



*The Role of Natural Areas
in Water Quality Issues*

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Abstract

Roads are widely recognized in the scientific literature as having a profound effect on the landscape and are one of the primary risks for a variety of environmental impacts. It has been recognized that unroaded areas and areas with low road density tend to have fewer and less severe impacts to their aquatic and riparian resources than heavily roaded areas. Several qualitative measures of stream and watershed health, water quality, and aquatic diversity have been used to assess stream conditions. We will compare these assessments to measures derived through GIS modeling. These GIS metrics will be used to compare low road density areas in the Southern Appalachian Mountains to areas of higher road density. We will also look at the efficacy and limitations of some of the strategies used to mitigate the effects of roads. The implications for management and preservation of unroaded and low road density areas are examined.

Early Focus on Water Quality

“A national policy which, though considering the direct influence of forests as a source of timber, fails to take full account also of their influence upon erosion, the flow of streams, and climate, may easily endanger the well-being of the whole people.”

*Dr. Raphael Zon, US Senate Document
No. 469, 1912*



LAUNCHED INITIAL DRIVE FOR PARK—Shown here are 31 of the delegates who attended a meeting at the old Battery Park hotel in Asheville in 1879 and organized the Appalachian National Park association to promote the establishment of a national park in the Southern Appalachian mountains. The photograph was made by A. B. Pope while the group was waiting the Biltmore estate. The engraving is from a print owned by George H. Southern, prominent Asheville attorney. Among those shown, from left to right, are: Front row, E. P. McQuinn, former manager of the Battery Park hotel, first; S. P. Ramez, of Asheville, third; S. C. Satterthwaite, fourth; Pleasant A. Sivall, of Savannah, Ga., fifth; Charles A. Wall, of Asheville, sixth; Dr. H. N. Walls, of Waynesville, seventh; Dr. Chas. P. Jenkins, of Asheville, eighth; back row, Frank Jester, of Dillsboro, first; Captain J. E. Fay, of Asheville, third; N. G. Gonzalez, of Columbia, S. C., chairman of the meeting, fourth; George S. Powell, of Asheville, fifth; Josephus Daniels, of Raleigh, sixth; Herbert Ferguson, of Waynesville, seventh; A. H. McQuinn, eighth; W. G. Cash, ninth; H. T. Collins, tenth; R. D. Gilmer, eleventh; Marion Butler, then U. S. senator from North Carolina, twelfth; George H. Slaughter, of Asheville, thirteenth; Sam Welch, of Waynesville, fourteenth; James R. DeBow, fifteenth; W. T. Crawford, of Waynesville, sixteenth; Linton Alexander, seventeenth; C. A. Schmitt, eighteenth, and S. Winkler, of Charlotte, nineteenth.

MESSAGE

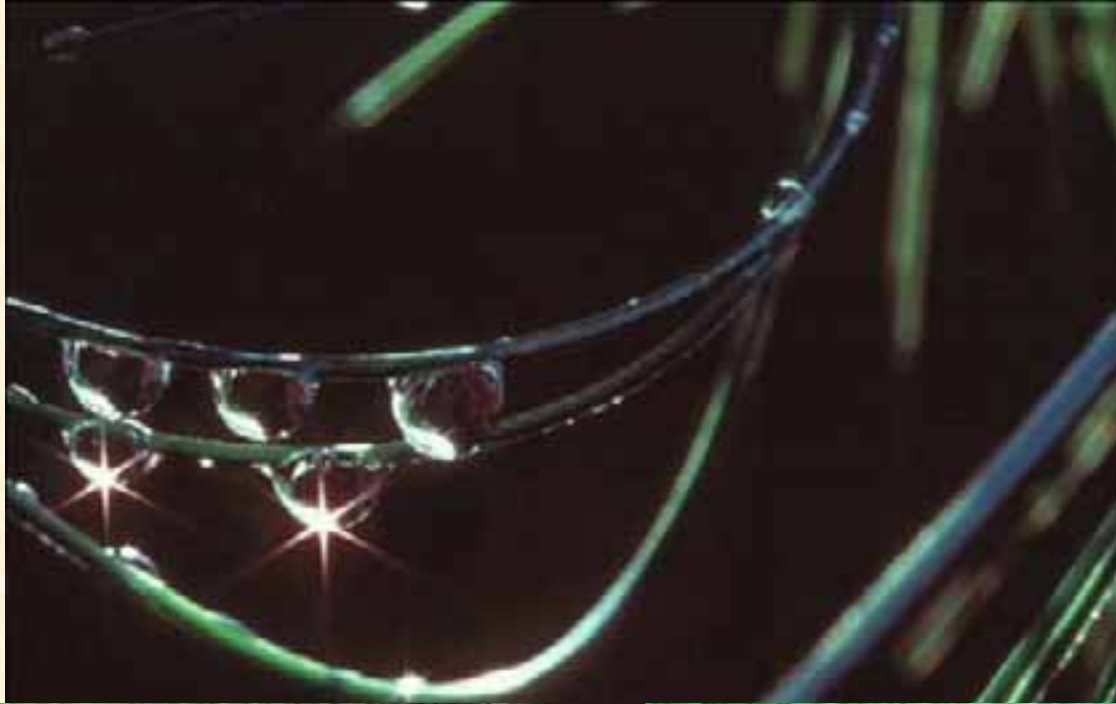
PRESIDENT OF THE UNITED STATES

A REPORT OF THE SECRETARY OF MINISTERS IN
RELATION TO THE FORESTS, RIVERS, AND
WATERWAYS OF THE SOUTHERN
APPALACHIAN REGION.

WASHINGTON,
GOVERNMENT PRINTING OFFICE,
1912.



Conservation Relevance of Water Quality Issues



*Impacts of Interstate Road Construction in
Mountain Terrain*



*Impacts of Road Construction
in Mountain Terrain*





United States
Department of
Agriculture
Forest Service

Pacific Northwest
Research Station

General
Technical Report
GTR-339
May 2001



Forest Roads: A Synthesis of Scientific Information



Terrestrial Effects of Roads

The terrestrial and terrestrial habitat effects of roads are profound...

Terrestrial Effects of Roads

Comprehensive mitigation of the full array of road-associated effects on terrestrial vertebrates of conservation concern poses one of the most serious of land management challenges.

Aquatic Effects of Roads

- ❖ *Degradation of Water Quality*
- ❖ *Erosion*
- ❖ *Sedimentation*
- ❖ *Mass Wasting*
- ❖ *Constraints on movement of Aquatic and Terrestrial Species*
- ❖ *Alteration of physical stream channel dynamics*

Aquatic Effects of Roads

- ❖ *Constraints on stream channel migration*
- ❖ *Constraints on the natural movement of aquatic and riparian components including large woody debris, fine organic matter, and sediment*
- ❖ *Isolation of Floodplains*

Aquatic Effects of Roads

At the landscape scale, increasing road densities and their attendant effects are correlated with declines in the status of some non-anadromous salmonid species.

Aquatic Effects of Roads

One of the few examples of landscape-scale analysis of road influences has been the interior Columbia River basin environmental assessment (Quigley and others 1997).

The evaluation of road density and forest and range integrity in that study may serve to illustrate landscape-scale interaction of roads with their surroundings.

Aquatic Effects of Roads

Of the five indicator variables used, the proportion of a subbasin composed of wilderness or roadless areas seemed most closely associated with subbasins having high integrity indices; 81 percent of the subbasins classified as having the highest integrity had relatively large proportions of wilderness and roadless areas (>50 percent).

Aquatic Effects of Roads

Conversely, of subbasins with the lowest integrity, 89 percent had low proportions of roadless and wilderness areas, 83 percent had relatively high proportions of at least moderate road density (0.27 miles/square mile). None of the seven subbasins having high rangeland integrity had areas of moderate or high road densities.

