

# WESTERN NORTH CAROLINA HARD AND SOFT MAST SURVEY REPORT

## FALL 2009



**North Carolina Wildlife Resources Commission**

**Compiled and written by:  
Colleen Olfenbuttel  
Black bear and Furbearer Biologist  
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Funding for the hard and soft mast survey was partially provided through a Pittman-Robertson Wildlife Restoration Multi-state Grant. The Federal Aid in Wildlife Restoration Act, popularly known as the Pittman-Robertson Act, was approved by Congress on September 2, 1937, and began functioning July 1, 1938. The purpose of this Act was to provide funding for the selection, restoration, rehabilitation and improvement of wildlife habitat, wildlife management research, and the distribution of information produced by the projects. The Act was amended October 23, 1970, to include funding for hunter training programs and the development, operation and maintenance of public target ranges.

Funds are derived from an 11 percent Federal excise tax on sporting arms, ammunition, and archery equipment, and a 10 percent tax on handguns. These funds are collected from the manufacturers by the Department of the Treasury and are apportioned each year to the States and Territorial areas (except Puerto Rico) by the Department of the Interior on the basis of formulas set forth in the Act. Funds for hunter education and target ranges are derived from one-half of the tax on handguns and archery equipment.

Each state's apportionment is determined by a formula which considers the total area of the state and the number of licensed hunters in the state. The program is a cost-reimbursement program, where the state covers the full amount of an approved project then applies for reimbursement through Federal Aid for up to 75 percent of the project expenses. The state must provide at least 25 percent of the project costs from a non-federal source.



## **Introduction**

North Carolina Wildlife Resources Commission (NCWRC) personnel have surveyed hard mast in the Mountain Region of North Carolina since 1983. From 1983-2005, North Carolina's hard mast surveys were conducted and reported using a method developed by Whitehead (1969) with slight modifications (Wentworth et al. 1992). This same protocol was used in whole or part by Georgia and Tennessee for many years and was adopted by South Carolina in the 1990's. In an effort to reduce costs and manpower commitments, while maintaining quality data and standard methodology among neighboring states, the member states of the Southern Appalachian Black Bear Study Group (SABBSG, Georgia, North Carolina, South Carolina, and Tennessee) have long searched for an improved technique for monitoring hard mast surveys. Beginning with the 2006 survey, we are using a new protocol and formula for determining mast indices (Greenberg and Warburton 2007). The new protocol only requires simple calculation of percent crown with acorns in the field. In order to maintain consistency with the old technique, the new technique uses statistically verified equations to convert mast index values to numbers previously used with the Whitehead (1969) method. Hard mast results reported in this document utilize the techniques described in Greenberg and Warburton (2007) and are described using the scale used by our agency since 1983. Due to small sample sizes, results will no longer be reported for individual routes for hickory and beech, but overall values for these species will be reported. Sample sizes are sufficient to allow the reporting of values for both the white oak and red oak groups by route.

## **Hard Mast Overall Results**

The 2009 hard mast survey was conducted on 12 routes in western North Carolina. A total of 1,357 trees were sampled including 546 from the white oak group, 639 from the red oak group, 135 hickories, and 37 beeches. Combining all groups of species, mast was rated in the poor range with an overall index of 1.67 (Table 1). Since 1983, North Carolina has experienced nine years in which the hard mast index was rated as poor.

For the second year in a row, white oak production (0.48; Table 1) rated as poor. This was the second worst year for white oak production since 1983 and below the long-term average of 1.80. When the white oak group is separated by species, both chestnut oak and white oak production rated at the low end of poor at 0.32 and 0.67, respectively. Red oak production was in the fair range (2.47; Table 1), but below the long-term average (2.80) for the species. Hickory production rated as poor (1.72), a decline from last year and below the long-term average (2.32) for the species. Beech production (5.58) was good; an increase from last year's production rating and above the long-term average (4.24).

