LANDUSE

Historical Land Cover/Land Use

Many historical accounts describe the land cover of the rugged hills of the Eleven Point River, as well as other rivers in the area such as the Jack's Fork and Current, as consisting primarily of forest (Nigh 1988). These forests were described as being primarily open, with little woody undergrowth and a dense herbaceous ground flora composed of bluestem (Andropogon sp.) and other wild grasses and non-woody species. Ridges with sandy, flint covered soils were covered with stands of shortleaf pine (Pinus echinata). White oak (Quercus alba) and black oak (Quercus velutina) were often mixed with the pines on the ridges, and along with northern red oak (Quercus rubra), black walnut (Juglans nigra) and shagbark hickory (Carya ovata) formed the dominant canopy of the side slopes. Along isolated stream valleys in this watershed, prairie openings were also observed. This is reflected in the names of places such as Mt. Prairie Hollow.

In the uplands portion of the Eleven Point Watershed, where the topography is less dissected, a more barren or savanna land cover is believed to have existed (Nigh 1988). This consisted of "impoverished" open stands of post oak, black oak, and black jack oak with a ground story of grass.

The earliest inhabitants of the Ozarks, the Native American Indian, are thought to have existed in the Ozarks as semi-nomadic tribes living in small, transient camps and subsisting on hunting and foraging during much of the archaic period (7000-1000 B.C.)(Jacobson and Primm 1994). Late in the Archaic period, tribes on the fringes of the Ozarks became less nomadic, existing in larger villages and increasingly depending on plants for food, while tribes in the interior retained their hunter-gatherer characteristics. Tribes within the interior began to construct more elaborate villages as well as incorporate more agriculture into their subsistence during the early Mississippian Period (A.D. 900-1200). By A.D. 1500 this culture had disappeared as large villages based on agriculture began to grow along the eastern fringe of the Ozarks and the Mississippi River. During this period the interior of the Ozarks was used as a seasonal hunting ground as well as a source for flint and chalcedony for making tools. It is believed that a climatic shift to cooler, drier summers and the resulting failure of maize crops, on which early agriculture was based, may have caused an abrupt abandonment of these larger villages This is believed to have been the case of Cahokia Mounds in Illinois. Remnants of these villages and tribes reassembled to form the Osage Tribe which existed throughout much of the Ozarks and was present as European settlement of the area began to occur in the late 1700s and early 1800s (Jacobson and Primm 1994). Native American use of fire is believed to have been a large factor in the types of vegetation found by Schoolcraft and others as exploration of the Ozarks interior began to occur after the Louisiana Purchase of 1803 (Schoolcraft 1821, Jacobson and Primm 1994). Fires, set for many reasons from harassment of enemies to aiding in hunting, also stimulated warm-season grasses such as bluestem and eliminated woody undergrowth thus creating open woodlands or savannas (Jacobson and Primm 1994). European settlement of the Ozark fringe began in the early 1700s under French and, later, Spanish political control. After the Louisiana Purchase of 1803, Americans began settling the same areas earlier occupied by the Spanish and French. Settlement of the Ozarks interior increased after the War of 1812 (Jacobson and Primm 1994). Many of the early settlers came from the Appalachian States such as Tennessee, Kentucky, and Virginia where they had learned the skills necessary for survival in land similar to the rugged Ozark wilderness (Nigh 1988). In addition to hunting and fishing, early settlers

survived by using the valley bottom land for gardens and row crops, and the wooded side slopes and natural grass of the uplands for grazing cattle, hogs, horses, and other livestock. This region remained isolated and only sparsely settled until the late 1800's. As the timber resource of the eastern states dwindled and an increasing number of settlers migrated onto the western plains, the demand for the timber of the Ozarks increased (Cunningham and Hauser 1989). Undoubtedly, the cheap price of land having uncut timber was also very attractive to eastern speculators. Uncut timber land often sold for a $1.00 an acre (Cunningham and Hauser 1989). The coming of the railroad to the Ozarks interior during this time not only provided a means of transportation for lumber products, but also was a great consumer of this resource for railroad ties. With the extension of the railroads into the Ozarks came the large-scale exploitation of the timber resource (Rafferty 1983).

The many different products produced from the timber of the Ozarks resulted in a wide range of species and sizes harvested. Larger shortleaf pine trees were harvested for lumber, while a variety of sizes of hardwood trees were harvested for products such as railroad ties, charcoal, barrel staves, and flooring (Rafferty 1983, Cunningham and Hauser 1989).

Nigh (1988) states that "little attention was paid to regeneration of the forest and by the 1930s the timber cutting boom was over." Many of the settlers associated with the timber industry were forced to turn to subsistence farming as a means of survival (Nigh 1988, Cunningham and Hauser 1989 , Jacobson and Primm 1994). "After the removal of the pine and larger hardwood trees, a dense growth of young oak timber sprang up and the wild grasses diminished in abundance, greatly reducing the value of the range for pasture" (Krusekopf 1921). Grasses were annually burned and hogs and cattle roamed free. Continual burning, grazing and the cultivation of marginal uplands caused further damage to the already degraded land (Nigh 1988, Jacobson and Primm 1994). Rivers and streams filled with gravel and water quality declined as soils, especially those on the steep rocky hillsides, suffered from severe erosion (Nigh 1988).

Attempts to farm the rugged country bordering the rivers in the Ozarks, including the Eleven Point, achieved limited success (Nigh 1988). Much of the population had left this area by the 1940s in order to find a better means of survival. Maintenance of the pasture land was more viable in the gentle uplands away from the rivers, where clearing of the land for grazing has continued up to the present. Jacobson and Primm (1994) indicate that although a significant portion of the watershed was purchased by the state and federal governments during the late 1930s, more intensive logging and agricultural practices on private land have countered the results of conservation practices employed on public lands.

An evaluation of present (1993) conditions of Ozark streams, pre-settlement period historical descriptions, stratigraphic observations, and accounts of oral-history responses on river changes during the last 90 years, led Jacobson and Primm (1994) to the conclusion that Ozark streams are disturbed from their natural conditions (Tables Lu01 and Lu02). Jacobson and Primm (1994) state that this "disturbance has been characterized by accelerated aggradation of gravel, especially in formerly deep pools, accelerated channel migration and avulsion, and growth of gravel point bars". Jacobson and Primm (1994) also suggest that "land use changes have disturbed parts of the hydrologic or sediment budgets or both".