Water Quality in the Southern Appalachians

❖ *Where Do We Find the Highest Quality Waters?*



Hypothesis

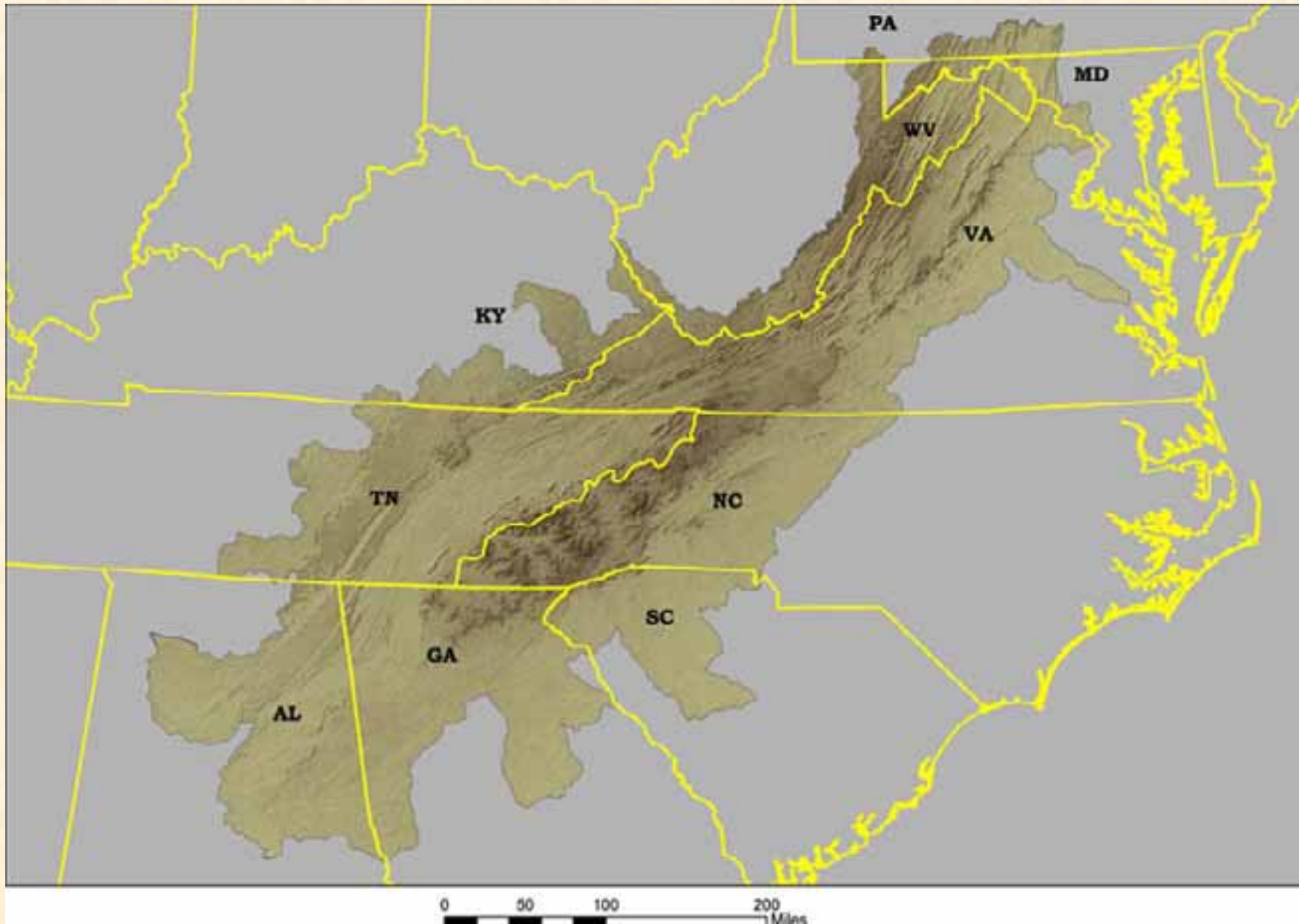
❖ *These high quality waters should be associated with watersheds of low road density*

Water Supply I - V (WS-I - V)

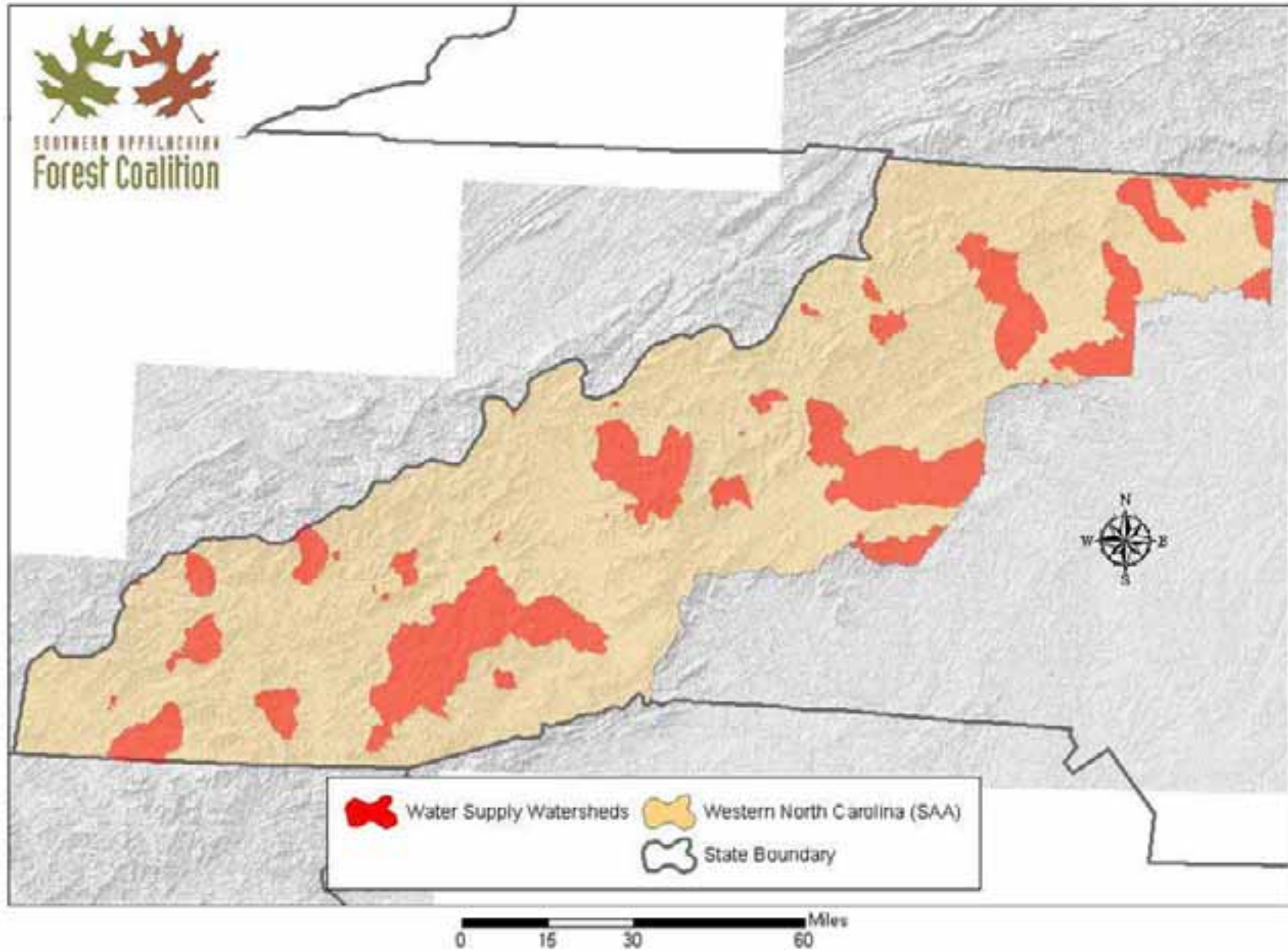
Waters used as sources of water supply for drinking, culinary, or food processing purposes.

WS-II, III, or IV classification is used where a WS-I classification is not feasible.