## **Hard Mast Survey Area Results**

As in previous years, hard mast production varied by location and species (Table 2). Two areas surveyed had red oak productivity rated as good, while three areas rated as fair and the remaining seven areas rated as poor (Figure 1). Fires Creek had the highest red oak index (5.9), while Cold Mountain had the lowest red oak index (0.4). Unlike red oak production, white oak production was consistently poor (0.4-0.8) across all areas surveyed (Table 2; Figure 2). Overall, red and white oak productivity was higher in the upper elevations (Table 3).

## **Summer Soft Mast Survey Results**

A soft mast survey was implemented during the summer and fall of 1993 to document berry production and abundance. The technique used for evaluating the soft mast survey has remained consistent throughout this period including the current year. Summer soft mast surveys have been conducted in conjunction with the Sardine Bait Station Survey (SBSS). During summer 2006, based on an agreement with the member states of the SABBSG, we did not conduct the SBSS. Review of data from the SBSS indicates that we can obtain long-term bear population trend information by conducting the survey every other year. Because of the new schedule, the summer soft mast survey will be conducted in odd years. The previous survey was conducted in 2007 and the next survey was conducted during the summer of 2009.

This summer's soft mast was below all overall averages (Table 4). Blackberry, blueberry and huckleberry produced fair crops, while pokeberry production was poor (1.09). Summer soft mast production varied significantly on a local basis with some areas failing to produce any significant fruit of certain species while producing "fair" to "good" crops of others (Table 5).

## **Fall Soft Mast Survey Results**

The 2009 fall soft mast survey is conducted in conjunction with the hard mast survey. Soft mast production was lower than 2008 and all species were below long-term averages, with three of four soft mast species rated as poor. Grapes had the highest index (2.33) followed by pokeberry (1.92), blackgum (1.83) and cherry (1.82; Table 6). As observed in previous years, local areas experienced variable production of fall soft mast with levels from 0 to 9 depending on species and area (Table 7).

## **Conclusion**

This season's hard mast crop was the ninth year since 1983 in which the overall hard mast index was poor. While white oak and hickory production was poor, red oak was fair and beech was good. Surrounding states also reported that white oak was scarce, while red oak was poor, but more abundant in the higher elevations. The mountain region has experienced drought conditions for three years and this year's poor abundance of soft and hard mast may be reflective of these weather conditions.

NCWRC and SABBSG efforts to refine and improve the mast survey technique should be continued. Furthermore, the management implications of the long-term mast survey should be examined in order to maximize the benefits of this survey in our state and regional black bear management efforts.

## **LITERATURE CITED**

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- Wentworth, J.M., A.S. Johnson, P.E. Hale, and K.E. Kammermeyer. 1992. Relationship of Acorn abundance and deer herd characteristics in the southern Appalachians. *Southern Journal of Applied Forestry* 16:5-8.
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Table 1. Hard Mast Survey Results for Western North Carolina, 1983-2009.

Year	White Oak	Red Oak	All Oaks	Hickory	Beech	Total
1983	1.43	2.59		1.99	5.51	2.25
1984	1.08	2.73		3.05	4.28	2.30
1985	2.01	3.66		0.80	3.06	2.80
1986	1.32	1.98		2.25	5.22	1.90
1987	1.16	0.56		3.57	5.75	1.31
1988	3.16	4.07		2.04	4.25	3.57
1989	0.43	4.89		2.78	6.44	3.14
1990	1.85	2.62		1.20	1.89	2.17
1991	2.38	1.93		3.75	6.89	2.43
1992	1.07	2.45		0.72	1.17	1.78
1993	0.65	3.58		2.43	4.77	2.48
1994	2.06	3.48		2.02	6.20	2.85
1995	2.80	5.60		2.48	0.36	4.22
1996	3.70	1.99		2.81	4.31	2.72
1997	0.53	1.79		1.17	2.35	1.29
1998	2.26	4.68		3.27	4.70	3.69
1999	3.28	2.76		2.80	6.22	3.05
2000	0.50	2.11		2.73	5.71	1.82
2001	2.83	4.92		2.88	3.97	3.98
2002	1.90	3.01		1.75	3.44	2.47
2003	1.24	0.68		3.58	5.42	1.33
2004	3.99	2.93		1.32	1.65	3.09
2005	0.70	3.11		1.86	4.30	2.14
2006	1.70	1.40	1.50*	3.20	4.10	1.80
2007	3.02	1.19	2.04	0.73	2.71	1.90
2008	1.01	2.40	1.76	3.82	4.34	2.06
2009	0.48	2.47	1.55	1.72	5.58	1.67
<b>Average</b>	<b>1.80</b>	<b>2.80</b>	<b>1.77</b>	<b>2.32</b>	<b>4.24</b>	<b>2.45</b>

