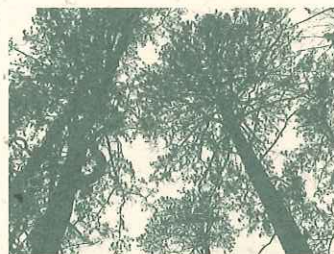


Missouri's Virgin Pine Walk & Pioneer Forest Interpretive Drive



*Located 25 miles south of Salem on Highway 19
(one mile south of Round Spring)*

Virgin Pine Walk

This brochure highlights the values of Missouri forests and two particularly noteworthy areas. The Virgin Pine Walk is an opportunity to experience one of only a few remnant forests of native, uncut shortleaf pine. Here you will walk through Missouri's Hall of Giants. Using this booklet and the several stops along the way, you will see how this forest grows and changes through time.

Our Forest Interpretive Drive extends for two miles through Pioneer Forest, explaining as you drive how our method of selectively cutting trees maintains mature trees and continuously-forested landscapes in the Ozarks.

Credits:
All photographs are by Bob Gestel.

The illustration on page 5 is by Richard Guyette and is reprinted from the "Natural Areas Journal," (Jan. 1990) with permission.

The illustrations from page 7 are by Charles Edward Faxon and Mary W. Gill from "Manual of Trees" (1961) and are reprinted with permission from Dover Publications, Inc.

The forest here is an original; this is one of Missouri's oldest "pineries," or natural old-growth pine forests.

It is from places such as these—areas containing old, native Ozark trees—where we learn so much about the natural history of Missouri's forests and about how well the trees have grown.

We encourage you to take the short walk—our loop trail will take approximately 20 minutes. This booklet will assist you in learning more about this area.

FOOTNOTE: In 1996 the L-A-D Foundation purchased 41.4 acres of the Virgin Pine from the Missouri Department of Transportation, leaving a 50-foot highway right-of-way. Today these two organizations share responsibility for the future protection of this forest of shortleaf pine giants.

STATION—A. At the turn of the 20th century our Ozark forests began to be cut commercially for the first time. Shortleaf pine was highly desirable, and was prized for its lumber when cutting was at its peak in Missouri.

It has been estimated that shortleaf pine extended across 4.2 million acres of the Missouri Ozarks at one time. Forests dominated by pine such as you see here are no longer common, and certainly "pineries" several hundred years old are rare.

Industrial-scale cutting of Missouri's forests began in the late 1800's. By 1940, the Missouri State Highway Department had purchased this forest in order to preserve it for the future. Among travelers in Missouri, this pine forest has been a widely-recognized scenic corridor, extending for one-mile along Highway 19.

Further down the trail you may notice several pine stumps on your right, on the uphill side of the trail. Around 1985 a strong windstorm swept up this hillside and toppled several of the weakest trees. A few trees were lost to the storm although most remained unharmed.

Generally the taproot of shortleaf pine makes this species resistant to blowdown. The deep taproot and the pine tree's relatively narrow crown are two characteristics that render it quite adaptable and prolific throughout its natural range.

STATION—B. As you walk through these giants, note the individual tree height and size. While we cannot physically measure the actual height of these trees, we estimate the canopy of this forest (distance from the ground to the treetop) to be 75 to 100 feet high. Most of the canopy trees here exceed 30 inches in diameter.

As you continue your walk through this forest you will notice several distinctive ways these pine trees change as they grow older:



- THE TOP OR CROWN OF A YOUNGER PINE TREE IS TAPERED WHILE THE CROWN OF AN OLD PINE TREE BECOMES FLAT.
- AS PINE TREES AGE THEIR BARK DEVELOPS INTO PLATES WHICH ARE SMOOTH AND FLAT.
- THERE IS A DIRECT RELATIONSHIP BETWEEN THE SIZE OF A PINE TREE AND THE SPACE OCCUPIED BY ITS CROWN. GENERALLY FOR EVERY INCH OF TRUNK DIAMETER THERE IS A FOOT OR MORE OF CROWN SPREAD.

STATION—C. By looking inside these trees, we can search their long history for clues about forest life. The science of dendrochronology, the study of tree rings, examines and measures tree growth over very long periods of time.