Although detailed data from the Eleven Point Watershed has not been compiled, Jacobson and Primm (1994) summarized the land use changes from pre-settlement conditions to the 1970's in the Jack’s Fork Watershed, which borders the Eleven Point River Watershed to the North (Table Lu03).

Jacobson and Primm (1994) state that: "Different types of land use have taken place on different parts of the landscape, and at different times, resulting in a complex series of potential disturbances. Uplands have been subjected to suppression of a natural regime of wildfire, followed by logging, annual burning to support open range, patchy and transient attempts at cropping, a second wave of timber cutting, and most recently, increased grazing intensity. Valley side slopes have been subjected to logging, annual burning, and a second wave of logging. Valley bottoms were the first areas to be settled, cleared, and farmed; removal of riparian vegetation decreased the erosional resistance of the bottom lands. More recently, some areas of bottomland have been allowed to grow back into forest. The net effects of this complex series of land-use changes are difficult to determine and separate from natural variability."

Jacobson and Primm (1994) offer the following observations which summarize the probable, qualitative changes to runoff, soil erosion, and riparian erosional resistance on parts of the Ozarks landscape relative to man's impact:

1. Initial settlement of the Ozarks may have initiated moderate channel disturbance because of decreased erosional resistance of cleared bottom lands. This trend would have been countered by decreased annual runoff and storm runoff that accompanied fire suppression in the uplands.

2. Because of low-impact skidding methods and selective cutting during initial logging for pine during the Timber-boom period, logging would have had minimal effects on runoff and soil erosion. Low-impact methods and selective cutting continued to be the norm in timber harvesting of hardwoods until the late 1940's, when mechanization and diversified markets for wood products promoted more intensive cutting. Locally, log and tie jams, tie slides, and logging debris may have added to channel instability by diverting flow, but because aggradation and instability also occurred on streams not used for floating timber, these factors were not necessary to create channel disturbance.

3. Significant channel disturbance probably began in the Timber-boom period because of continued clearing of bottomland forests and road building in the riparian zone. This hypothesis is supported by evidence that significant stream disturbance began before the peak of upland destabilization in the post-timber-boom period. Extreme floods during 1895 to 1915 may have combined with lowered erosional thresholds on bottom lands to produce the initial channel disturbance.

4. The regional practice of annual burning to maintain open range had the most potential to increase annual and storm runoff and soil erosion because of its considerable areal extent and repeated occurrence. Burning would have been most effective in increasing runoff and erosion on the steep slopes that had been recently cut over during the timber boom. Generally, accelerated soil erosion was not observed after burning, and relict gullies presently (1993) are not apparent on valley-side slopes and uplands. These observations support the hypothesis that burning did not produce substantial quantities of sediment.

5. The greatest potential for soil erosion on valley slopes and upland areas occurred during the post-timber-boom period when marginal upland areas were cultivated for crops. Accelerated erosion of plowed fields was observed and noted by oral-history respondents and by soil scientists working in the Ozarks during the post-timber-boom period.

6. Valley bottoms have the longest history of disturbance from their natural condition because they were the first to be settled, cleared, and farmed. The lowered resistance to stream erosion that results from removing or thinning riparian woodland would have been a significant factor, especially on small to

medium sized streams for which bank stability and roughness provided by trees are not overwhelmed by discharge. Disturbance of bottomland riparian forest increased as free-range grazing, crop production, and use of valley bottoms for transportation expanded and reached a peak in the post-timber-boom period. Headward extension of the channel network because of loss of riparian vegetation may have increased conveyance of the channel network (and hence flood peaks downstream) and removed gravel from storage in first and second order valleys at accelerated rates. This hypothesis is supported by a lack of other source areas for gravel and by observations that gravel came from small stream valleys, not off the slopes.

7. During present (1993) conditions, channel instability seems somewhat decreased in areas where the riparian woodland has recovered, but stability is hampered by high sedimentation rates because of large quantities of gravel already in transport and effects of instability in upstream reaches that lack a riparian corridor.

8. Land use statistics indicate that the present trend in the rural Ozarks is toward increased populations of cattle and increased grazing density (MDA and USDA 1994). This trend has the potential to continue the historical stream-channel disturbance by increasing storm runoff and sediment supply with consequent remobilization of sediment already in transit."

Land Type Associations

Land type associations (LTAs) are units of land which are relatively similar in landform and in patterns of geologic parent material, aspect, soils and potential natural vegetation. Within the Eleven Point River Watershed, 9 LTAs have been identified. Each has a characteristic pattern of landform geology, soil and vegetation. Figure Lu01 indicates the distribution of these LTAs. Table Lu04 gives descriptions of LTAs within the watershed. LTAs could prove to be a useful tool for planning and implementing management activities (ie. water quality and aquatic biodiversity)

Current Land Use

The Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Classification (1997) is currently the most recent compiled land use data available. This data, as analyzed by Caldwell (1998), indicates estimated forest/woodland cover within the watershed at 64.9% while grassland/cropland comprises 34.4% of the total land cover. Urban land use accounts for only 0.4% (Table Lu05, Figure Lu02, Lu03, and Lu04). The population density of the watershed is approximately 14 persons per square mile (Blodgett J. and CIESIN 1996). While forest/woodland is the most dominant cover type within the all three major drainage sections (Upper Eleven Point, Middle Eleven Point, and Lower Eleven Point), the Middle Eleven Point Drainage Section contains the highest combined percentage of forest/woodland cover at 79.2 percent. This is due, in large part, to the fact that much of this drainage is in public ownership as part of the Mark Twain National Forest (Figure Lu05). The Little Creek 14 Digit Hydrologic Unit (10003) has the lowest percentage of forest/woodland cover at 37.6 percent. The Middle Hurricane Creek 14 Digit Hydrologic Unit (30004) has the highest percentage of forest/woodland cover at 91.9 percent. This hydrologic unit primarily consists of public land (Figure Lu04 and Lu05).

Common trees within the Eleven Point Watershed include white oak (Quercus alba), black oak (Quercus velutina), northern red oak (Quercus rubra), scarlet oak (Quercus coccinea), post oak (Quercus stallata), chinkapin oak (Quercus muehlenbergii), black walnut (Juglans nigra), and shortleaf pine (pinus echinata). Less common species are silver maple (Acer saccharinum), american elm (Ulnus americana),

american basswood (Tilia americana), green ash (Fraxinus pennsylvanica), eastern cottonwood (Populus deltoides), and black locust (Robinia pseudoacacia).

