Wind River Bulk Deposition Program
Bridger-Teton National Forest
Summary of 2006 Data
May, 2007

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And
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Introduction to 2006 Bulk Deposition Report

This introduction is intended to give a brief overview of the program, highlight some changes made in the report for 2006, and to describe some noteworthy observations. This is intended to be a data summary, no detailed statistical analysis of the data has been done.

Overview of Bulk Deposition Sampling This program was initiated in 1985, and currently involves sampling precipitation (rain and snow) from 2 sites in the Bridger Wilderness (Hobbs and Black Joe Lakes) to determine the chemical deposition of particles in the air, being washed out with the precipitation. These sites are sampled every 2 weeks in the summer, and every 4 weeks in the winter. Rocky Mountain Research Station analyzes samples and the Forest Service reviews and summarizes the data to complete an annual report for the WY-DEQ and industry. These sample sites are co-located at with Long-term Lake Sampling sites to allow study of cause and effect of pollutants. Industry and WY DEQ agreements finance the Bulk Deposition Monitoring.

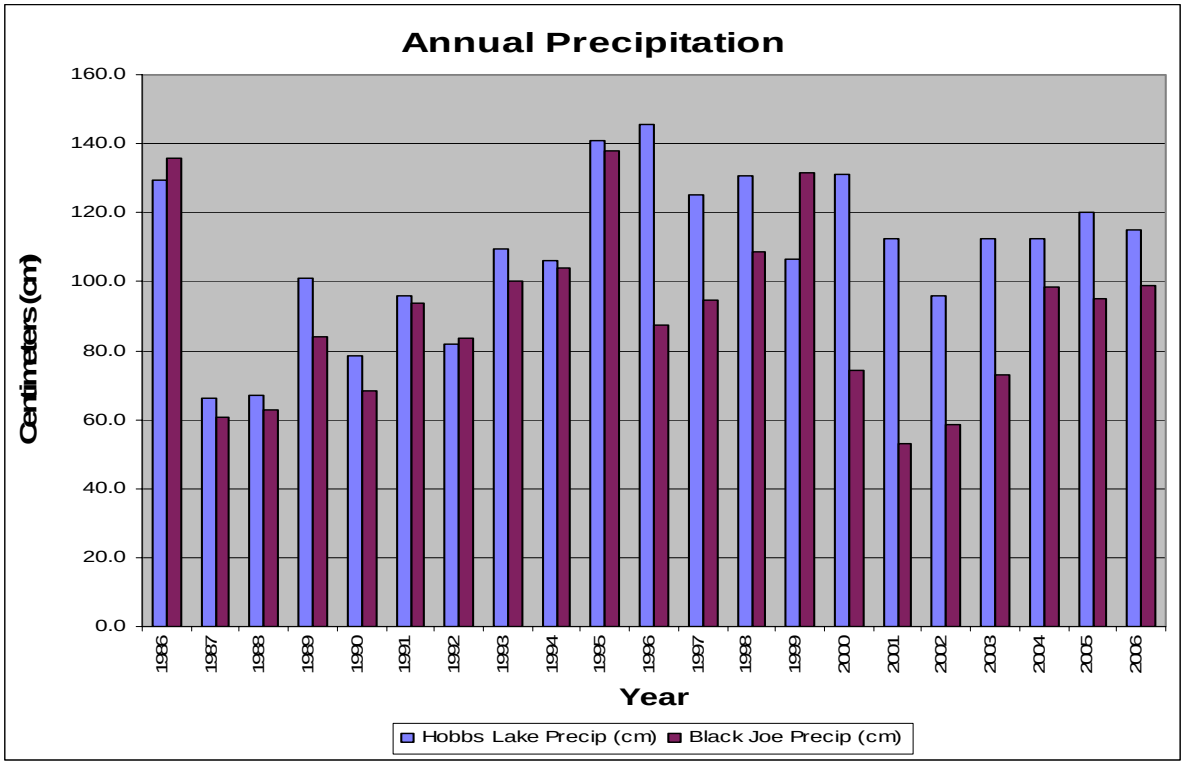
Changes made in the report:

1. We have added numbers and graphs related to total nitrogen (NO3 + NH4) and total sulfur (SO4). Discussions with the National Park Service and U S Geological Survey led to the conclusion that these numbers would be useful to better understand the loading of these elements on the forest. This will also facilitate a comparison of the data to ongoing research on "critical loads". In our discussions, we concluded that using the NH4 in the calculation of total nitrogen would likely underestimate the total nitrogen since some parts of the NH4 could be volatilized and lost as NH3, especially in summer months.
2. The format order of the report was changed slightly to look at things in this order:
   a. Annual Precipitation
   b. Historical Chemistry
   c. Total Nitrogen
      - Nitrates
      - Ammonium
   d. Total Sulfur
      - Sulfates
   e. 2006 Bulk Deposition Data Summary Methods.

Noteworthy observations:

1. Precipitation at both the Hobbs and Black Joe sites was slightly above the average for the last 20 years.
2. Total nitrogen is elevated at the Black Joe site for the 2nd year in a row.
3. Nitrate concentrations appear to be much higher at the Black Joe site during the summer months, and are higher than past years.
4. Monthly weighted nitrate (NO3) samples at the Hobbs site appear to be lower than normal, this can also be attributed to contaminated samples described in the "2006 bulk deposition data summary methods", and the process of averaging pre and post samples for filling in the gap. Actual samples showed nitrate levels comparable to the Black Joe site.

5. Ammonium (NH4) appears to be relatively high again for the 2nd year running at the Black Joe site.
6. Ammonium concentrations also appear to be much higher at the Black Joe site.
7. Ammonium concentrations have not been calculated prior to 2006, therefore the historical trend is lacking.
8. Total sulfur and sulfate deposition are elevated at the Black Joe site for the 2nd year running.
9. Sulfate concentrations appear to be much higher at the Black Joe site, but this could be from data averaging described in item 4.