In 1993 a researcher from the University of Missouri collected several "core samples" from dominant trees in this forest. The age of germination for these larger trees ranged from the year 1781 to 1791. Of course there are many trees here, ranging from very young saplings that are thriving beneath the canopy openings, to these very old trees which form the canopy.

As with any forest, individual trees are continuously germinating on the forest floor, growing up and into the canopy, then maturing and finally dying. This continuous growth and replacement creates a forest with trees of many different ages.

STATION—D. As shortleaf pine trees age, they become susceptible to several species of fungi

which cause heartrot. Two species of fungi enter the tree through a wound or opening near the base of the tree. Frequent fires encourage this type of heartrot.

Another fungus enters the tree through branch stubs, knot holes, or any opening occurring on the upper portion of the tree. The result is that the disease travels down the tree, turning the sapwood or heartwood a dark reddish color. From this characteristic the disease is commonly known as "redheart."

This shortleaf pine forest, and others nearby, served as home for the red-cockaded woodpecker. These woodpeckers excavated cavities in the older living trees infected with the fungus. Excavations were made easier in the softer heartwood.

With the cutting of the old-growth pine, the population of red-cockaded woodpeckers steadily declined over the next several decades. The last red-cockaded woodpeckers known in Missouri were observed in these forests in 1946.

Also once occurring in these pine forests were the brown-headed nuthatch and the Bachman's sparrow.

Today, many birds still use these pine trees, leaving behind their tell-tale signs. Pileated woodpeckers excavate an oval-shaped hole in the upper trunk, while yellow-bellied sapsuckers create rows of small holes through which the tree's sap oozes and attracts insects which the birds return to feed on.

STATION—E. You have left the virgin pine forest. The forest you are now standing in is being managed using periodic harvests which remove individual trees for a variety of commercial products.

The pine here are much younger; most of these smaller and younger pine trees are perhaps 65 years old. Notice as you walk how the number of pine trees changes as you change your position on the slope. Generally, pine favor

Studying Tree Rings

Wood is an essential resource for gathering tree ring information. From tree rings we can learn about climate and ecological change.

Information is obtained from living trees, from dead trees that are standing or down, or from buried or submerged timbers. Typically, as is the case here, we gather information from living trees, removing a very small sample of the tree. These samples are called "cores" and are obtained by hand-boring with a special tool from one side of a tree, to at or near the center.

After a soda-straw sized sample of the tree has been removed, continued growth covers over the opening in the tree and little, if any, damage occurs.

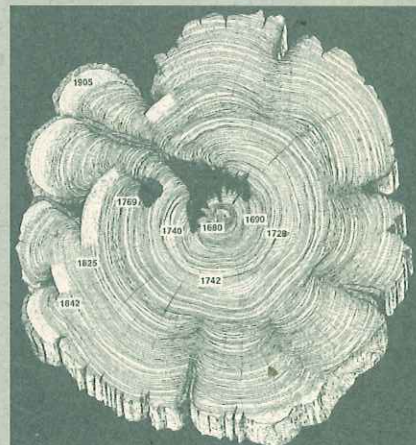


ILLUSTRATION of a cross-section from a dead eastern red cedar. The dates shown indicate natural events which occurred during this particular tree's lifetime, for example, drought, fire, injury, and death.

- The study of tree rings helps us understand the age of a tree, the age of a forest canopy, and the population structure within a forest.
- Comparing growth rings with environmental or climate data allows us to compare responses to change between species, both within a forest, or within a region.
- Changes in the environment can also be determined by looking within these annual growth rings. For example, in Missouri, increased sulfur levels inside the wood coincide with increased industrial activity, such as coal-burning and lead smelting.
- Tree-ring information collected from individual trees from several different areas helps us to pinpoint environmental trends occurring within an area or across a region. Past drought patterns as well as human- and nature-caused fires within the Ozark region can be easily studied from white oak, eastern red cedar, and shortleaf pine because of the longevity of these species.

ridgetops and upper slopes.

STATION— F. These forests are dominated by oak, hickory, and pine. These species form the canopy of Missouri Ozark forests. For a tree to reach the canopy it must be well-adapted to an area and then out-compete all the other trees. This process of taking advantage of opportunities within the forest is constant.