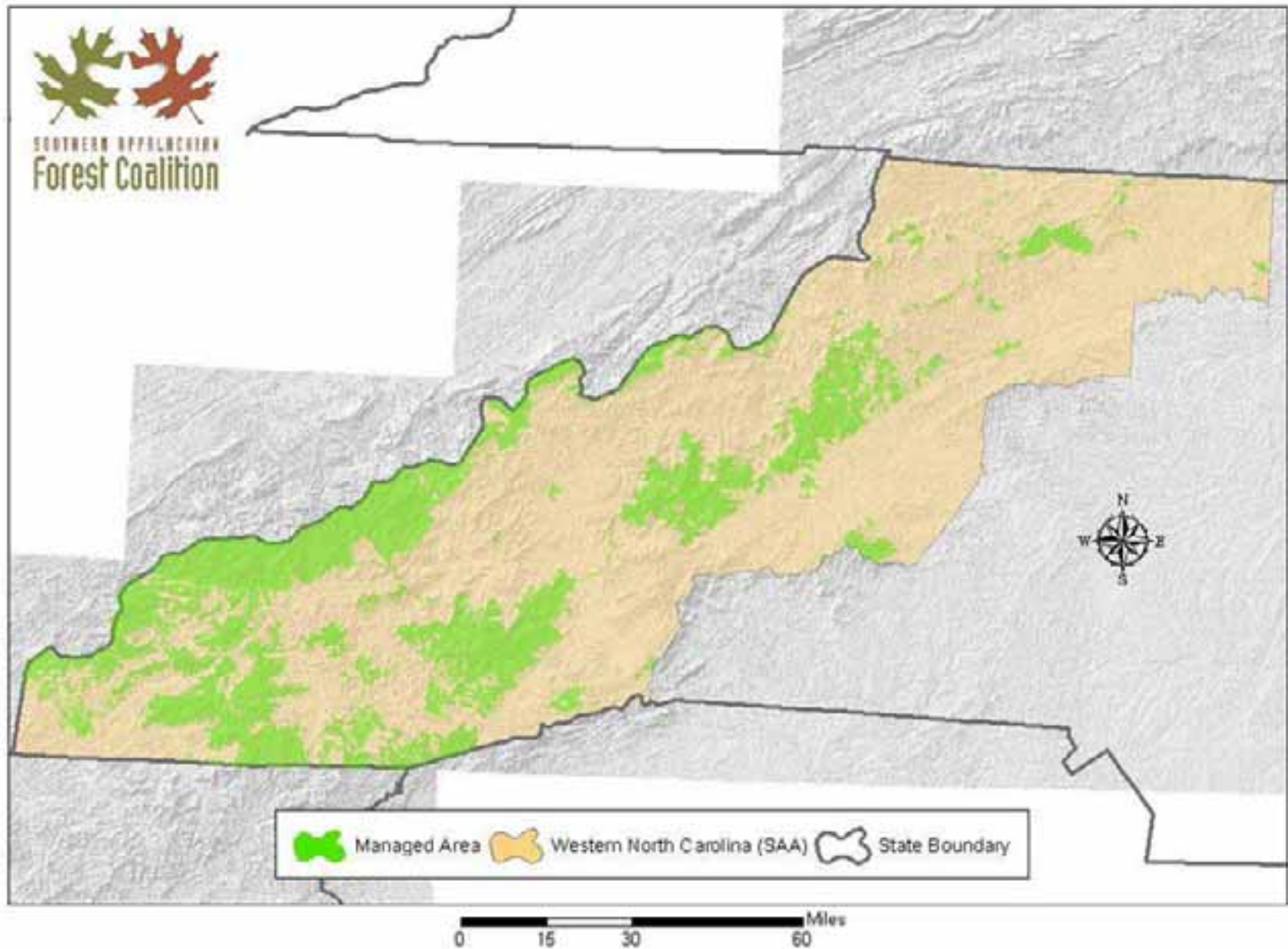
Southern Appalachian Region



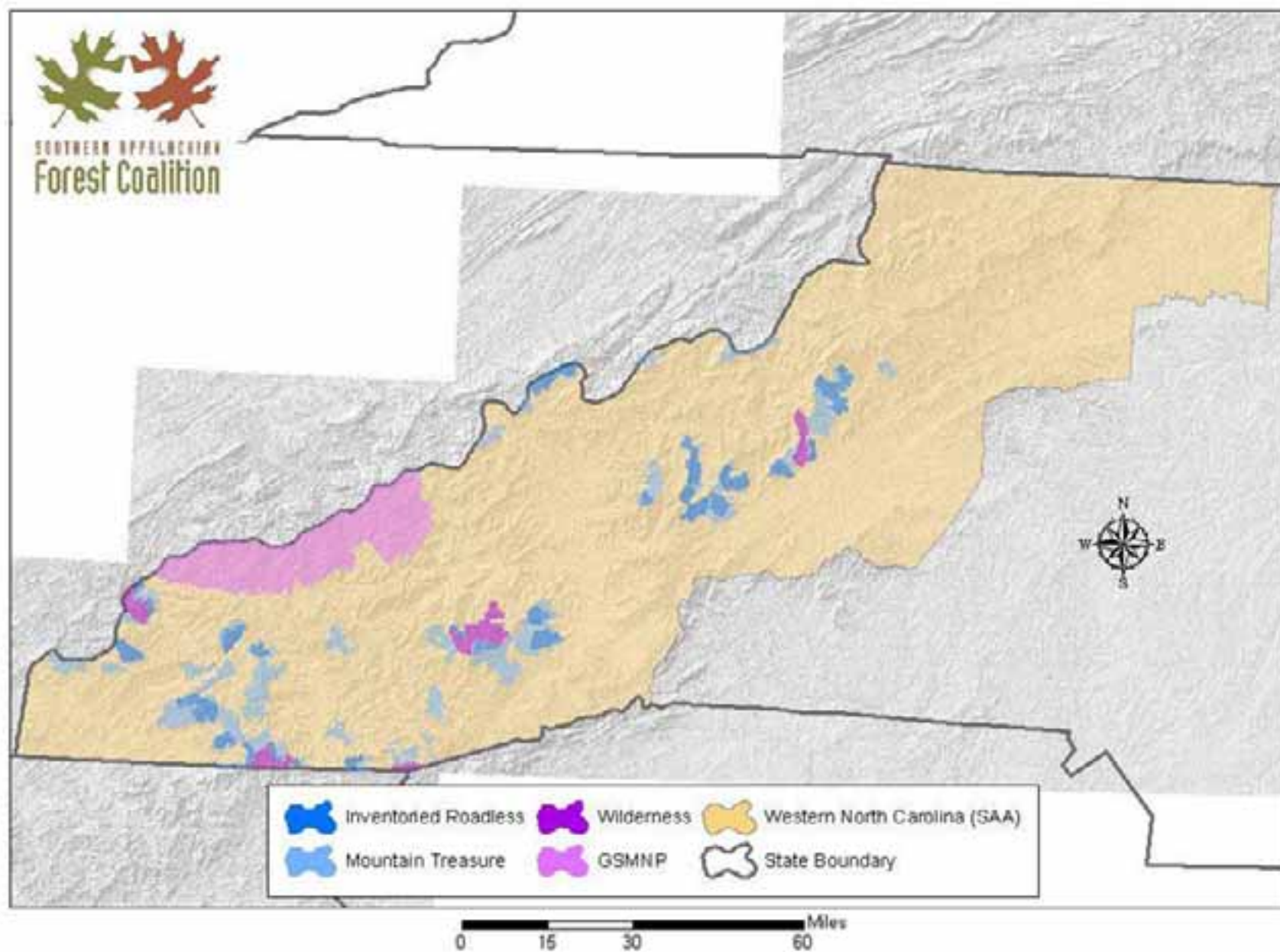
Water Supply Watersheds in Western North Carolina