The Natural Resource Conservation Service (NRCS) rates sheet erosion as low at 2.5-5 tons per acre annually, which is considered an acceptable rate of soil loss. Gully erosion is only a slight problem at 0-0.16 tons per acre annually (MDNR 1994).

Soil Conservation Projects

At the time of this writing (1999),the Eleven Point Watershed has no completed, ongoing or planned Public Law 566 (PL-566) watershed projects or Special Area Land Treatment (SALT) projects within the watershed (Robbins, personal communication). The proposed Fredrick Creek and Piney Creek PL-566 projects were terminated.

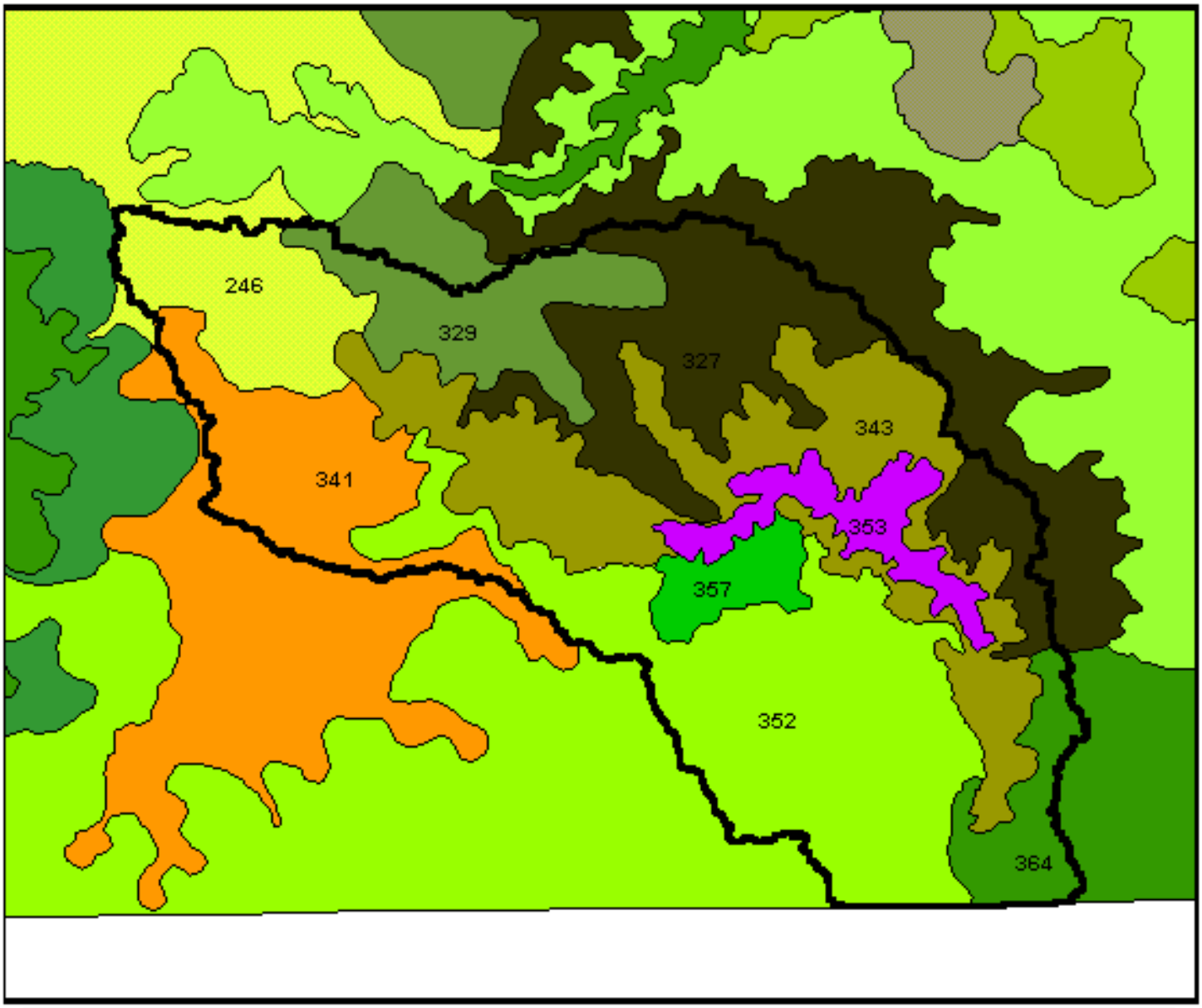
Public Areas

Approximately 143,778 acres, or 22 % of the Eleven Point Watershed is in public ownership (Table Lu06 and Figure Lu05). Approximately 86% (137,442 acres) of the public land is part of the Mark Twain National Forest maintained by the United States Forest Service (USFS). In the upper reaches of the watershed are two Missouri Department of Conservation (MDC) sites: Simms Valley Community Lake near Mountain View and Dean Davis Conservation Area about halfway between Willow Springs and West Plains (MDC 1995). The MDC maintains 2 additional conservation areas (CA): Cover Memorial CA, and Birch Creek CA. Cover Memorial CA is located five miles west of Alton on Highway P. Birch Creek CA is part of the Kerr-McGee lands and is located 3 miles south of Birch Tree on Highway 99. In addition, the MDC has 3 tower sites within the Watershed. The MDC also maintains one access site (Myrtle access) located on the Eleven Point River, 15 miles East of Thayer. Myrtle access is 26 acres with a concrete boat launch. The USFS maintains 8 stream access sites and 8 float camp sites along the Eleven Point River within the National Scenic River Area (USFS 1995). A detailed map identifying access sites and float camp locations is available from the United States Forest Service in Rolla, Missouri (573) 364-4621.

Figure Lu01.