As you stand here, particularly in the spring and summer months, you will notice there are other species present such as dogwood and maple. Dogwood trees are quite common in the understory of these Ozark forests: their white flowers celebrate spring and announce the coming of another summer. Dogwoods, though common among the small trees and shrubs, never reach the canopy of an Ozark forest.

Maple trees occur throughout Ozark forests, commonly on the shaded forest floor, though individual trees occasionally grow tall enough to reach the canopy. Maple is never a dominant forest tree in Ozark forests. Even in old-growth forests here in the Ozarks, where maples have had ample time to grow into the canopy and where ideal conditions of shade occur, they are not common.

STATION— G. As you stand here, notice the large pine tree below and the large scarlet oak behind you. Oftentimes the size of a tree is used as a general method of comparing the age of a tree— the larger the tree, the older the tree. This is not always accurate. You may be surprised to know that the large pine below you is more than 150 years old, while the large scarlet oak above you is less than 80 years old.

Common Trees Of Pioneer Forest & The Ozarks

SHORTLEAF PINE

hard, strong, and usually coarse-grained wood, although a softer wood than oak and hickory; largely important for lumber. Shortleaf pine is one of several species also commonly known as "pitch pine," named for the resin obtained from the tree's sap.

WHITE OAK

a strong, close-grained wood; used in barrel-making, baskets, cabinet-making, and railroad ties.

POST OAK

similar to white oak, a very heavy, close-grained wood; used in fencing and railroad ties.

BLACKJACK OAK

heavy, hard, and strong wood; not particularly valuable except for fuel and for manufacturing charcoal.

SCARLET OAK

hard, strong, coarse-grained wood; used in construction, and for hardwood flooring, cabinets, and furniture.

BITTERNUT HICKORY

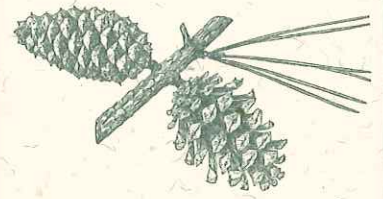
strong, heavy, very hard; has been used for tool handles and baskets.

BLACK GUM

a heavy, soft, and very tough wood; not durable and not valuable as a wood product today, but once used for ox-yokes, rollers, and wheel hubs.

WHITE ASH

a heavy, hard, close-grained wood; often used for tool handles, oars, and in the interior finish of buildings.



Pioneer Forest Interpretive Drive

The interpretive drive starts at the Virgin Pine Walk, along the east side of Highway 19 and extends east for two miles through Pioneer Forest, a private, conservatively managed forest of nearly 160,000 acres. One goal of Pioneer Forest is to harvest trees for wood products while continuously maintaining the natural character of the forest for watershed protection, recreation, continuous mast (nuts and fruits from trees and shrubs) production for wildlife, as well as visual and other ecological benefits.

We have designed this brochure to explain how our method of forest management works. At the end of the drive, the turnaround is marked; you will return the same two miles back to Missouri Highway 19. There will be several other areas along the drive where you will be able to turn around as well.

STOP— 1. You can watch the land for signs of its history. A forest will tell you a great deal, not only about how it has been cared for, but a lot about its future potential. The most obvious things we can look for include the age and size of the trees, what kind of trees they are, and their condition.

You may have noticed the age of the forest you are now driving through looks much younger than the virgin pine forest along Highway 19. When this forest was originally cut in 1946, many large shortleaf pine and white oak were cut and removed. It is reported that trees cut from this area were used to build the nearby Fort Leonard Wood military base. However, a number of the large pine trees were left scattered through the remaining forest.

The large diameter shortleaf pine on the right, along with many others this size, were left to serve as seed trees for this subsequent forest. Following the harvest, a fire swept through this area on Easter Sunday in 1953. The combination of an open canopy along with fire provided the necessary disturbance factors,

and at just the right time for the seeds from these large trees to germinate.

We know from this example and other research, that fire stimulates the development of pine forests, providing necessary conditions for seed germination. More than 50 years in the making, the forest you now see was established because these parent seed trees were left in the forest.

