

Public Lands in Hocking County, Ohio

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A report for the Ohio Environmental Council (OEC) prepared by the Denison University Environmental Practicum class.



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Overview:

Nine Environmental Studies students collaborated with the Ohio Environmental Council (OEC) to evaluate public land issues in Hocking County, OH. Wayne National Forest, Hocking County State Forest, and Hocking County State Parks and Nature Preserves are the four areas of interest in this inventory report.

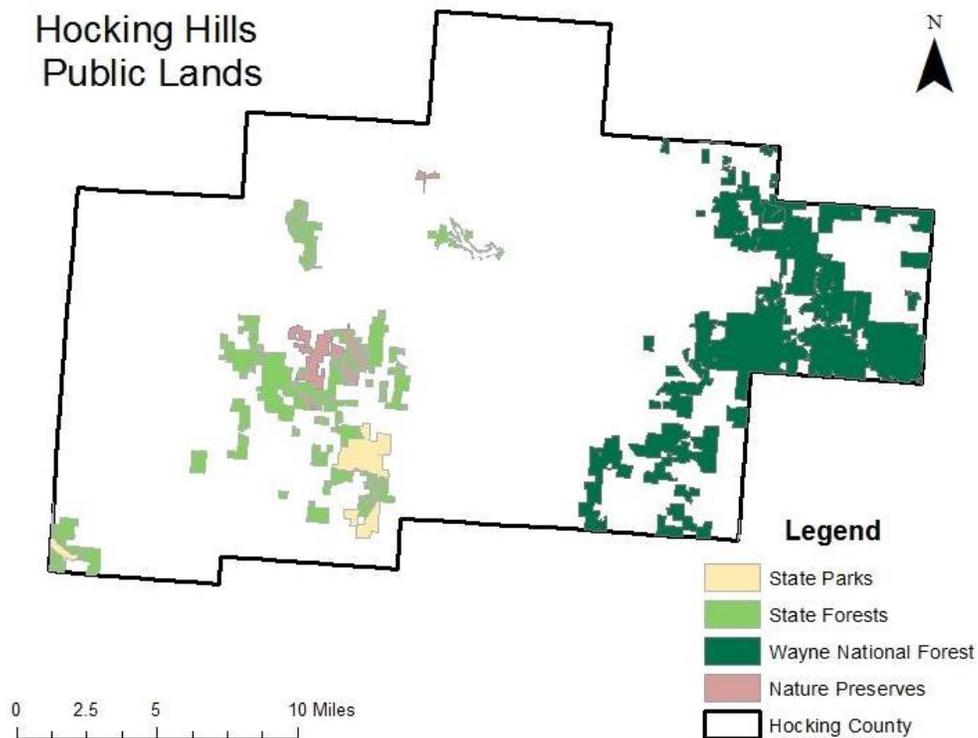


Figure 1. Public land holdings in Hocking Hills as of 2016. Data collected from Hocking Hills Mapping and Drafting Department.

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Each Chapter Includes:

1. Inventory/Maps
 - a. Overall map of county with forest or park pinpointed
 - b. Ecosystem diversity
 - c. Recreation and Tourism
2. Ecosystem Services
 - a. Biotic Services
 - b. Abiotic Services
 - c. Cultural Services
3. Ecosystem Goods
 - a. Commodity Production
 - b. Operation
 - c. Cost/Benefit & Statistics

I. Executive Summary:

The beginning of this report describes the character of Hocking County at large. Census information, general demographics of the region, endangered species and ecosystem goods that are common throughout the county are explored in depth. The purpose of this section of the report is to present commonalities amongst Wayne National Forest, Hocking State Forest and Hocking State Parks and Preserves prior to analysis of each area specifically.

The following three chapters provide an analysis of Wayne National Forest, Hocking State Forest and Hocking State Parks and Preserves. Recreational opportunities, including: hiking, hunting, and fishing are noted and discussed. Ecosystem services, cultural services, and an in-depth cost benefit analysis follow. Each chapter also discusses stressors on the land including oil and gas extraction as well as clear cutting and or logging efforts.

The purpose of this report is to bring to light the multiple different services Ohio's public lands offer. This report attempts to highlight the economic and ecosystem benefits these public lands offer to the community. Economic and ecosystem benefits are not always related to one another, but this report shows how the two services can combine and be dependent on one another and positively influence the environment.

The Ohio Environmental Council will benefit from this report internally and externally. Not only will this report be useful to the staff at the OEC, but this report is also a tangible resource for the OEC to give to the public to educate individuals about the status of public lands in Hocking County. Overall, this report is important because public lands are of high importance in regards to protecting old growth forests, endangered species and key resources like gas and oil. This report highlights the key resources and stressors in the Wayne National Forest, Hocking State Forest and Hocking State Parks and Nature Preserves.

II. The Character of Hocking County

A. Census Information: The Demographic Character of Hocking County

The following maps create visual representation on the Census information provided for Hocking County Ohio in 2010.

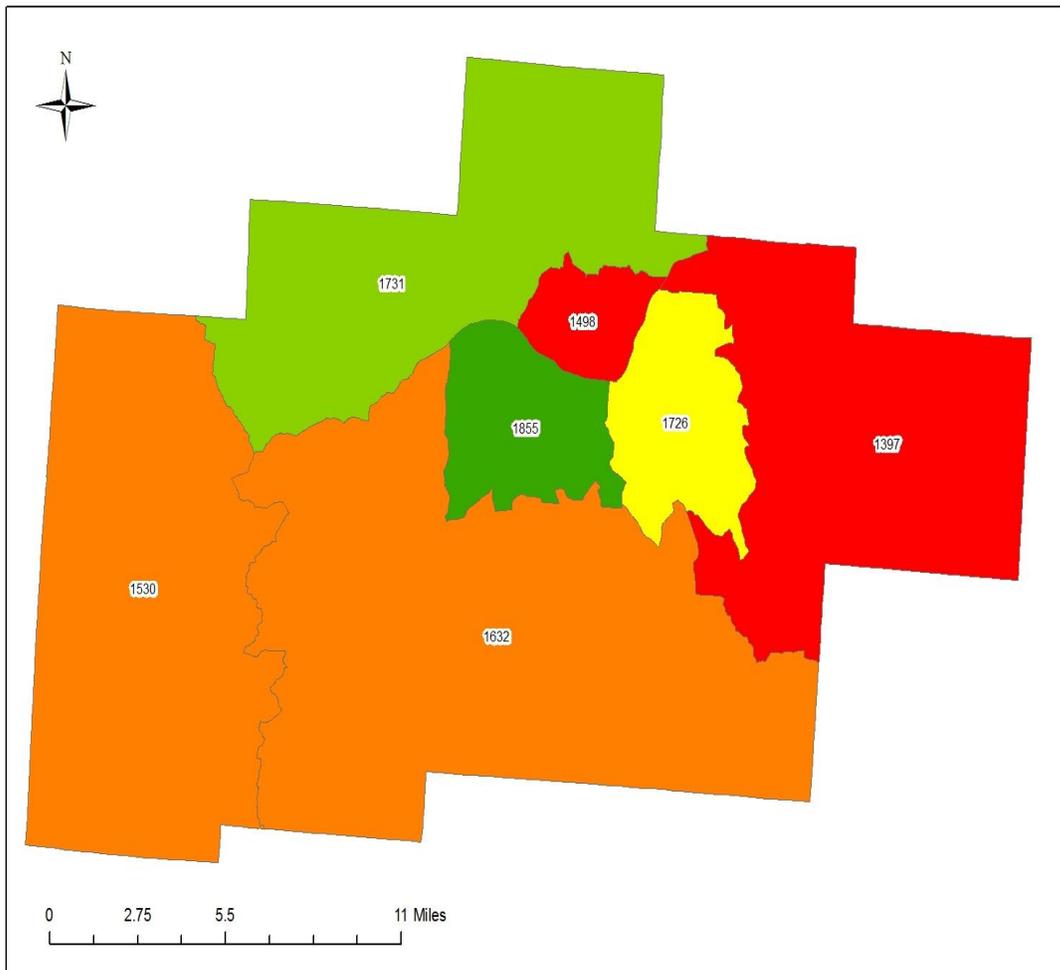


Figure 2. Total number of households by census tract in Hocking County. Source: <https://factfinder.census.gov/faces/nav/jsf/pages/seachresults.xhtml?refresh=t>

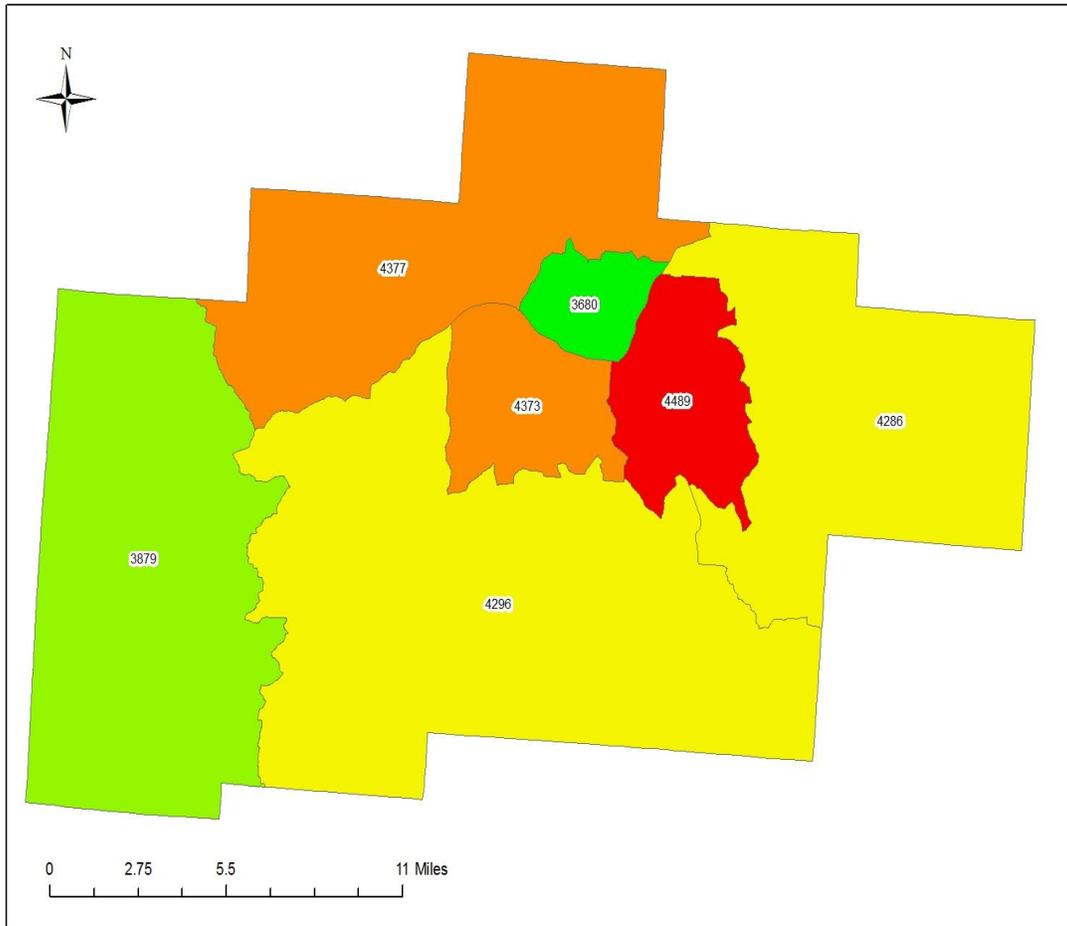


Figure 3. Number of individuals (male and female) by census tract in Hocking County. Source: <https://factfinder.census.gov/faces/nav/jsf/pages/seachresults.xhtml?refresh=t>