Precipitation

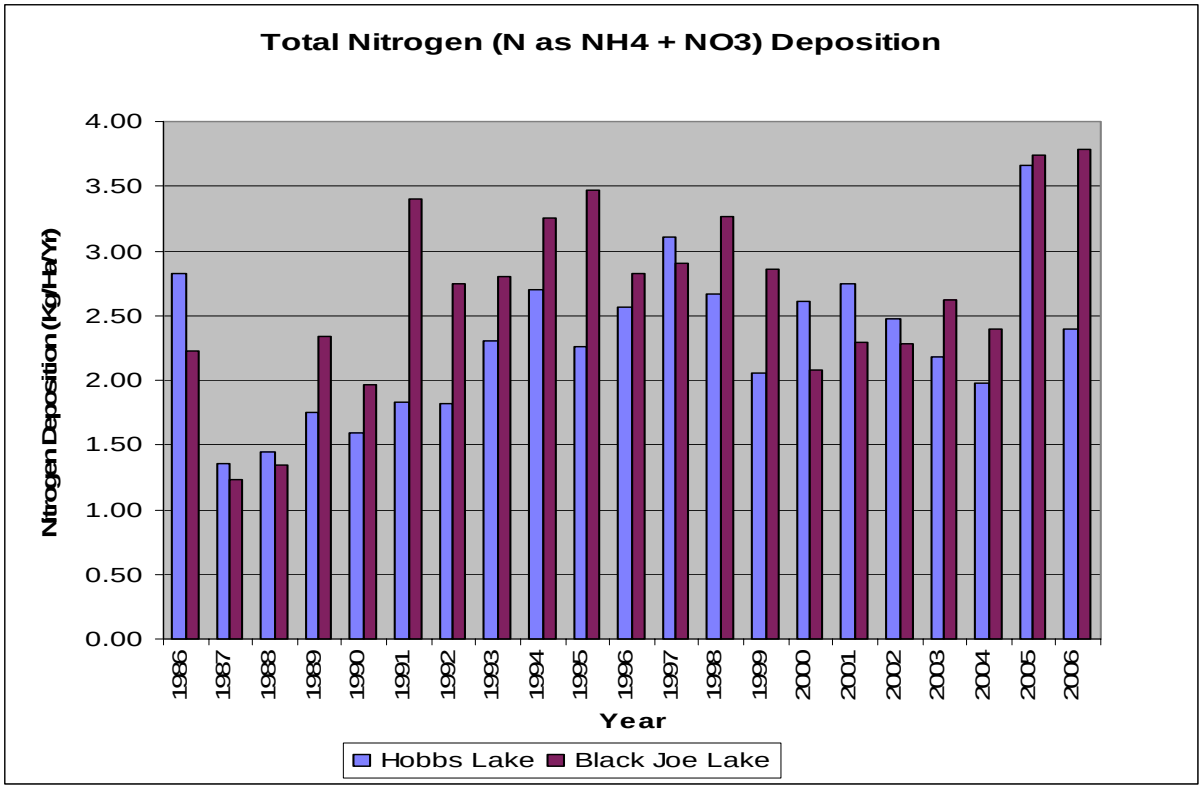
Year	Hobbs Lake Precip (cm)	Black Joe Precip (cm)
1986	129.6	135.8
1987	66.0	60.7
1988	67.0	62.9
1989	101.0	84.1
1990	78.4	68.4
1991	95.8	93.9
1992	81.8	83.4
1993	109.4	100.1
1994	106.3	104.0
1995	140.9	138.1
1996	145.5	87.4
1997	125.4	94.8
1998	130.8	108.6
1999	106.5	131.5
2000	131.2	74.1
2001	112.6	52.9
2002	95.9	58.7
2003	112.5	72.9
2004	112.3	98.3
2005	120.2	95.1
2006	115.0	99.0
Average	**108.8**	**90.7**

Hobbs Lake Annual Deposition (Kilograms/hectare/year)

	Ca	Mg	K	Na	Cl	NH4	N as NH4	NO3	N as NO3	SO4	S as SO4	Total N	Precip (cm)
1986	2.60	0.31	1.14	1.86	2.78	2.35	1.49	5.91	1.34	5.84	1.94	2.83	129.6
1987	2.08	0.29	0.45	1.01	1.59	0.80	0.51	3.77	0.85	3.52	1.17	1.36	66.0
1988	1.69	0.21	0.74	1.19	1.78	0.78	0.50	4.23	0.96	3.90	1.30	1.45	67.0
1989	2.21	0.27	0.59	1.35	1.87	0.79	0.50	5.53	1.25	4.52	1.51	1.75	101.0
1990	1.66	0.23	0.31	0.77	1.03	0.65	0.41	5.21	1.18	4.12	1.37	1.59	78.4
1991	2.38	0.35	0.30	0.93	0.94	0.95	0.60	5.43	1.23	4.67	1.56	1.83	95.8
1992	2.01	0.26	0.40	0.71	1.42	0.87	0.55	5.59	1.26	4.42	1.47	1.82	81.8
1993	2.07	0.26	0.24	0.91	0.97	1.20	0.76	6.79	1.53	5.33	1.77	2.30	109.4
1994	3.32	0.37	0.26	0.93	0.94	1.32	0.84	8.25	1.86	6.30	2.10	2.70	106.3
1995	1.54	0.23	0.45	0.93	0.98	1.34	0.85	6.22	1.41	4.87	1.62	2.26	140.9
1996	2.66	0.33	0.22	0.72	1.08	1.36	0.86	7.50	1.69	4.69	1.56	2.56	145.5
1997	2.40	0.29	0.30	0.79	0.84	1.67	1.06	9.06	2.05	5.29	1.76	3.11	125.4
1998	2.40	0.29	0.28	1.38	1.20	1.18	0.75	8.48	1.92	6.35	2.11	2.67	130.8
1999	1.37	0.19	0.31	0.41	0.74	1.09	0.69	6.05	1.37	4.08	1.36	2.06	106.5
2000	4.77	0.59	0.79	2.13	1.29	1.11	0.71	8.41	1.90	5.74	1.91	2.61	131.2
2001	2.61	0.40	0.40	0.85	0.92	1.44	0.91	8.12	1.83	5.39	1.79	2.75	112.6
2002	7.76	1.02	0.72	1.44	1.09	1.46	0.93	6.83	1.54	5.24	1.74	2.47	95.9
2003	2.36	0.24	0.52	0.72	0.67	1.18	0.75	6.34	1.43	4.29	1.43	2.18	112.5
2004	2.10	0.53	0.53	0.49	0.64	1.09	0.70	5.67	1.28	3.094	1.03	1.98	112.3
2005	3.64	0.48	0.23	0.76	0.90	2.43	1.55	9.36	2.12	7.195	2.40	3.66	120.2
2006	3.33	0.48	0.61	0.89	0.81	1.57	1.00	6.22	1.41	3.91	1.30	2.40	115.0
Average	**2.71**	**0.36**	**0.47**	**1.01**	**1.17**	**1.27**	**0.81**	**6.62**	**1.50**	**4.89**	**1.63**	**2.30**	**108.77**

