NORTH CAROLINA

Agricultural Water Use

2020

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NORTH CAROLINA
2020 Agricultural Water Use Survey

The ninth statewide survey was conducted to document water use for the agricultural sector during 2020. As directed in legislation enacted in 2008 (SL2008-0143), the North Carolina Department of Agriculture and Consumer Services, Agricultural Statistics Division, is required to collect annual information from farmers who withdraw 10,000 gallons or more in any one day. Individual responses remain confidential and are only used in combination with other reports to produce totals.

Farmers who use over 1,000,000 gallons in any one day are required to report their water usage directly to the Department of Environmental Quality (DEQ). DEQ's report can be found on *http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report* .

When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 4 is most representative of total water use. Because farms that withdraw the largest amounts of water do not make those withdrawals every day, the average daily use across all days of the year is most representative of relative volumes used. On average, farm operations that use irrigation will withdraw water about 17 days each month. Field crop operations use water even less often, primarily to supplement rainfall. While there are other agricultural users of water, including livestock and poultry producers, aquaculture farms, and others, the largest volume of water use is from irrigators. The average North Carolina farm that uses water does so infrequently and in relatively small amounts. Table 2 on page 7 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.

The results of this survey reflect water withdrawals from ground and surface sources. Many comparisons across sectors will incorporate an estimate of consumptive use of withdrawals. The definition of a consumptive use varies depending on the source. Most experts in agricultural sciences consider consumptive use to be the amount of water that is either taken up by plants, or evaporated. According to an Economic Research Service (USDA) report, irrigation consumptive use on farms is about 61 percent of total withdrawals nationally. This can vary greatly between regions depending on the type of system used and efficiency of the irrigation equipment. https://www.ers.usda.gov/webdocs/publications/41964/30286_wateruse.pdf?v=41143

Of the farms surveyed in the state, 852 withdrew over 10,000 gallons of water in any one day. Soil conditions were considered normal throughout the majority of the state for the entire year. July was the largest water use month in 2020, averaging 83.6 million gallons daily, with a maximum daily withdrawal of 204.1 million gallons. The annual average daily water usage for 2020 was 50.2 million gallons. The daily withdrawal capacity for the 852 operations totaled 1.2 billion gallons in 2020.

A questionnaire was mailed to operations which had potential for large water usage. Operations that did not respond were contacted by telephone follow-up. In addition, livestock and poultry contractors in the state were contacted by email, phone, or mail.

The unique number of operations, the annual average daily ground and surface usage, as well as the capacity is published by county and by hydrologic unit codes (HUC). The capacity is the potential amount of ground and/or surface water that could be withdrawn in a 24-hour period. The published capacity represents the sum of capacities for all reporting operations in that county or HUC. In nearly all cases, this capacity was never met. Data was not disclosed if there were less than three operations in any category or if one report comprised 60 percent or more of the total.

One survey instrument was used to gather data for the whole state as well as for the Central Coastal Plain Capacity Use Area (CCPCUA). Results for the CCPCUA are summarized and published in a separate table.

Table 1: Total & Average Daily Water Withdrawn [1]
2020 North Carolina Water Use by Month

Month	Operations	Monthly Total Ground	MonthlyTotal Surface	Average Across All Days-Ground	Average Across All Days-Surface
	Number	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	577	263,728,887	934,486,708	8,507,383	30,144,733
February	587	248,631,534	960,291,109	8,573,501	33,113,487
March	638	300,584,795	1,152,149,899	9,696,284	37,166,126
April	683	426,523,740	1,043,747,472	14,217,458	34,791,582
May	705	613,141,470	1,262,119,415	19,778,757	40,713,530
June	750	748,971,036	1,403,486,729	24,965,701	46,782,891
July	785	828,172,085	1,761,943,317	26,715,229	56,836,881
August	724	661,318,598	1,282,356,706	21,332,858	41,366,345
September	661	540,809,597	874,879,020	18,026,987	29,162,634
October	626	327,480,338	811,973,635	10,563,882	26,192,698
November	584	288,107,861	694,612,911	9,603,595	23,153,764
December	556	274,021,781	669,708,378	8,839,412	21,603,496
Annual Average				**15,068,421**	**35,085,681**

Operations:

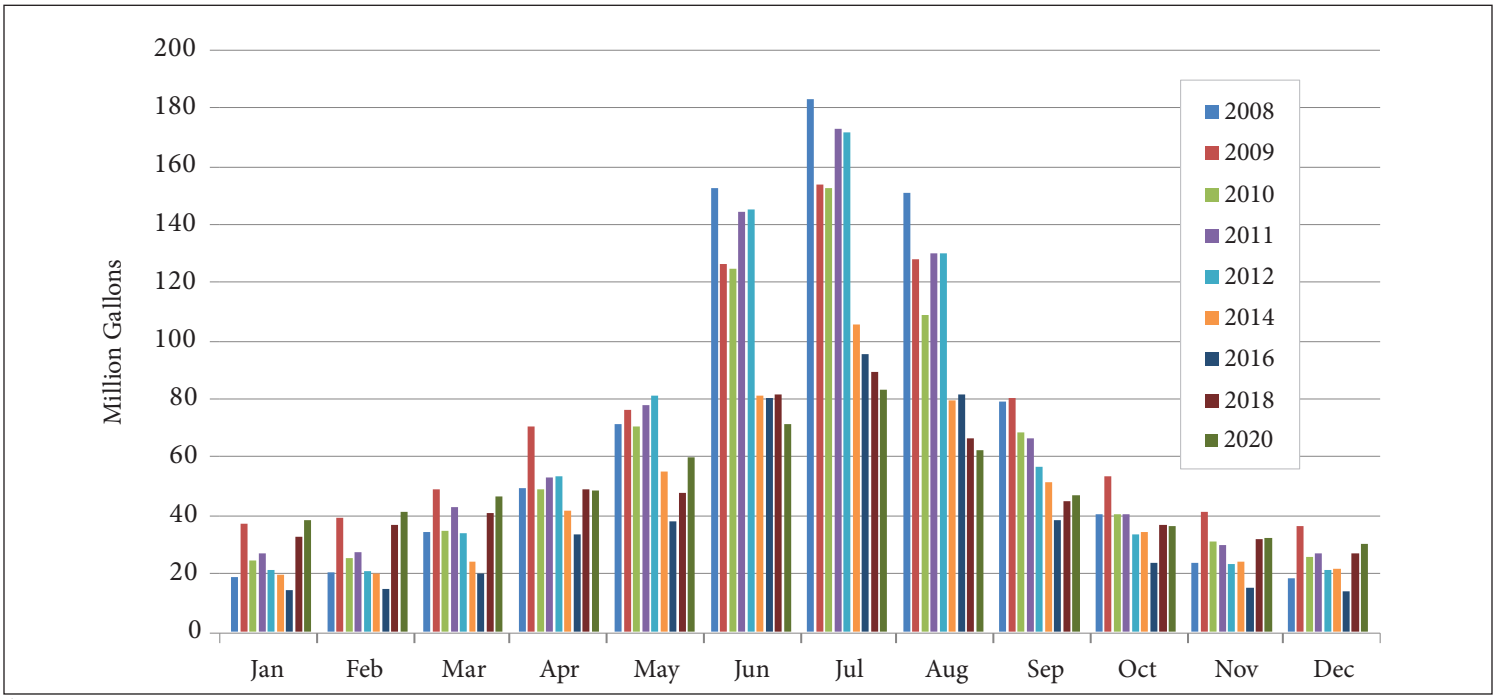
852 *Total Operations*

Daily Withdrawal Capacity (incl. ground & surface):