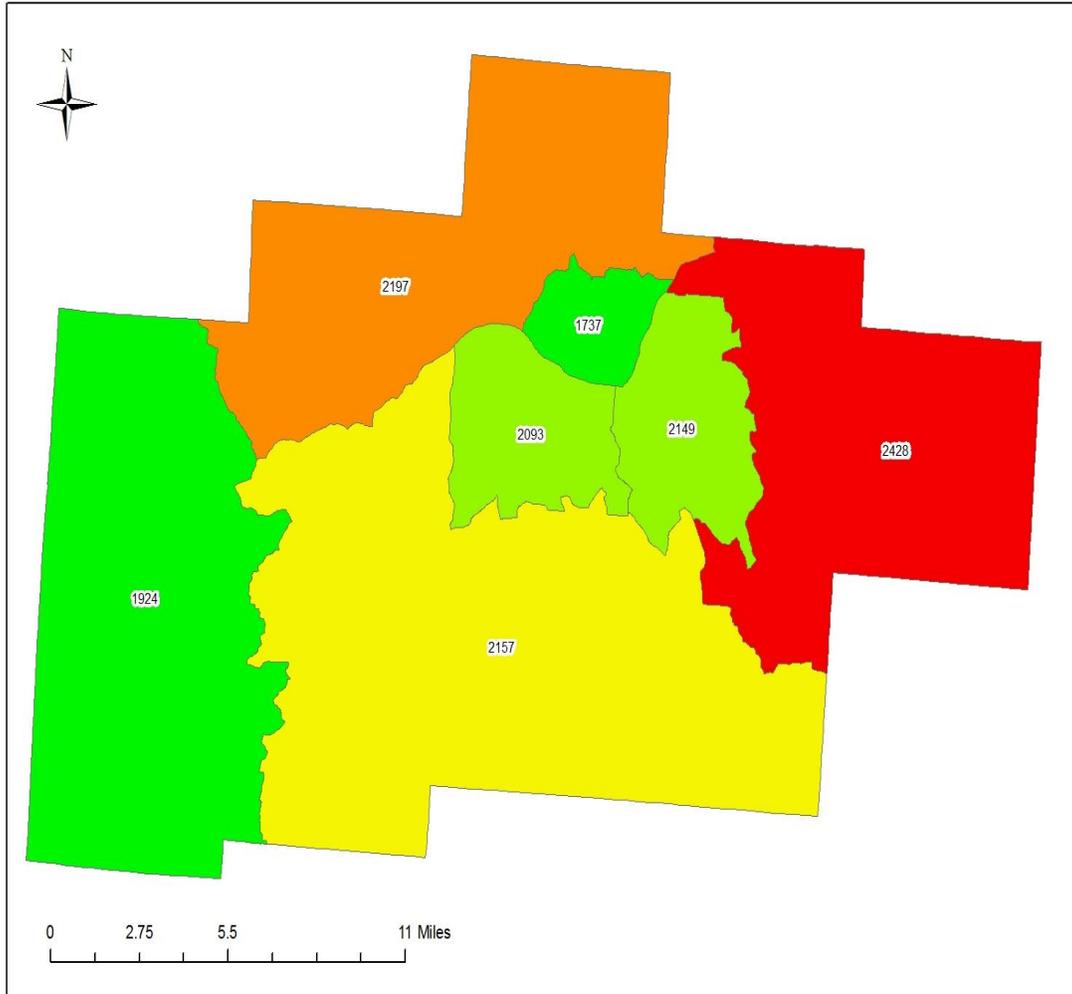


Figure 4. Number of males by census tract in Hocking County. Source: <https://factfinder.census.gov/faces/nav/jsf/pages/seachresults.xhtml?refresh=t>

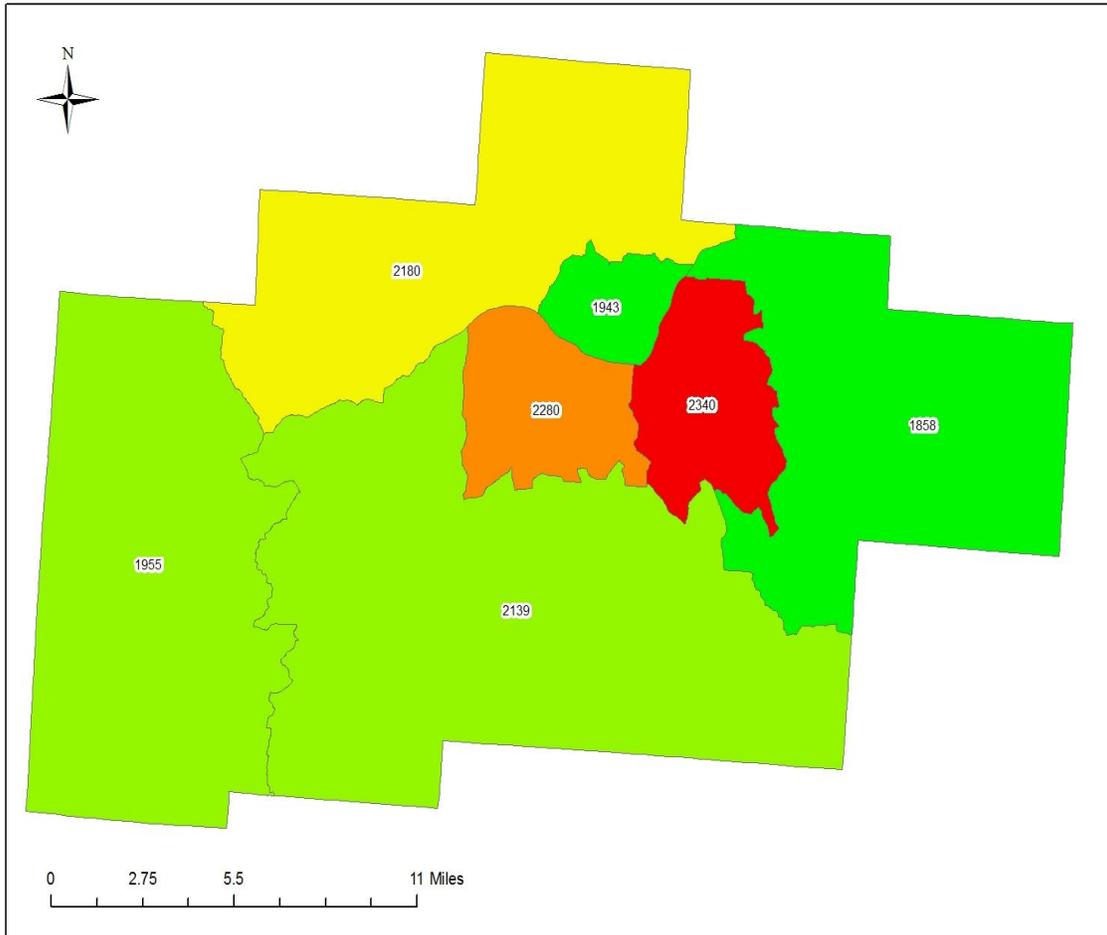


Figure 5. Number of females by census tract in Hocking County. Source: <https://factfinder.census.gov/faces/nav/jsf/pages/seachresults.xhtml?refresh=t>

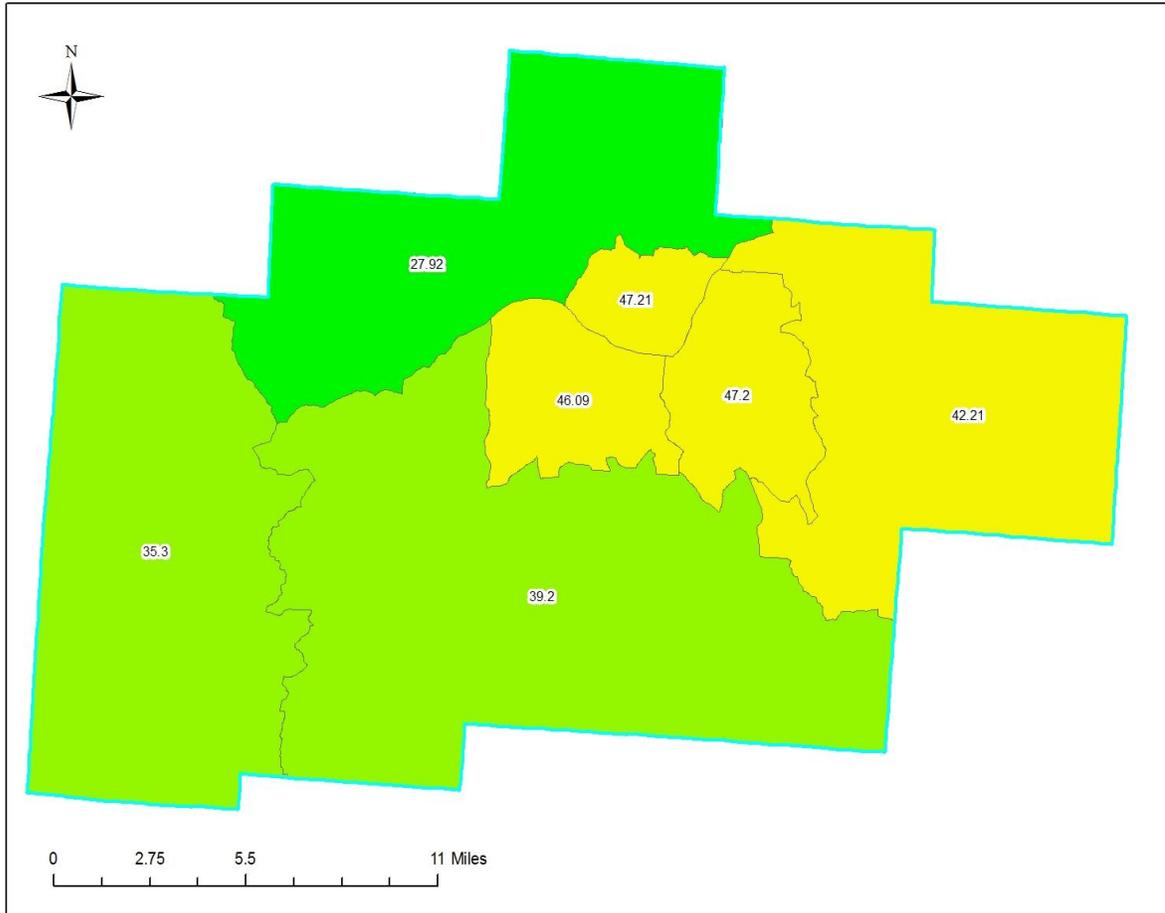


Figure 6. Percent of census tract population that falls into low to moderate income bracket for the area. Low to moderate income bracket based upon individuals or families whose household income does not exceed 115 percent of the median income for the area when adjusted for family size. Source: <https://hudgov.prod.parature.com/link/portal/57345/57355/Article/4684/How-is-a-Low-to-Moderate-Income-individual-or-family-defined>

B. Ecosystem Services of Hocking County

Forest Ecosystem Services include cultural, material, regulatory, and supportive services. Cultural services encompass recreational activities associated with the forest such as hiking, hunting, fishing, camping, or swimming. Material services include extraction of timber, natural gas, fresh water, oil, or coal. Regulating services are the forest's ability to perform functions such as carbon sequestration or air purification. Lastly, supporting services are the forest's ability to support wildlife habitat, nutrient cycling, water purification, groundwater and surface flow regulation, erosion control, and mitigate runoff.

Ohio forests have doubled in area since 1942 to now total 7.9 million acres, or 30% of the State's land. They hold more biomass, provide more wildlife habitat, and store more carbon than 15 years ago (Ohio Forests, 2006). However, ecosystem services can be threatened by development and extraction. This has had a wide effect on specific services across Ohio especially Hocking County. Public lands in Hocking County have been shown to have common services and these include, regulating services and supporting services. In this section, a watershed map has been listed, along with specific wildlife of interest within the county as they have commonality with the National, State, and State Parks and Nature Preserves sections. These services are later defined within each chapter upon importance to that specific area.

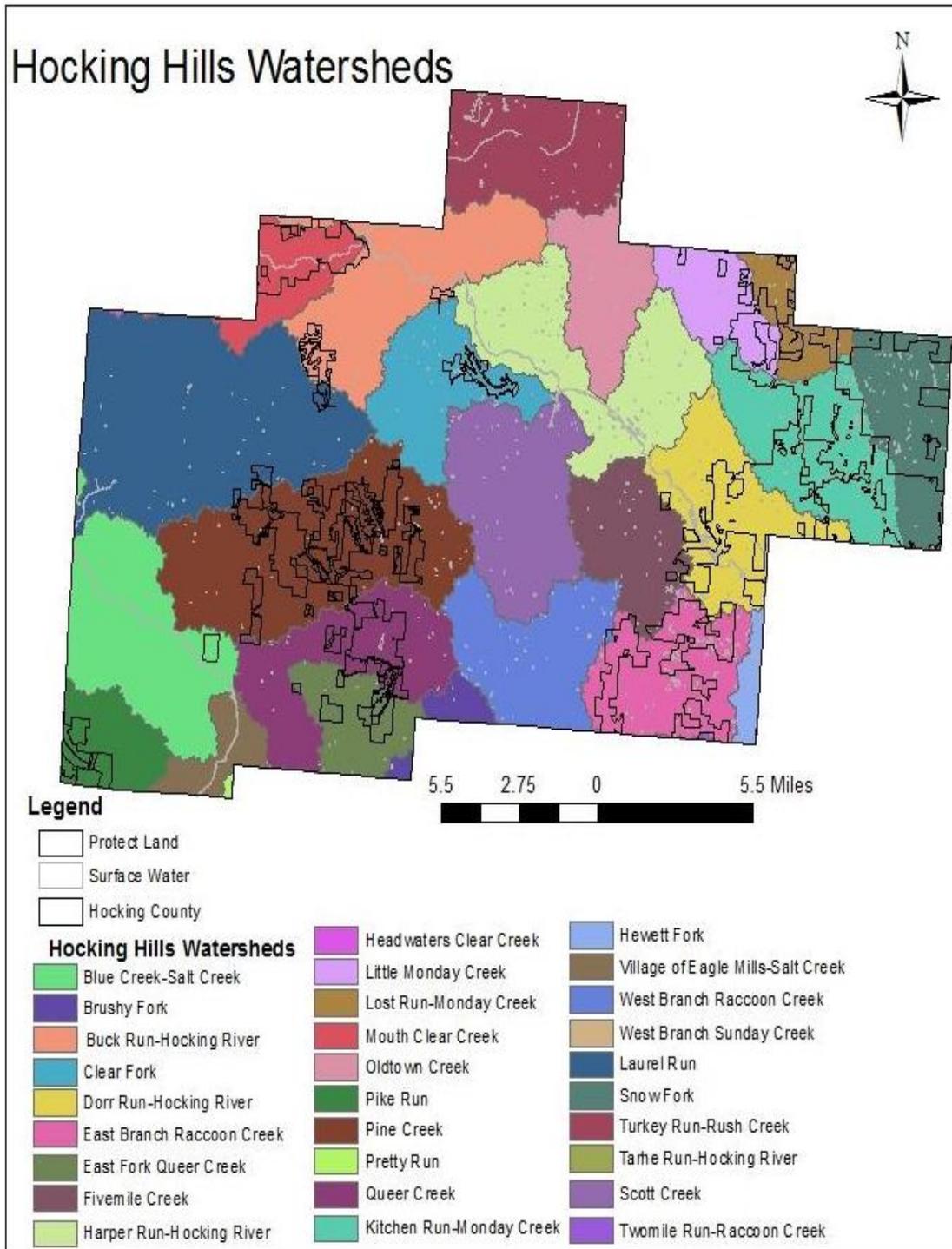


Figure 7. Current watersheds in Hocking Hills and their relation to protected lands. Data for this map was collected from Ohio EPA Geographic Data.