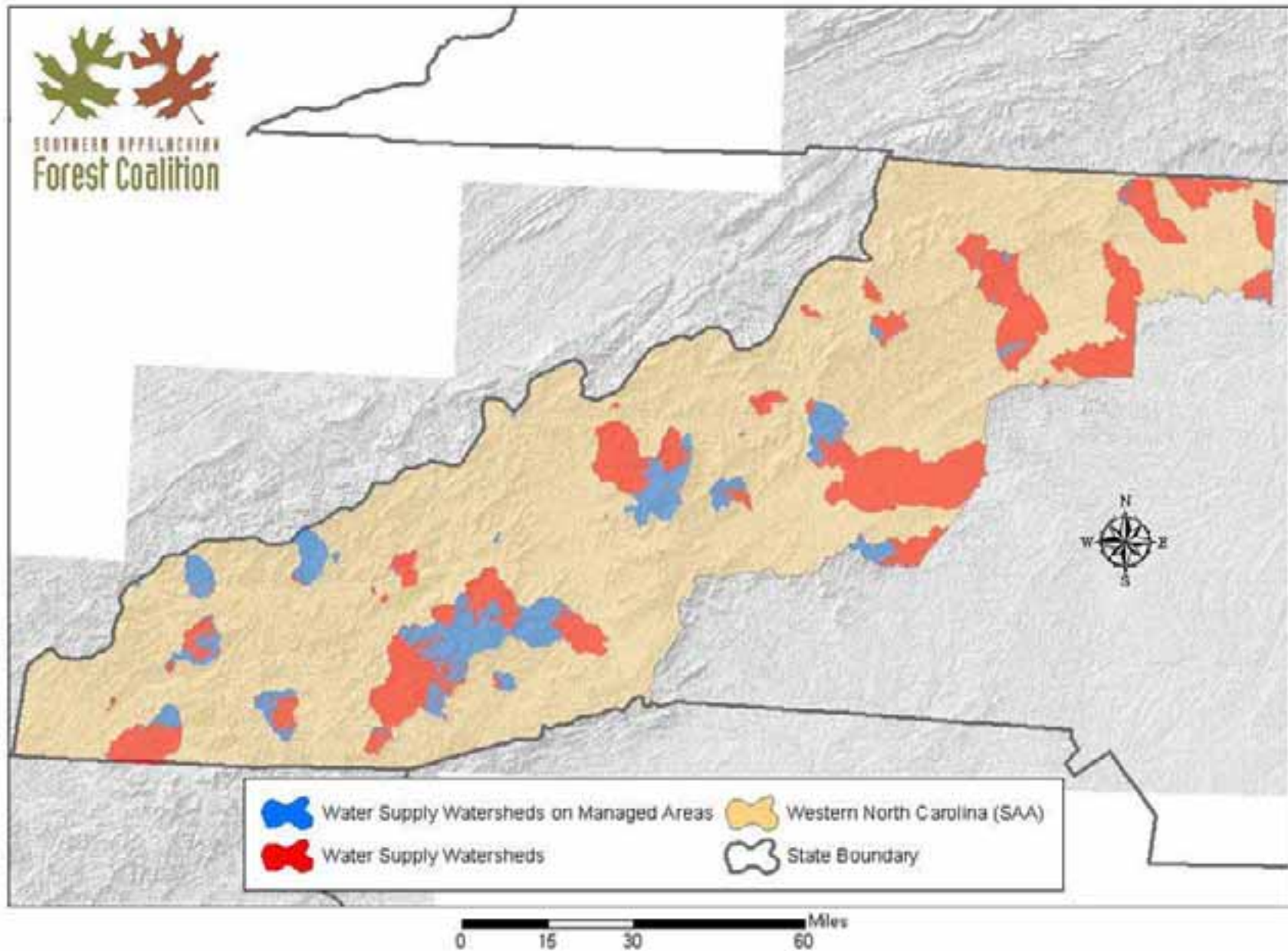
Managed Areas in Western North Carolina



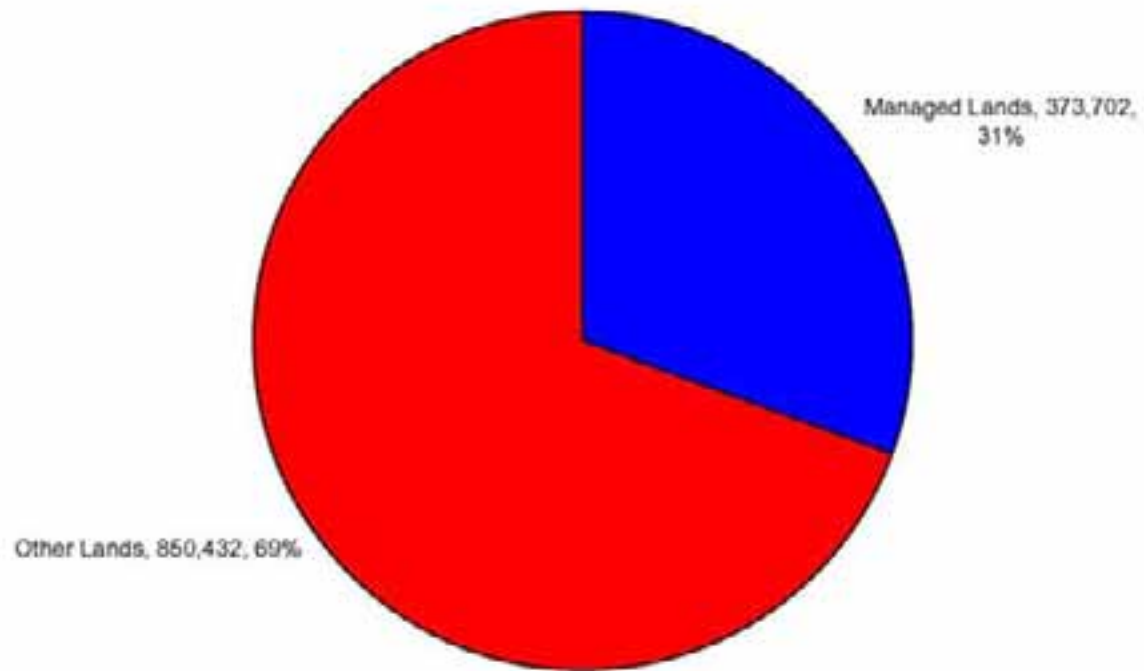
Roadless and Low Road Density Public Lands



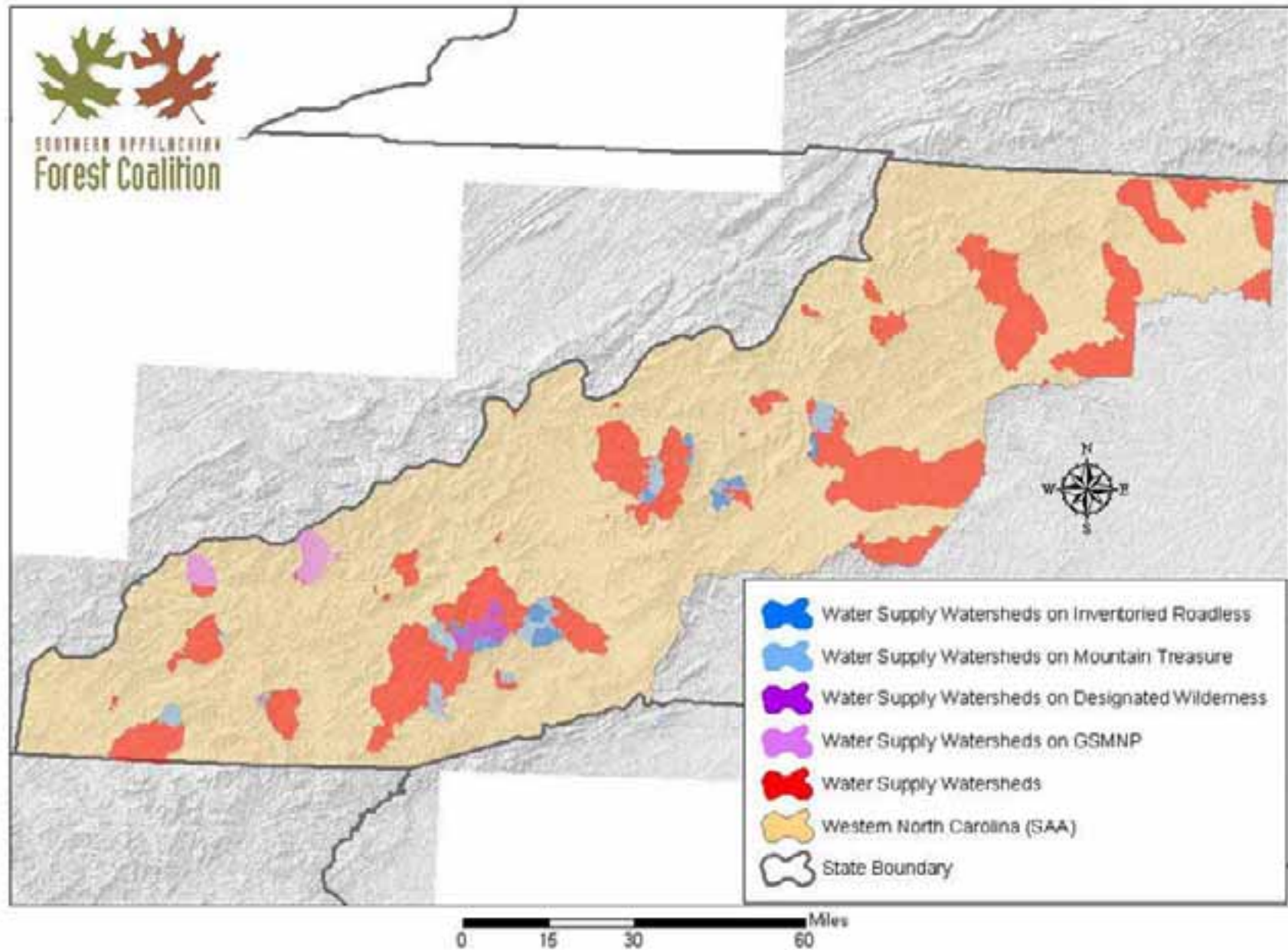
Water Supply Watersheds on Managed Areas in Western North Carolina