Eleven Point Watershed

Land Type Associations



Legend

Watershed Boundary

Land Type Association

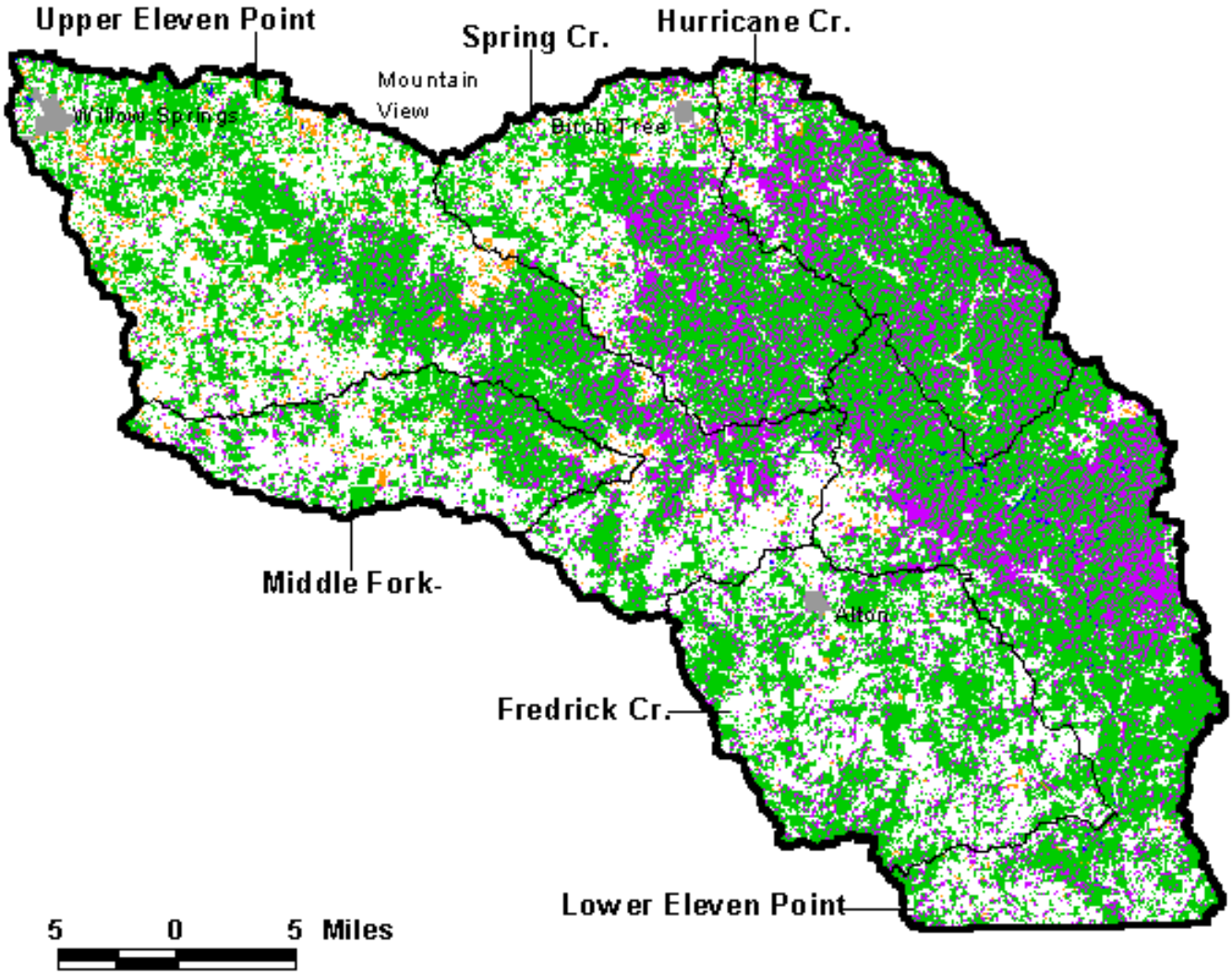
- Alton Oak Savanna/Woodland Plain (357)
- Current-Eleven Point Pine-Oak Woodland Dissected Plain (327)
- Eleven Point Oak-Pine Forest Breaks (353)
- Eleven Point River Oak-Pine Woodland/Forest Hills (343)
- Howell-Oregon Counties Oak Woodland Dissected Plain (352)

Mt. View Oak Savanna/Woodland Plain (329)
Ripley County Oak Woodland Dissected Plain (364)
Upper Gasconade Oak Woodland Dissected Plain (246)
West Plains Oak Savanna/Woodland Plain (341)
Current River Oak Forest Breaks
Current River Oak-Pine Woodland/Forest Hills
Eminence Igneous Glade/Oak Forest Knobs
Jacks Fork River Oak-Pine Forest Breaks
North Fork Pine-Oak Woodland Dissected Plain
Summersville Oak Savanna/Woodland Plain

MDC 5/1999

Figure Lu02.

Eleven Point Watershed
Land Cover/Land Use



Legend

- Subwatershed Boundary
- Deciduous Forest and Woodland
- Evergreen & Mixed Forest & Woodland
- Grassland
- Cropland
- Urban
- Water

Missouri Resource Assessment Partnership (MoRAP)
Phase 1 Land Cover Map
December, 1997

MDC 5/1999

Figure Lu03.