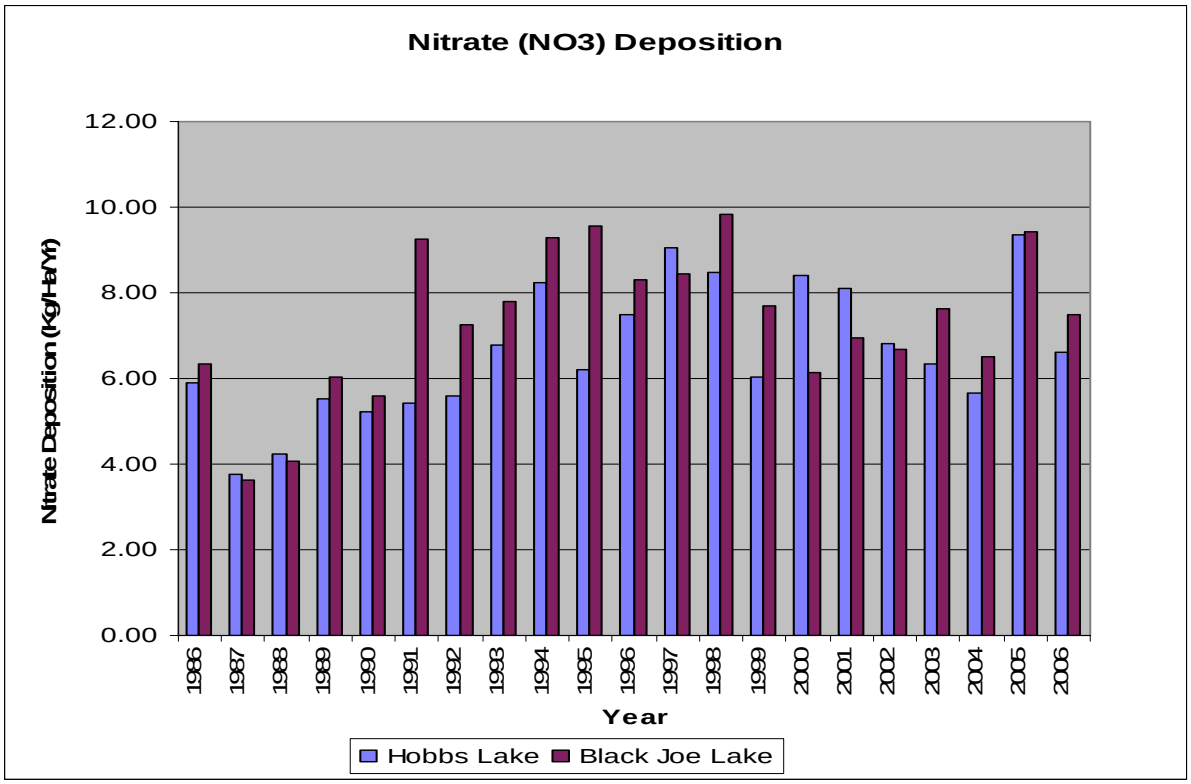
Black Joe Annual Deposition (Kilograms/hectare/year)

	Ca	Mg	K	Na	Cl	NH4	N as NH4	NO3	N as NO3	SO4	S as SO4	Total N	Precip (cm)
1986	2.26	0.31	0.53	1.04	1.53	1.25	0.80	6.34	1.43	6.52	2.17	2.23	135.8
1987	1.52	0.19	0.36	0.64	1.07	0.64	0.41	3.64	0.82	4.11	1.37	1.23	60.7
1988	1.88	0.21	0.32	0.79	1.00	0.68	0.43	4.08	0.92	4.73	1.58	1.35	62.9
1989	2.92	0.36	0.45	1.09	1.31	1.53	0.97	6.03	1.36	5.71	1.90	2.34	84.1
1990	1.87	0.24	0.26	0.67	0.87	1.10	0.70	5.60	1.27	4.52	1.51	1.97	68.4
1991	6.21	0.62	0.37	1.41	1.43	2.06	1.31	9.25	2.09	8.60	2.86	3.40	93.9
1992	2.45	0.28	0.26	0.67	0.97	1.75	1.11	7.24	1.64	5.91	1.97	2.75	83.4
1993	2.33	0.31	0.24	1.42	1.12	1.64	1.04	7.79	1.76	7.52	2.50	2.80	100.1
1994	2.81	0.32	0.26	0.82	0.89	1.82	1.16	9.28	2.10	7.19	2.39	3.25	104.0
1995	2.66	0.34	0.42	1.31	1.26	2.05	1.30	9.57	2.16	7.37	2.45	3.47	138.1
1996	3.54	0.41	0.22	0.97	0.96	1.51	0.96	8.29	1.87	5.58	1.86	2.83	87.4
1997	2.23	0.30	0.67	1.53	2.27	1.56	0.99	8.43	1.91	5.61	1.87	2.90	94.8
1998	3.04	0.37	0.40	1.20	1.31	1.63	1.04	9.82	2.22	7.32	2.44	3.26	108.6
1999	2.56	0.38	0.60	0.70	0.75	1.76	1.12	7.69	1.74	7.31	2.43	2.86	131.5
2000	3.15	0.38	0.42	0.84	0.66	1.09	0.69	6.16	1.39	4.62	1.54	2.08	74.1
2001	2.65	0.34	0.30	0.66	0.71	1.13	0.72	6.94	1.57	4.15	1.38	2.29	52.9
2002	5.22	0.55	0.50	1.21	0.86	1.22	0.78	6.67	1.51	4.87	1.62	2.28	58.7
2003	4.16	0.43	0.36	0.78	0.64	1.41	0.90	7.64	1.73	5.26	1.75	2.62	72.9
2004	2.49	0.41	0.50	0.60	0.68	1.47	0.93	6.50	1.47	4.11	1.37	2.40	98.3
2005	2.11	0.47	0.32	0.94	0.92	2.53	1.61	9.44	2.13	7.46	2.48	3.74	95.1
2006	5.63	0.73	0.73	1.25	1.08	2.19	1.39	10.63	2.40	7.37	2.45	3.79	99.0
Average	**3.03**	**0.38**	**0.40**	**0.98**	**1.06**	**1.52**	**0.97**	**7.48**	**1.69**	**5.99**	**2.00**	**2.66**	**90.70**