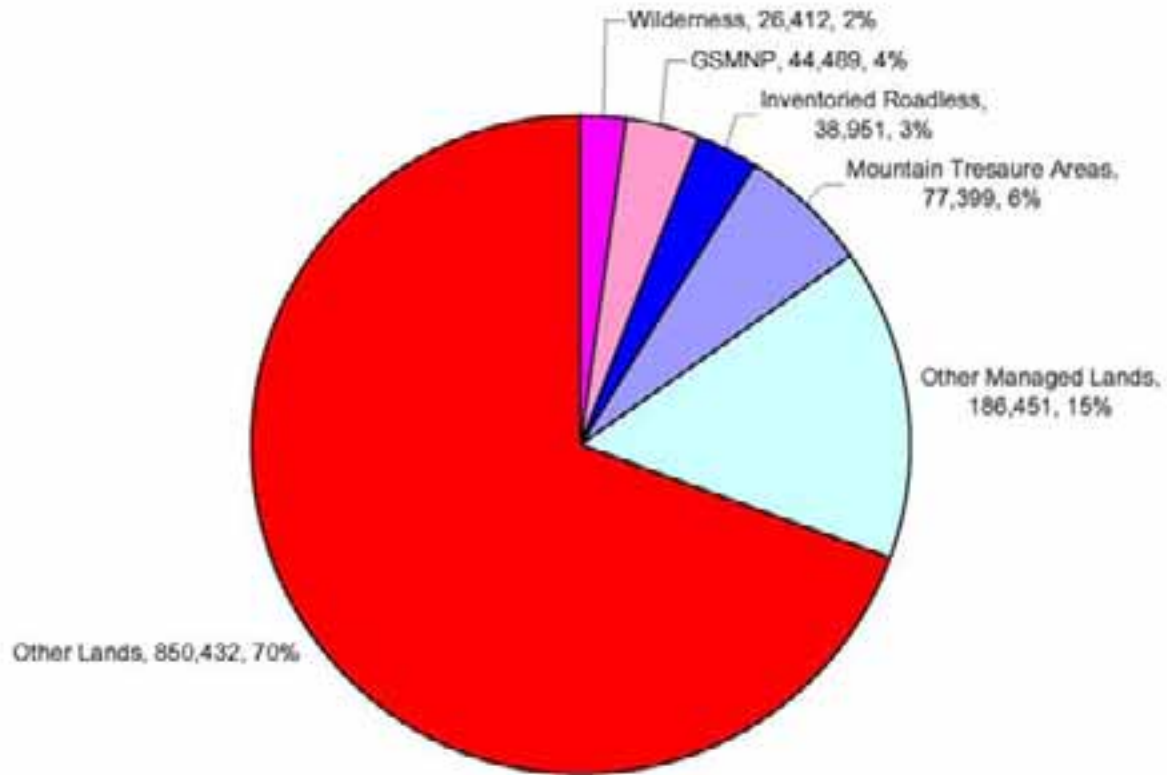
Composition of Water Supply Watersheds



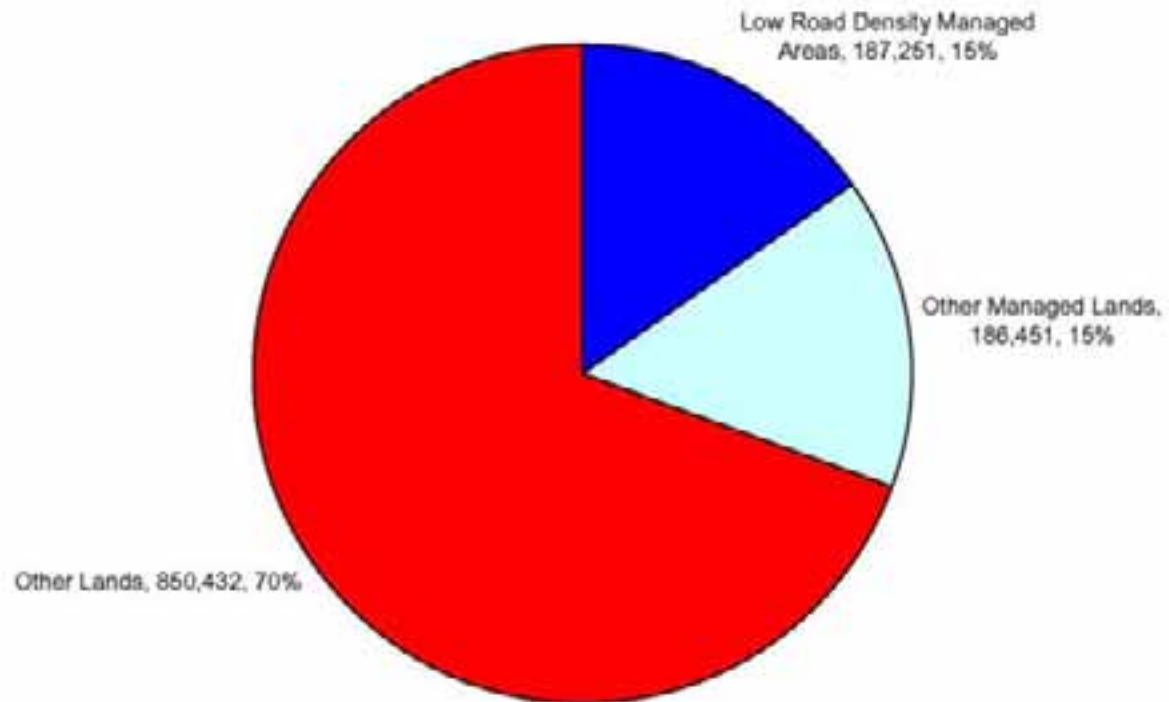
Water Supply Watersheds on Unroaded and Low Road Density Areas in Western North Carolina



Composition of Water Supply Watersheds



Low Road Density Composition of Water Supply Watersheds



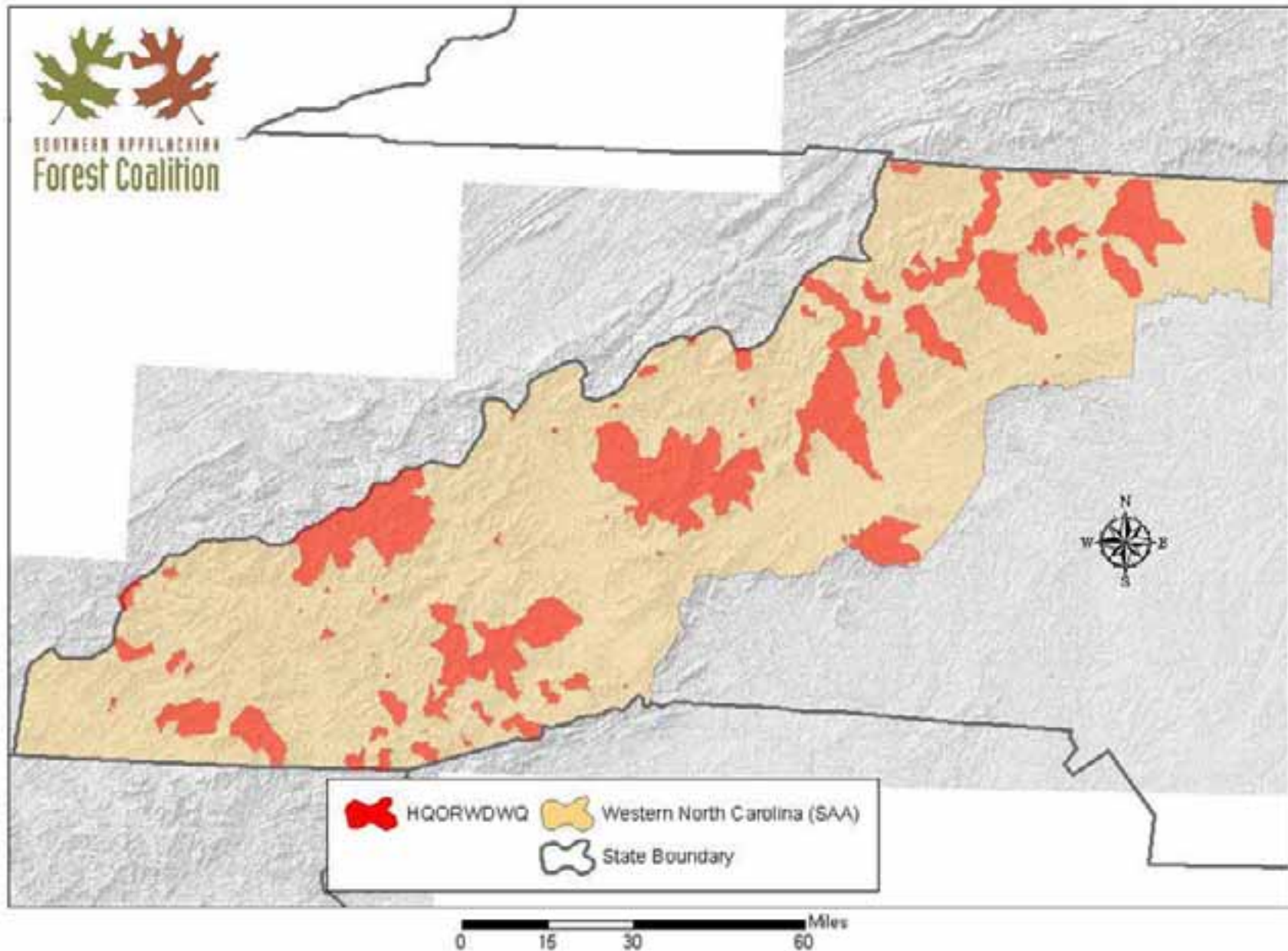
High Quality Waters (HQW)

Supplemental classification intended to protect waters with quality higher than state water quality standards.