Eleven Point Watershed

14 Digit Hydrologic Unit Forest/Woodland Cover

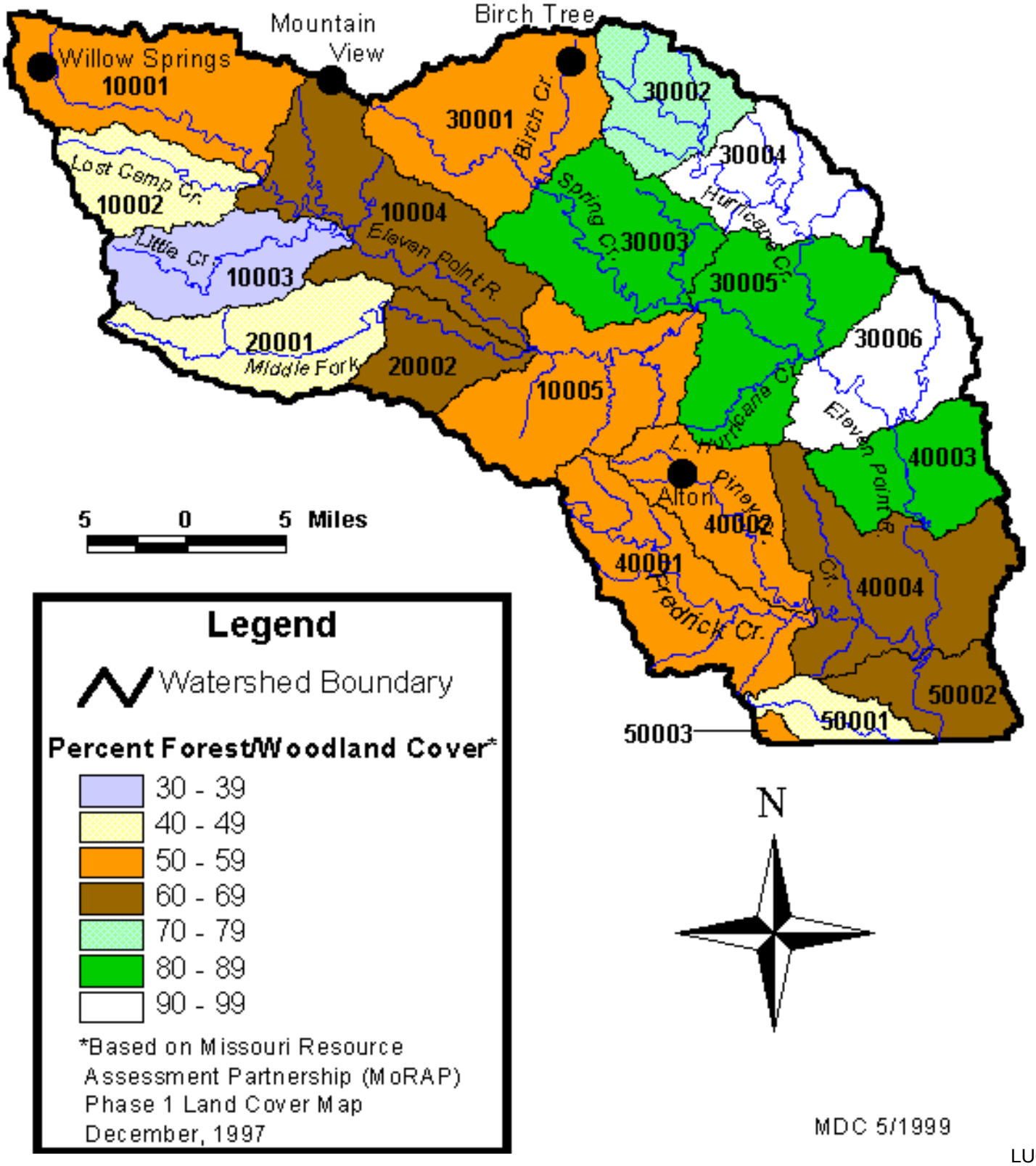
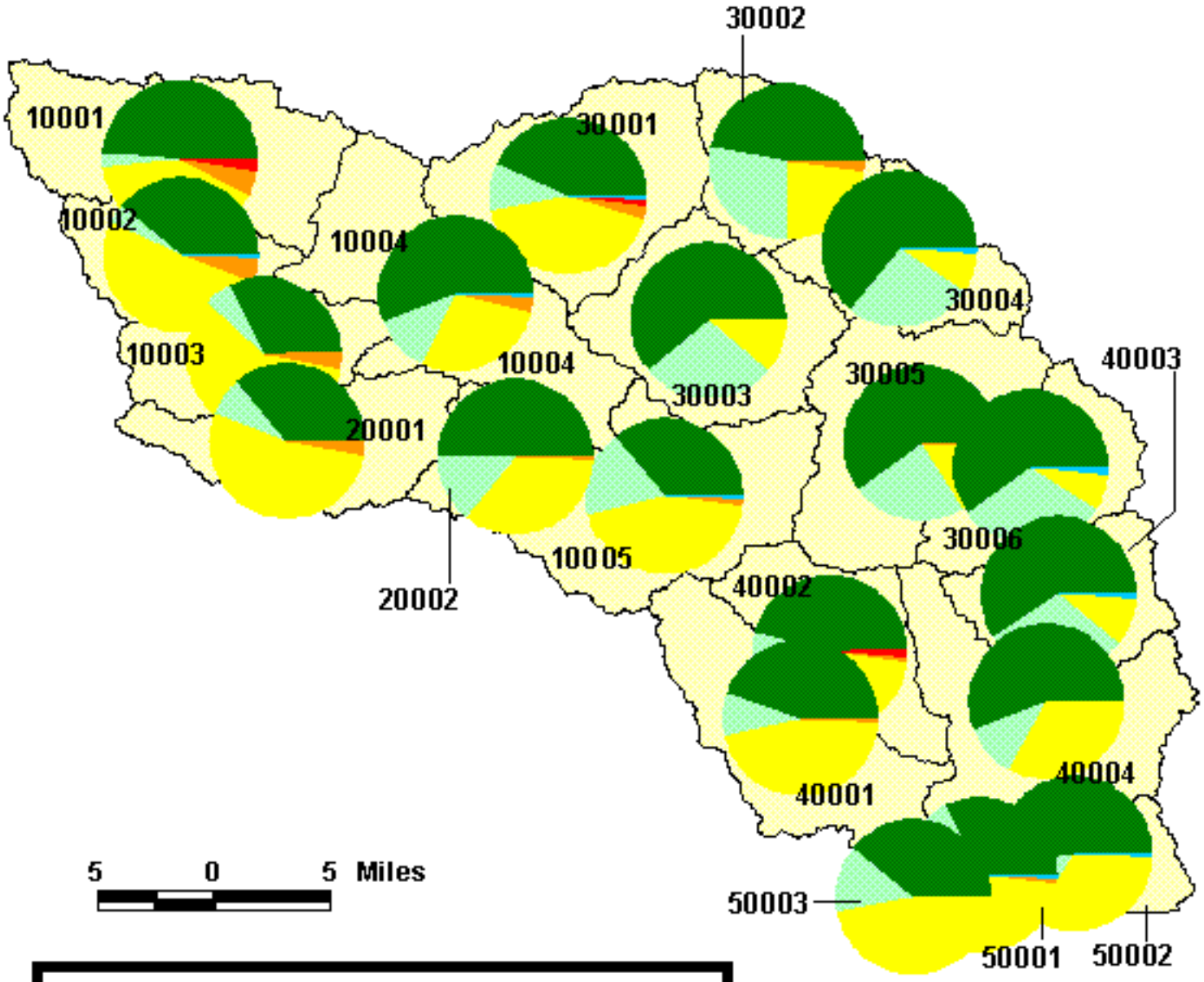


Figure Lu04.