Endangered Species:

Mammals

- Indiana Bat (*Myotis sodalis*)

Endangered In: Athens, Hocking, Morgan, Perry, Vinton

Habitat: Hibernate in winter in caves or abandoned mines. These caves must be cool and humid with stable temperatures under 50°F but above freezing. Migrate from winter hibernation locations in wooded areas, roosting usually under loose tree bark on dead and dying trees.

Behavior: Mate during the fall before they enter caves to hibernate. Females store sperm until spring when they ovulate and fertilize eggs with the stored sperm. Once they have migrated to their summer habitats the females will give birth to only one pup per year.

Why It's Endangered: Due to the highly specific nature of their hibernation habitats, the Indiana Bat is highly vulnerable to disturbance by human foot traffic. The commercialization of caves is a large cause of this, and will drive bats away. Changing the structure or temperature of their hibernation caves can also have a huge effect on mortality rates. Clear cutting and forest fragmentation also destroys their summer habitat. Reduction of food (insects) due to high usage of pesticides also affects mortality rates of the Indiana Bat.

Birds

- Cerulean Warbler (*Setophaga cerulea*)

Endangered In: North America

Habitat: Prefers mature wooded areas, and has been found to favor ridges. Shows no preference between forest edge or interior.

Behavior: Songbirds that mainly nest and breed in mature deciduous forests.

Why It's Endangered: Deforestation and mountaintop mining have caused these birds to lose much of their habitat. (Weakland, Wood, 2004)

- Worm-eating Warbler (*Helmitheros vermivorus*)

Endangered in: Eastern North America

Habitat: Prefers a variety of old growth, deciduous and mixed deciduous-coniferous forest types, which include eastern hemlock, beech-maple, and oak-hickory.

Behavior: Songbirds that mainly nest and breed in the eastern United States during the summer seasons.

Why It's Endangered: Loss of habitat in both their summer and wintering locations. During the summer mainly due to the loss of oak trees. During the winter mainly due to the loss of broad leaved tropical trees. (Hanners and Patton, 1998)

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- Wood Thrush (*Hylocichla mustelina*)
Endangered in: Eastern North America
Habitat: Prefers old growth, deciduous forests
Behavior: Songbirds that mainly nest in their preferred habitat, often found scavenging through leaf litter.
Why it's Endangered: Loss of habitat, and fragmentation of forests. It also is a common target for cowbirds.
(Roth, 1996)

Molluscs (Mussels)

- Fanshell (*Cyprogenia stegaria*)
Endangered In: Athens, Morgan
Habitat: Medium to large rivers.
Behavior: Requires a stable, undisturbed habitat to reproduce, as well as a sufficient population of fish to complete larval development.
Why It's Endangered: Dams and reservoirs flooded its habitat, reducing the gravel and sand it burrows in as well as reduces the number of fish hosts present in its environment. Commercial harvesting may also have an effect on this species. Dredging for channel maintenance also destroys this species habitat. Erosion caused by strip mining, logging, and farming adds silt to many rivers, which can prevent the mussels from feeding and even bury them completely. Runoff from agricultural and industrial production also limit development.
- Pink Mucket Pearlymussel (*Lampsilis abrupta*)
Endangered In: Athens, Morgan
Habitat: Mud, sand, and shallow riffles and shoals swept free of silt in major rivers and tributaries.
Behavior: Requires a stable, undisturbed habitat to reproduce, as well as a sufficient population of fish to complete larval development.
Why It's Endangered: Dams and reservoirs flooded its habitat, reducing the gravel and sand it burrows in as well as reduces the number of fish hosts present in its environment. Erosion caused by strip mining, logging, and farming adds silt to many rivers, which can prevent the mussels from feeding and even bury them completely. Runoff from agricultural and industrial production also limit development.
- Sheepnose (*Plethobasus cyphus*)
Endangered In: Athens, Morgan Counties
Habitat: Large rivers and streams. Usually found in shallow areas with moderate to swift currents.

Behavior: Requires a stable, undisturbed habitat to reproduce, as well as a sufficient population of fish to complete larval development.

Why It's Endangered: Dams and reservoirs flooded its habitat, reducing the gravel and sand it burrows in as well as reduces the number of fish hosts present in its environment. Dredging for channel maintenance also destroys this species habitat. Erosion caused by strip mining, logging, and farming adds silt to many rivers, which can prevent the mussels from feeding and even bury them completely. Runoff from agricultural and industrial production also limit development.

- Snuffbox (*Epioblasma triquetra*)

Endangered In: Athens County

Habitat: Small to medium sized creeks, living in areas with a swift current. Adults burrow into deep sand, gravel, or cobble substrates. Typically feed on algae, bacteria, detritus, microscopic animals, and dissolved organic material.

Behavior: Requires a stable, undisturbed habitat to reproduce, as well as a sufficient population of fish to complete larval development.

Why It's Endangered: Dams and reservoirs flooded its habitat, reducing the gravel and sand it burrows in as well as reduces the number of fish hosts present in its environment. Commercial harvesting may also have an effect on this species. Erosion caused by strip mining, logging, and farming adds silt to many rivers, which can prevent the mussels from feeding and even bury them completely. Runoff from agricultural and industrial production. Invasion from nonnative species like Zebra Mussels causes a decrease in available nutrients because they proliferate in such high numbers.

Insects

- American Burying Beetle (*Nicrophorus americanus*)

Endangered In: Athens, Hocking, Morgan, Perry, Vinton Counties

Habitat: Survives in many types of habitat. Prefers grasslands and open understory oak hickory forests.

Behavior: Use carrion the size of a dove or chipmunk to reproduce.

Why It's Endangered: The availability of carrion is determinant of where they can live.

Threatened Species:

Mammals

- Northern Long-eared Bat (*Myotis sodalis*)

Threatened In: Athens, Hocking, Morgan, Perry, Vinton Counties

Habitat: Winter: caves and mines. Summer: underneath bark, in cavities or crevices in both living and dead trees.

Behavior: Breeding begins in late summer or early fall. Females store sperm until spring when they ovulate and fertilize eggs with the stored sperm. Maximum lifespan of a

Northern Long-eared Bat is estimated to be up to 18.5 years. They emerge at dusk to feed, consuming moths, flies, leafhoppers, caddisflies, and beetles.

Why It's Threatened: White-nose syndrome is a disease that causes a distinctive fungal growth around the mouth, nose, and wings of hibernating bats. At this time there is no known treatment. Impacts to hibernacula (winter habitat), loss or degradation of summer habitat, as well as an increase in wind turbines have also had an effect on Northern Long-eared Bat mortality rates.

Plants

- Northern Monkshood (*Aconitum noveboracense*)

Threatened In: Hocking County

Habitat: Partially shaded cliffs, algific talus slopes, or cool, streamside sites.

Behavior: Perennial that reproduces from both seed and small tubers. Flowers bloom between June and September and are pollinated by bumblebees.

Why It's Threatened: Contamination and filling of sinkholes, grazing and trampling by livestock, human foot traffic, logging, maintenance of highways and power lines, misapplication of pesticides, quarrying, and road building. Collection of individuals for scientific research has also affected population numbers.

- Running Buffalo Clover (*Trifolium stoloniferum*)

Threatened In: Hocking, Vinton Counties

Habitat: Areas of periodic disturbance and a somewhat open habitat. Usually found in rich soils in the ecotone between open forest and prairie

Behavior: Produces flowers from late spring to early summer.

Why It's Threatened: May depend on bison to periodically disturb areas and create habitat, as well as to disperse seeds. As bison populations declined, so did the prevalence of Running Buffalo Clover. Clearing land for agricultural development has also caused a decrease in population sizes. Introduction and colonization of non-native and invasive plants has also reduced its habitat.

- Small Whorled Pogonia (*Isotria medeoloides*)

Threatened In: Hocking County

Habitat: Grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory.

Behavior: The single or paired green/yellow flowers are about .5-1 inch long and appear from May to June. The fruit, an upright ellipsoid capsule, appears later in the year.

Why It's Threatened: Largest effect on mortality rates is the continuing loss of habitat due to developed or developing urban expansion. Habitat may also be degraded due to recreational activities and trampling.

C. Ecosystem Goods of Hocking County

- Oil and Gas

Ohio has a rich history of oil and gas production, starting from 1814, when oil was first discovered in Noble County, to 1860, when Ohio first started oil production. The Division of Oil and Gas Resource Management oversees all production of Ohio's oil and natural gas resources. Ohio has a total of 64,378 active wells which are productive in 79/88 of its counties and Ohio ranks 4th nationwide in number of wells drilled (Ohio Oil and Gas Association, 2017).

Both hydraulic fracturing and shale formation are methods used to obtain oil and natural gas in Hocking County, Ohio. As of 2015, Hocking County has a total of 544 currently producing wells, and 32 producing operations as seen in Figure # (Ohio Oil and Gas Association, 2017).

- a. Production

Most wells in Ohio can be drilled with rotary rigs in 10 days or less. Cable tool wells may take up to a month or more (ODNR, 2017).

- Hocking County produced **59,564 barrels** of oil in January 2015. (DrillingEdge)
- Hocking County produced **72,660 MCF** of natural gas in January 2015.
- Ohio produced a total of **26,695,140 barrels** of oil in 2015. (ODNR)
- Ohio produced a total of **1,007,382,220 MCF** of natural gas in 2015.

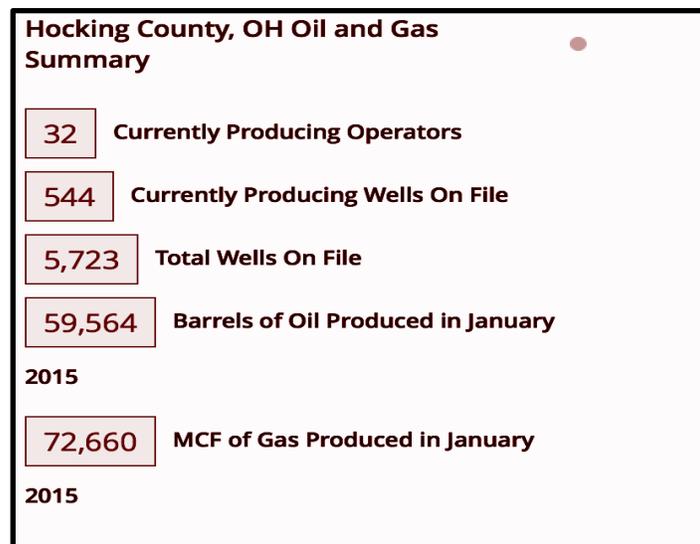


Figure 8: Summary of oil and gas production operators and wells in Hocking County from 2015. Source: <http://www.drillingedge.com/ohio/hocking-county> as reported by DrillingEdge