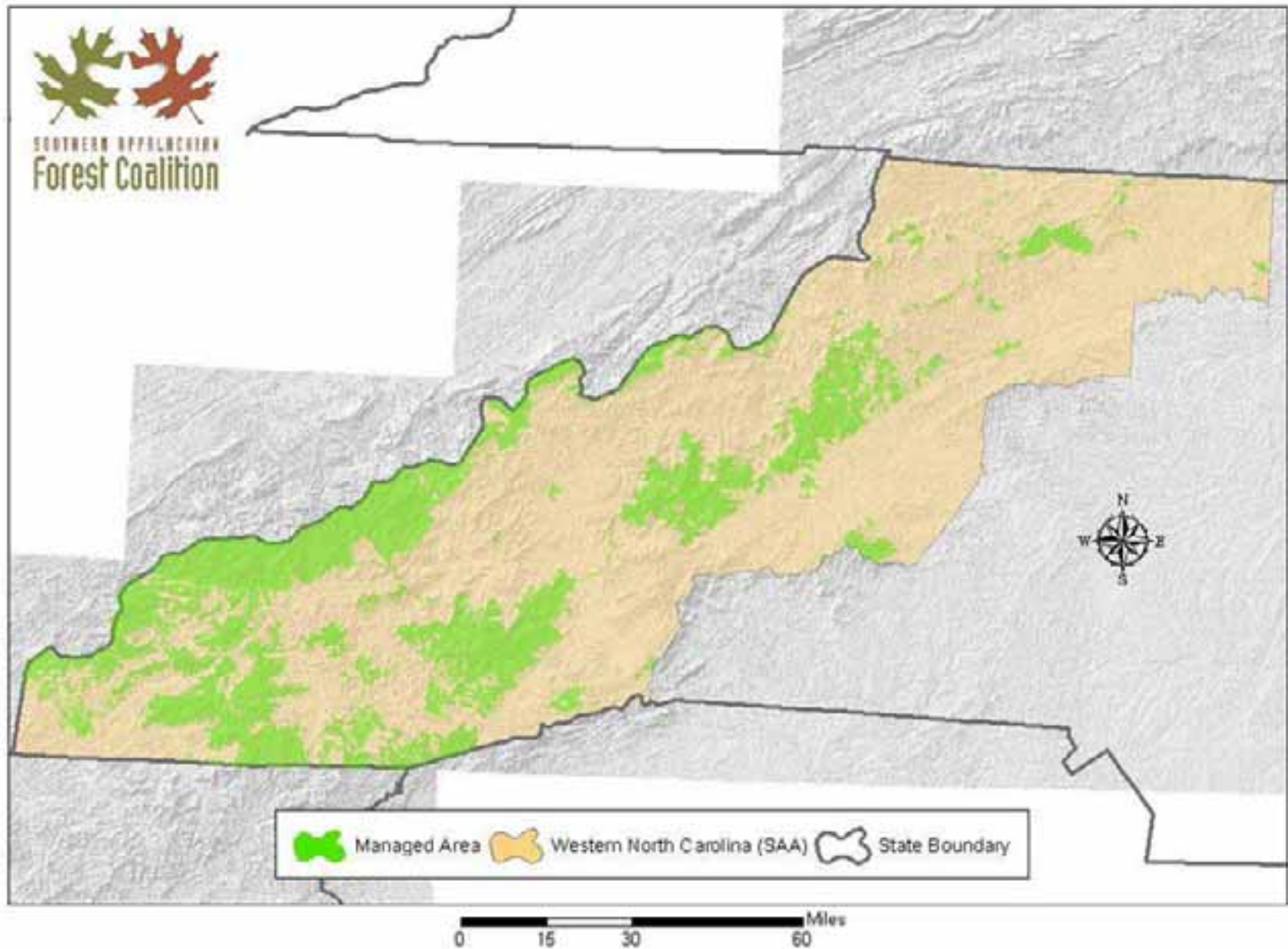
Outstanding Resource Waters (ORW)

Supplemental classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new discharges or expansions of existing discharges shall be permitted.

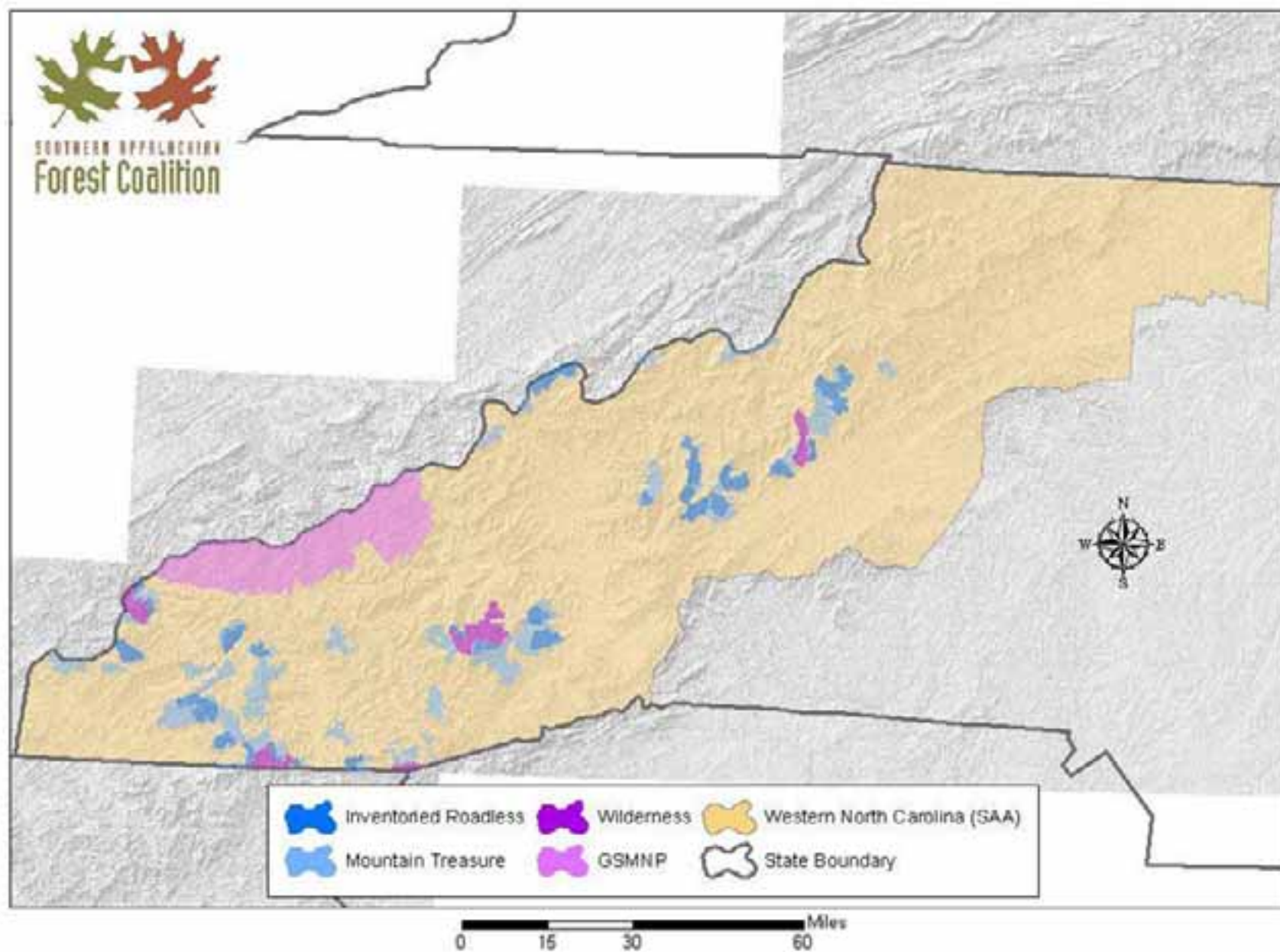
High Quality Waters and Outstanding Remarkable Waters in Western North Carolina