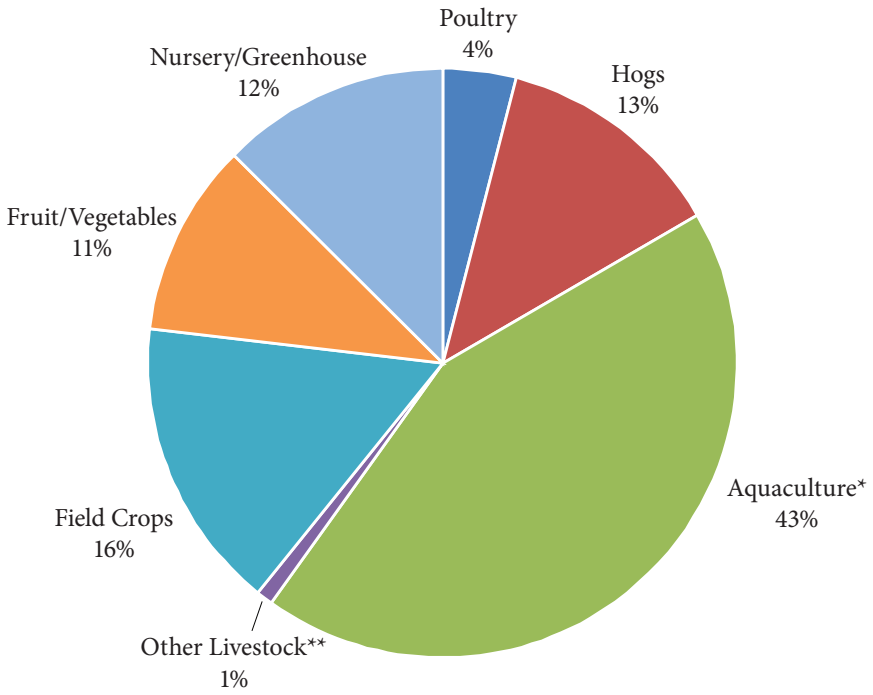
1,154,025,613 *Gallons*

[1] *Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DEQ by July25, 2021 have been excluded. The monthly number of operations will not add to the total. Some operations reported both surface and ground water withdrawals, which are counted twice in the monthly number of operations. However, the total number of operations represents operations that withdrew water at any time during the year, regardless if withdrawn from multiple sources.*