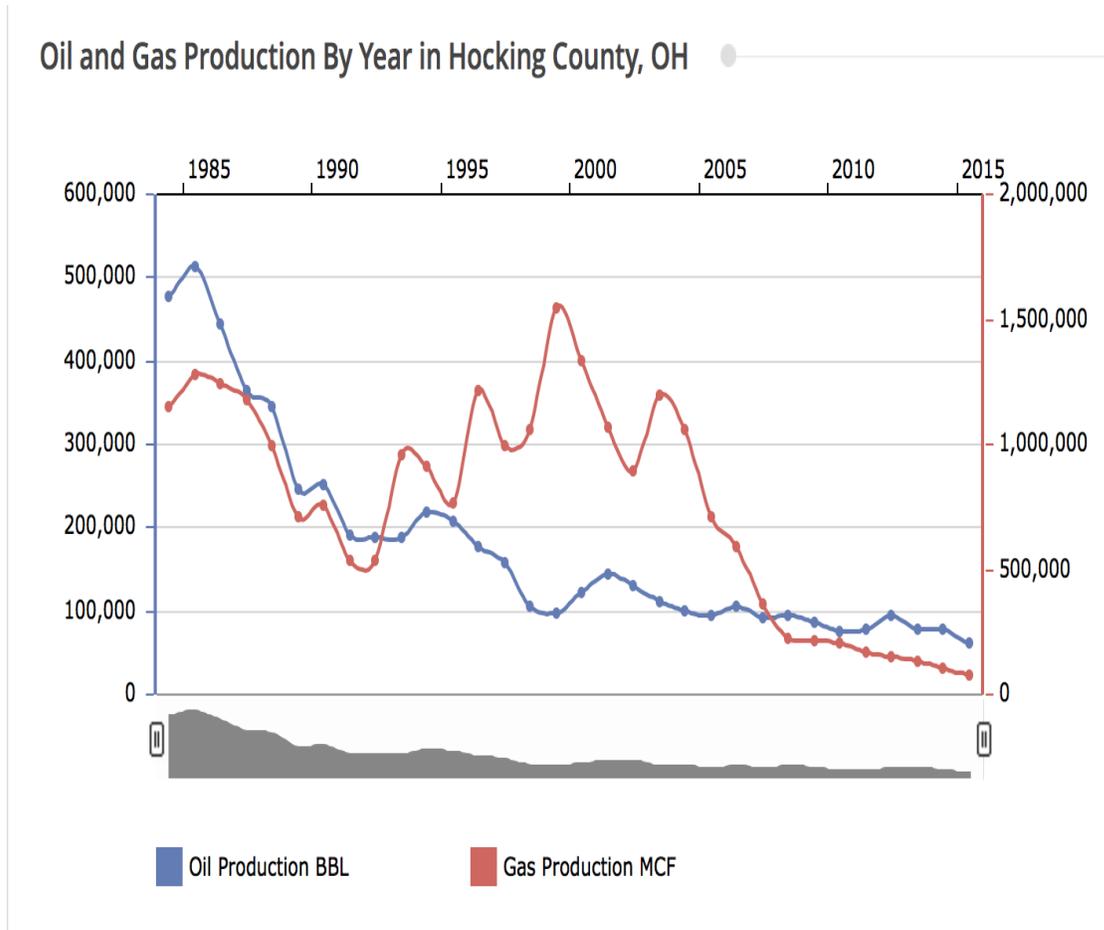


Figure 9: Oil and gas production by year in Hocking County from 1985-2015. Source: <http://www.drillingedge.com/ohio/hocking-county> as reported by DrillingEdge.

b. Operation & Ownership

- 31 of 544 wells in Hocking County are federally owned, the rest are privately owned
 - Any individual or company intending to use a well for either domestic or commercial (non-domestic) use must become a registered well owner (ODNR, 2017).
 - Landowners who own mineral rights will receive royalties on products removed from their property
- Logging
 - Ohio has a history of logging beginning when settlers first came here around 200 years ago, when the forests were the predominant occupier of land. The expanding

development of communities in Ohio has affected the amount of forestry (ODNR). Logging can be detrimental to ecosystems and parks. It can take nutrients from the soil and allow for potentially more runoff into the surrounding streams and lakes. If logging sites are not evaluated by potential harms first, they could prove to be harmful to habitats and the ecosystem.

There is currently a large amount of wooded, log-able land in Hocking County, which provides jobs and other community services. These wooded areas and agricultural farms generate \$74.2 million dollars in industrial output and \$3.77 million in taxes (Ohioline).

- Costs of Extraction
 - a. Water Contamination
 - Flowback water picks up minerals from shale formation that may contain radioactive elements and high concentrations of total dissolved solids
 - Potential effect on water quality and aquatic life
 - Risk of groundwater contamination
 - Hazardous for drinking water
(Tribal Energy and Environmental Information Clearinghouse)
 - b. Air Pollution
 - Emissions of Volatile organic compounds (VOCs), nitrogen oxides, sulfur dioxide, carbon monoxide, benzene, toluene, ethylbenzene, xylenes, polycyclic aromatic hydrocarbons (PAHs), hydrogen sulfides, particulates, ozone, methane, carbon dioxide
 - Emissions of greenhouse gases contributing to climate change
 - c. Land and Soil Degradation
 - Heavy transportation can cause noise pollution
 - Noise and habitat destruction
 - Habitat destruction and/or fragmentation
 - May disturb species
 - Clear cutting destroys habitats for many of these endangered and threatened species
 - May conflict with livestock and farming operations
 - d. Waste
 - Sludge, oil, metals, and Fracking fluids
 - The clearing of forests allows for much more runoff into the streams at the bottom of these hills, which threatens the biodiversity of these ecosystems and increases the number of different chemicals that are not normally in these environments
 - Logging causes the soil to become unstable and production value is decreased exponentially
 - If forests are not properly managed the forest health, aesthetics, and wildlife habitats are injured substantially
 -

-
- e. Health and Safety risks
 - Health impacts from water contamination, dust and other air emissions, noise, soil contamination, and stress associated with living near wells
 - Potential for fires and explosions
 - Impacts well-being of nearby residents
 - Noise and aesthetics
 - During the time a well is being drilled, the rig must run 24/7 (ODNR, 2017).

Benefits of Extraction (Tribal Energy and Environmental Information Clearinghouse, 2017)

- a. Socio-Economic Benefits
 - Creates new jobs. Oil and gas extraction supports nearly 3 million jobs worldwide
 - The oil and gas industry is one of the highest paying industries in Hocking County. Oil and gas extraction is the most specialized job in hocking county, and second highest paying. Logging helps the community by providing jobs to many of these low income and low education homes

- b. Revenue Generation (Energy In Depth, 2015)

Tax revenue. From 2010-2015 the oil and natural gas industry contributed \$43.7 million to six Ohio counties and is projected to increase to \$200-250 million from 2016-2026.

 - 60-70% of tax goes to Ohio Local Schools. It lowers gas prices; in July 2008, the national average price of regular gas was \$4.06 a gallon and today it's just over \$2. Ohio was among the first states to see gas prices drop below \$2 in mid-December of 2015, which was the first time since 2009. Lower cost for heating and home electricity; in 2012, the average U.S. household had an additional \$1,200 in disposable income due to lower costs of energy from hydraulic fracturing

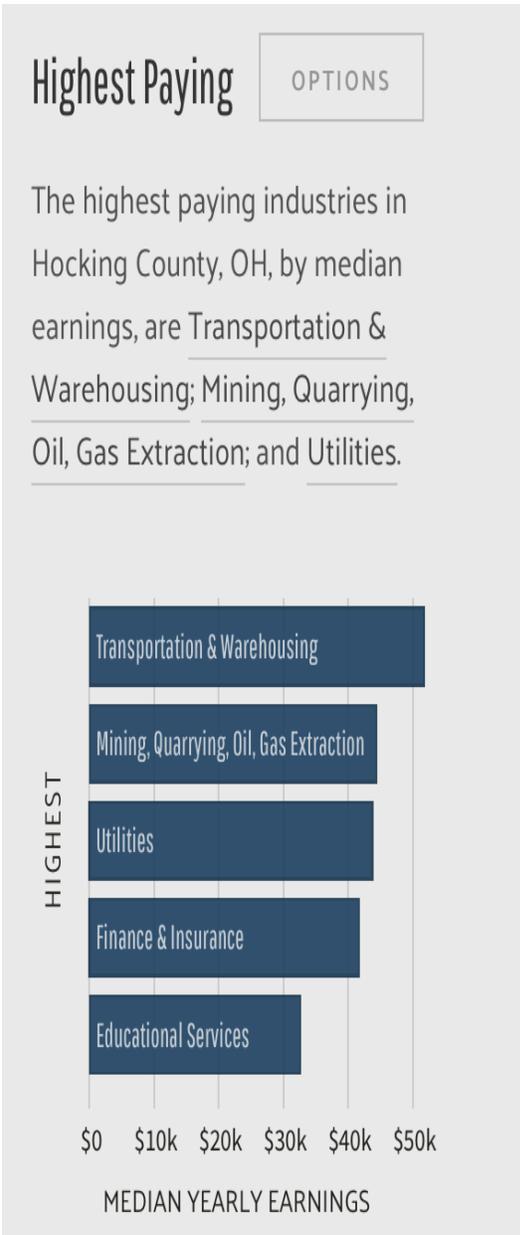
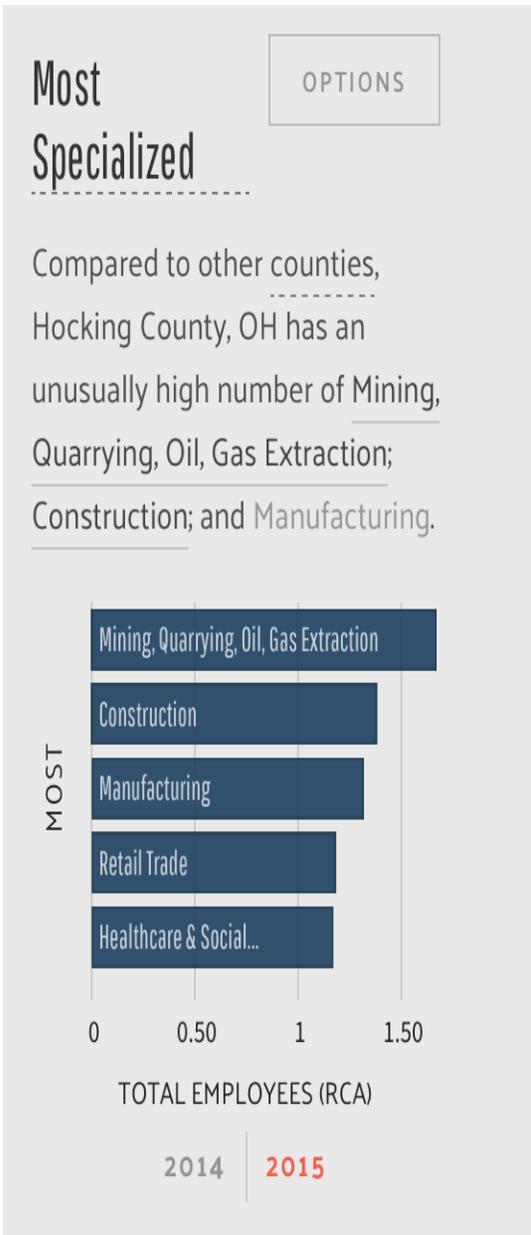


Figure 10: The most specialized and highest paying jobs in Hocking County in 2015. Source: <https://datausa.io/profile/geo/hocking-county-oh/> reported by DataUSA

The following table shows the jobs associated with the industrial services within Hocking County, and who they employ, their labor income, value added and industrial output.

Industry NAICS Description	Employment	Labor Income	Value Added	Industrial Output
11 Agriculture, Forestry, Fishing, and Hunting	419	\$4,379,924	\$7,619,696	\$20,616,832
113 Forestry and Logging	26	\$757,959	\$2,399,651	\$3,914,210
21 Mining	199	\$9,418,245	\$13,943,003	\$28,174,041
22 Utilities	17	\$605,477	\$2,583,499	\$5,072,232
23 Construction	762	\$20,013,282	\$27,228,409	\$79,251,045
31–33 Manufacturing	890	\$49,160,254	\$72,577,195	\$245,864,735
321 Wood Products Manufacturing	131	\$4,890,620	\$6,109,446	\$18,832,855
322 Paper Manufacturing	171	\$8,134,653	\$11,377,462	\$51,064,583
42 Wholesale Trade	87	\$5,709,716	\$10,321,889	\$13,323,573
44–45 Retail Trade	1,024	\$24,512,714	\$36,973,477	\$54,984,396
48–49 Transportation and Warehousing	148	\$4,481,676	\$5,727,553	\$11,687,865
51–56 Professional Services	1,310	\$29,315,650	\$142,064,597	\$228,963,597
61–72 Educational, Health, and Recreation Services	2,343	\$44,799,405	\$59,654,737	\$122,117,501
81 Other Services	687	\$16,186,462	\$17,182,599	\$41,195,688
92 Government and non-NAICS Industries	2,003	\$100,718,008	\$113,451,395	\$129,738,797
Forest Industries	331	\$13,921,569	\$20,052,865	\$74,203,798
Total	9,888	\$309,300,812	\$509,328,047	\$980,990,302

Figure 11: Direct industrial contributions within Hocking County's economy, 2010. The IMPAN model's 440 sectors were aggregated into 12 industries by each sector's 2-digit North American Industry Classification Systems (OSU.edu)

