



CONSERVING BIODIVERSITY IN THE
ARBUCKLE PLAINS AND BLUE RIVER

The Arbuckle Plains and Blue River

Geologically, the Arbuckle Plains is an area of folded and faulted limestone and granites. The limestones give rise to a fluviokarstic landform. In true Karst landforms, no water exists on the land surface. It must all be carried underground and circulated through cracks and fissures in the rock. Fluviokarstic landforms, of which the Arbuckle Plains are an example, have many hydrologic and land forming processes and structures in common with Karst landform, underground circulation of water and cave formation. They differ from a true Karst in that they exhibit both stream and soil formation.

The fluviokarstic landform in the Arbuckle Plains, in addition to having it's own flora and fauna, form



the foundation of both the terrestrial and aquatic systems. The Arbuckle Plains are covered with springs and caves with unique fauna, including the Oklahoma cave amphipod, an invertebrate known from only four caves, all of which are located in the Arbuckle Plains. The streams get water from two main sources: stormflow, and springflow originating from the Arbuckle-Simpson Aquifer associated with the Arbuckle Plains fluviokarstic landform. These streams have a distinct fauna, with many isolated species. The Blue River, the major stream flowing from the aquifer, is the only river in Oklahoma that is still entirely free-flowing, meaning that it flows to the ocean without being impeded by man-made reservoirs. At the surface the aquifer expresses itself as limestone bedrock outcrops with very shallow topsoil, giving rise to a unique vegetative community with many species tolerant to extremely arid conditions and shallow soils.

The terrestrial communities that make up the Arbuckle Plains are a mixture of Crosstimbers, prairie and limestone outcrop communities, with bottomland hardwood forest along the streams. These communities evolved within a pattern of frequent and widespread fire. Prior to the relocation of Native American tribes to Oklahoma in the 1830s and statehood, the region had a history of frequent fire. In addition to lightning-set fires that most often burned in the spring and summer, the indigenous Plains Indians were known to have set fires each autumn. Fires were set to improve forage for bison and other wildlife, to drive bison herds, increase visibility for hunting & protection, increase plant diversity for foods & medicines, and many other uses.

Left: Fire is a key component of healthy ecosystems

Ecosystem Health and Impacts

The overall health of the conservation area is considered fair. Owing to the shallow, rocky nature of the soils associated with the Arbuckle Plains, most of the crosstimbers and prairie remains unplowed. Critical threats to the conservation area include: excessive groundwater withdrawal, incompatible grazing practices, invasive species, fire suppression, and conversion to agriculture.

Excessive groundwater withdrawal is the single greatest threat facing the Arbuckle Plains and Blue River, and affects nearly all of the systems. The city of Ada and rural people rely on the Arbuckle–Simpson Aquifer as their source of water. Unfortunately, the rate at which water is withdrawn is greater than the rate at which the aquifer can recharge, resulting in lowering of the level of water inside the aquifer.

Limestone outcrops are in good condition. The main challenge facing limestone outcrops is limestone quarrying, which effects patch size. Because of the harsh, dry conditions in which this plant community evolved, it is extremely hardy to drought and grazing, making it difficult to impair this community by other means.

Bottomland hardwood forest is in fair condition and is impacted by incompatible agriculture, hydrologic changes and fire suppression. Because bottomland hardwood forest occurs on deep, loamy alluvial soils, it has been converted to cropland and used for cattle grazing practices.

Below: Shortgrass prairie



Overly heavy grazing reduces the density of existing vegetation, opens the canopy, and impairs growth of new trees. This has left the remaining patches of bottomland hardwood forest fractured and small. Finally, the flood patterns within the bottomland hardwood forest may be impaired by reductions in aquifer discharge, especially in areas at higher elevations on the aquifer.

Caves and streams both are in fair condition. Many caves have decreased flows due to groundwater withdrawals, and some have gone dry. In addition, many springs have been altered at the cave opening, to divert water for municipal, household or agricultural use. These alterations range from the addition of a small dam to hold water for cattle, having no real impact on the fauna, to a major structure that severely degrades habitat quality. Streams, like springs, are affected by reduced discharge. Stream channel instability is also a problem due to channelization, streamside land use and changes in stream discharge.