Average Across All Days
Ground & Surface Water Withdrawals
2008–2020

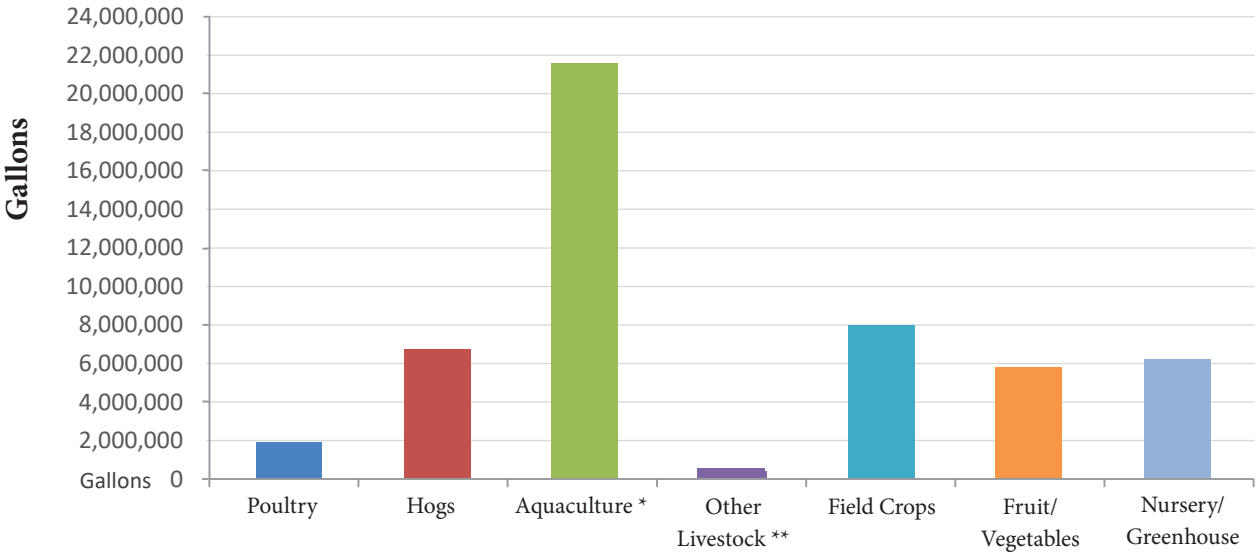


2020 Annual Water Withdrawals by Percent



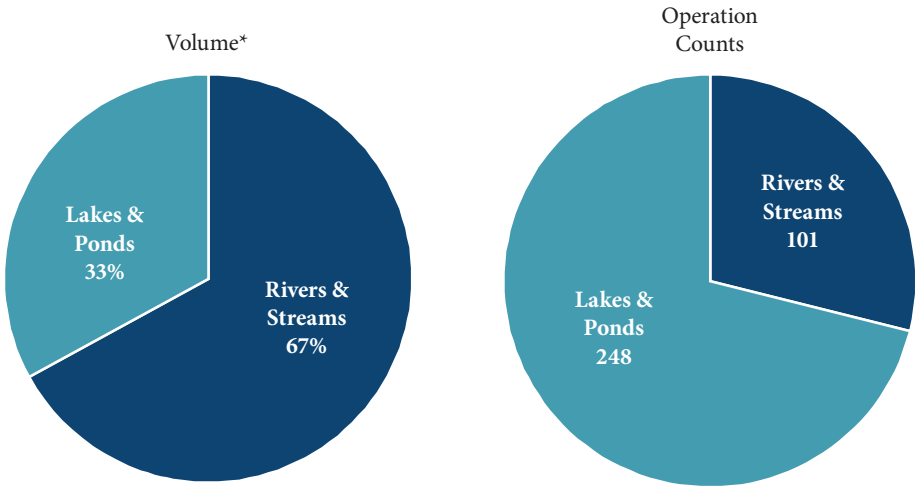
**95% of aquaculture water withdrawals occurred in western counties from rivers and streams and are typically flow through /non-consumptive.*
*** Other Livestock includes cattle, horses, goats, sheep, etc.*

2020 Average Daily Water Withdrawals



**95% of aquaculture water withdrawals occurred in western counties from rivers and streams and are typically flow through non-consumptive **Other Livestock includes cattle, horses, goats, sheep, etc.*

2020 Annual Surface Water Withdrawals



**42% of River & Stream Withdrawals were made by aquaculture operations from the western portion of the state and are typically flow through/non-consumptive.*

Table 2: Demand Use for Days Applied [1]
2020 North Carolina Water Use by Month

Month	Average Days Applied Ground	Average Days Applied Surface	Total Average Daily-Ground	Total Average Daily-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	Days	*Days*	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	28	16	9,102,816	31,769,976	10,159,877	31,825,204
February	26	14	9,422,238	66,893,013	11,741,692	67,935,459
March	27	14	14,390,549	87,310,801	19,484,872	95,781,102
April	27	14	18,358,876	69,609,064	21,397,981	74,724,785
May	27	16	28,745,536	61,612,916	38,962,148	66,462,998
June	26	16	42,922,739	80,448,462	53,096,939	106,428,565
July	27	16	46,089,362	128,241,068	56,502,456	147,587,760
August	27	17	37,639,601	66,105,112	46,447,662	83,556,809
September	27	16	28,318,520	62,257,848	32,872,056	66,084,195
October	28	17	12,752,252	30,198,023	14,788,496	33,371,700
November	28	16	10,692,312	25,211,337	12,614,229	25,491,063
December	27	17	10,034,459	23,114,649	11,874,149	23,161,417
Annual Average			**22,372,438**	**61,064,356**		

[1] Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn during the days of application. Farms that reported their withdrawals directly to DEQ by July 25, 2021 have been excluded.

2020 North Carolina Water Use
County Summary

County	Unique Operations [1]	Annual Average Daily [2] Ground	Annual Average Daily [2] Surface	Daily Withdrawal Capacity [3]
	Number	*Gallons*	*Gallons*	*Gallons*
Alexander	5	46,578	*	816,629
Anson	10	69,683	*	*
Bertie	8	103,746	*	*
Bladen	66	1,027,201	405,835	163,364,105
Chatham	8	31,030	*	*
Columbus	8	126,717	*	2,285,296
Duplin	90	1,832,437	*	35,556,981
Edgecombe	11	76,473	*	16,631,180
Greene	11	113,878	*	*
Halifax	9	93,630	*	*
Harnett	15	94,050	*	11,313,914
Haywood	4	*	60,341	*
Hertford	10	132,106	*	*
Johnston	22	100,980	458,019	*
Jones	13	228,778	*	755,267
Lee	9	12,673	*	5,629,319
Lenoir	10	116,713	*	*
Montgomery	8	37,680	*	2,117,864
Nash	12	200,010	506,500	*
Northampton	19	282,266	*	21,562,536
Pender	18	386,152	*	142,284,354
Pitt	13	184,405	*	9,387,126
Richmond	10	127,083	*	2,605,531
Robeson	48	3,098,208	*	83,489,564
Rockingham	10	*	79,761	6,797,534
Rowan	6	19,402	*	*
Sampson	85	1,867,239	*	39,494,521
Scotland	15	213,945	*	760,369
Surry	10	72,988	*	*
Union	17	186,302	*	8,849,980
Warren	7	52,060	*	*
Wayne	16	262,961	*	4,995,400
Wilkes	18	97,470	*	2,417,192
Other Counties[4]	231	3,773,577	33,575,225	599,708,485
State	**852**	**15,068,421**	**35,085,681**	**1,154,025,613**

