WESTERN NORTH CAROLINA HARD AND SOFT MAST SURVEY REPORT

FALL 2010

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 2010 hard mast survey was conducted on 12 routes in western North Carolina. A total of 1,360 trees were sampled including 550 from the white oak group, 639 from the red oak group, 134 hickories, and 37 beeches. Combining all groups of species, mast was rated in the fair range with an overall index of 3.66 (Table 1), which is the highest index for hard mast since 2001. Since 1983, North Carolina has experienced eighteen years in which the hard mast index was rated as fair.

Reversing a two year trend, white oak production (3.46; Table 1) improved and rated as fair. This was the third best year for white oak production since 1983 and above the long-term average of 1.86. When the white oak group is separated by species, chestnut oak and white oak production rated as fair at 3.00 and 4.01, respectively. Red oak production was in the fair range (3.97; Table 1) and above the long-term average (2.84) for the species. Hickory production rated as fair (3.50), an improvement from last year and above the long-term average (2.37) for the species. Beech production (0.87) was poor; a decline from last year's production rating and below the long-term average (4.12).

Hard Mast Survey Area Results

As in previous years, hard mast production varied by location and species (Table 2; Figure 1 and 2). One area surveyed had red oak productivity rated as excellent, while five areas rated as good, two areas rated as fair and the remaining four areas rated as poor (Table 2). Fires Creek had the highest red oak index (6.6), while Edgemont had the lowest red oak index (0.6). White oak production ranged from excellent to poor (0.4-6.1) across the areas surveyed (Table 2; Figure 2). As with red oak productivity, Fires Creek had the highest white oak index (6.1) and

Edgemont had the lowest white oak index (0.4). 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 2009 and the next survey will be conducted during the summer of 2011. Results from the 2009 summer soft mast surveys can be seen in Tables 4 and 5.

Fall Soft Mast Survey Results

The 2010 fall soft mast survey is conducted in conjunction with the hard mast survey. Soft mast production was higher than 2009 and pokeberry, cherry and grapes were above long-term averages. Overall soft mast was rated as fair. Cherry had the highest index (5.8) followed by grapes (4.8), blackgum (2.9) and cherry (1.4; 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 eighteenth year since 1983 in which the overall hard mast index was fair. Hard mast productivity in 2010 was the fourth highest recorded since surveys began in 1983. White oak, red oak and hickory production was fair, while beech was poor. Surrounding states have reported that overall white and red oak productivity had improved from 2009, when many states experienced mast failure. The mountain region experienced drought conditions from 2007 through 2009, which may have impacted last year's poor abundance of soft and hard mast. However, weather conditions were more favorable in 2010, which may have influenced this year's mast abundance.

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, 1983-2010.

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
2010	3.46	3.97	3.75	3.50	0.87	3.66
Average	**1.86**	**2.84**	**2.12**	**2.37**	**4.12**	**2.50**

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, 2010.

County	Area	White Oak	Red Oak	All Oaks
Transylvania	Avery Creek	1.8	3.0	2.5
Haywood	Cold Mountain	4.1	1.6	2.8
Avery & Caldwell	Edgemont	0.4	0.6	0.5
Clay	Fires Creek	6.1	6.6	6.4
Haywood	Harmon Den	4.6	4.6	4.6
Burke & McDowell	Linville Mtn.	2.3	1.6	2.0
Macon	Nantahala	2.2	2.9	2.7
Mitchell	Poplar	4.4	4.4	4.5
Graham	Santeetlah	5.4	5.8	5.7
Haywood	Sherwood	4.4	5.4	5.2
Burke	South Mountains	1.1	1.2	1.2
Macon	Standing Indian	4.5	5.7	5.2