Beginning in the early 1950's, these lands were bought by Pioneer Forest and a landscape-scale forest restoration program was begun in order to return the full woodland character to these lands.

STOP— 2. The orange markings on the pine tree to the right identify forest inventory plots. They are part of an on-going, long-term study of forest conditions and change. Pioneer Forest began the study in 1952 and our sampling and measurements continue today.

There are 486 plots located throughout the forest. Each of these research plots is 1/5-acre in size. Every five years our staff records and measures all trees present on each plot, including the height, diameter, species, and individual vigor of each tree.

This study is the longest-running and most extensive forest research project ever conducted in the state—it samples nearly 160,000 acres of land and has been continuously conducted for more than 50 years.

The extensive data collected thus far offer several measures of the improved quality of forests that are managed conservatively, using single-tree selection techniques:

- Even with harvesting under way since 1952, the volume of tree growth measured forestwide has continued to increase.
- You can see from your drive that this forest continues to perpetuate itself. In other

words, seedlings and saplings have continuously replaced trees which are periodically cut.

- Sawlog volume per acre has also continually increased, indicating the forest's quality has measurably improved through time.
- Measurements remaining consistent over such a long period and for such a large area indicate that conservative forest management, as applied here, can be readily duplicated for similar forested areas throughout the Ozarks.

NOTE: The road forks just ahead; you should keep to the right.

STOP— 3. Here is how this system of forest management works. At this particular location we conducted the most recent harvest in 1995. You can see the cut stump where we removed one of the black oaks. As you continue down the road you will notice several other examples where we have removed individual trees.

Our method of forest management uses a single-tree selection harvest to create openings in the forest canopy. These openings, high in the forest, allow light to penetrate through the canopy to the forest floor. You can see how other large and small trees surrounding the opening can now benefit from the increased light. Seedlings will germinate and develop on the more open and sunlit floor of the forest. Twenty years from now some of the larger trees you see here may be cut during the next harvest.

This example shows how a conservative method of forest management can be used by any landowner to produce an ongoing source of income while continuously maintaining the full character of our Ozark woodlands. In fact, periodic cutting produces the same, or more, volume per forest acre than extensive forms of cutting would. The landowner benefits from the income, maintains the forest, benefits wildlife, protects forest soils, and

promotes a healthy watershed with less soil runoff into the streams.

STOP— 4. Notice the older, hollow tree to the left. Such dead and dying trees are valuable for wildlife, sometimes serving as den trees; also, they often have holes created by cavity-nesting birds. Although often of no commercial value, these trees are of great value for such forest-dwelling animals as squirrels, owls, pileated woodpeckers, nuthatches and other birds, raccoons, broad-headed skinks, and several species of bats.

Such trees could be cut during the harvest; however, they play a useful role in a forest such as Pioneer Forest. A forest which is managed in this way is continuously producing not only valuable harvest trees but other trees valuable for forest wildlife, as well.

NOTE: The road ahead to the left is unimproved; stay straight ahead.

STOP— 5. Notice the structure of an uneven-aged forest. A single-tree-selection harvest leaves trees standing in the forest which vary greatly in size. At each harvest a number of trees are cut and removed. However, we always leave more than half of the trees in the forest to continue to grow. An average acre on Pioneer Forest has 32 trees of all sizes and diameters. Each harvest removes only 10-12 trees per acre.

Harvests for any given area of the forest occur every 20 years. We always leave the best and highest quality trees in the forest, removing individual trees based on species, signs of stress, damage, deformity, or based on the general spacing of trees within the forest.

Here the forest has continued to develop its characteristic multi-layered structure with large and mature overstory trees in the canopy. There are also trees ranging from 8 to 12 inches in diameter which are also either in

the canopy or just beneath it. These smaller trees then grow faster, thus beginning to fill the holes following each harvest.



You can see numerous saplings, and if you look closely on the forest floor, there are oak and hickory seedlings, often around an older rotting tree stump. All of these trees are valuable components of a healthy and continuously growing forest.

STOP— 6. During the late 1970's a windstorm swept up this hillside and blew down a number of trees. They fell along with their root systems and the attached soil. The down trees were salvaged for their lumber. However, you can still see the "tip-up" mounds where the roots and soil were pulled from the ground.