Crosstimbers and prairie are in good condition but are subject to overgrazing, conversion to agriculture, fire suppression and invasive species. Fire suppression leads to densification and homogenization of forest communities and a subsequent loss of fire-dependent woodlands and savannas. The closed-canopy structure and a dense litter layer in the crosstimbers forest have reduced the diversity and biomass of herbaceous plants in the understory, an important food component for white-tailed deer, wild turkey, bobwhite quail, and other game species. Invasive species range from eastern redcedar and sericia lespedeza to feral hogs. Eastern redcedar and sericia are noxious species that can become so abundant that they crowd out most other plant species, reduce the economic productivity of the land, and are of little value as wildlife habitat. Cedar can be effectively controlled by implementing a prescribed fire regime with a recurrence of 3–5 years. Sericia lespedeza invades disturbed areas, crowding out native vegetation. It is harder to control than cedar, and fire is not an effective control. Some managers have had good results spraying invaded areas with herbicides.

Biodiversity

To address key species within and across the native habitats at this conservation area, plant and animal species and plant communities were nested under broader systems. Nested species are imperiled, ecologically linked to a system and can be conserved with strategies designed for that system.

Crosstimbers and Prairie

This system consists of three communities: crosstimbers forests, mixed-grass prairie and tallgrass prairie. The different communities are expressed along gradients of fire frequency and moisture. Tallgrass prairie occurs in mesic soils on uplands. Mixed-grass prairie occurs in drier, well-drained soils and rocky slopes. Tallgrass and mixed-grass prairie provide important habitat for many species including Henslow's sparrow and dickcissel.

The crosstimbers forest occurs in the eastern and central portions of Oklahoma and is fairly widespread. These forests provide habitat for Harris sparrow, summer tanager, and black-billed cuckoo.

Crosstimbers, mixed-grass prairie and tallgrass prairie form a patchy mosaic of forest, woodlands and prairie that blend into each other. All of these communities evolved with and are shaped by fire, an essential ecological process. The patchy mosaic of these communities provide habitat for species that rely on edge like the prairie warbler, Bell's vireo and wild turkey.



Limestone Outcropping

This system occurs on the limestone outcroppings of the Arbuckle Plains. Common species include hilly sandwort and pincushion cactus. Associated species include shooting star and nodding ladies'-tresses as well as numerous other flowers. This community provides important habitat for snakes and lizards, including the Texas horned lizard and it is on these outcrops that most of the caves, seeps and springs are located.

Bottomland Hardwood Forest

This system is described as a temporarily flooded forest, dominated by American elm, slippery elm, sugarberry and green ash. This community provides important habitat for species such as the pileated woodpecker, bald eagle and yellow-throated vireo.

Left: Texas horned lizard
Above: Pileated woodpecker
Right: Aquatic cave

Systems and nested species

Streams

The streams considered in this plan include the south-flowing tributaries of the Washita River, the east-flowing tributaries of the Clear Boggy and the whole of the Blue River watershed. The Blue River is one of the most unusual and unique rivers in Oklahoma. This stream arises from large spring boils and is the last free-flowing streams in the state. The solution of limestone rocks has led to travertine deposits downstream creating waterfalls and ledges. A rich native fish fauna with unique species occupies the stream, including a disjunct form of the least darter which will likely be described as a new species. An isolated population of southern redbelly dace, an Ozark fish, occurs in Mill Creek and Pennington Creek, tributaries of the Washita River. The Blue River and its tributaries are also home to an isolated population of seaside alder, a woody plant found in southern Delaware State and adjacent counties of eastern Maryland.

Caves, Seeps and Springs

The fluviokarstic geology of the Arbuckle Plains has created a complex network of caves and springs by the dissolving limestone bedrock. These springs drain the Arbuckle-Simpson Aquifer and provide small windows into this important subterranean ecosystem. These springs have unique flora and fauna, including the rare stream orchid and spring coralroot. The Oklahoma cave amphipod, known from only four springs, occurs entirely within the Arbuckle Plains. The spring with the greatest abundance of amphipods is on the Pontotoc Ridge Preserve. There are also numerous isopods, crickets, crayfish, other species in these caves and springs.