Numerical Rating = Crop Quality	
0.0 to 2.0 = Poor	2.1 to 4.0 = Fair
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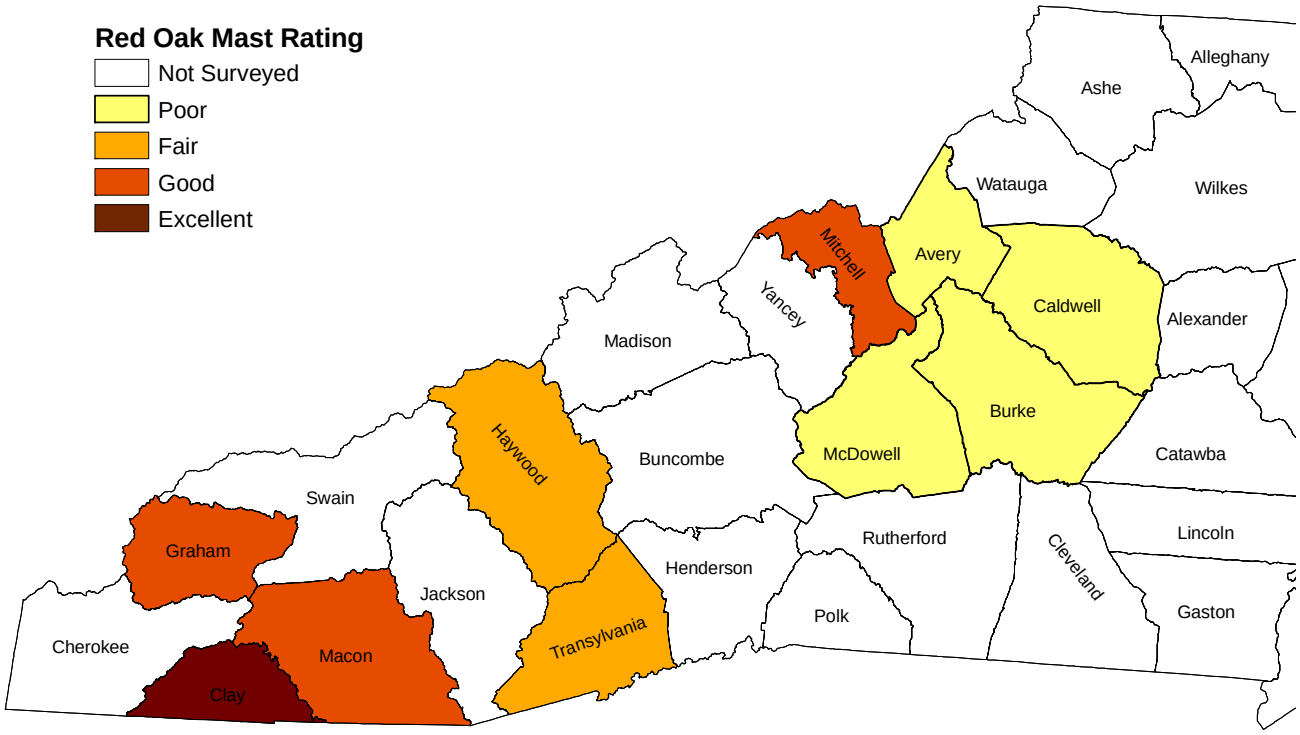

Figure 1. Red Oak Index by County in western North Carolina, 2010.