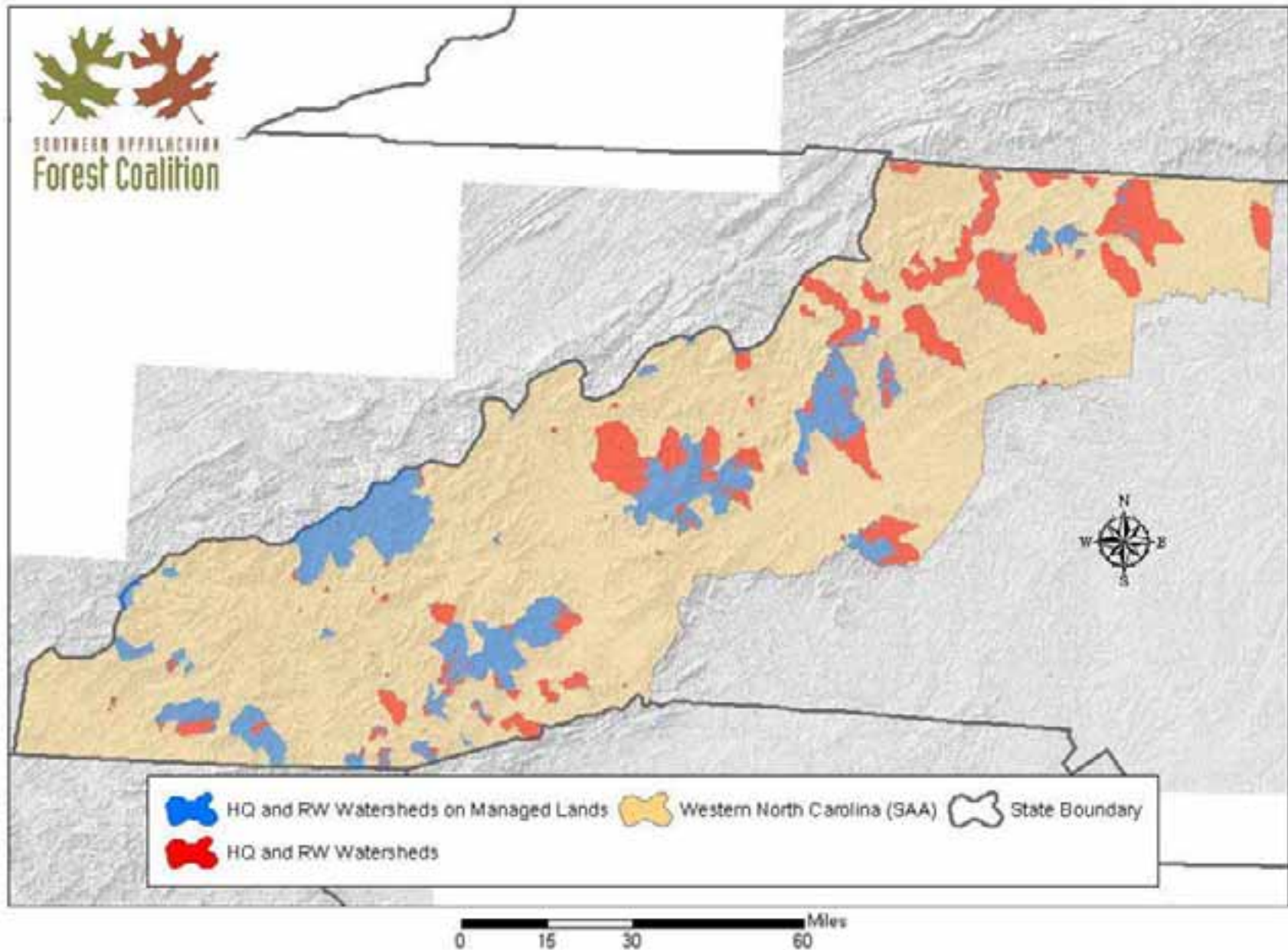
Managed Areas in Western North Carolina



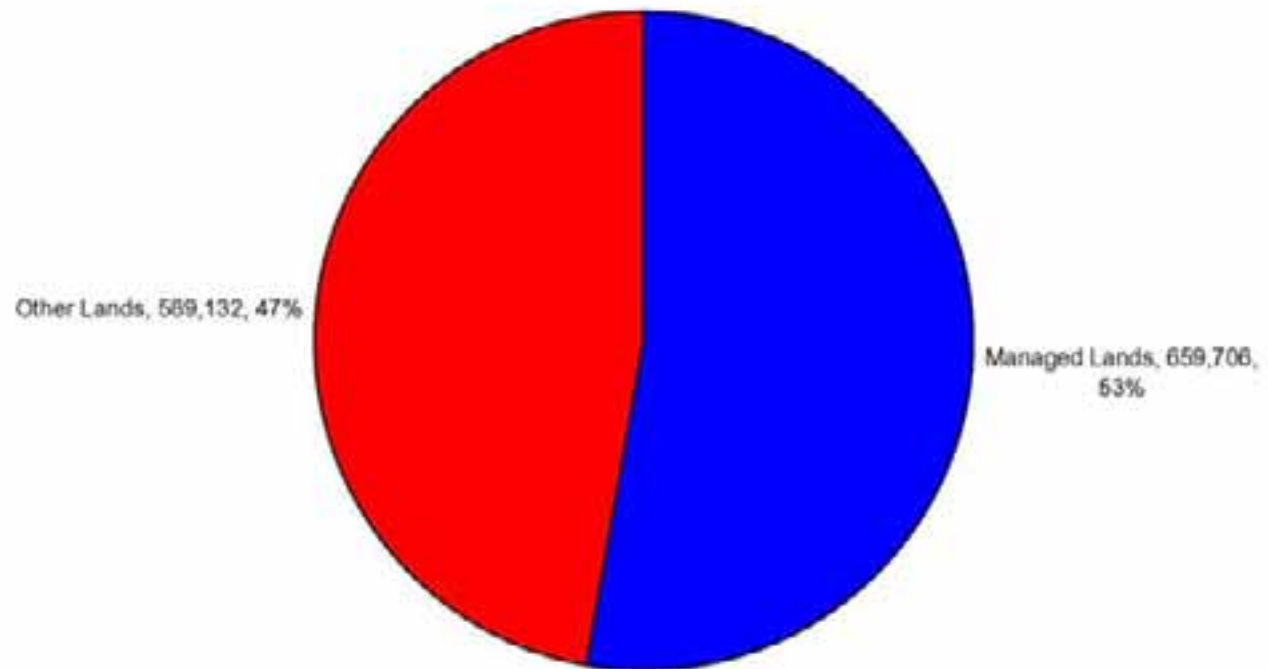
Roadless and Low Road Density Public Lands



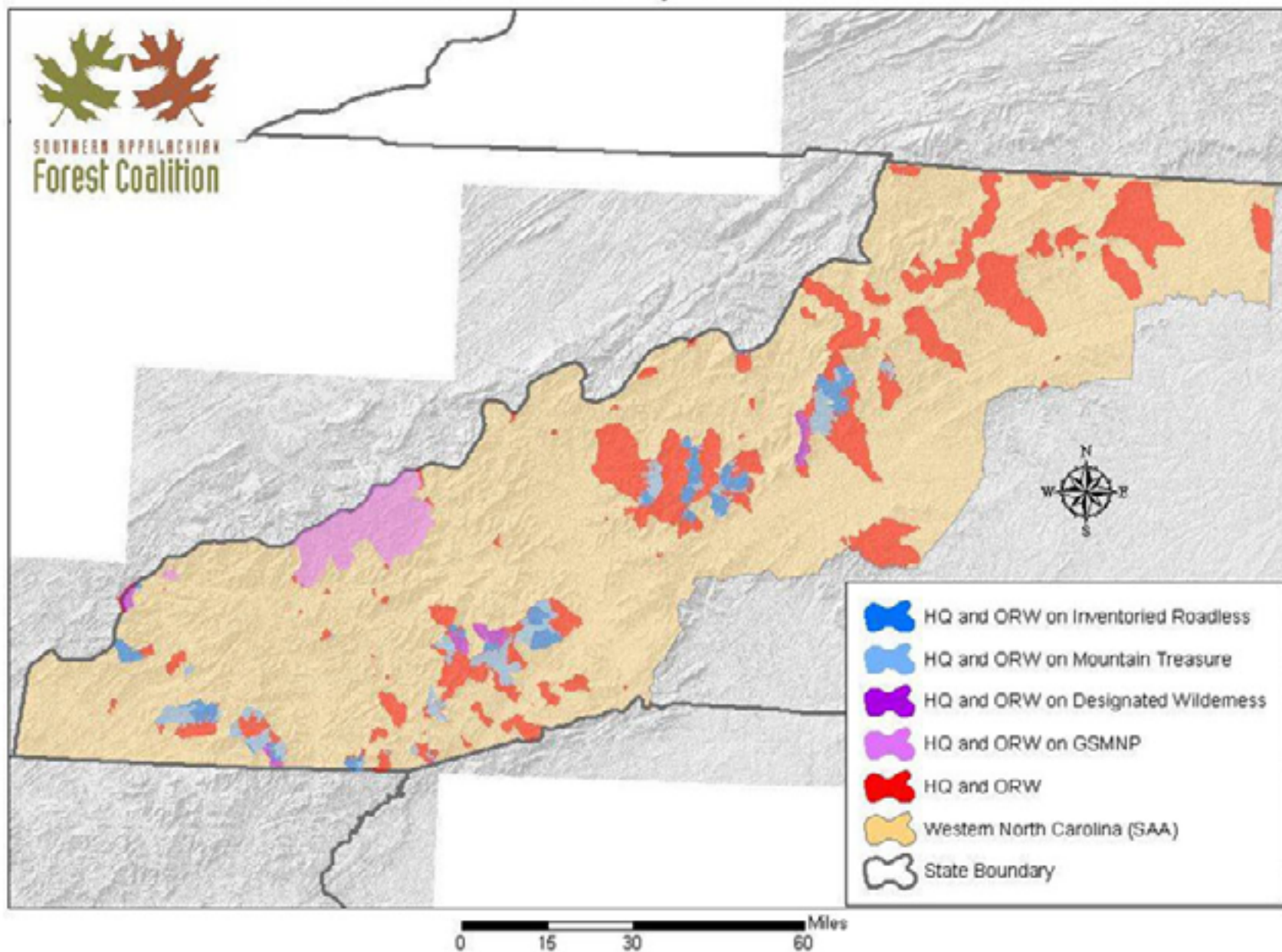
High Quality and Outstanding Resource Waters on Managed Areas in Western North Carolina