Eleven Point Watershed

14 Digit Hydrologic Unit Land Cover /Land Use



Legend

Percent Land Cover/Land Use*

- Forest
- Cropland
- Woodland
- Urban
- Grassland
- Water

*Based on analysis by Caldwell (1999) of Missouri Resource Assessment Partnership (MoRAP) Phase 1 Land Cover Map December 1997

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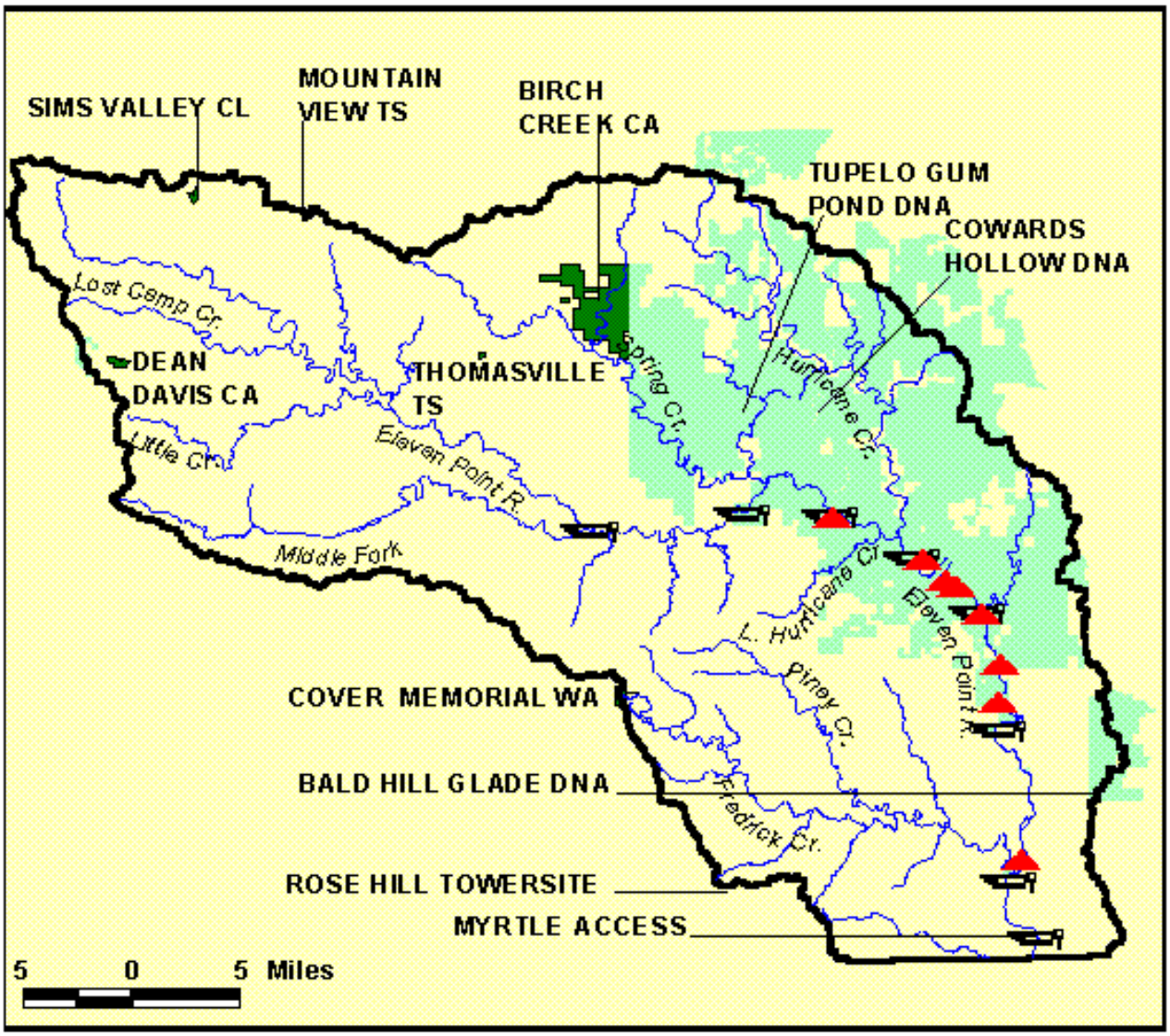
MDC 5/1999

Figure Lu05.

Eleven Point Watershed
Public Land



Legend

- Watershed Boundary
- Missouri Department of Conservation*
- United States Forest Service*
- Access*
- Float Camp*

CA=Conservation Area
DNA=Designated Natural Area
WA=Wildlife Area
TS=Tower Site
CL=Community Lake

*This figure is not a final authority.
Data subject to change.

N

MDC 5/1999

Table Lu01. Summary of probable qualitative changes to runoff, soil erosion, and riparian erosional resistance on parts of the Ozarks landscape relative to pre-settlement period conditions. Copied in whole from Jacobson and Primm (1994).

Period	Uplands	Valley Slopes	Valley Bottoms
Pre-settlement	Baseline	Baseline	Baseline
Early Settlement	-	-	-
Annual Runoff	Decrease	Slight Increase	N/A
Storm Runoff	Decrease	Slight Increase	N/A
Upland Sediment Yield	Decrease	Slight Increase	N/A
Riparian Erosional Resistance	N/A	N/A	Moderate Decrease
Timber-Boom	-	-	-
Annual Runoff	Slight Increase	Slight Increase	N/A
Storm Runoff	Slight Increase	Moderate Increase	N/A
Upland Sediment Yield	Slight Increase	Moderate Increase	N/A
Riparian Erosional Resistance	N/A	N/A	Decrease
Post-Timber-Boom	-	-	-

Annual Runoff	**Moderate Increase**	**Increase**	**N/A**
Storm Runoff	**Moderate Increase**	**Increase**	**N/A**
Upland Sediment Yield	**Moderate Increase**	**Increase**	**N/A**
Riparian Erosional Resistance	**N/A**	**N/A**	**Substantial Decrease**
Recent	**-**	**-**	**-**
Annual Runoff	**Slight Increase**	**Slight Increase**	**N/A**
Storm Runoff	**Slight Increase**	**Moderate Increase**	**N/A**
Upland Sediment Yield	**Slight Increase**	**Slight Increase**	**N/A**
Riparian Erosional Resistance	**N/A**	**N/A**	**Decrease**

Table Lu02. Sequence of land-use changes on parts of the rural Ozarks landscape. Data is for the following Missouri counties: Butler, Carter, Crawford, Dent, Howell, Iron, Laclede, Oregon, Pulaski, Phelps, Reynolds, Shannon, Texas, Wright (Jacobson and Primm 1994).

