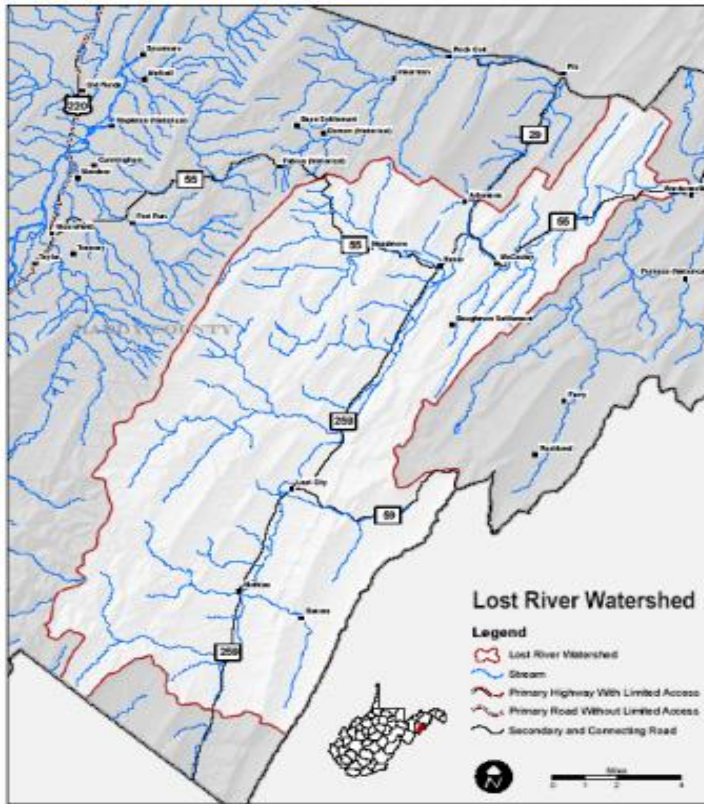


Background



The [*Cacapon River and Lost River watersheds*](#) are made up of three major river segments and many smaller stream watersheds. Overall, the watershed includes the Lost and North River watersheds and many smaller streams for a total of 680 square miles. The Cacapon watershed is one of five major West Virginia basins that flow to the [*Chesapeake Bay*](#).

The watershed is located in the Appalachian Mountains of West Virginia's Eastern Panhandle Region. One of the counties within the watershed is Hardy County. Through this county is a wide valley containing fertile, farming lands. Agriculture and stock raising have always been the main source of employment in this area, with hay, corn, wheat, apples, peaches, melons, cattle and poultry being important to the local economy.

Hardy County also includes high mountains with rough terrain and vast areas of forestland. Because of the forest's wildlife is plentiful and includes game species such as deer, bear, turkey, squirrels, and some ruffed grouse. However, grouse populations are declining due to lack of habitat. The populations of small game species, such as rabbits, beaver, and quail, have been declining for decades. Non-game species include neo-tropical migrant birds and bald eagle. Theories suggest poor habitat quality or decreased habitat may be causative factors.

Hunting has always been a major recreational activity in the county, but chronic wasting disease (CWD) has put a dent in deer hunting. Although there is no evidence CWD is transmitted to humans, people may not eat deer meat in areas where CWD has been reported. In general, hunting in Hardy County and the surrounding region has decreased. [*WV Division of Natural Resources*](#) (WVDNR) wildlife managers indicate that older hunters have stopped hunting, and the younger generation isn't replacing them.

Hardy County is part of the Appalachian oak forest region which is characterized by a system of parallel valleys and ridges. Northern red, black, scarlet, chestnut, and white oaks, various species of hickory, and Virginia and white pines make up the majority of the trees in the region. Forest managers are concerned that the large deer populations have impacted oak reproduction to the point where oak seedlings are lacking in most areas. If the forests aren't managed for oak, they'll eventually revert to maple. Oak, which is important to wildlife, will become a minority species over the decades.

Golden-winged and Cerulean warblers have been found in Hardy County, but their populations are low. Both lack habitat. However, about three habitat restoration projects began in 2019 to improve the habitat for the cerulean warbler. The county is eligible for golden-winged warbler habitat improvements through the [Working Lands for Wildlife](#), but no landowners have been contacted regarding participation.

The unincorporated community of [Baker](#), located at the intersections of U.S. Route 48, West Virginia Route 55, and WV Routes 29 and 259, is in Hardy County. The population for Baker's zip code was 1,262 following the 2000 [Census](#). Note: The zip code covers a much larger area than the actual community itself. The most recent Census data estimates the county's population at 13,757, which is a 1.8% decrease. The water supply for Baker and its surrounding area comes from the 34.5-acre impoundment, Parker Hollow Lake, which is fed by Camp Run and Parker Hollow, tributaries of Baker Run. The lake is located adjacent to County Route 11 (Parker Hollow Road).

The lake was built in 2006 with a maximum depth of 35 to 40 feet. No camping is allowed, and restrooms are not available. A concrete boat ramp and dock are available for boating convenience. Motorboats are restricted to electric motors only. The use of live minnows for bait is prohibited. A large parking lot, accommodating 30 vehicles, lies adjacent to the lake and provides easy maneuverability for boat trailers. The shoreline area adjacent to the parking lot also provides easy bank fishing access.