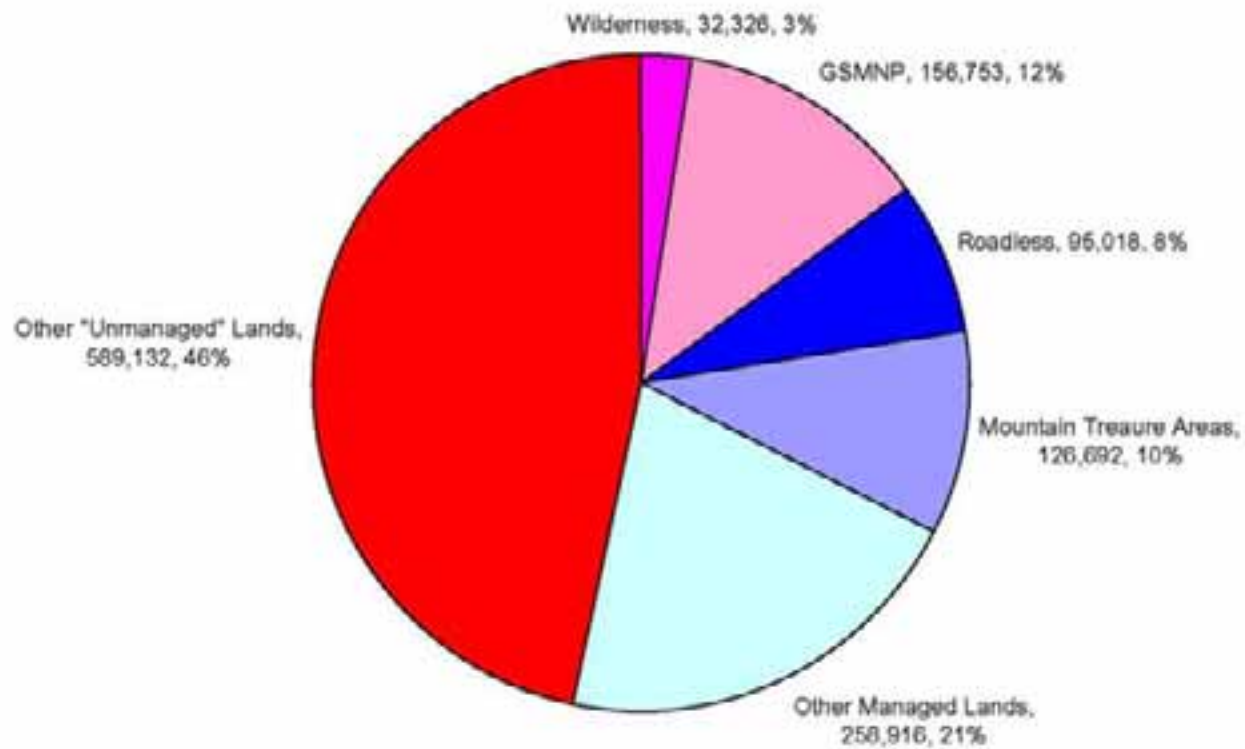
Composition of HQ and ORW Lands



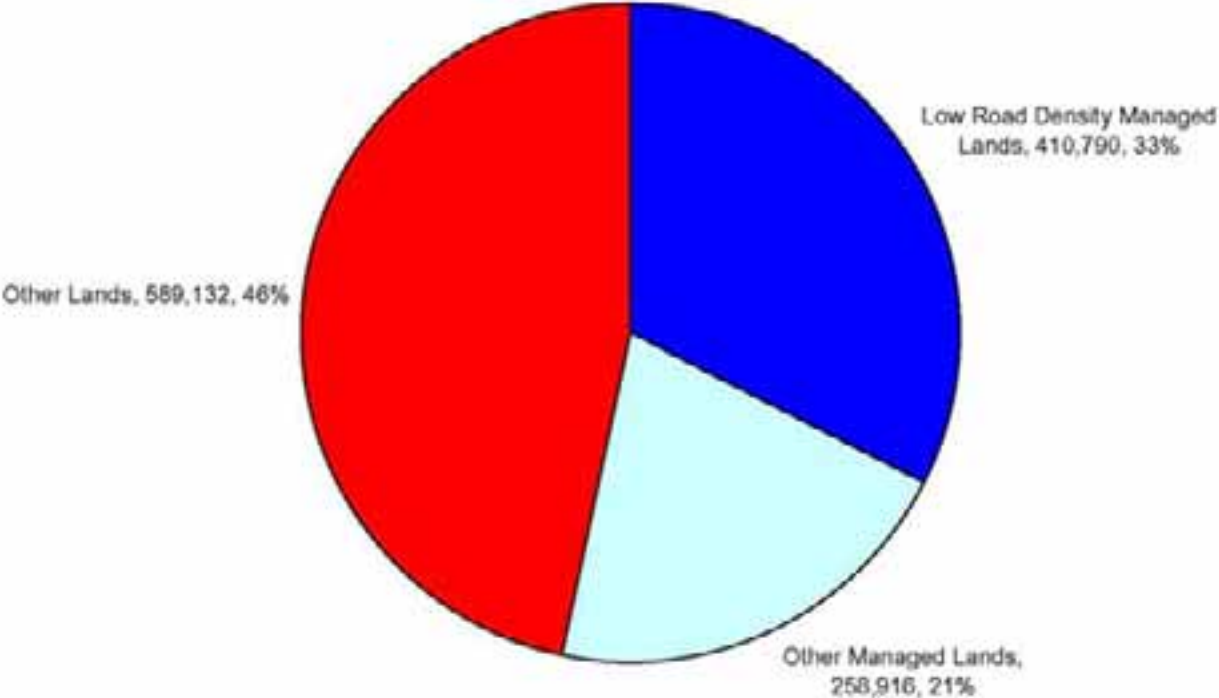
High Quality and Outstanding Resource Waters on Unroaded and Low Road Density Areas in Western North Carolina



Composition of HQ and ORW Lands



Low Road Density Composition of HQ and ORW Lands



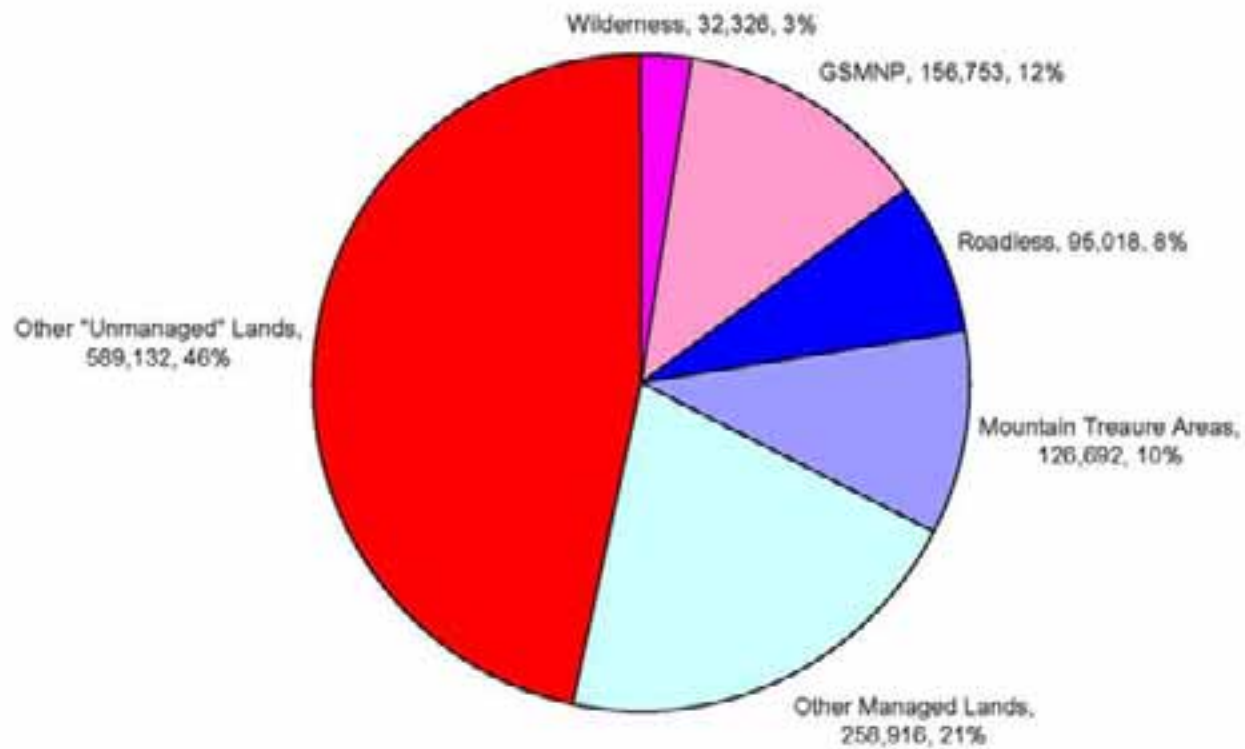


Conclusions

❖ *In Western NC high water quality is associated with managed watersheds where the effects of management are either minimal or are mitigated*

❖ *In Western NC low road density public lands (wilderness, national park, inventoried roadless, Mountain Treasures Lands) are highly represented within watersheds receiving high quality rankings and also in the public water supply*

Composition of HQ and ORW Lands





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