Period	Uplands	Valley Slopes	Valley Bottoms
Pre-settlement before 1800	Patchy prarie and oak savannah	Thick oak-hickory and yellow pine	Thick deciduous forest
Early-settlement 1800-1880	Patchy prarie, used for grazing and minor row crops	Thick oak-hickory with minor cutting	Cleared for pasture and row crops
Timber-boom 1880-1920	Cutover, fire supression	Cut over	Cleared for pasture and row crops
Post-timber-boom 1920-1960	Increasing pasture, row crops	Woodland grazing, seasonal burning	Cleared for pasture and row crops, open-range grazing
Recent 1960-present (1993)	Increased grazing and row crops	Woodland grazing, managed timber little burning	Cleared for pasture and row crops with some reversion to forest

Table Lu03. Land cover/ land use change from pre-settlement period conditions (1820's) to the 1970's in the Jack's Fork Watershed, Missouri (Jacobson and Primm 1994).

1820's		1970's		
Category	Area sq. miles	Category	Area sq. miles	%
Shrub and brush rangeland	55.4	Urban/developed	1.6	3
		Pasture/cropland	26.5	48
		Deciduous forest	27.3	49
Deciduous forest	242.0	Pasture/cropland	59.9	25
		Deciduous forest	178.6	75
Evergreen forest	3.5	Deciduous forest	3.5	100
Mixed forest	323.1	Pasture/cropland	34.5	11
		Deciduous forest	281.6	87
		Mixed forest	7.0	2
Barrens	29.2	Pasture/cropland	15.5	53
		Deciduous forest	13.7	47

Table Lu04. Descriptions of land type association (LTAs) groups as well as a condensed (1 of 5) description of LTAs within the Eleven Point Watershed. Descriptions are quoted in part or whole from MDC (1997).

Oak Woodland Dissected Plains and Hills Group

Landform: Distinguished by rolling to moderately dissected topography. Local relief is 75-150 feet. Very broad, flat ridges give way to gentle side slopes and broad stream valleys. Karst plains with frequent shallow sinkhole depressions are common. Broad stream valleys most often occupied by losing streams, however occasional seeps do occur and can spread across substantial portions of a valley.

Geology: Commonly underlain by Jefferson City-Cotter dolomites with a common loess cap. Some minor areas underlain by Roubidoux sandstones.

Soils: Soils are variable, ranging from shallow to bedrock and fragipan soils, to deep, cherty and well-drained loams. Tree root growth is often restricted by bedrock, pans or clay mineralogy, especially high in the landscape.

HistoricVegetation: Open woodlands with occasional prairie and savanna openings was the principal vegetation type. Post oak and black oak were the principal woodland tree species. Historic fire likely played an important role in maintaining an open canopy, sparse understory and a dense herbaceous ground flora. More dissected lands likely contained mixed oak woodland and forest. Unique sinkhole ponds, wet prairies and seeps were scattered in the broad valleys and depressions.

Current Conditions: Currently a mosaic of fescue pasture (35-65% cover) and dense, often grazed oak forest. The transition from open grassland to closed forest is abrupt and the patch work blocky. Very few native grasslands or savannas are known, and the dense second growth woodlands have very little ground flora. Most sinkholes, wet prairies and seeps have been drained and heavily grazed. Many roads, towns, cities and businesses are located in these LTAs.

Howell-Oregon Oak Woodland Dissected Plain: Dissected Plain in southern Howell and Oregon Counties. More dissection, better soils, and more existing timber than most other LTAs in this group.
Ripley County Oak Woodland Dissected Plain: Very dissected plain between lower Eleven Point and Current Rivers. Contains an unusual cluster of dolomite knobs on east side of Eleven Point.
Upper Gasconade Oak Woodland Dissected Plain: Broad divide encompassing the headwaters of the Big Piney and Gasconade River Watersheds.

Oak Savanna/Woodland Plains Group

Landform: Very broad flat uplands slope gently to very broad flat drains or solution (karst) depressions. Local relief is less than 75 feet.

Geology: Underlain mainly by Jefferson City-Cotter dolomites with a common loess cap. Minor areas of the Roubidoux formation occur. Headwater streams are nearly all losing.

Soils: Fragipan soils or soils with shallow restrictive clays or bedrock are common, inhibiting tree root growth.

HistoricVegetation: Oak savannas and woodlands with common prairie openings were the predominant historic vegetation. While few prairies were named by original land surveyors, early descriptions portray an open, "oak prairie" landscape. Fire likely played a principal role in maintaining a grassland-open woodland structure. Some sinkhole depressions would have had unique ponds and seeps.

Current Conditions: The largest blocks and greatest acres of grassland (45-65% cover) are currently associated with these LTAs; grasslands are mainly fescue pasture. Less than 40% of these LTAs are timbered, mainly in dense, second growth oak forest (post and black oaks) with common grazing pressure. Very few quality native prairies, savannas, woodlands, sinkhole ponds or seeps are known. Many of the regions roads, towns, and businesses are associated with these LTAs.

Alton Oak Savanna/Woodland Plain: Small flat area on south flank of Eleven Point River above Greer.

Mtn. View Oak Savanna/Woodland Plain: Broad, flat divide between upper Jack's Fork and Eleven Point Rivers.

West Plains Oak Savanna/Woodland Plain: Very extensive, flat upland in the center of Howell County.

Oak-Pine Woodland Forest Hills Group

Landform: Mainly broad ridges, moderately sloping (<25%) side slopes, and relatively broad entrenched valleys with local relief between 150-250 feet. Steeper, more dissected areas occur locally near larger stream valleys. Sinkhole depressions are common on broader ridges. Stream valleys vary somewhat from broad and rather shallow, to more deeply entrenched, narrow, and meandering. Many losing streams occur in valleys distant from the main rivers. Cliffs, caves and springs are commonly associated with larger, perennial stream valleys.

Geology: Roubidoux cherty sandstones and dolomites occupy most ridges and upper side slopes, while lower side slopes, especially near major streams are in cherty upper Gasconade dolomite materials.

Soils: Soils are mainly deep, highly weathered and very cherty silt loams with clays at varying depth. Broad ridges may have a loess cap with occasional fragipans, and shallow soils with dolomite bedrock near the surface occur frequently on steeper, exposed slopes.

Historic Vegetation: Pine and mixed oak-pine woodland originally dominated the more gently sloping upland surface associated with the Roubidoux Formation. Early descriptions portray an open, grassy and shrubby understory in these woodlands, a condition related to the prevalence of fire in the historic landscape. Oak and oak-pine forest occupied lower slopes and more dissected, hilly parts of these landscapes, as well as the wider and more well-drained bottom. Bottoms with richer alluvial soils and more abundant water likely were forested in mixed hardwood timber. Dolomite glade and open savanna/woodland complexes were common on exposed slopes with shallow soils. Sinkhole ponds and fens were dotted occasionally throughout.