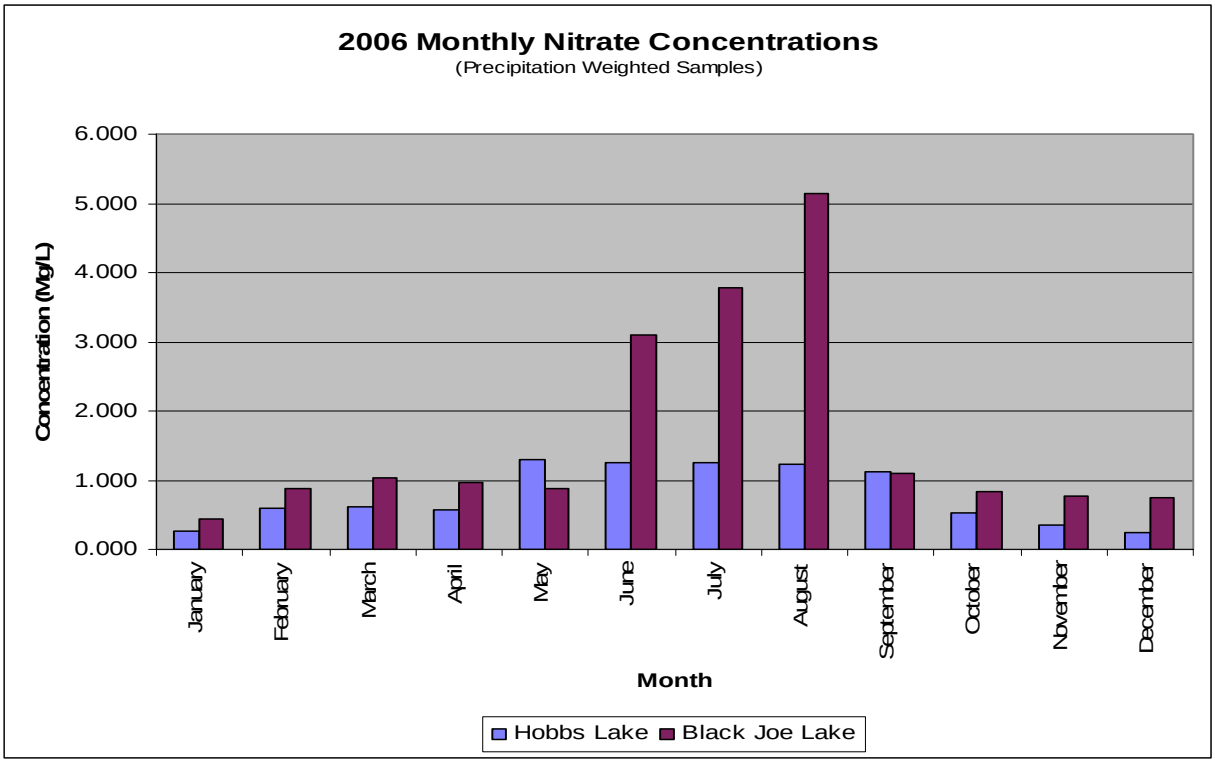
Nitrogen Deposition (Kg/Ha/Yr)

Year	Hobbs Lake	Black Joe Lake
1986	2.83	2.23
1987	1.36	1.23
1988	1.45	1.35
1989	1.75	2.34
1990	1.59	1.97
1991	1.83	3.40
1992	1.82	2.75
1993	2.30	2.80
1994	2.70	3.25
1995	2.26	3.47
1996	2.56	2.83
1997	3.11	2.90
1998	2.67	3.26
1999	2.06	2.86
2000	2.61	2.08
2001	2.75	2.29
2002	2.47	2.28
2003	2.18	2.62
2004	1.98	2.40
2005	3.66	3.74
2006	2.40	3.79
Average	**2.30**	**2.66**



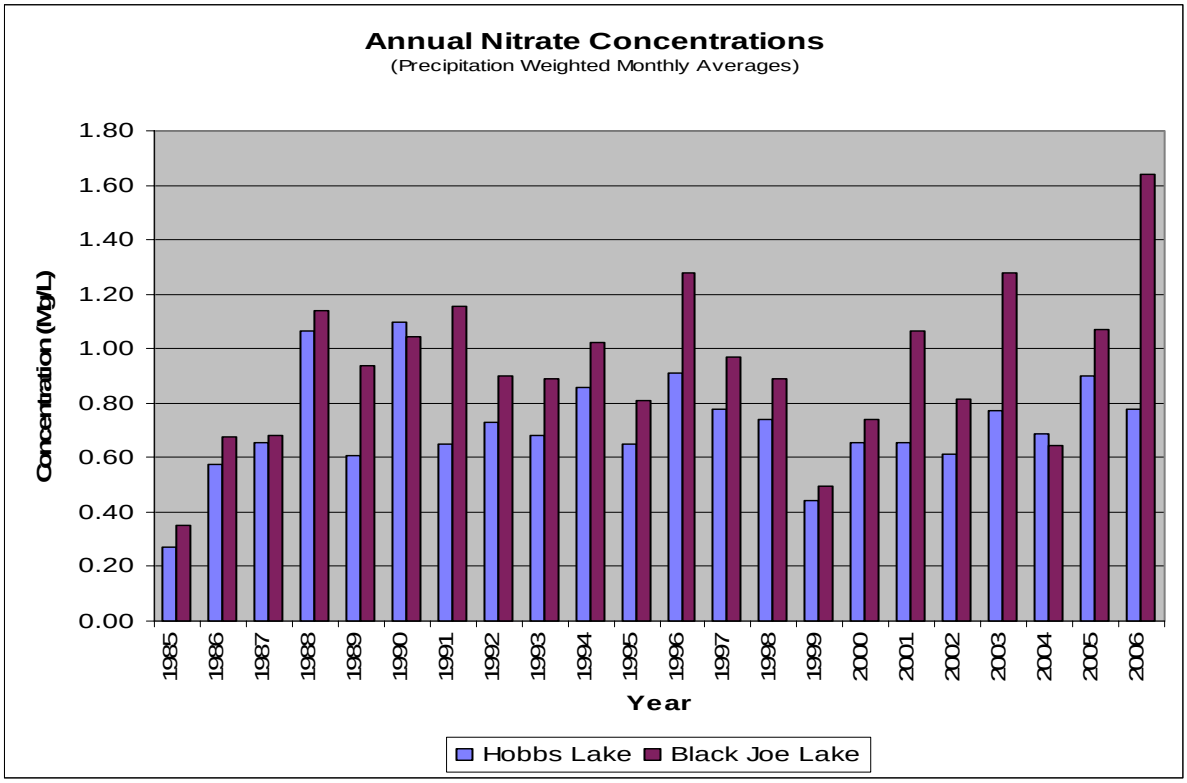
Nitrate Deposition (Kg/Ha/Yr)

Year	Hobbs Lake	Black Joe Lake
1986	5.91	6.34
1987	3.77	3.64
1988	4.23	4.08
1989	5.53	6.03
1990	5.21	5.60
1991	5.43	9.25
1992	5.59	7.24
1993	6.79	7.79
1994	8.25	9.28
1995	6.22	9.57
1996	7.50	8.29
1997	9.06	8.43
1998	8.48	9.82
1999	6.05	7.69
2000	8.40	6.15
2001	8.12	6.94
2002	6.83	6.67
2003	6.34	7.64
2004	5.67	6.50
2005	9.36	9.44
2006	6.62	7.48
Average	6.64	7.33