III. Wayne National Forest

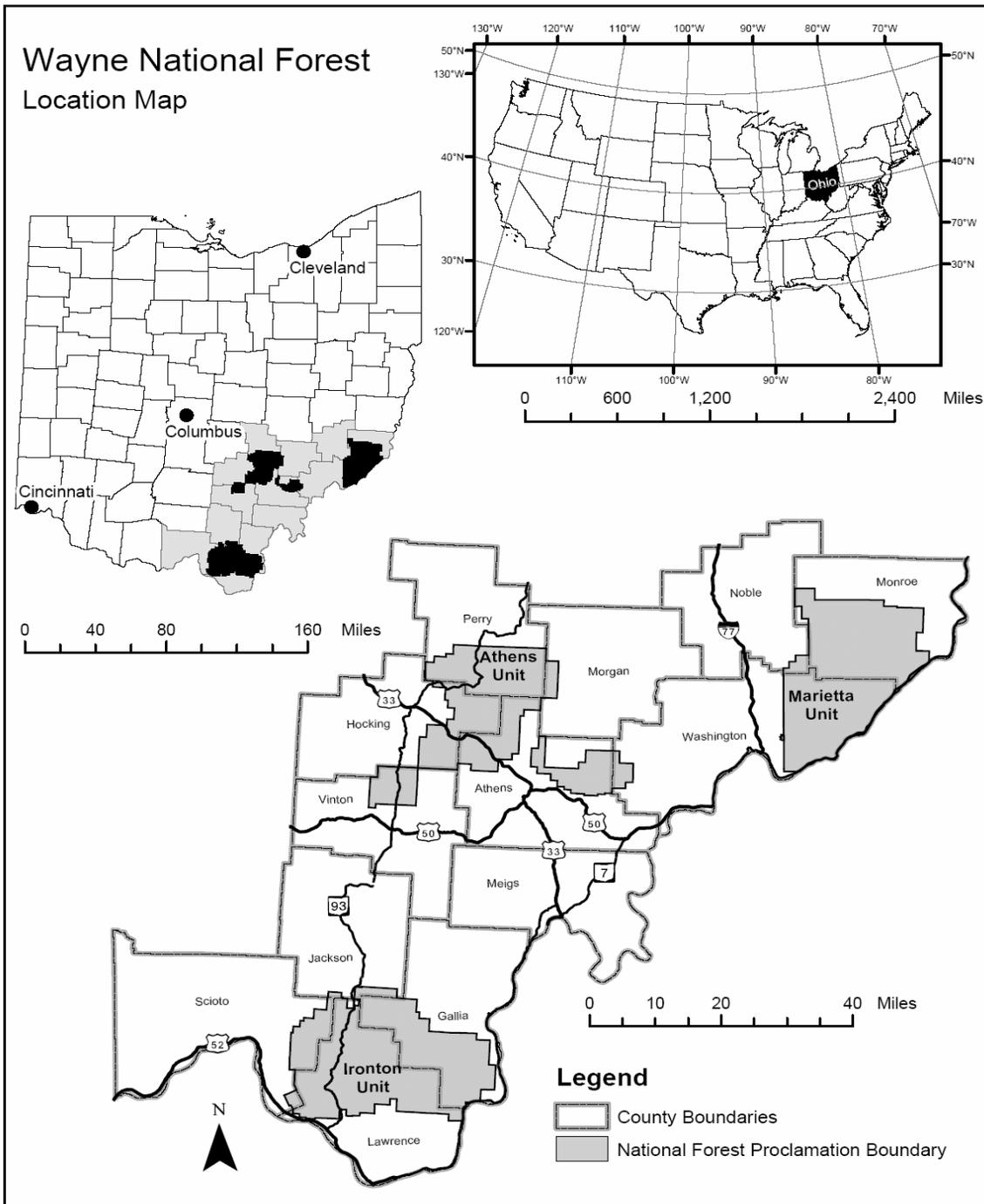


Figure 12: This clearly defines where Ohio is and where Wayne National Forest is in relation to the major cities.
 Source: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_005657.pdf

A. Wayne National Forest Inventory

Wayne National Forest lies in the Southeast part of Ohio and covers quarter million acres of the Appalachian foothills. It consists of 240,101 acres of land within the 834,000 acres of total forest boundary. Currently, WNF has 28% ownership of the proclamation boundary. One of the increasing attractions for oil and natural gas extraction in Wayne National Forest are the Utica Shale reserves distributed throughout WNF's 12 counties: Athens, Gallia, Hocking, Jackson, Lawrence, Monroe, Morgan, Noble, Perry, Scioto, Vinton and Washington. The availability of dry and wet gas windows found in Southeastern Ohio, along with shallow Utica reserves makes drilling for investors less expensive and even more attractive.

Wayne National Forest in Hocking County:

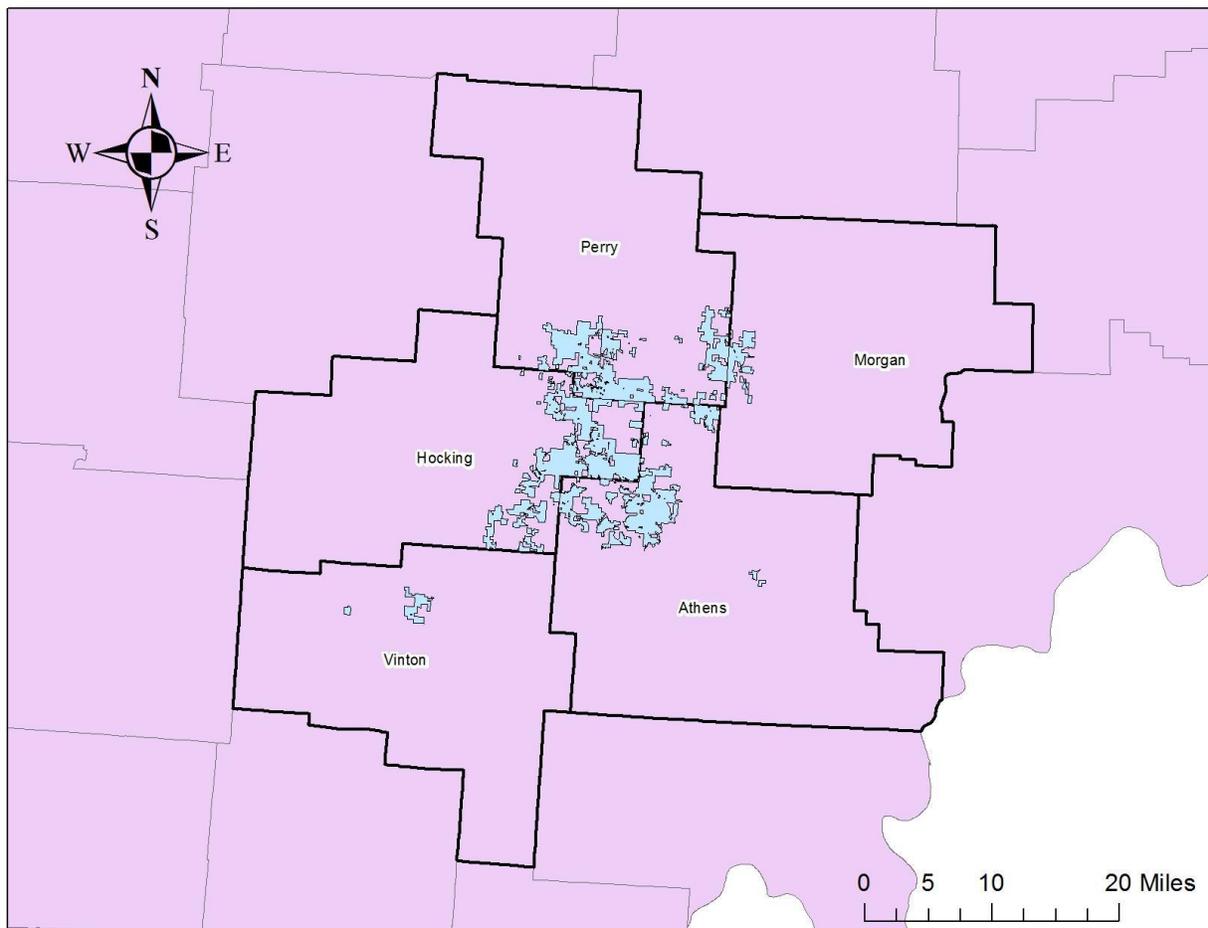


Figure 13: Map of Wayne National Forest inside of Hocking County. Source: Hocking County Mapping and Drafting Department <https://www.co.hocking.oh.us/maps/>

B. Wayne National Forest Ecosystem Services

Wayne National Forest encompasses 240,101 acres of federally owned land. The forest is divided into three units: Athens, Marietta, and Ironton. It is administered by ranger districts at Athens and Ironton with a field office located in Marietta (<http://waynenationalforest.com/>).

There are 300 miles of trails in Wayne National Forest. Popular trails include:

- Archers Fork Trail: 9.5 mi
- Covered Bridge Trail: 8 mi
- Hanging Rock Trail: 24 mi
- Kinderhool Trail: 12.3 mi
- Lamping Homestead Trail: 5 mi
- Monday Creek Trail: 70 mi
- North Country Trail: 24 mi
- Ohio View Trail: 7 mi
- Pine Creek Trail: 7 mi
- Rock House Trail: 0.75 mi
- Scenic River Trail: 3.4 mi
- Stone Church Trail: 19.4 mi
- Utah Ridge Pond Trail: 0.25 mi
- Vesuvius Backpack Trail: 16 mi
- Vesuvius Boardwalk Trail: 0.32 mi
- Vesuvius Horse Trail 42.7 mi
- Vesuvius Lakeshore Trail: 8 mi
- Wildcat Hollow Trail: 15 mi

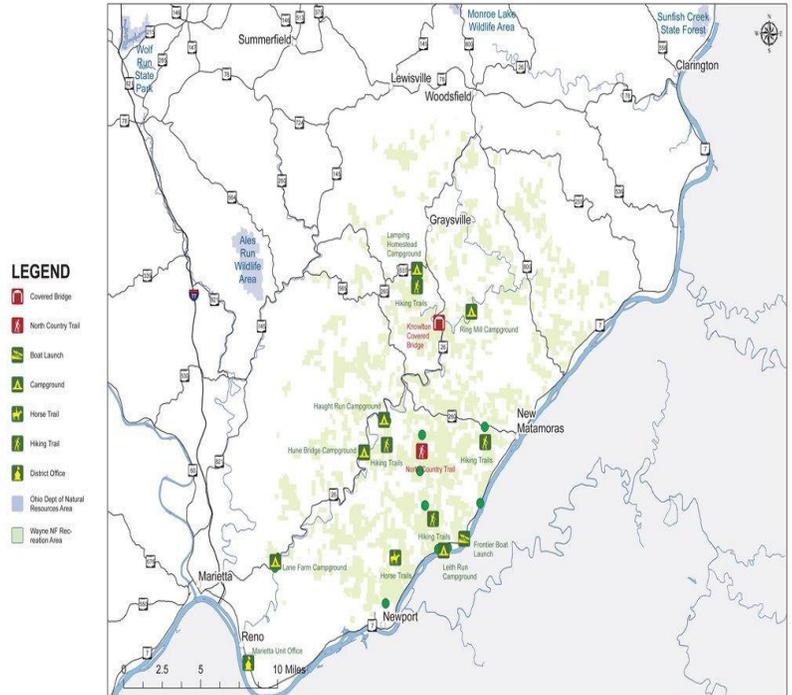


Figure 14: Trail Map of Wayne National Forest.

Source: http://www.mobilemaplets.com/thumbnails/5359_thumbnail-1024.jpg.

Biotic Factors:

Wayne National Forest has 500 acres of lakes and ponds. Lake Vesuvius, Timber Ridge Lake, Pumintown Lake, and the Ohio River are the major bodies of water in Wayne National Forest. Lake Vesuvius is 43 acres and it is the biggest body of water in Wayne National Forest. Four warm water streams flow through Wayne's boundaries and The Ohio River borders most of the forest. (Wayne National Forest).

Cultural Services:

- Interpretive historical sites in Wayne National Forest:
 - a. Covered Bridge Scenic Byway
 - b. Hune Bridge Campground
 - c. Ora Anderson Nature Trail
 - d. Ring Mill Campground

-
- e. Underground Railroad: Blackfork
 - f. Underground Railroad: Payne Cemetery
 - g. Underground Railroad: Poke Patch Rd
 - h. Underground Railroad: Vesuvius Furnace
 - i. Underground Railroad: Wayne National Forest

Backpacking is permitted anywhere on Wayne National Forest land. There are ATV (all-terrain vehicle) riding trails which include: Monday Creek ATV/OHM Trail System, Hanging Rock ATV/OHM Trail System, and Pine Creek ATV/OHM Trail System. There are mountain biking trails and seventy nine horseback riding trails in which you must bring your own horse. Other activities in Wayne National Forest include geocaching and outfitter/Guide Commercial Permits.

Hunting and Fishing

Hunting is allowed on all of the Wayne National Forest land except for recreation areas with designated boundaries. Big game hunting is permitted in the Timber Ridge Lake while small game hunting of squirrels, birds, and turkeys, is permitted in the Timber Ridge Lake.

Estuary Fishing is permitted in the Leith Run Recreation Areas. Lake and Pond fishing is permitted in Burr Oak Cove Campground, Hanging Rock OHV Trail System, Lake Vesuvius Recreation Area, Lamping Homestead, Sand Run Picnic Area, and Timbre Ridge Lake. River and Stream Fishing is permitted in Arabia Canoe Launch Site, Haught Run Campground, Hune Bridge Campground, Lane Farm Campground, Leith Run Recreation Area, Ring Mill Campground, and Symmes Creek/Morgan Sister Trail.