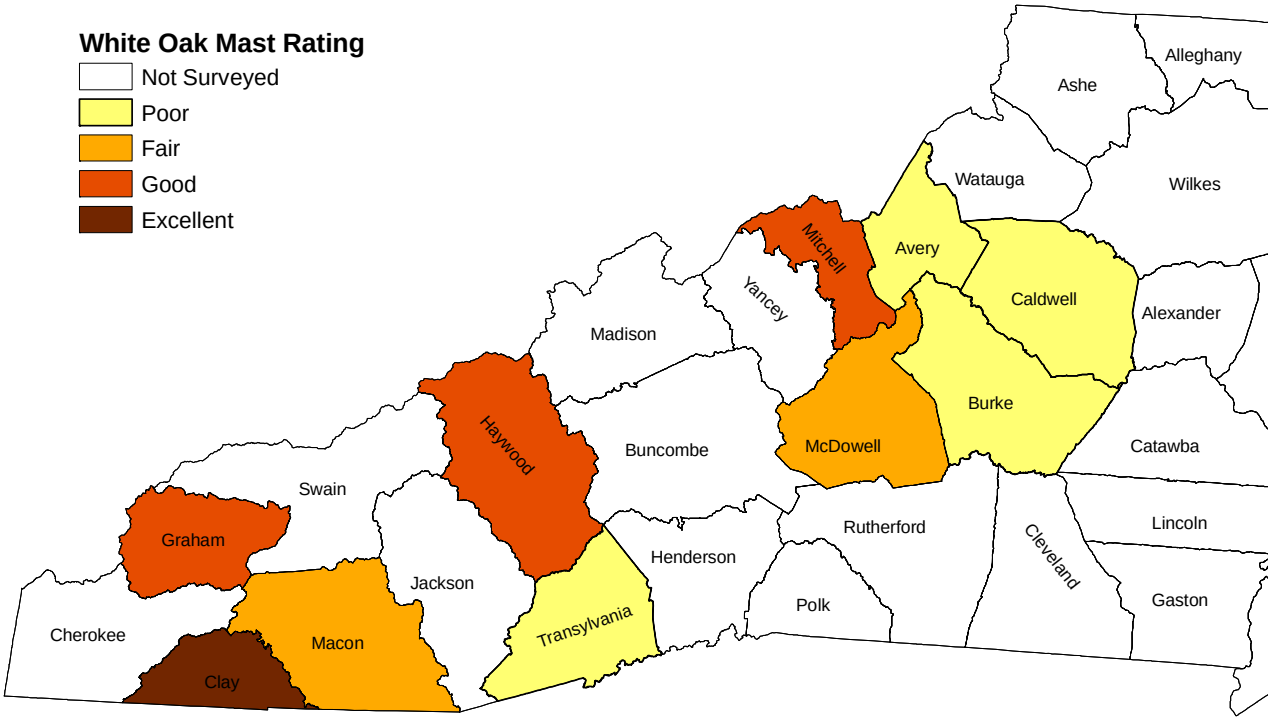

Figure 2. White Oak Index by County in western North Carolina, 2010

Table 3. Hard Mast Survey Results by Elevation, 2010.

Elevation (ft.)	Red Oak	White Oak
<1900	1.81	2.78
2000-2900	3.90	3.13
3000-3900	4.08	3.15
4000-4900	4.01	5.54
5000+	5.79	4.29

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[1].

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
Average	**2.28**	**2.32**	**3.31**	**1.54**

[1] After 2005, summer soft mast surveys are conducted every two years.

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

Area	Blueberry	Huckleberry	Blackberry	Pokeberry
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
Average	**2.08**	**2.06**	**2.78**	**1.09**

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, 1993-2010.

Year	Pokeberry	Cherry	Grapes	Blackgum
1993	2.00	2.71	2.14	0.43
1994	3.11	2.00	3.78	1.71
1995	2.67	5.00	2.22	1.78
1996	2.40	1.63	3.25	1.75
1997	4.20	1.25	3.14	0.75
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
2010	2.90	5.80	4.80	1.40
Average	**2.64**	**2.78**	**3.05**	**1.55**

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, 2010.

County	Area	Pokeberry	Cherry	Grapes	Blackgum
Transylvania	Avery Creek	2	2	4	0
Haywood	Cold Mountain	2	9	4	4
Avery & Caldwell	Edgemont	2	2	4	0
Clay	Fires Creek	2	9	9	2
Haywood	Harmon Den	2	6	6	1
Burke & McDowell	Linville Mtn.	4	6	0	3
Macon	Nantahala	-	-	-	-
Mitchell	Poplar	3	6	4	2
Graham	Santeetlah	4	9	9	2
Haywood	Sherwood	4	9	6	0
Burke	South Mountains	4	0	2	0
Macon	Standing Indian	-	-	-	-
	Average:	**2.90**	**5.80**	**4.80**	**1.40**

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