As you walk through other forested hillsides, you may notice the combination of a depression together with a mounded up area. This results from a tree falling or being blown down.

STOP— 7. As you look across this landscape, you see an important example of land conservation. Below is the Current River valley where the river and immediate lands are managed as part of the Ozark National Scenic Riverways. This national park, Missouri's largest, preserves a corridor of public land along both the Current and Jacks Fork rivers of approximately 1/2-mile in width.

As you look farther across this river valley, the lands to the north are also being protected as part of Pioneer Forest and are privately owned. Beginning here and extending downriver for approximately 15 miles, Pioneer Forest provides a permanent and

extensive forested buffer along one or both sides of the Current River.

Because these forests are never completely cleared from any acre of land, they demonstrate how single-tree selection harvests continuously provide commercial products along with the recreational benefits we all enjoy.

STOP— 8. Turn around here. The two roads leading from here either dead-end or become quite rough.

Forests As Economic Assets

Pioneer Forest demonstrates that forest landowners can maintain a healthy forest while benefiting from periodic income. Forests become assets, just as important as a home. Like our homes, our forests can continue to increase in value through time when they are well-cared for.

Single-tree selection harvests allow landowners to take advantage of the increasing price for trees as well as the continuing increase in the size of individual trees left uncut.

First, the market for timber in Missouri has increased from only \$20 per thousand board feet in 1975 to more than \$180 per thousand board feet in 2005. Second, while the market continues to increase in value, the best trees are left in the forest and continue to grow.

For the forest landowner this combination of increasing values is the essence of using single-tree selection harvests to provide periodic income long into the future.

Forests can be a valuable asset and, if managed wisely, can provide a significant investment to pass along to the next generation.

Conservation & Ecological Benefits of Single-Tree Selection Harvests

Careful management of forests using single-tree selection harvests originated in Europe as long ago as the early 1800's in Germany and France. In these European countries, the knowledge of managing forests using these techniques was generally passed along through word of mouth.

Then, in the late 1800's, a more formal description of this method of management was produced by Henri Boilley in Switzerland and Adolphe Gurnaud in France. From Gurnaud came the idea of the sustainability of single-tree selection harvests while Boilley developed the technical rules for its use as a management tool.

Single-tree selection harvesting has been the only forest management technique practiced here on Pioneer Forest since 1951.

Ozark forests include a great variety of trees as well as many plants and animals, but it is the trees within these forests that are the longest-lived. On Pioneer Forest white oaks can live to be 300-400 years old and shortleaf pine can live for 200-300 years. Because of their longevity, trees provide the strongest anchor maintaining the complicated structure of these forests.

In order to provide the long-term benefit of commercial production, removing selected trees from the forest is proving to be better than removing the forest. The forest remaining following a single-tree selection harvest continues to provide non-commercial benefits as well as commercial ones.

It turns out that the most common method of tree loss in nature is one tree at a time. Commercial production using single-tree selection harvests is perhaps the closest mimic of this natural, individual tree loss. The individual trees which are selected for cutting within the forest are those which are weak or under stress and would otherwise be lost in an unmanaged forest, while the best trees are left. In one sense, single-tree selection harvesting carefully accelerates the removal of the weakest trees, producing income and maintaining the full and diverse character of the forest.

A wide range of research on Pioneer Forest is proving this technique of harvesting trees benefits most species within the forest and results in the least impact to the forest.

THE FOREST TREES. One key question for forest management is whether the chosen management technique significantly changes the forest or the natural species which make up the forest. Since 1951, single-tree selection harvests on Pioneer Forest have resulted in an increase in the number of trees forestwide and an increased average diameter, thereby actually improving the forest character. At the same time, the dominant forest species measured today are the same as those measured 50 years ago.

MIGRANT SONGBIRDS. Certain bird species which are apparently dependent on these mature forests are also present. Acadian flycatchers, red-eyed vireos, ovenbirds, and hooded warblers all have preferences for a high percent canopy closure, large trees, and high shrub stem counts. Each of these forest characteristics results from single-tree selection harvesting. Interestingly, from a study completed in part on Pioneer Forest, numbers of birds compared most closely with forests which had not been cut.