Small open fires are permitted except during extremely high fire danger. Dead materials are only used for firewood purposes. A Forest Trail Permit is required to operate off-road vehicles and mountain bikes or to ride horses on the Wayne National Forest. Please review the Forest Trail Permit System. (Wayne National Forest - Recreation)

C. Wayne National Forest Ecosystem Goods

The increase in drilling for oil and gas is regarded as a matter of national importance defined under the Energy Policy Act of 2005. The act encourages the development of domestically-produced energy through renewable and nonrenewable sources. Furthermore, federal laws like, Mineral Leasing Act and Federal Land Policy, the Management Act of 1976, and the Wayne National Forest Land and Resource Management Plan of 2006, allow the US government to legally lease the federally owned oil and gas rights in Wayne National Forest (WNF). The key stakeholders of WNF are the Bureau of Land Management (BLM), Department of Interior (DOI), United States Department of Agriculture- Forest Services (USDA- FS), Ohio State Department of Natural Resources and Division of Oil and Gas Resources Management (ODNR- DOGRM), private landowners, local community, lessees and permit holders.

a. Production:

- Number of Producing Gas Wells- Ohio: 26,599
- Number of Gas producing Oil Wells- Ohio: 5,941
- Crude Oil Production (Annual Thousand Barrels)- Ohio: 25,901
- Active Vertical Wells in Wayne (public + private), June 2015: 1,273

There are two types of mineral ownerships that are administered on the Wayne National Forest. Federal mineral ownership is the first type; these are mineral rights owned by the United States of America which is 41%. The second is private mineral rights that are not currently owned by the USA which is 59%. Thus, WNF has an interesting interspersed patch-work of public and private land ownership.

Mineral Ownership (+/-)	2015 Acres / % of WNF Forest land	Leased Acres	Active Wells
Federally Owned Minerals	100,139 / 41%	38, 858 acres	493 wells
Outstanding & Reserved Rights (Privately owned minerals)	144,103 / 59%	Pvt. Opns	780 wells

Figure 15: This shows the difference between the amount of oil and gas wells on both private and federal lands.
 Source: <https://www.fs.usda.gov/detail/wayne/home/?cid=STELPRDB5376502>

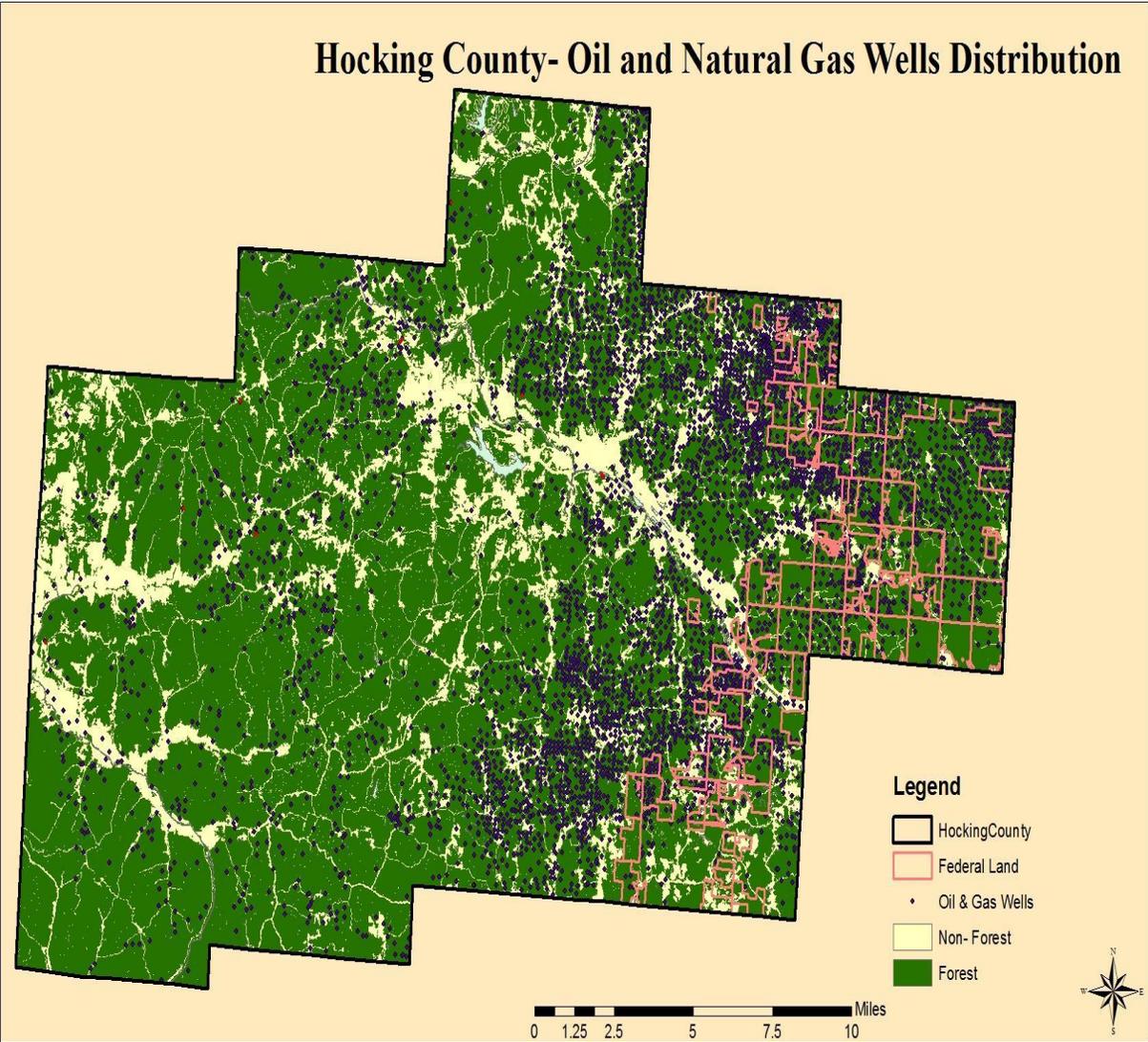


Figure 16: Oil and Natural Gas wells map of Hocking County, demarcating federal land ownership. Source: Ohio Department of Natural Resource - Division of Geological Survey, Ohio Department of Natural Resource - Division of Oil and Gas Resources Management

Recent Developments:

On December 6th, 2016, BLM opened an auction for Competitive Oil and Gas Lease Sale for 17- 21 parcels of Marietta, Noble and Washington County. The BLM auctioned 719 acres of public land in the Wayne National Forest's Marietta Unit opening up the forest to large-scale, high-volume fracking of the Marcellus and Utica shales for the first time. Apart from drilling for oil and gas production, the lease is a 10- year permit for buyers to explore the land for oil and natural gas resources. In December, BLM made \$1.7 million by auctioning 700 acres for fracking. The Bureau of Land Management (BLM) has announced that it will lease another 1,186 acres in Ohio's Wayne National Forest (WNF) in an upcoming auction set for March 23. In doing so, the BLM has increased the acreage up for sale by 65 percent over the last offering.

Figure 17: Sources: https://www.biologicaldiversity.org/news/press_releases/2017/wayne-national-forest-01-26-2017.php; <https://energyindepth.org/ohio/bureau-land-management-to-lease-another-1186-acres-in-ohio/>; https://www.fs.usda.gov/detailfull/wayne/about-forest/?cid=fsm9_006090&width=full

Cost and Benefit Analysis

- Costs
 - a. Invasive Species
 - More than 1441 acres of WNF land is projected to be exposed to increased risks of establishment and spread from NNIS due to Energy and Minerals related management activities (Economic Analysis, 2006)
 - b. Land Fragmentation
 - Increases threat to biodiversity
 - Increases risk of NNIS
 - Disturbance of ecological services
 - c. Air Pollution
 - All the 12 counties of WNF, except Washington County, are considered in attainment for hazardous pollutants like sulfur dioxide, and nitrogen oxides, by EPA standards.
 - d. Water Contamination
 - The 2014 Monroe County well pad fire resulted in the contamination of a creek near the national forest. Wastewater and fracking chemicals spilled into Opossum Creek — an Ohio River tributary — killing 70,000 fish over a five-mile stretch.
 - e. Land & Soil Degradation
 - Contamination through chemical injection, toxic waste and contaminated water leaks
 - “In addition, Ohio is currently receiving great quantities of fracking waste from within Ohio and adjacent states which is then injected into class 2 injection wells. This proposed extraction will increase the waste created thereby increasing this burden.” (Center for

Biological Diversity)

f. Endangering Wildlife & Habitat

- Increased land fragmentation and drilling activities can reduce habitat for species especially for those that require uninterrupted and large tracts of interior forests.
- The Indiana Bat is an example of endangered species, which is affected by the fracking activities in Ohio along with the consequent climate changes that disturbs its habitat.

g. Aesthetics & Recreation

- The increase in land fragmentation, deforestation, mineral extractions decreases the forest's aesthetic and recreational value.
- Historic and cultural features potentially destroyed.

h. Health & Safety risks

- Water, soil and air contamination can directly impact the health of the neighboring county members.

i. Job Variability

- The unstable nature of the price of the resources in interest can directly impact job security and satisfaction.

j. Land & Mineral Ownership Disputes

- Improper marking of public land can create conflict, leading to incidents of trespassing on private lands.
- Acquisitions of land ownership by local communities reduce the tax base, especially for property taxes of the counties, and reduce funding for schools in these communities.
- There are privately held minerals located under the federally owned surface of the forest, which often leads to dispute over mineral ownership and land and property rights between the federal government and the private landowners.

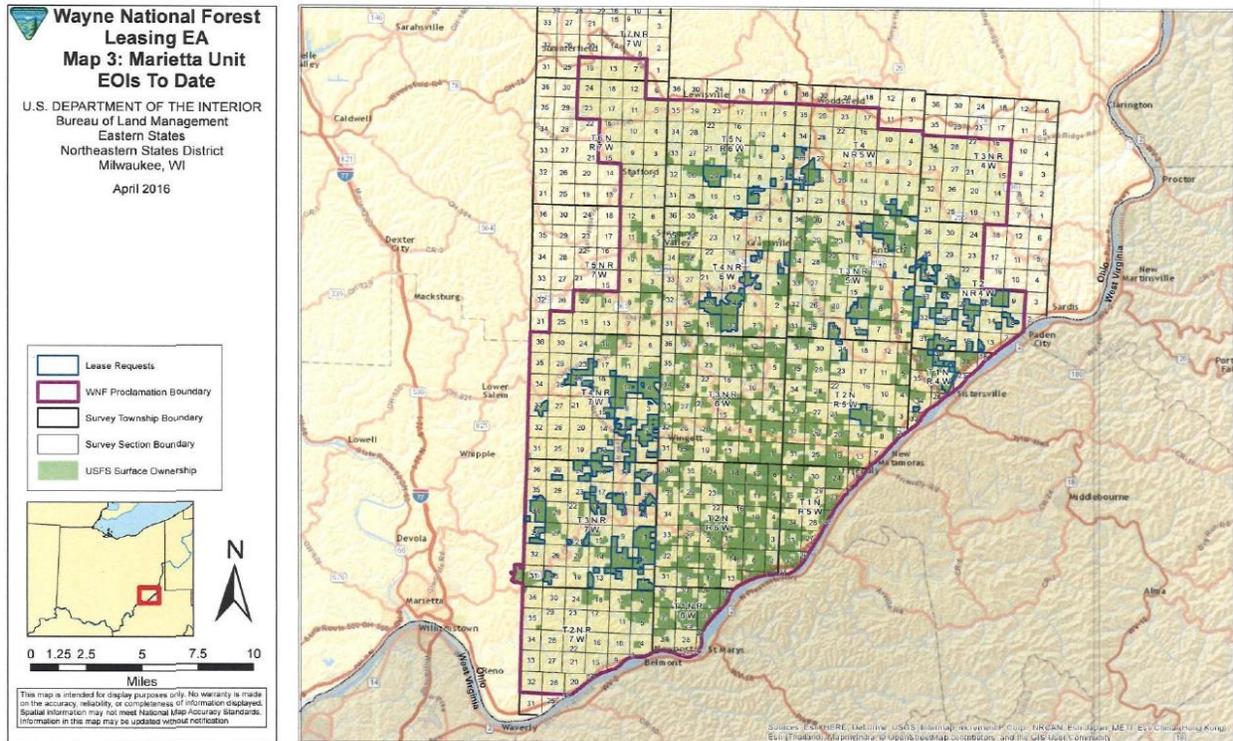


Figure 18: The boundary of Wayne National Forest and which sections are up for lease or have already been leased out to oil and gas companies. Source: <https://energyindepth.org/ohio/blm-finds-no-significant-impact-from-fracking-allows-leasing-ohios-wayne-national-forest/>