Numerical Rating = Crop Quality

0.0 to 2.0 = Poor

2.1 to 4.0 = Fair

4.1 to 6.0 = Good

6.1 to 8.0 = Excellent

\* Not reported for prior years.

Table 2. Hard Mast Survey Results by Area, 2009.

<b>County</b>	<b>Area</b>	<b>White Oak</b>	<b>Red Oak</b>	<b>All Oaks</b>
Transylvania	Avery Creek	0.4	3.1	1.8
Haywood	Cold Mountain	0.4	0.4	0.4
Avery & Caldwell	Edgemont	0.4	0.7	0.5
Clay	Fires Creek	0.8	5.9	3.2
Haywood	Harmon Den	0.4	1.6	1.0
Burke & McDowell	Linville Mtn.	0.4	1.9	1.0
Macon	Nantahala	0.4	2.4	1.8
Mitchell	Poplar	0.4	1.4	1.0
Graham	Santeetlah	0.5	4.2	2.6
Haywood	Sherwood	0.7	1.3	1.1
Burke	South Mountains	0.4	0.6	0.5
Macon	Standing Indian	0.6	2.9	2.0

Numerical Rating = Crop Quality

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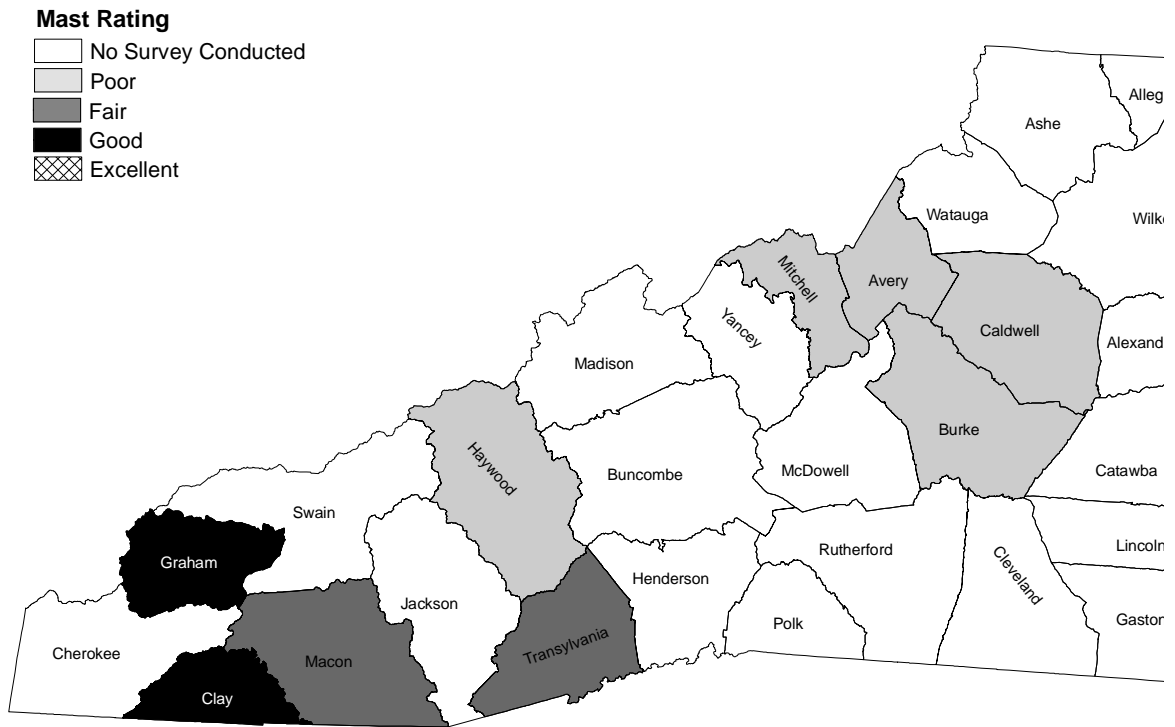


Figure 1. Red Oak Index by County, 2009.