Parker Hollow Lake was stocked with bluegill and largemouth bass in 2007. Green sunfish were present in the watershed before the lake was filled and naturally breed with bluegill, creating hybrid sunfish. To enhance sport fish populations and to encourage reproduction, several channel catfish stockings have been conducted in conjunction with a variety of habitat improvements during and after the construction of the lake. Black crappies are also present in the lake due to unauthorized release by anglers. Crappie were stocked before an ideal forage base could be established by WVDNR, and, therefore, may never become a sustainable fishery. Standing dead trees remain in both the Parker Hollow Run and Camp Branch arms of the lake and provide for diverse fishing opportunities and refuge habitat for young fish.

Algal blooms have developed in the lake over the past several years, often affecting a large portion of the lake's surface area. These blooms are often fed by nitrate and phosphorous, which commonly appear in water contaminated by runoff from farm fields and poultry operations upstream. WVDNR and [WV Department of Environmental Protection](#) (WVDEP) have confirmed the presence of the harmful blue green algae *Microcystis aeruginosa*. This one-celled bacteria is a genus of freshwater cyanobacteria that can produce neurotoxins and hepatotoxins (liver toxins), such as [microcystin](#) and [cyanopeptolin](#), which have led to fish kills in Parker Hollow Lake and to probable health hazards to humans. Since they can form large surface blooms, they are capable of out-competing other phytoplankton by monopolizing light in the lake's photic zone. They thrive because of the high nutrient levels flushing in from upstream agricultural lands and the warm water temperatures of the lake.

Because of the recent algal blooms State agencies determined that the level of toxins in Parker Hollow Lake make it potentially unsafe for water contact activities. Boating and other recreational activities are allowed, but the public is advised to use caution and to avoid prolonged exposure to the water, and, in particular, to avoid any activity that could lead to ingestion. There are risks to humans from prolonged contact with skin and ingestion. Symptoms from external exposure include skin rashes, lesions, and blisters not to mention internal digestive discomfort and other serious

problems. Animals that drink the water or groom themselves after a swim are also susceptible to the same risks as humans.

A water treatment plant downstream from the lake required the removal of turbidity, organic carbon, bacteria, and viruses, which are subject to seasonal fluctuations. After some operational adjustments the plant came online in 2012, and at that time met minimum drinking water standards. Although the plant is functioning, current systems do not adequately treat increased sediment, organics, and bacteria loads from the lake. In order to treat these additional problems, the plant would need upgrading at a significant cost to the county and local residents.

Landowners upstream of the reservoir have been contacted regarding how they could help improve the reservoir's water quality. Many are interested in implementing practices to improve water quality, and they care about seeing the safest water delivered to the plant's customers, particularly the local school and nursing home. However, most do not believe that their efforts would help significantly.

Solution

Your team consists of a panel of expert watershed managers who have helped communities with their water, wildlife, and forest resource issues. With the information provided here, the suggested internet links and your own research, your team must address the following:

1. What can be done to decrease the effects of the blue-green algae that's creating toxic conditions in the lake?
2. What needs to be done to convince upstream landowners to become involved in water quality improvements?
3. How can habitat be improved for the Golden-winged and Cerulean warblers and other wildlife species?
4. What BMPs can be used to decrease the need for additional water treatment thus reducing costs?
5. How can forest landowners better manage their forest resources and increase oak production?
6. Explain the interaction of surface water and groundwater with respect to how they interact and are affected by agriculture activities, forestry activities, man-made structures.
7. Describe how various conservation agencies and other stakeholders can partner for conservation success. Who are the nongovernmental and local stakeholders? How can local and regional efforts better coordinate?
8. Research past and present select watershed and source water planning documents for the region and determine if these are useful for future planning purposes. Identify your selections, and briefly summarize the resources regarding their usefulness. Make recommendations in areas where the documents may fall short.

References

[Parker Hollow Lake](#) (Google map)

[WVDNR – Parker Hollow Lake](#)

Algal blooms

- [Anabaena](#)
- [Harmful algal blooms](#) (USEPA)
- [Microcystis](#)

Nutrient and BMPs

- [Phosphorus cycle](#) and [Nitrogen cycle](#)
- [BMP technologies clearinghouse](#)
- [BMPs to minimize phosphorus impacts to water quality](#)
- [Erosion and Sediment Control BMP Manual](#)
- [Management of nitrogen and phosphorus](#)

Groundwater and karst

- [Appalachian karst map](#)
- [Groundwater](#)
- [US karst maps](#) (USGS)
- [WV Geologic and Economic Survey](#)

Watershed management

- [Lost River watershed based plan](#)
- [Lost River watershed](#) (NRCS)
- [Moorefield comprehensive plan](#)
- [Safe Water – Baker Project](#)
- [WVDHHR source water and wellhead programs](#)
- [Water resources sustainability and safe yield in WV](#)
- [WVDEP: water resources management plan](#)

Other resources

- [Cerulean Warbler](#)
- [Confined Animal Feeding Operation \(CAFO\) permit info](#)
- [Golden-winged Warbler Working Group](#)
- [Working Lands for Wildlife](#)
- [WV Forest Stewardship Program](#)