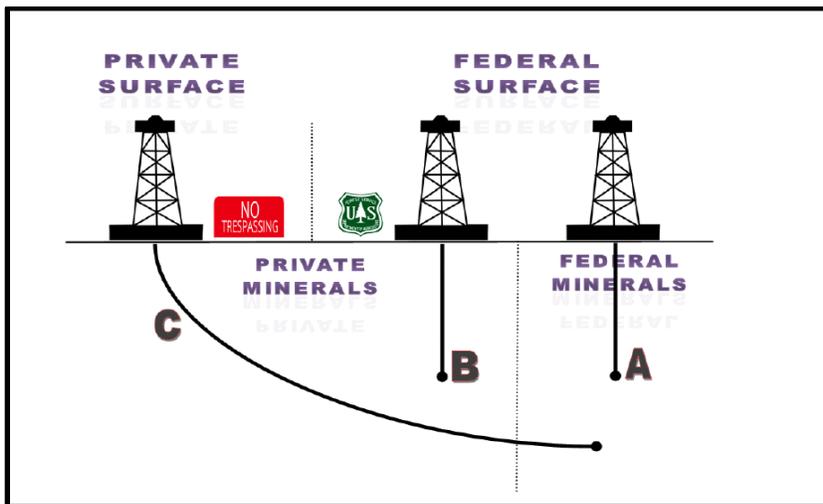
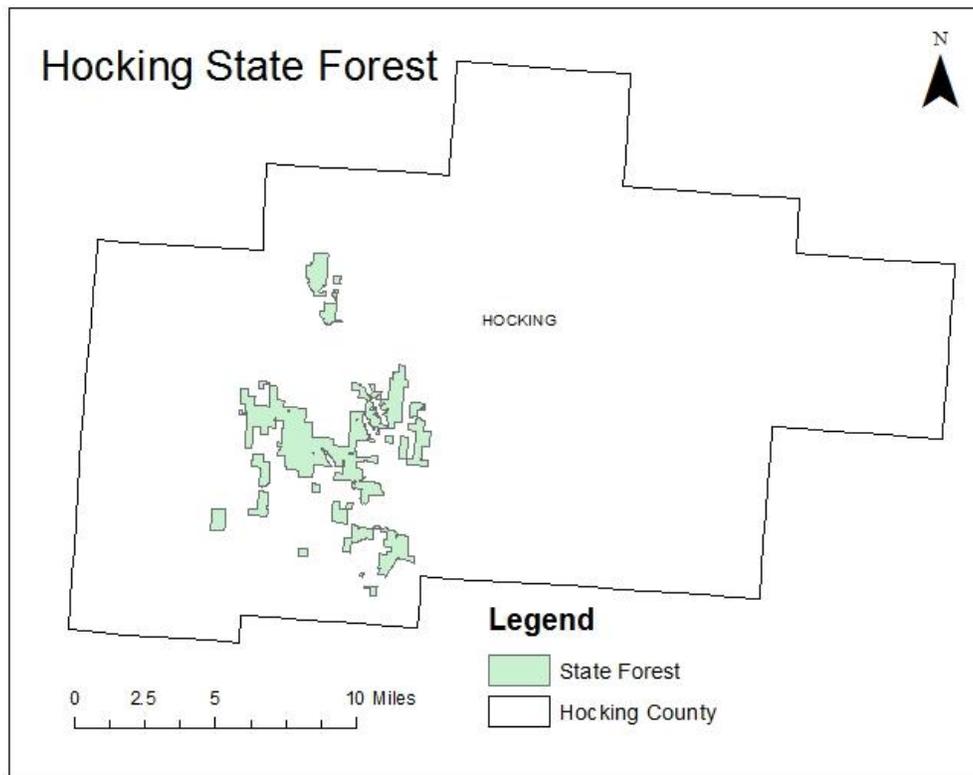


Figure 19: This shows how private oil and gas wells end up accessing public resources (Mineral and surface ownership scenarios on Forest Service lands). Source: <https://energyindepth.org/ohio/blm-finds-no-significant-impact-from-fracking-allows-leasing-ohios-wayne-national-forest/>

- Socio- Economic Benefits
 - In 2005, mining reached more than 3% of earnings in Ohio.
 - In three of the counties, Athens, Gallia, and Scioto, mining accounts for less than one percent of all earnings by place of work for most years. (Economic Analysis, 2006).
 - In Monroe County, oil and gas extraction is playing an increasingly important role in earnings, rising to 6.5% of earnings in 2005, up from 0.6% in 2001, with some slight volatility. Mining, including oil and gas as well as other mineral extraction, went up from 1.5% to 7.6%.
- a. Revenue Generation
 - The federal government provides compensation to the neighboring counties through:
 - Indirect taxes due to recreational activities
 - Funds are provided to local community for law enforcement and management
 - As the federal government owns only a fraction of the minerals under the surface, the private landowners can benefit from leasing their land for mineral development

IV. Hocking State Forest

Figure 20: Map of Hocking State Forest. Source: <http://oilandgas.ohiodnr.gov/well-information/oil-gas-well-database>



identified as High Conservation Value Forests (5 year Plan For State Forests).

Two state nature preserves have been established in Hocking State Forest, Sheick Hollow and Little Rocky Hollow. They have unique and fragile ecological systems. The nature preserves are managed by the ODNr Division of Natural Areas and Preserves (hockinghills.com)

C. Ecosystem Goods

Current activities and programs in Hocking State Forest include: a horseman's camp, regulated hunting and fishing, hiking, camping in designated areas, ninety-nine acres of forest land that have been set aside for rock climbing and rappelling, and canoeing (hockinghills.com). Per the Ohio Division of Forestry Offices, they do not keep economic data regarding recreational income. The use of Hocking State Forest is free to the public and does not have any user fees.

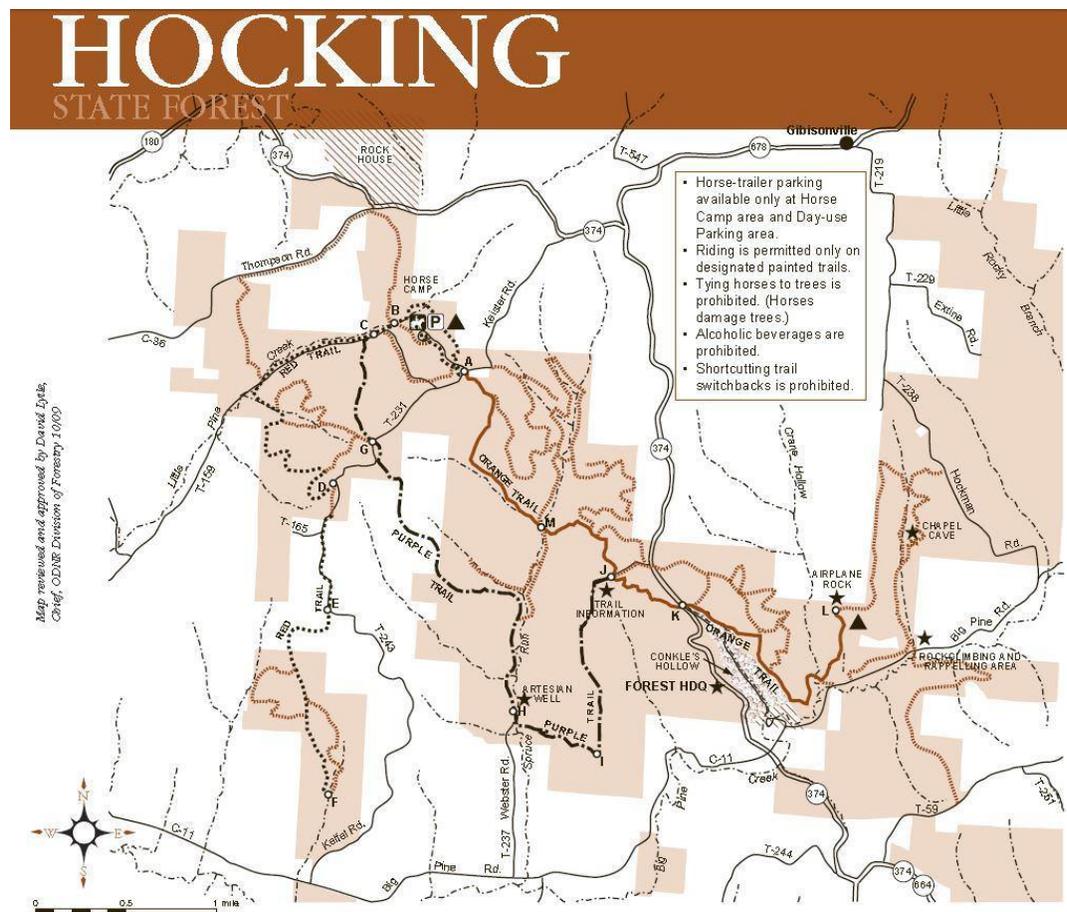


Figure 22: Map of Hocking State Forest Trails. Source: hockinghills.com.

Jobs associated with recreation in Hocking State Forest include: tour guide services, forest maintenance, and mountain mule expedition packages (hockinghills.com).

Hocking County's forest industries generate \$74.2 million in industrial output and \$3.77 million in taxes (OSU.edu).

In 2011, tourists visiting Hocking County generated 115 million in business activity, 28 million in personal income, and 16 million in taxes, which supported 1 out of 7 salaried jobs in Hocking County (Tourism Economics).

Karen Raymore, general manager of the Hocking Hills Tourism Association stated Hocking Hills is responsible for one of every seven jobs in the county, and in 2011 it generated \$53 million in income and \$12 million in state and local tax revenue (Vogt Santer Insights).

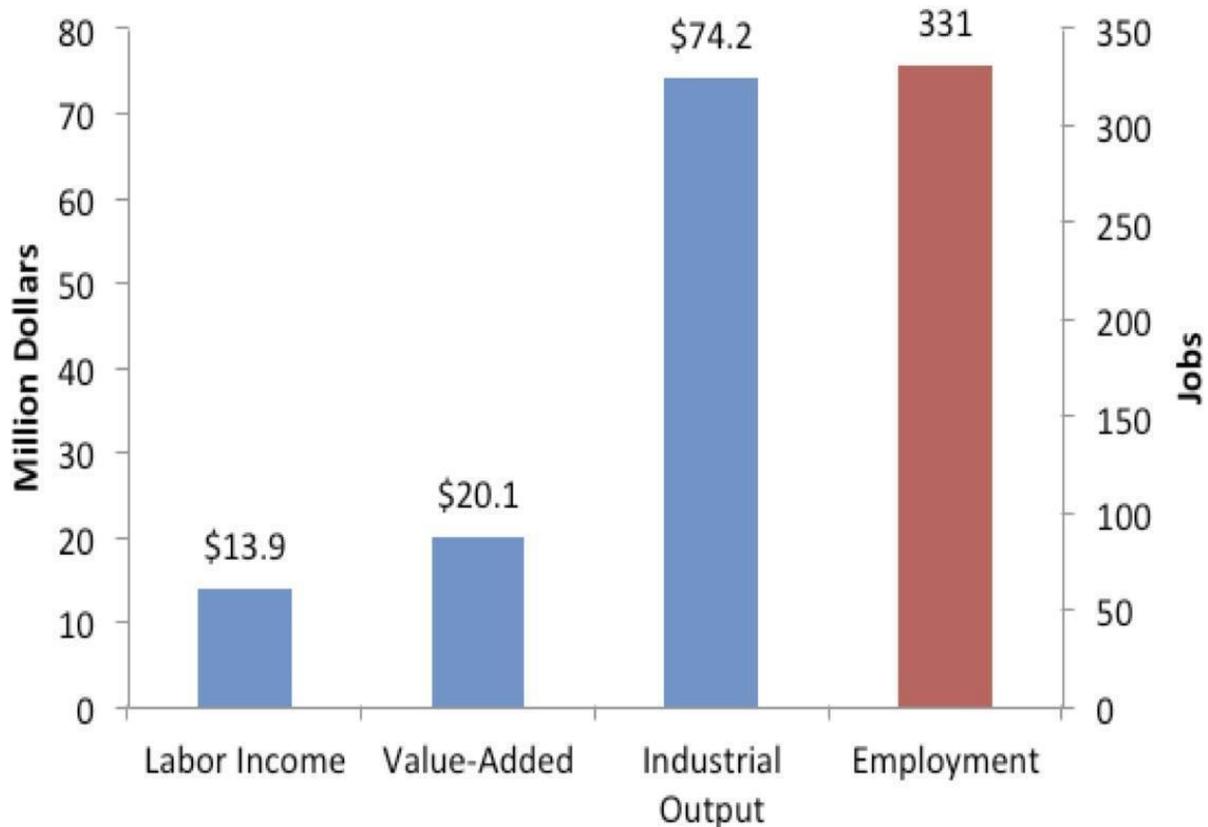


Figure 23: Direct economic impact of Hocking County's forest industries, 2010. Labor income, value-added, and industrial output are represented on the left Y-axis, and employment is represented on the Y-axis. Source: OSU.edu.

