient that makes the understory good foraging habitat for turkey poults and quail chicks.

Traditionally, understory burns were conducted during January or February. In recent years, quail managers have experimented with growing season burning (early-May and August). Given Virginia's weather patterns, these months may actually be more feasible than traditional winter months for accomplishing a burn. Growing season burns are also more effective at controlling hardwoods and encouraging herbaceous plant growth. Studies have shown that burning during these time periods has no negative effect on bird populations, or subsequent hunting success.

Regardless of season, burns should be conducted on days of building high pressure. Air should be rising. Humidity should be between 30% and 55%. Wind speed inside the stand should not exceed 3 mph. Moisture of fine fuels should be 15% to 20%. Consult a contract burner, Department of Forestry or the Department of Game and Inland Fisheries for more details. Potential for cost-share exists.

There are many small things that can be done to enhance a farm for wildlife, but focusing on improving the larger acreages like pine plantations is the place to start. Planting properly, thinning and then managing the thinned stands with prescribed burn-ing will bring economic and wildlife benefits. You can reward your family both economically and spiritually by managing for profit and wildlife.

(Photo Steve Capel)

(Photo Dwight Dyke)

Once a loblolly stand is thinned, hardwood competition again becomes a problem. Herbicides can be used, but maintenance prescribed burning offers more wildlife benefits. Loblolly pines are fire-adapted and thrive under a burning regime. Abundant herbaceous wildlife food plants are also produced. The resultant pine savannah is a wildlife mecca.
(Photo Pat Keyser)

Forestry Best Management Practices

Activities that disturb the land have the potential to negatively impact soil and water quality. Road construction, stream channel crossings, felling and skidding trees and preparing sites for planting during timber harvesting will disturb the land, increasing the chances of impacting soil and water quality. At the same time quail respond well to some soil-disturbing activities. Best management practices (BMPs) reduce soil erosion and control water pollution resulting from forestry activities. The challenge is to shape BMPs to conserve soil and yield quail benefits.

Pre-Harvest Planning

Pre-harvest planning should be used to outline specific BMP's required during timber harvesting. Although the need for some BMP's will not become apparent until harvesting begins, the need for many BMP's can be identified before the first tree is felled.

Streamside Management Zones

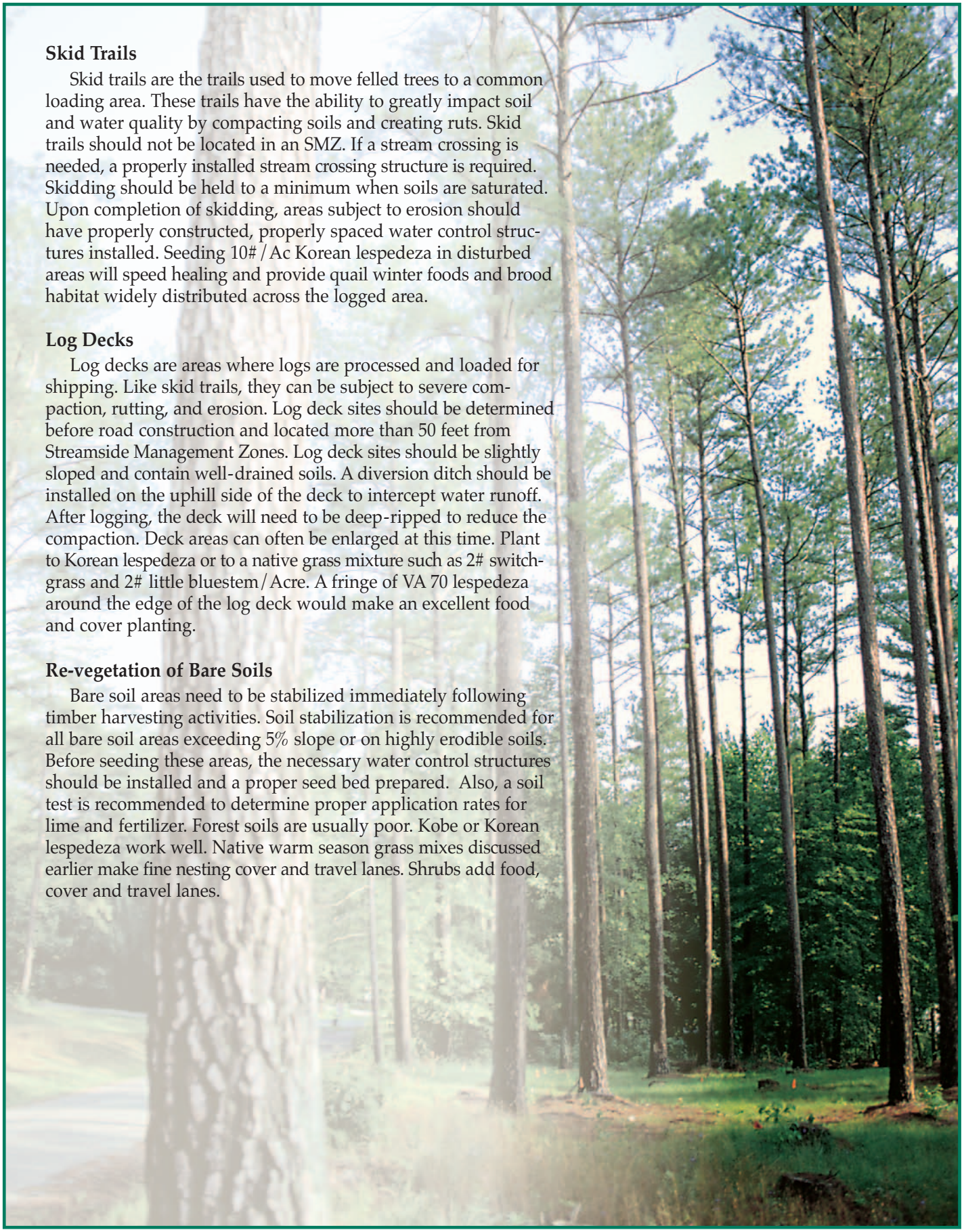
Streamside Management Zones (SMZ's) are areas adjacent to streams that protect water quality. For perennial streams, SMZ's must be a minimum of 50 feet wide. For intermittent streams, the SMZ must be 25 feet wide. These minimum widths should be increased as slope increases, or if trout streams or water supply sources are adjacent. Trees can be harvested in SMZ's. However, the maximum amount of canopy cover that can be removed is 50%. You may want to protect valuable mast producing trees or shrubs just outside the SMZ — black gum, oaks, dogwoods, spicebush and viburnums in particular.