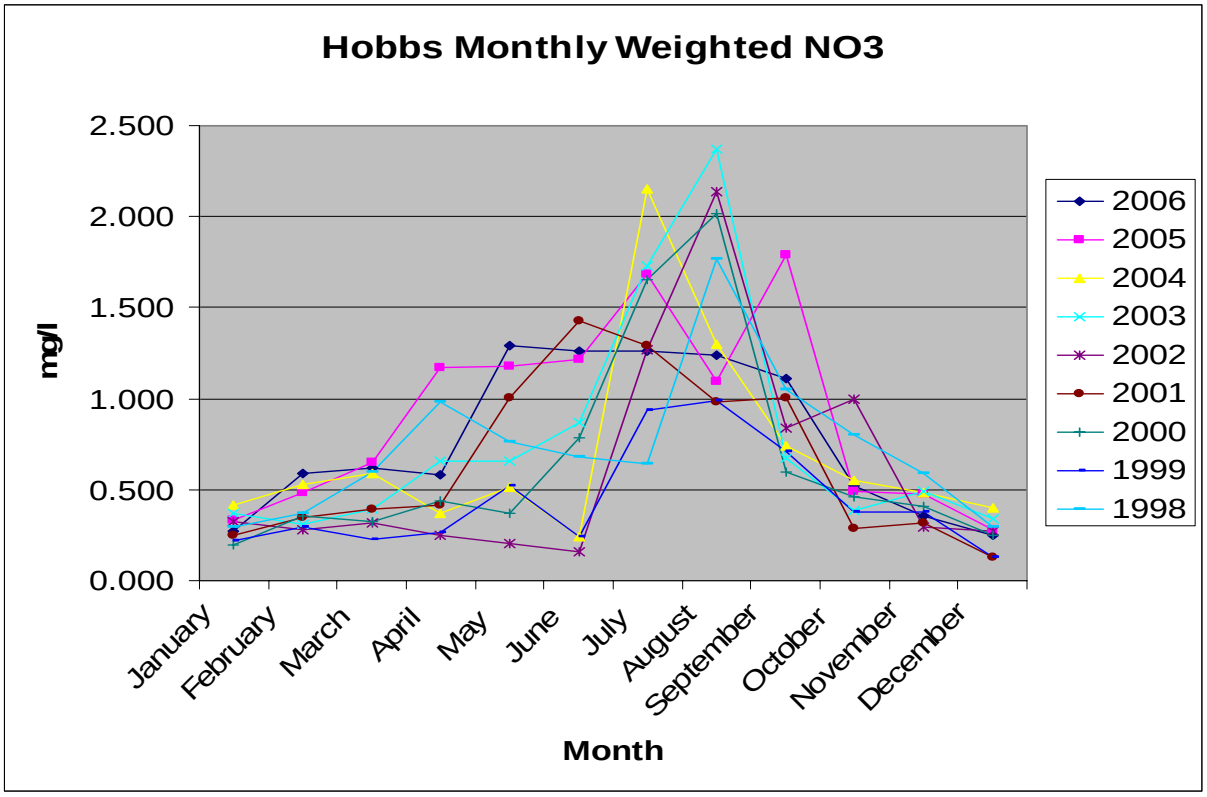
2006 Monthly Nitrate Concentrations of Precipitation (Mg/L)

Month	Hobbs Lake	Black Joe Lake
January	0.269	0.441
February	0.586	0.869
March	0.616	1.040
April	0.579	0.974
May	1.291	0.870
June	1.260	3.106
July	1.260	3.780
August	1.235	5.144
September	1.113	1.098
October	0.518	0.834
November	0.353	0.771
December	0.249	0.757
Average	**0.777**	**1.640**



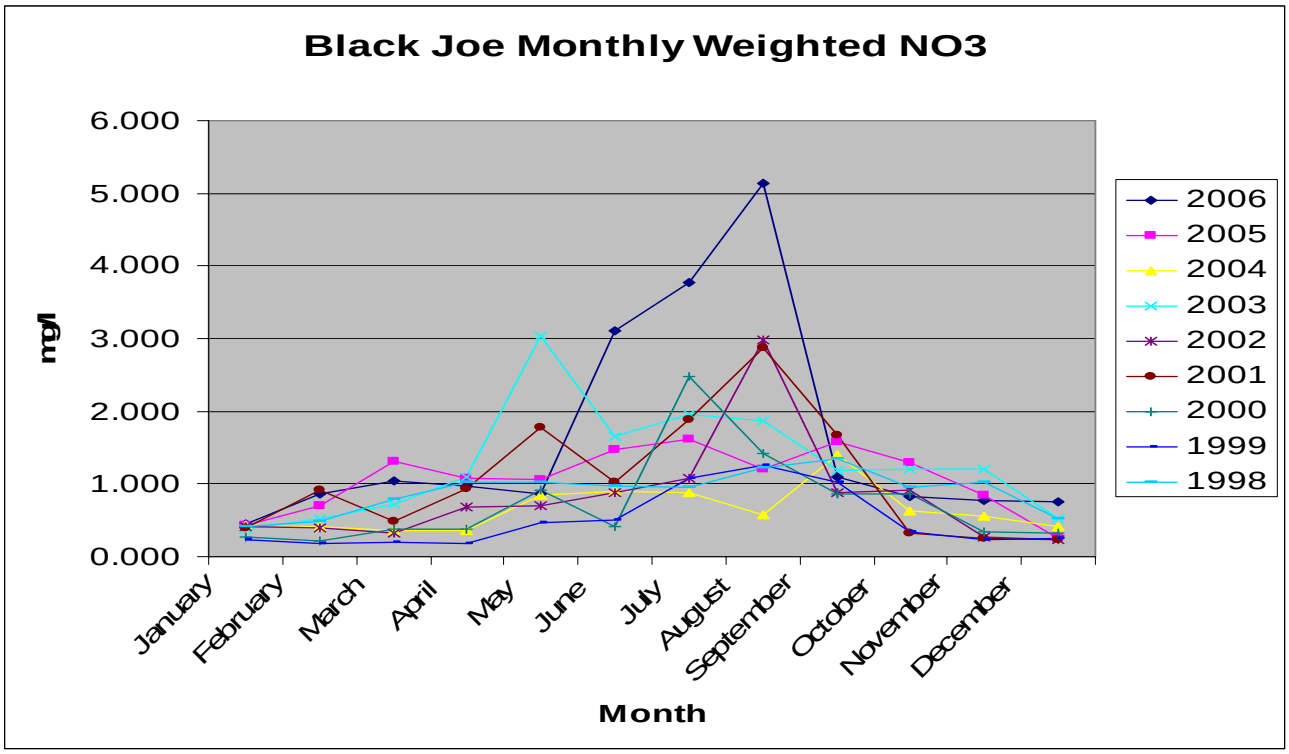
Annual Nitrate Concentrations (Precipitation Weighted Monthly Averages) (Mg/L)

	Hobbs Lake	Black Joe Lake
1985	0.27	0.35
1986	0.58	0.68
1987	0.66	0.68
1988	1.07	1.14
1989	0.61	0.94
1990	1.10	1.05
1991	0.65	1.16
1992	0.73	0.90
1993	0.68	0.89
1994	0.86	1.02
1995	0.65	0.81
1996	0.91	1.28
1997	0.78	0.97
1998	0.74	0.89
1999	0.44	0.50
2000	0.65	0.74
2001	0.65	1.06
2002	0.61	0.81
2003	0.77	1.277
2004	0.69	0.65
2005	0.90	1.07
2006	0.78	1.64