Current Conditions: Mainly forested in second growth oak and oak-pine forests; forest cover ranges from sixty to over 80%. Most forests are rather dense, near even-age second growth, with very little woodland ground flora. The occurrence of shortleaf pine in these forests has diminished from its original extent, today having only 20-30% of the forest cover containing a substantial component (>25%) of pine. Even age stands dominated by scarlet, black, and white oak are common, oak die back is a common problem. Much of the existing timber land is associated with public land ownership. Cleared pasture lands occupy many of the broad stream valleys and highest, flattest ridges. Many glades and woodlands suffer from woody encroachment, and sinkhole ponds and fens have been drained or severely overgrazed. An exceptional proportion of state-listed species sites are associated with the streams, springs, caves, cliffs, fens, and sinkhole ponds in this group.

Current River Oak-Pine Woodland Forest Hills: Hills associated with the Current and Jacks Fork Rivers, excluding steep breaks.

Eleven Point River Oak-Pine Woodland Forest Hills: Hills associated with Eleven Point River, mainly north of the river; excludes breaks.

Pine-Oak Woodland Dissected Plains

Landform: Broad, flat to gently rolling plains which give way to moderately dissected and sloping lands associated with the headwaters of major drainages. Valleys are broad and local relief 100-150 feet. Clusters of karst sinkholes are common. Streams are mainly headwater streams with flashy, intermittent flow.

Geology: Underlain by cherty sandstone and dolomite of the Roubidoux Formation with frequent loess deposits on the flatter uplands.

Soils: Soils are formed principally in cherty sandstone and dolomite residuum from the Roubidoux Formation. Soils are mainly deep, cherty, and highly weathered, low base soils. However occasional fragipans and shallow to bedrock soils do occur. Most soils are extremely well drained and droughty.

HistoricVegetation: Originally covered in woodlands of shortleaf pine and mixed pine oak with an open understory of dense grass and shrub ground cover. Post oak woodlands occupied occasional loess covered flats and unique sinkhole ponds dotted the landscape.

Current Conditions: Over 75% of this group are currently forested in dense, even-age oak and oak-pine forest. Only 20% of these forests have a strong pine component. However, the proportion of forests containing shortleaf pine is the highest in this group. Dense stands of near even age scarlet, black, and post oak occur in the place of pine. Understories are dense, woodland ground flora sparse, and oak die-back common. A substantial component of these forested lands are publicly owned. Approximately 20% of this group is currently pasture, which often occupies the broad valley bottoms or karst plains. Most sinkhole ponds have been drained, dozed or severely overgrazed. Headwater streams are subject to grazing and bank erosion.

Current-Eleven Point Pine-Oak Woodland Dissected Plain: High, flat to rolling divide between Current and Eleven Point Rivers; most extensive acreage of this group.

Oak and Oak-Pine Forest Breaks

Landform: Distinguished by local relief over 300 feet, narrow ridges, steep side slopes and mainly narrow sinuous valleys. Cliffs, caves, and springs are common.

Geology: Thick caps of Roubidoux Sandstone on ridges and upper slopes streams cut into the Lower Gasconade Dolomite.

Soils: Soils formed from Roubidoux and Upper Gasconade materials.

HistoricVegetation: Originally forested in oak pine, oak and mixed hardwood forest types. Scattered glades and open woodlands would have occurred on exposed slopes and ridges, especially in areas of shallow soil. Relatively small fen openings occasionally filled narrow tributary valleys.

Current Conditions: **A high percentage of public land (45%) is associated with this group. Because of the large amount of public land, as well as the steep topography, this group is still mostly forested(88%) in second growth oak, oak-pine and mixed hardwood timber. Open areas are confined to valleys, so bottomland forest is less than originally. Dolomite glades are largely overgrown with eastern red cedar, and many fens have been drained or heavily grazed. Numerous rare or endangered species, some restricted to this group, are associated with the streams, springs, caves, cliffs, and fens in these landscapes. The rivers have been recognized as national treasures and are an important recreational resource in the region.**
Eleven Point River Oak-Pine Forest Breaks: **Abrupt and somewhat wide sinuous valley with outstanding cliff communities, some harboring unique flora. Well developed alluvial bottoms and somewhat deep river.**

Table Lu05. Percent land cover/land use for 14 digit hydrologic units within the Spring River Tributaries Watershed. Data is based on MoRAP Phase 1 Land Cover (1997) as analyzed by Caldwell (1998).

Hydrologic Unit	FOR	WDL	GRS	CRP	URB	WAT
10001	49.4	3.1	39.7	4.8	2.8	0.3
10002	39.4	3.5	51.4	5.5	0	<0.1
10003	31.7	5.9	58.5	3.7	0	0.1
10004	56.4	12.1	28.1	2.7	0.5	0.3
10005	36.5	17.7	44.0	1.4	0	0.4
20001	35.5	8.4	52.8	3.2	<0.1	<0.1
20002	49.9	13.7	34.9	1.5	0	<0.1
Upper Eleven Point	43.7	9.5	42.7	3.2	0.6	0.2
30001	42.8	10.4	42.5	3.2	1.0	<0.1
30002	46.6	28.1	23.2	2.1	0	<0.1
30003	61.1	27.5	10.7	0.5	0	0.2
30004	64.4	27.5	7.7	0.3	0	0.1
30005	59.6	23.9	15.0	0.9	0	0.6
30006	60.1	31.2	7.5	0.4	0	0.8
Middle Eleven Point	55.5	23.7	18.9	1.3	0.2	0.3
40001	45.4	9.5	44.5	0.6	0	<0.1
40002	45.6	9.7	42.1	0.7	1.9	<0.1
40003	59.1	30.2	10.4	<0.1	0	0.2
40004	55.7	10.5	33.2	0.4	0	0.1
50001	32.2	10.2	56.4	1.1	0	<0.1
50002	52.8	13.4	33.1	0.4	0	0.4
50003	38.9	13.6	47.3	<0.1	0	<0.1
Lower Eleven Point	50.2	13.3	35.6	0.4	0.3	0.1

Eleven Point Watershed	**49.5**	**15.4**	**32.6**	**1.8**	**0.4**	**0.2**

FOR =Forest, WDL=Woodland, GRS=Grassland, CRP=Cropland, URB=Urban, WAT=Water