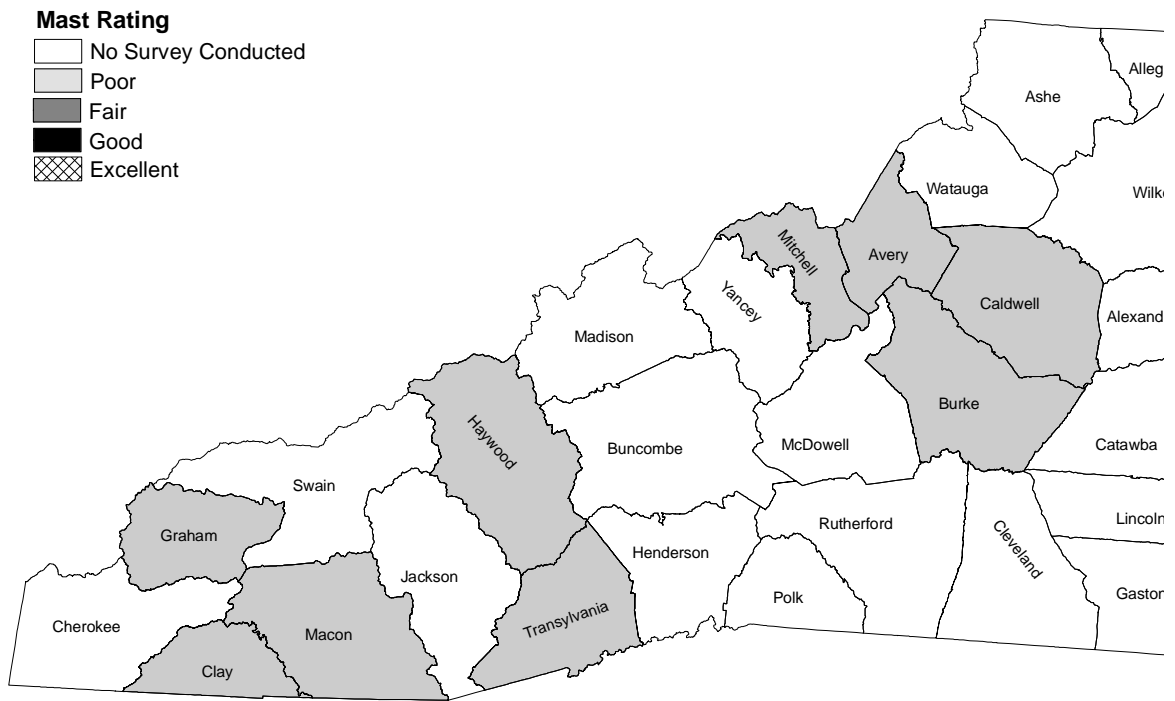


Figure 2. White Oak Index by County, 2009.

Table 3. Hard Mast Survey Results by Elevation, 2009.

Elevation (ft.)	Red Oak	White Oak
<1900	0.67	0.38
2000-2900	2.41	0.41
3000-3900	2.62	0.42
4000-4900	2.89	0.77
5000+	1.34	2.34

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Numerical Rating = Crop Quality

0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent

Table 4. Results of Mountain Summer Soft Mast Surveys, 1993-2009<sup>1</sup>.