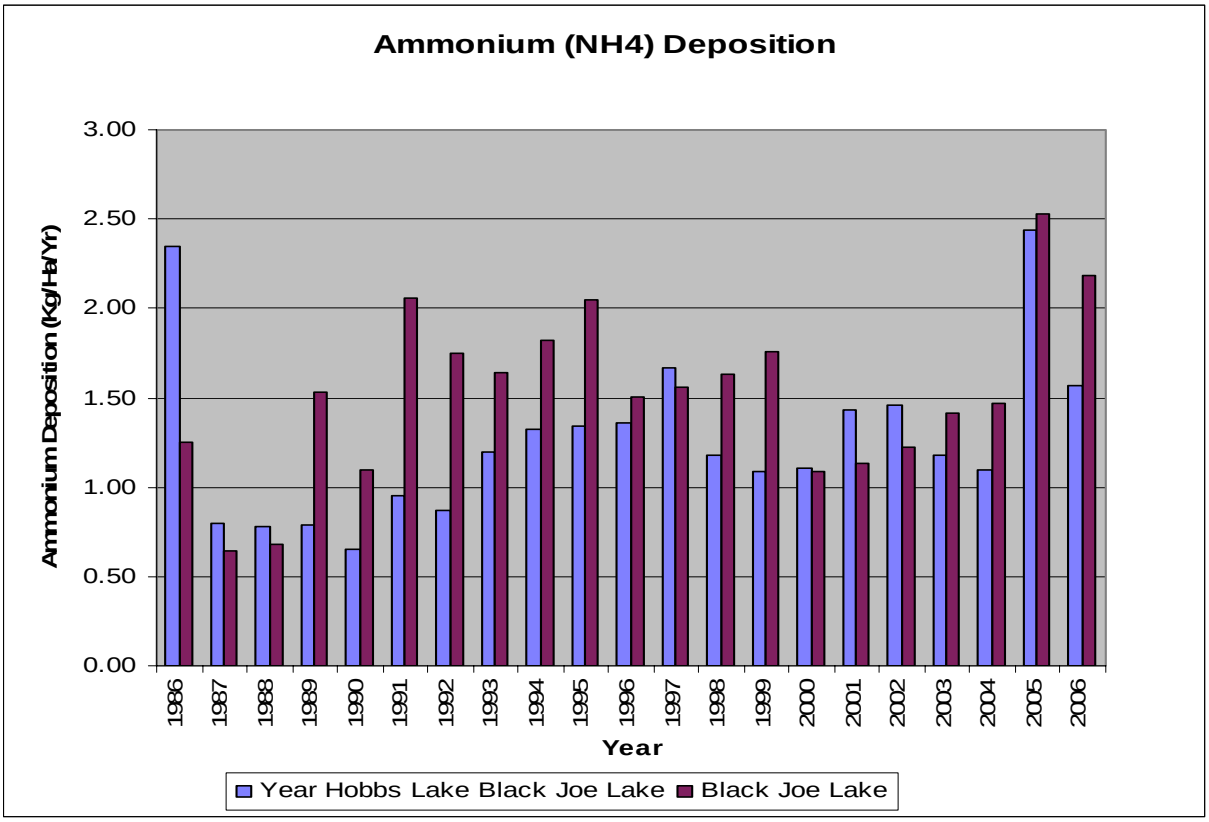
Hobbs Lake NO3 Monthly Weighted Concentrations (mg/l)

	2006	2005	2004	2003	2002	2001	2000	1999	1998
January	0.269	0.331	0.412	0.367	0.328	0.250	0.200	0.219	0.292
February	0.586	0.483	0.528	0.312	0.280	0.344	0.352	0.297	0.372
March	0.616	0.652	0.586	0.392	0.319	0.396	0.321	0.226	0.600
April	0.579	1.172	0.370	0.655	0.250	0.414	0.439	0.264	0.979
May	1.291	1.175	0.511	0.655	0.205	1.006	0.368	0.522	0.763
June	1.260	1.217	0.238	0.866	0.156	1.431	0.784	0.240	0.679
July	1.260	1.687	2.152	1.728	1.270	1.291	1.654	0.933	0.639
August	1.235	1.097	1.298	2.373	2.137	0.981	2.017	0.988	1.766
September	1.113	1.793	0.741	0.672	0.842	1.003	0.595	0.711	1.047
October	0.518	0.494	0.552	0.386	1.000	0.285	0.459	0.375	0.802
November	0.353	0.476	0.481	0.493	0.295	0.314	0.409	0.376	0.588
December	0.249	0.281	0.398	0.342	0.273	0.126	0.249	0.126	0.296
Average	**0.777**	**0.905**	**0.689**	**0.770**	**0.613**	**0.653**	**0.654**	**0.440**	**0.735**



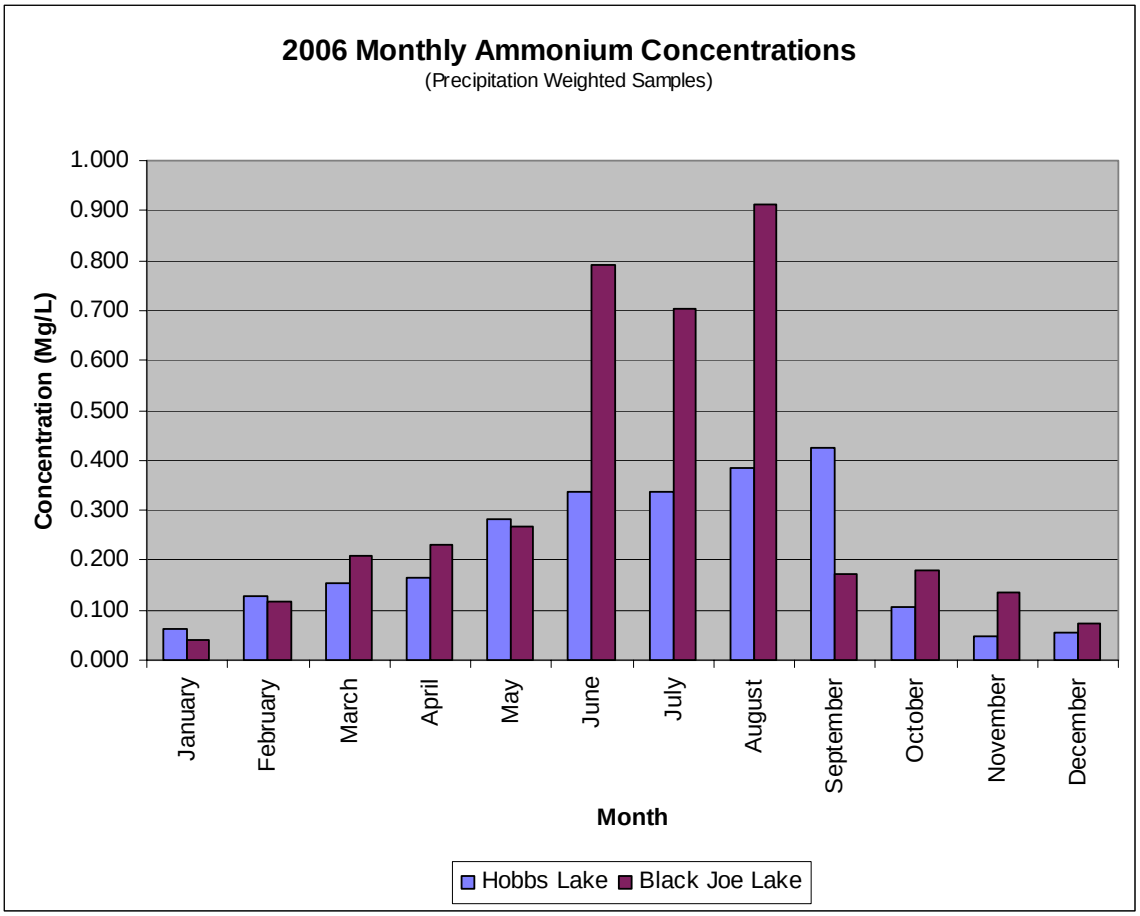
Black Joe Lake NO3 Monthly Weighted Concentrations (mg/l)