Crosstimbers and prairie

Henslow's Sparrow *Ammodramus henslowii*
dickcissel *Spiza americana*
Harris sparrow *Zonotrichia querula*
summer tanager *Piranga rubra*
black-billed cuckoo *Coccyzus erythrophthalmus*
prairie warbler *Dendroica discolor*
Bell's vireo *Vireo bellii*
wild turkey *Meleagris gallopavo*
bald eagle *Haliaeetus leucocephalus*
Arogos skipper *Atrytone arogos*
dotted skipper *Hesperia attalus*

Limestone outcrops

hilly sandwort *Arenaria benthamii*
pincushion cactus *Echinocereus riechenbachii*
shooting star *Dodecatheon meadia*
nodding ladies'-tresses *Spiranthes cernua*
Texas horned lizard *Phrynosoma cornutum*

Bottomland hardwood forest

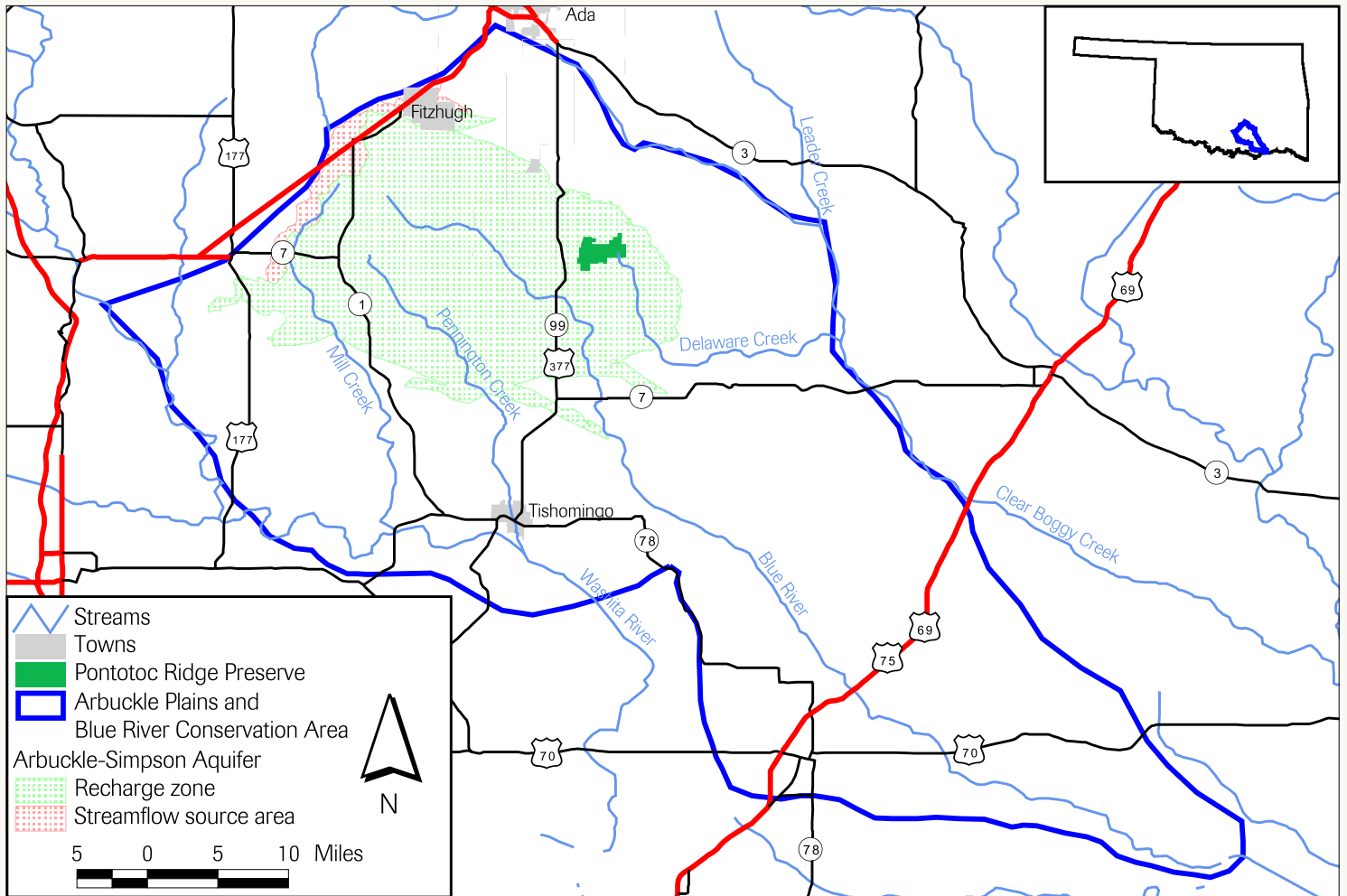
burr oak *Quercus macrocarpa*
shooting star *Dodecatheon meadia*
bald eagle *Haliaeetus leucocephalus*
red-headed woodpecker *Melanerpes erythrocephalus*
Acadian flycatcher *Empidonax virescens*
pileated woodpecker *Dryocopus pileatus*
northern parula *Parula americana*
broad-headed skink *Eumeces laticeps*
gray treefrog *Hyla versicolor*