Year	Blueberry	Huckleberry	Blackberry	Pokeberry
1993	3.20	3.60	3.80	2.40
1994	3.20	3.50	3.50	1.40
1995	1.90	2.50	3.10	1.20
1996	2.00	2.00	3.40	1.50
1997	2.80	3.00	3.80	2.00
1998	1.90	1.20	3.30	2.33
1999	2.72	2.45	2.90	1.78
2000	2.70	2.72	2.99	1.64
2001	2.27	2.73	2.87	0.87
2002	1.87	2.22	3.55	1.32
2003	2.27	2.74	3.20	1.02
2004	1.67	1.61	4.25	1.41
2005	1.57	1.41	4.07	1.48
2007	2.11	1.23	2.48	1.84
2009	2.08	2.06	2.78	1.09
<b>Average</b>	<b>2.28</b>	<b>2.32</b>	<b>3.31</b>	<b>1.54</b>

<sup>1</sup> After 2005, summer soft mast surveys are conducted every two years.

Table 5. Mountain Summer Soft Mast Survey Results by Area, 2009.



<b>Area</b>	<b>Blueberry</b>	<b>Huckleberry</b>	<b>Blackberry</b>	<b>Pokeberry</b>
Daniel Boone	1.00	1.00	0.67	0.33
Fires Creek/Santeetlah	1.60	2.40	3.20	2.20
Flattop	0.50	0.50	4.00	1.00
Harmon Den Area	1.33	1.50	1.50	1.00
Mt. Mitchell	2.75	1.75	3.75	0.25
Pisgah Area	2.20	2.00	1.00	0.75
Rich Mountain	1.00	1.00	1.00	0.00
Standing Indian	0.00	1.33	0.50	0.00
T. Chatham	3.33	2.00	0.33	0.00
Cheoah	1.00	1.00	4.00	1.00
South Mountains	2.00	2.00	2.00	4.00
Highlands	2.33	2.33	4.00	1.67
Gorges State Park	9.00	9.00	9.00	2.00
Lake James State Park	1.00	1.00	4.00	1.00
<b>Average</b>	<b>2.08</b>	<b>2.06</b>	<b>2.78</b>	<b>1.09</b>

Numerical Rating = Crop Quality

0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
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Table 6. Results of Mountain Fall Soft Mast Surveys, 1993-2009.

<b>Year</b>	<b>Pokeberry</b>	<b>Cherry</b>	<b>Grapes</b>	<b>Blackgum</b>
1993	2.00	2.70	2.10	0.40
1994	3.10	2.00	3.80	1.70
1995	2.70	5.00	2.20	1.80
1996	2.40	1.60	3.30	1.80
1997	4.20	1.30	3.10	0.80
1998	4.63	2.67	2.80	1.50
1999	2.40	2.70	3.25	1.10
2000	2.20	2.70	3.30	1.00
2001	2.80	3.30	4.18	2.33
2002	1.10	2.45	2.73	1.27
2003	2.33	3.00	2.55	2.22
2004	1.67	2.70	3.00	1.44
2005	2.45	2.09	1.36	1.55
2006	3.73	2.00	3.17	2.50
2007	2.08	1.58	2.73	0.67
2008	2.91	4.64	4.08	2.58
2009	1.92	1.82	2.33	1.83
<b>Average</b>	<b>2.62</b>	<b>2.60</b>	<b>2.94</b>	<b>1.55</b>

Numerical Rating = Crop Quality

0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent

Table 7. Local Results of Mountain Fall Soft Mast Surveys, 2009.

<b>County</b>	<b>Area</b>	<b>Pokeberry</b>	<b>Cherry</b>	<b>Grapes</b>	<b>Blackgum</b>
Transylvania	Avery Creek	4	0	2	0
Haywood	Cold Mountain	2	4	4	4
Avery & Caldwell	Edgemont	1	0	0	0
Clay	Fires Creek	4	4	6	2
Haywood	Harmon Den	1	-	1	0
Burke & McDowell	Linville Mtn.	2	4	0	5
Macon	Nantahala	0	0	0	0
Mitchell	Poplar	2	0	2	2
Graham	Santeetlah	4	6	9	4
Haywood	Sherwood	1	2	2	1
Burke	South Mountains	2	0	2	4
Macon	Standing Indian	0	0	0	0
<b>Average:</b>		<b>1.92</b>	<b>1.82</b>	<b>2.33</b>	<b>1.83</b>

Numerical Rating = Crop Quality

0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
4.1 to 6.0 = Good	6.1 to 8.0 = Excellent