	2006	2005	2004	2003	2002	2001	2000	1999	1998
January	0.441	0.438	0.435	0.372	0.415	0.398	0.274	0.225	0.413
February	0.869	0.693	0.405	0.523	0.397	0.909	0.220	0.182	0.493
March	1.040	1.316	0.366	0.710	0.323	0.480	0.385	0.202	0.783
April	0.974	1.085	0.357	1.098	0.688	0.940	0.379	0.182	1.021
May	0.870	1.053	0.843	3.040	0.701	1.785	0.912	0.469	1.017
June	3.106	1.473	0.900	1.656	0.878	1.019	0.413	0.510	0.964
July	3.780	1.611	0.884	1.953	1.082	1.892	2.488	1.083	0.958
August	5.144	1.208	0.573	1.864	2.980	2.868	1.416	1.258	1.213
September	1.098	1.587	1.394	1.186	0.875	1.678	0.870	1.017	1.356
October	0.834	1.287	0.633	1.202	0.913	0.316	0.862	0.343	0.946
November	0.771	0.848	0.561	1.201	0.271	0.255	0.344	0.227	1.021
December	0.757	0.251	0.410	0.520	0.235	0.232	0.315	0.253	0.517
Average	**1.640**	**1.071**	**0.647**	**1.277**	**0.813**	**1.064**	**0.740**	**0.496**	**0.892**



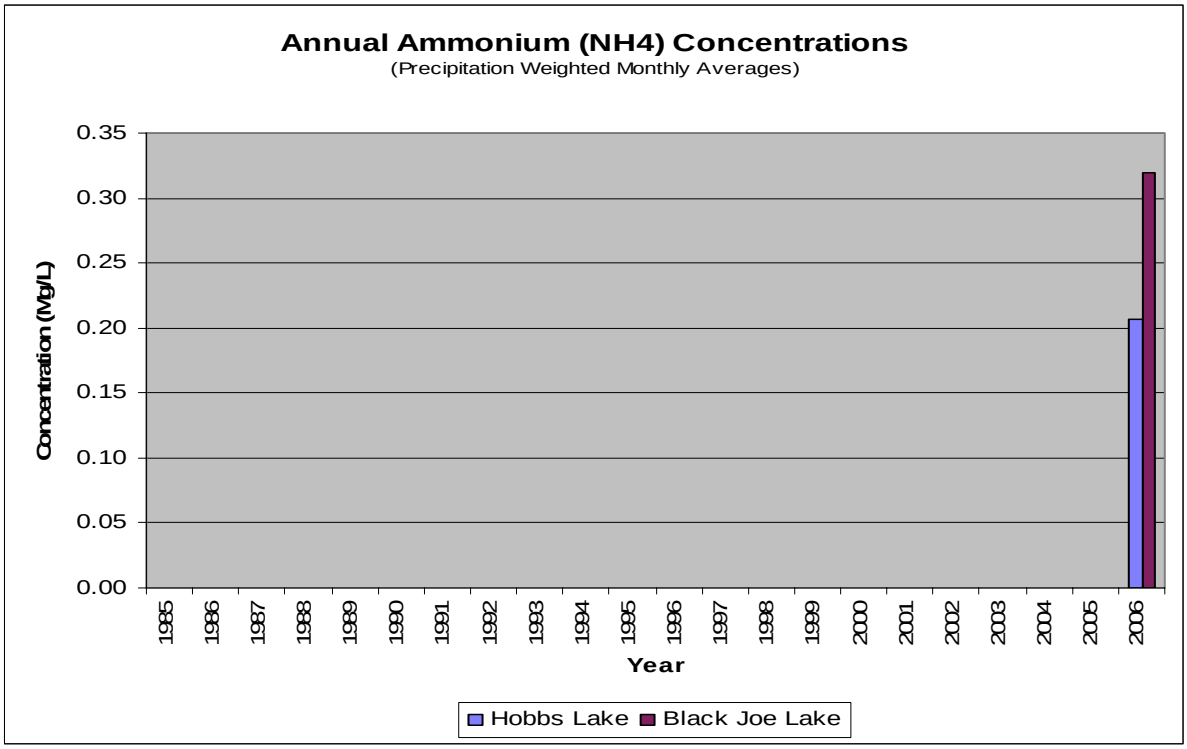
Ammonium Deposition (Kg/Ha/Yr)

Year	Hobbs Lake	Black Joe Lake
1986	2.35	1.25
1987	0.80	0.64
1988	0.78	0.68
1989	0.79	1.53
1990	0.65	1.10
1991	0.95	2.06
1992	0.87	1.75
1993	1.20	1.64
1994	1.32	1.82
1995	1.34	2.05
1996	1.36	1.51
1997	1.67	1.56
1998	1.18	1.63
1999	1.09	1.76
2000	1.11	1.09
2001	1.44	1.13
2002	1.46	1.22
2003	1.18	1.41
2004	1.09	1.47
2005	2.43	2.53
2006	1.57	2.19
Average	1.27	1.52