Table 24 – Agricultural Services, Forestry, Fishing, and Other Employment as a Percent of Total Employment (2000)

Location	Agricultural Services, Forestry, Fisheries, and Other Employment		Total for all Economic Sectors		Agricultural Services Sector as a Percent of the Total for all Economic Sectors	
	Jobs	Wages (1996 \$ in millions)	Jobs	Wages (1996 \$ in millions)	Jobs	Wages (1996 \$ in millions)
Athens	210	\$2.48	27,760	\$661.94	0.8%	0.4%
Gallia	160	\$1.49	16,340	\$389.19	1%	0.4%
Hocking	70	\$2.46	10,300	\$228.19	0.7%	1%

Figure 24: Hocking County’s Agriculture Services, Forest, Fishing, and Other Employment statistics. Source: Hocking Hills Healthy Woodlands.

V. Hocking State Parks and Preserves

Figure 25: This displays available activities in Hocking

Hills public lands. Source: hockinghillsstatepark.com

Activity	Facilities	Quantity
Resource	Land, acres	2,356
	Water, acres	17
	Nearby State Forest, acres	9,238
Activities	Fishing	yes
	Hiking Trail, miles	26
	Picnicking	yes
	Picnic Shelters	4
	Visitor Center	yes
	Summer Nature Programs	yes
	Restaurant (seasonal)	yes
	Game Room (seasonal)	yes
	Outdoor Swimming Pool (seasonal)	yes
	Winter	Ice Fishing
Cottages	Family Cottages, #	40
Camping	Non-electric Campsites	12

A. Inventory

Hocking County is home to breathtaking natural attractions such as cascading waterfalls, cliffs, deep recess caves, forestland, gorges, and rock outcrops. Hocking County has two state parks and eight nature preserves that covers approximately 5,489 acres. The state parks include the Hocking Hills State Park and Lake Logan. The nature preserves include Boch Hollow, Conkle’s Hollow, Crane Hollow, Kessler Swamp, Little Rocky Hollow, Rockbridge, Saltpetre Cave, and Sheick Hollow. These areas are well known for their old growth Eastern Hemlock, Black Birch, and Canada Yew as well as other endangered and threatened species in the area. Many travel to these locations to see the unique landscape and natural structures such as Blackhand Sandstone, and the intrinsic caves and waterfalls. Most nature preserves and state parks are used to provide services to people, whether it be for recreational, hunting, or cultural. Most nature preserves are reserved for trails, and hunting opportunities, while the state parks mainly exist for their tourism aspects. Recreation in these areas

includes fishing, camping, canoeing, horseback riding, shopping, climbing, ATV Trails, plane rides, hiking and nature watching.

Permits:

- A valid Ohio fishing license is needed before a person can fish in Rose Lake.

B. Ecosystem Services

Each of these areas offer specific environmental services that have proven to have significant value to the public.

Biotic Services

Within the Hocking County State Parks and Nature Preserves there are many species of interest within the area such as the prominent Eastern Hemlock Trees. These areas have also been known to house white and black oak, tuliptree, shagbark and pignut hickory trees. There are eight recorded endangered species and two threatened species in these areas. Species of high value and interest in the area include three species of warblers, the Indiana Bat, the running buffalo clover, the northern monkshood and the small whorled pogonia. Each species has a preferred habitat and range that make it significant to this area.

Endangered Species

- Indiana Bat (*Myotis sodalis*)

During winter seasons the Indiana bat seeks shelter in caves and abandoned mines to hibernate. After hibernation the bats migrate to wooded areas where they roost under loose tree bark or snags within the area (Menzel etc. 2001).

- Warblers

The cerulean warbler (*Setophaga cerulea*) worm-eating warbler (*Helminthos vermivorus*) and wood thrush (*Hylocichla mustelina*) are all birds of high interest within the area. Most of these birds favor mature woodland cover for breeding and nesting, which the state parks and preserves are known for.

- Running Buffalo Clover (*Trifolium stoloniferum*)

Plant of interest within Hocking State Park specifically as it can be found in a few key areas.

Invasive Species

- According to the ODNR, the woolly adelgid (*Adelges tsugae*) is main invasive species of the area as it poses a threat to most of the eastern hemlock trees within Hocking County. There have been efforts to prevent the woolly adelgid from moving further north in Ohio by treating most of the hemlock trees in the area, mainly in Hocking Hills State Park.

Hocking Hills State Park Trail Map

19852 SR 664
Logan, Ohio 43138

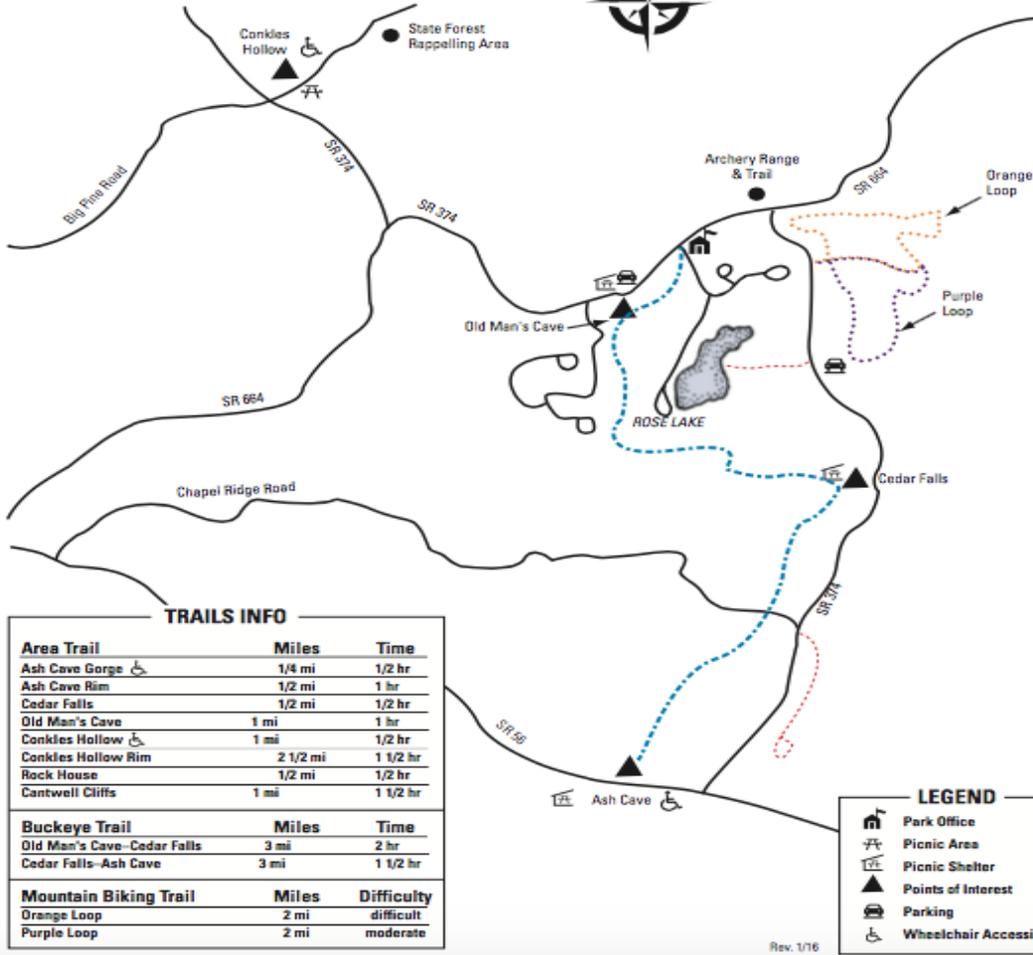
(740) 385-6841 ext. 3 - Park Office
(740) 385-6165 ext. 250 - Camp Office

TRAILS

- Mountain Bike- Orange Loop
- Mountain Bike- Purple Loop
- Rose Lake/Hiking Trail
- Grandma Gatewood/Buckeye Trail

N

Scale
0 1/2 1 mile



TRAILS INFO

Area Trail	Miles	Time
Ash Cave Gorge	1/4 mi	1/2 hr
Ash Cave Rim	1/2 mi	1 hr
Cedar Falls	1/2 mi	1/2 hr
Old Man's Cave	1 mi	1 hr
Conkles Hollow	1 mi	1/2 hr
Conkles Hollow Rim	2 1/2 mi	1 1/2 hr
Rock House	1/2 mi	1/2 hr
Cantwell Cliffs	1 mi	1 1/2 hr

Buckeye Trail	Miles	Time
Old Man's Cave-Cedar Falls	3 mi	2 hr
Cedar Falls-Ash Cave	3 mi	1 1/2 hr

Mountain Biking Trail	Miles	Difficulty
Orange Loop	2 mi	difficult
Purple Loop	2 mi	moderate

LEGEND

- Park Office
- Picnic Area
- Picnic Shelter
- Points of Interest
- Parking
- Wheelchair Accessible

Rev. 1/16

Abiotic Services

Much of these areas are well known for their unique landscape. Per ODNR these parks and nature preserves have qualified this land to be one of the oldest preserved locations in Ohio due to it being an unglaciated plateau.

Figure 26: Map of the Hocking Hills State Park trails. Source: parks.ohiodnr.gov

Aquatic Services

Per the Hocking Hills Woodland Plan, the Hocking Watershed drains northern and eastern sections of the plan area and includes other sub-watershed from other streams.

The Scioto Watershed drains the western section of the plan area for Hocking Hill State Park, and includes the sub-watershed from other streams in that area.

There are a few surface water areas, this mainly includes Lake Logan, but also the network of streams in the area. Even so, it is worth noting that the Hocking County public mainly uses groundwater as their main source.

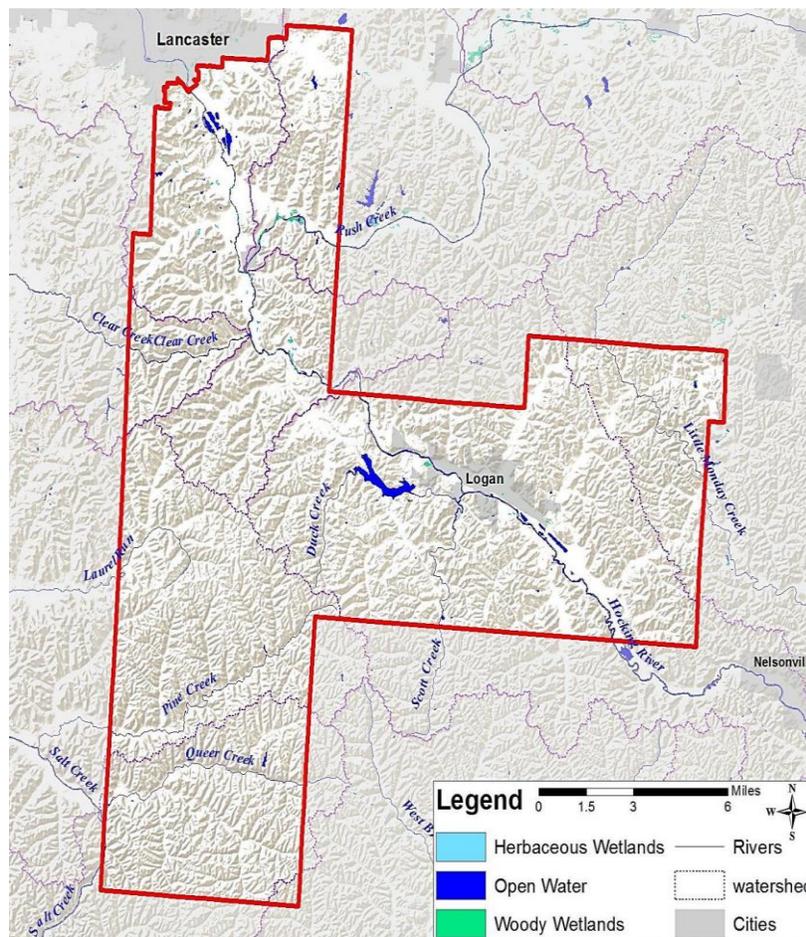


Figure 27: Watersheds for the planned area of Hocking Hills Woodlands. (ODNR, 2013). Figure also shows their managed area, which includes most Hocking county nature preserves and Hocking Hill State Park.

Soil Services

There are a few woody wetlands in the area that may prove to have specific soils and

ecosystem unique to these areas. Most of the other land consists of the soils in the Allegheny Plateau. In general, these soils occurring on the southwest facing slopes have thinner A1 and more developed A2 and B horizons in the soils on the Northeast-facing slopes (Finney, 1962).

Cultural Services

These lands serve as special landmarks where we find history, beauty and unique habitats. Hocking Hills State Park and other nature preserves contain beautiful caves that are unique to Ohio. Per the ODNR there are historical intrinsic landscapes that have been around for thousands of years and display one of the few unglaciated areas of Ohio that have been relatively untouched. Some of these cultural services have become specific tourist attractions at these locations: Ash Cave, Cedar Falls, Old Man's Cave, Conkle's Hollow, Cantwell Cliffs, and Rock House.

C. Ecosystem Goods

- Active Mines in Hocking Hills State Park
As of 2016 there are no active mines in Hocking Hills State Park
- Oil and Gas in Hocking Hills State Park
While there is oil and natural gas drilling in Hocking Hills, none of this drilling is taking place in the State Park.
- Logging
In Hocking Hills State Park there are current laws that prohibit loggers from logging any part of the park. But it is becoming an area of increased interest because of the forest coverage and revenue it could produce for the area.

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