** disclosure - one operation is greater than 60% of total or less than 3 operations reported. [1] represents the unique # of operations which withdrew surface and or ground water [2] represents the average across all days of the year [3] includes ground and surface [4] includes nondisclosed data from the table above and all data for counties not listed in the above table.*

2020 North Carolina Water Use - Hydrologic Unit Code Summary

Hydrologic Unit Code	Unique Operations [1]	Annual Average Daily [2] Ground	Annual Average Daily [2] Surface	Daily Withdrawal Capacity [3]
	Number	*Gallons*	*Gallons*	*Gallons*
03010104	10	*	43,756	*
03010107	19	244,389	*	32,838,999
03010203	21	284,946	*	25,497,001
03010204	9	113,724	*	*
03020101	24	207,278	351,476	21,957,435
03020102	12	85,971	423,250	8,107,483
03020103	11	187,960	*	16,146,829
03020201	40	201,973	751,390	52,669,949
3020202	22	288,055	78,736	18,447,011
03020203	29	280,728	252,708	30,694,842
03020204	8	80,192	*	*
03020302	6	153,080	*	1,378,014
03030002	32	*	1,310,371	29,130,189
03030004	22	171,592	*	11,455,457
03030005	15	228,023	*	*
03030006	107	1,827,949	466,925	68,145,811
03030007	118	2,325,940	*	158,599,339
03040101	35	188,002	*	13,757,725
03040102	9	73,170	*	4,390,315
03040103	59	611,879	1,353,485	147,639,042
03040104	11	52,082	46,531	2,421,375
03040105	22	*	85,757	21,386,077
3040203	46	2,806,461	*	46,152,121
03040206	11	230,233	*	*
03050101	12	*	215,031	*
03050105	10	138,707	*	1,450,697
06010106	4	*	60,341	*
Other Hucs[4]	**128**	**4,286,087**	**29,645,924**	**441,759,902**
State	**852**	**15,068,421**	**35,085,681**	**1,154,025,613**

** disclosure - one operation is greater than 60% of total or less than 3 operations reported. [1] represents the unique # of operations which withdrew surface and or ground water [2] represents the average across all days of the year [3] includes ground and surface [4] includes nondisclosed data from the table above and all data for HUCS not listed in the above table.*

2020 Central Coastal Plain Total Water Use by Month [1]

Month	Operations	Average Across All Days-Ground	Average Across All Days-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	Number	*Gallons*	*Gallons*	*Gallons*	*Gallons*
January	155	2,530,924	1,379,092	2,747,382	1,394,722
February	154	2,523,255	1,866,967	4,234,103	13,770,414
March	167	2,757,286	2,464,568	4,512,277	11,772,676
April	172	3,208,187	2,668,582	3,892,579	9,861,145
May	176	2,807,294	2,991,964	3,521,858	5,098,431
June	181	3,254,759	5,072,888	4,694,627	11,888,306
July	177	4,079,550	5,242,437	5,770,649	15,077,721
August	171	3,372,417	4,404,087	4,459,480	7,969,799
September	162	3,416,644	3,318,970	3,937,114	9,715,922
October	159	2,872,971	2,397,634	3,415,856	2,637,659
November	154	2,571,549	1,628,976	2,838,279	1,774,839
December	149	2,614,755	1,250,777	2,910,606	1,250,777
Annual Average		**3,000,799**	**2,890,579**		

Operations:

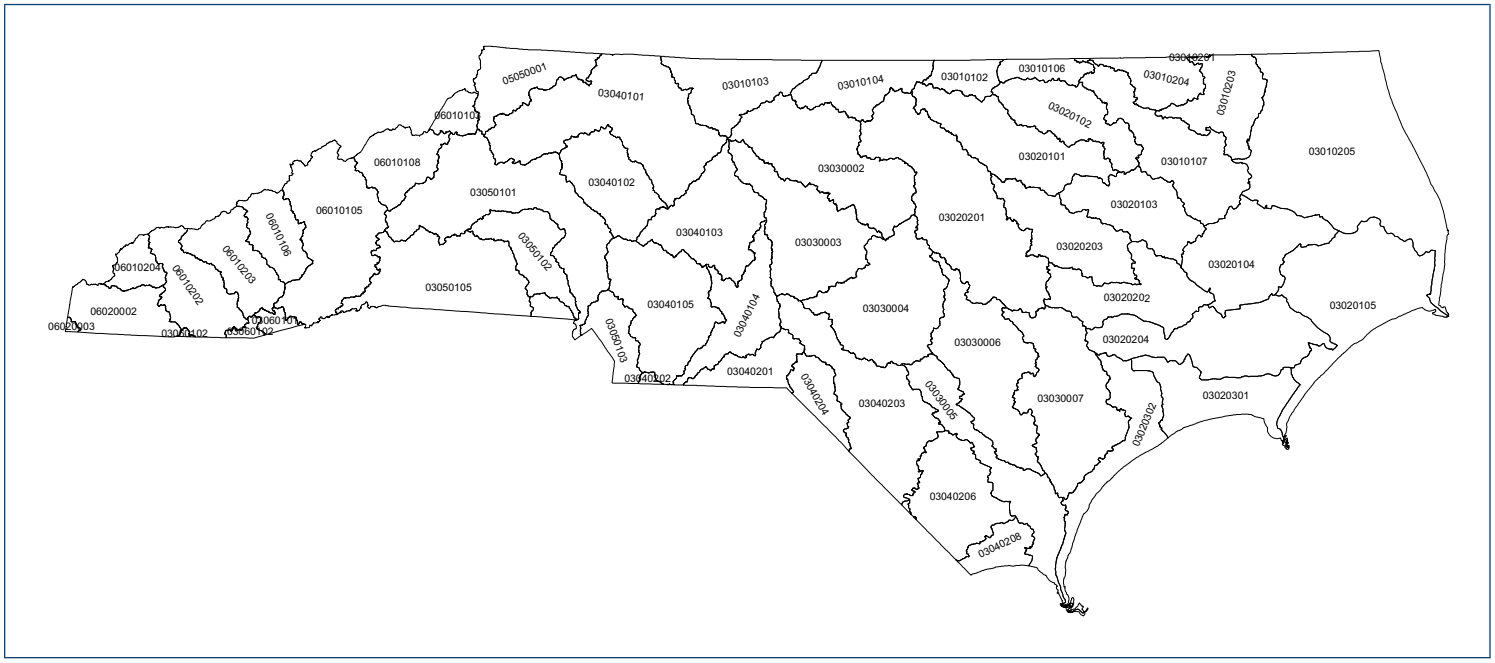
191 *Total Operations*

Daily Withdrawal Capacity (incl. ground & surface):

210,227,464 *Gallons*

[1] Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DEQ by July 25, 2021 have been excluded. The total number of operations represents operations that withdrew water at any time during the year. Central Coastal Plain Counties include Beaufort, Carteret, Craven, Duplin, Edgecombe, Greene, Jones, Lenoir, Martin, Onslow, Pamlico, Pitt, Washington, Wayne, and Wilson

Hydrologic Unit Codes (HUC)



Statistical Defensibility

The North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Division conducted a census of all known farm operations in North Carolina which had farming types that could potentially use more than 10,000 gallons of water in one day. More than 3,300 such operations were contacted and included farms with a history of withdrawing more than 10,000 gallons on any one day from surface or ground sources. Also included were operations with large numbers of poultry, hogs, cattle, aquaculture, fruits, vegetables, nursery/ greenhouse crops, tobacco, or other field crops which are often irrigated. A 79% response rate was attained via mail, phone, or electronically via the web or email. Historical data for all respondents was reviewed to insure comparability with previous surveys. Operations were offered work sheets which assisted them, if necessary, in reporting their withdrawals.

The Census of Agriculture List, the most comprehensive source of farms, was used as the basis for this survey. Although no under-coverage estimator has been applied, the list of NC farmers is expanded on a daily basis as new operations are discovered through routine list building activities. Since agricultural operations that withdraw at least 10,000 gallons of water per day tend to be larger, more intensive farms, under-coverage for this survey is minimal based on historic surveys with similar operations. When reasonable, non-respondents' usage was estimated based on their own historical reports.

Taking the above steps, including conducting a census of all known farm operations that use at least 10,000 gallons of water on any one day, results in zero sampling error around the estimates and minimal non-sampling and coverage error. A nonresponse adjustment expansion factor was applied. It was derived by dividing the universe count by the count of records with usable data.

Prior to the 2008 NC Agricultural Water Use Survey, there was no official statistically defensible data set to represent agricultural water use in North Carolina.