Streams

seaside alder *Alnus maritima*
least darter *Etheostoma microperca*
tadpole madtom *Noturus gyrinus*
paddlefish *Polyodon spathula*
American eel *Anguilla rostrata*
chicken turtle *Deirochelys reticularia*

Caves, seeps, springs

stream orchid *Epipactis gigantea*
snowy whitetop *Rhynchospora nivea*
spring coralroot *Corallorhiza wisteriana*
Oklahoma cave amphipod *Allocragonyx pellucidus*
upland chorus frog *Pseudacris triseriata*
Strecker's chorus frog *Pseudacris streckeri*



The Arbuckle Plains and Blue River Conservation Area

Pontotoc Ridge Preserve

The Conservancy has had a presence in the Arbuckle Plains since 1994, when Buddy Smith gifted 2,174 acres to the Oklahoma Chapter of the Nature Conservancy to be protected in its wild and natural state. The Pontotoc Ridge Preserve is a prime example of healthy, natural crossttimbers, including bottomland hardwood forest, limestone outcrops and prairie. There are also several high quality springs and seeps on the preserve draining from the Arbuckle-Simpson Aquifer, including one of the four springs known to house the Oklahoma cave amphipod. This particular spring is one of the most important locations due to the sheer abundance of amphipods. The Pontotoc Ridge Preserve is also known for its high diversity of butterfly and plant species due to the mixture of different communities. Over 25 snake species and 125 bird species have also been documented.



Vision

Restore and conserve the Arbuckle Plains and Blue River as an ecologically functioning fluviokarstic aquifer system with its dependant aquatic and terrestrial communities

Goals

- ☞ Restore a fire return interval of 3-5 years to 50,000 acres in the Arbuckle Plains.
- ☞ Maintain hydrologic flows through the Arbuckle–Simpson Aquifer, associated springs and the Blue River watershed.
- ☞ Protect and stabilize 5 miles of stream channel in the Arbuckle Plains.
- ☞ Protect all known Oklahoma cave amphipod springs and caves.
- ☞ Protect and restore ten 1,600-acre patches of high quality bottomland hardwood forest.
- ☞ Restore 20,000 acres of crosstimbers and prairie.
- ☞ Restore 20,000 acres of high quality limestone outcrops.

Strategies

Develop demonstration projects to promote compatible land stewardship practices on the following topics on the Pontotoc

- Effective invasive species control
- Fire restoration practices

Develop fire cooperatives to increase internal and external capacity

- Continue with efforts on fire cooperative to develop manpower and education opportunities
- Develop and maintain partnership with Arbuckle Restoration Association, local rural fire departments, Noble Foundation and OSU
- Pursue funding for fire program from the US Fish and Wildlife Service (Partners for Fish and Wildlife) and the Forest Service
- Develop internal fire capacity and infrastructure
- Coordinate and host fire training workshop for local landowners using preserve as training area

Participate in the Arbuckle–Simpson Aquifer discussion

- Advocate sustainable water use
- Get involved in the ecological impact studies by
 - 1 Identifying research needs to be met, and organizing those
 - 2 Participating in all public discussions
- Designate the Blue River a scenic river by the Oklahoma State Legislature
- Encourage use of water conservation measures



Above: Crosstimbers forest