SALAMANDERS. Salamanders are the most abundant vertebrate animals within Ozark forests. More than half of all salamander species are purely terrestrial. These terrestrial salamanders are mostly restricted to environments providing microhabitats with high levels of moisture. Stabilizing influences for their populations are temperature, humidity, and soil moisture. These factors are largely a result of vegetative structure. Timber harvesting can cause

extreme differences in vegetative structure.

A recent study of salamanders from Ozark forests showed that the average number of salamanders (southern redback, slimy, and longtail) from an area of forest where the trees averaged 70-80 years old was nearly 300 per acre, while the average number from uncut forests was more than five times greater. Similar attempts to collect salamanders from areas where the forest had been clearcut produced fewer than 15 individuals per acre.

These population differences are dramatic as well as instructive. The studies suggest that maintaining the forest and substantially increasing the age and mature character of the trees within a forest will serve these populations best.

LEAF LITTER ON THE FOREST FLOOR. Another study on Pioneer Forest sampled insects, spiders, and other leaf litter arthropods from three different forested sites— an uncut area of Pioneer Forest, a managed single-tree selection forest on Pioneer Forest, and a clearcut outside the forest. This study determined how different forest management regimes influence forest structure and arthropod community composition at various levels of spatial scale.

Results indicate that arthropod species richness and abundance are significantly higher in the single-tree selection sites than in the clearcut areas sampled elsewhere. Furthermore, these results suggest that single-tree selection harvests may be a management regime more similar to the historical disturbance regime in the area.

FOR MORE INFORMATION. You can learn more about the L-A-D Foundation and this unique, privately-owned forest from our website at pioneerforest.org. The website details the method of forest management we practice as well as many of the recreational opportunities offered throughout these forested lands.

NEARBY. The **Roger Pryor Pioneer Backcountry** is a large, undeveloped area of Pioneer Forest, nearly 61,000 acres in size. The backcountry, named for the legendary Missouri conservationist, is located just north of here, bordered by Highway 19 on its west side, and by the Current River along its southern border. The size of this backcountry woodland, its extensive landscapes and its primitive nature offer challenging experiences which are not available anywhere else in Missouri. Activities popular here are day-hiking, camping, backpacking, and nature study.

You can reach this area by driving north from Round Spring on Highway 19. Cross the Current River and then watch for the first county gravel road (Shannon County 19-250, also known as the "Camp Zoe Road") going east. This county gravel road will take you into the backcountry.

Fall Color Drive. Camp Zoe Road (Shannon County 19-250) is a notable drive during the fall. This road connects Highway 19 and Midridge, and leads to State Highway P. For nearly 10 miles you will be driving through Pioneer Forest.

The L-A-D Foundation

The L-A-D Foundation was established in 1962 by Leo Drey as a Missouri private operating foundation and since that time has acquired and preserved in the public interest outstanding areas of natural, geologic, cultural and historic interest. One of the areas owned and preserved by the L-A-D Foundation is this virgin pine forest.

As a result of Leo Drey's donation in 2004, Pioneer Forest, as a limited liability corporation, is now owned by the L-A-D Foundation; the Foundation will continue to manage the Forest as it has been since its beginning in the 1950's.

About Pioneer Forest

Pioneer Forest was established in 1951 by Leo Drey to provide a practical demonstration of sustainable forest management. Combined benefits include showing private landowners how to successfully restore and enhance the forested landscape, that increased economic return is possible from a well-managed Ozark forest, that significant species and natural community diversity can thrive in a well-managed forest, and that maintaining a forest also provides ongoing recreational as well as educational opportunities.

Recreation on Pioneer Forest includes hunting and fishing by persons licensed by the Missouri Department of Conservation. Existing county roads are used for drives through the forest. In addition to this Forest Interpretive Drive, Pioneer Forest provides short- and long-distance foot-trails and abundant opportunities for camping, nature study, and picnicking.

Natural conditions on the forest include uneven trail surfaces, water, cliffs, down trees, caves, etc. We ask that you use common sense and respect for the woods as you enjoy your visit to these areas.

Pioneer
FOREST LLC

P.O. Box 497
Salem, Missouri 65560
www.pioneerforest.org



Printed on 100% recycled paper/
50% post consumer waste