Haul Roads

Road construction is generally considered to have the greatest potential to negatively impact soil and water quality. However, careful planning and construction can minimize these impacts. Roads should follow the contour, avoiding level ridgetops and wet flood plain soils that do not drain well. Gradients should be between 2% and 10%. Avoid stream channel crossings whenever possible. Properly constructed and appropriately spaced water control devices (water bars) should be used on all roads. Roads should be "daylighted" by harvesting timber along one or both sides creating a corridor 40–120 feet wide. This allows ample sunlight to reach the road surface. Partridge pea and korean lespedeza are excellent choices for seeding along roads. Orchardgrass and ladino clover are also a good option where wildlife is a priority. On steeper slopes where there is a serious threat of erosion, crown vetch should be included in any seeding mix.

(Photo Jim Mehring)

Best Management Practices minimize the environmental impacts of logging operations. Leaving a buffer of standing trees along water courses (Streamside Management Zones), revegetating fire-guards (Herbaceous Buffers) and re-seeding log roads, skid trails and log decks (Permanent Vegetative Cover) are among the practices a professional forester will design into a logging operation to insure that water quality and wildlife are not damaged, and in many cases even enhanced. (Photos DOF)



Skid Trails

Skid trails are the trails used to move felled trees to a common loading area. These trails have the ability to greatly impact soil and water quality by compacting soils and creating ruts. Skid trails should not be located in an SMZ. If a stream crossing is needed, a properly installed stream crossing structure is required. Skidding should be held to a minimum when soils are saturated. Upon completion of skidding, areas subject to erosion should have properly constructed, properly spaced water control structures installed. Seeding 10#/Ac Korean lespedeza in disturbed areas will speed healing and provide quail winter foods and brood habitat widely distributed across the logged area.

Log Decks

Log decks are areas where logs are processed and loaded for shipping. Like skid trails, they can be subject to severe compaction, rutting, and erosion. Log deck sites should be determined before road construction and located more than 50 feet from Streamside Management Zones. Log deck sites should be slightly sloped and contain well-drained soils. A diversion ditch should be installed on the uphill side of the deck to intercept water runoff. After logging, the deck will need to be deep-ripped to reduce the compaction. Deck areas can often be enlarged at this time. Plant to Korean lespedeza or to a native grass mixture such as 2# switchgrass and 2# little bluestem/Acre. A fringe of VA 70 lespedeza around the edge of the log deck would make an excellent food and cover planting.

Re-vegetation of Bare Soils

Bare soil areas need to be stabilized immediately following timber harvesting activities. Soil stabilization is recommended for all bare soil areas exceeding 5% slope or on highly erodible soils. Before seeding these areas, the necessary water control structures should be installed and a proper seed bed prepared. Also, a soil test is recommended to determine proper application rates for lime and fertilizer. Forest soils are usually poor. Kobe or Korean lespedeza work well. Native warm season grass mixes discussed earlier make fine nesting cover and travel lanes. Shrubs add food, cover and travel lanes.

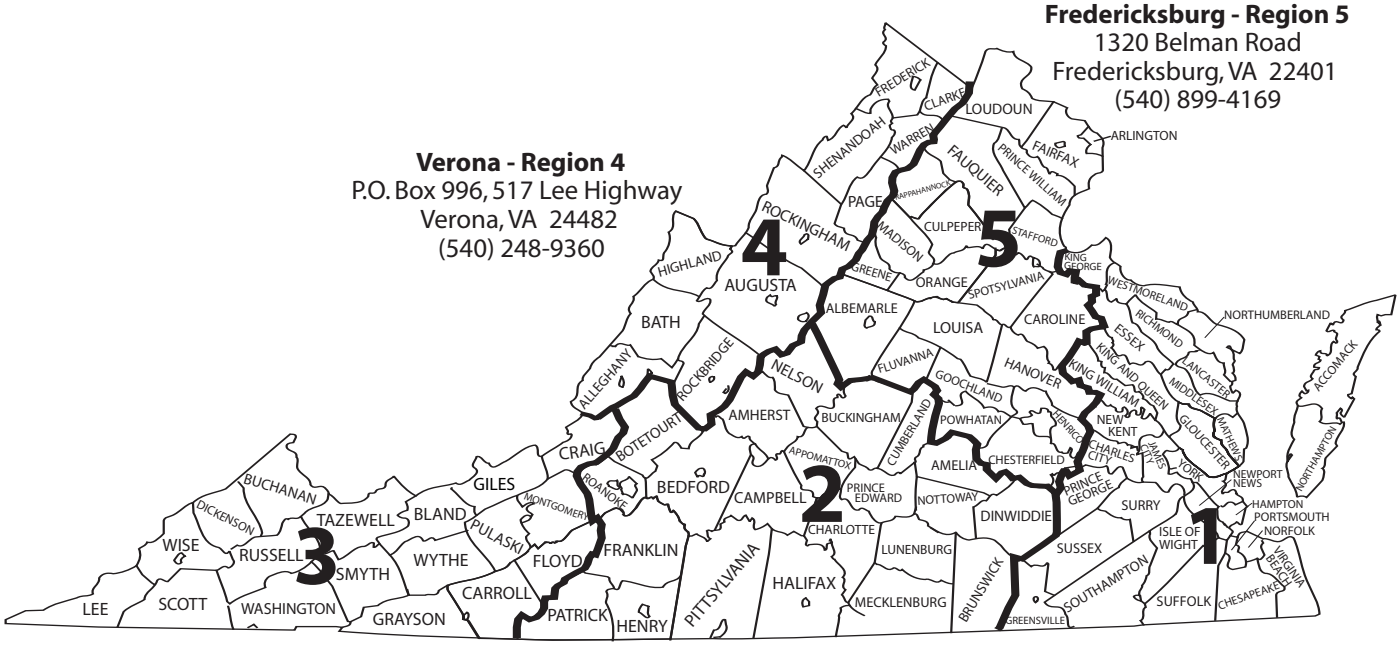
(Photo Jim Mehring)

Cost-Share Programs for Managing Forest Lands

The Virginia Department of Forestry and the Natural Resources Conservation Service offer conservation incentive programs to assist landowners interested in managing Virginia's forests. For the latest information on cost share programs please contact your District Wildlife Biologist with the Department of Game and Inland Fisheries.

Fredericksburg - Region 5
1320 Belman Road
Fredericksburg, VA 22401
(540) 899-4169

Verona - Region 4
P.O. Box 996, 517 Lee Highway
Verona, VA 24482
(540) 248-9360



Marion - Region 3
1796 Highway Sixteen
Marion, VA 24354
(276) 783-4860

Forest - Region 2
1132 Thomas Jefferson Road
Forest, VA 24551-9223
(434) 525-7522

Charles City - Region 1
3801 John Tyler Memorial Hwy.
Charles City, VA 23030
(804) 829-6580

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Attn: Compliance Officer
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Richmond, Virginia 23230-1104