2006 Monthly Ammonium Concentrations of Precipitation (Mg/L)

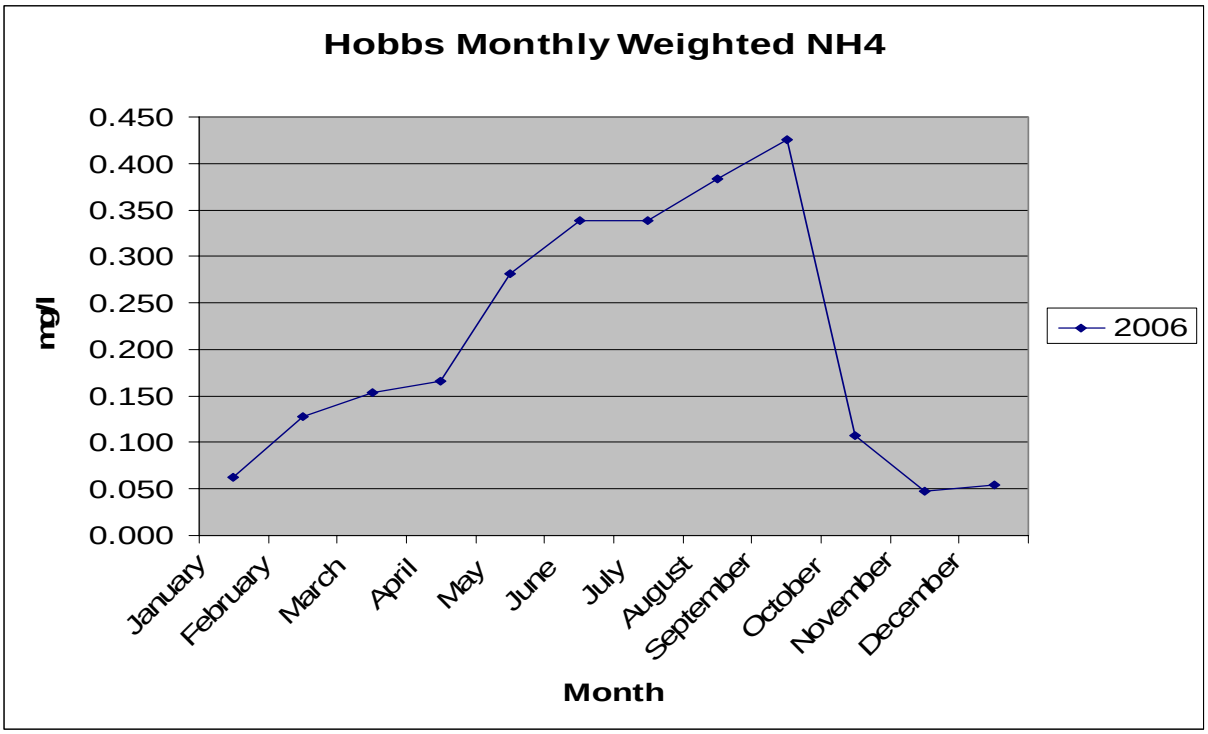
Month	Hobbs Lake	Black Joe Lake
January	0.063	0.041
February	0.128	0.116
March	0.153	0.209
April	0.166	0.232
May	0.281	0.268
June	0.338	0.793
July	0.338	0.702
August	0.384	0.912
September	0.426	0.173
October	0.107	0.180
November	0.048	0.134
December	0.054	0.074
Average	**0.207**	**0.320**



Annual Ammonium Concentrations (Precipitation Weighted Monthly Averages) (Mg/L)

	Hobbs Lake	Black Joe Lake
1985		
1986		
1987		
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999		
2000		
2001		
2002		
2003		
2004		
2005		
2006	0.21	0.32

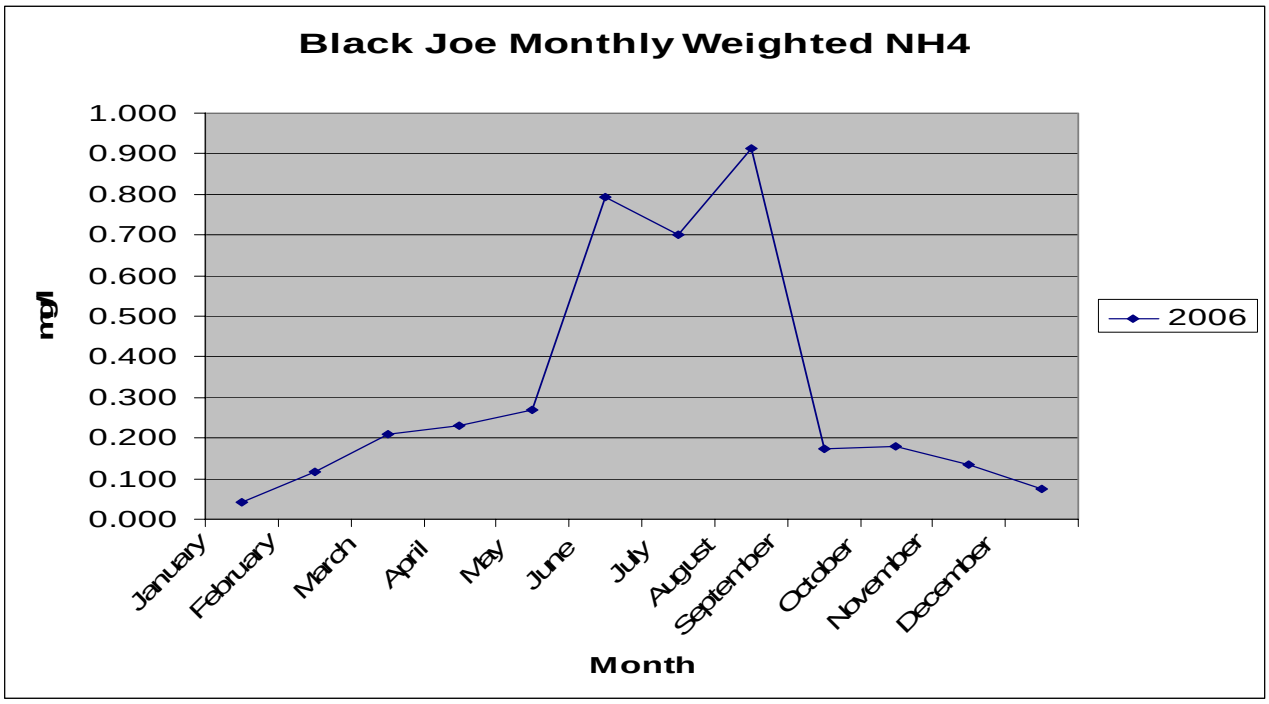
NOTE: NH4 concentrations from 1985 to 2005 have not been calculated.



Hobbs Lake NH4 Monthly Weighted Concentrations (mg/l)

	2006
January	0.063
February	0.128
March	0.153
April	0.166
May	0.281
June	0.338
July	0.338
August	0.384
September	0.426
October	0.107
November	0.048
December	0.054
Average	0.207

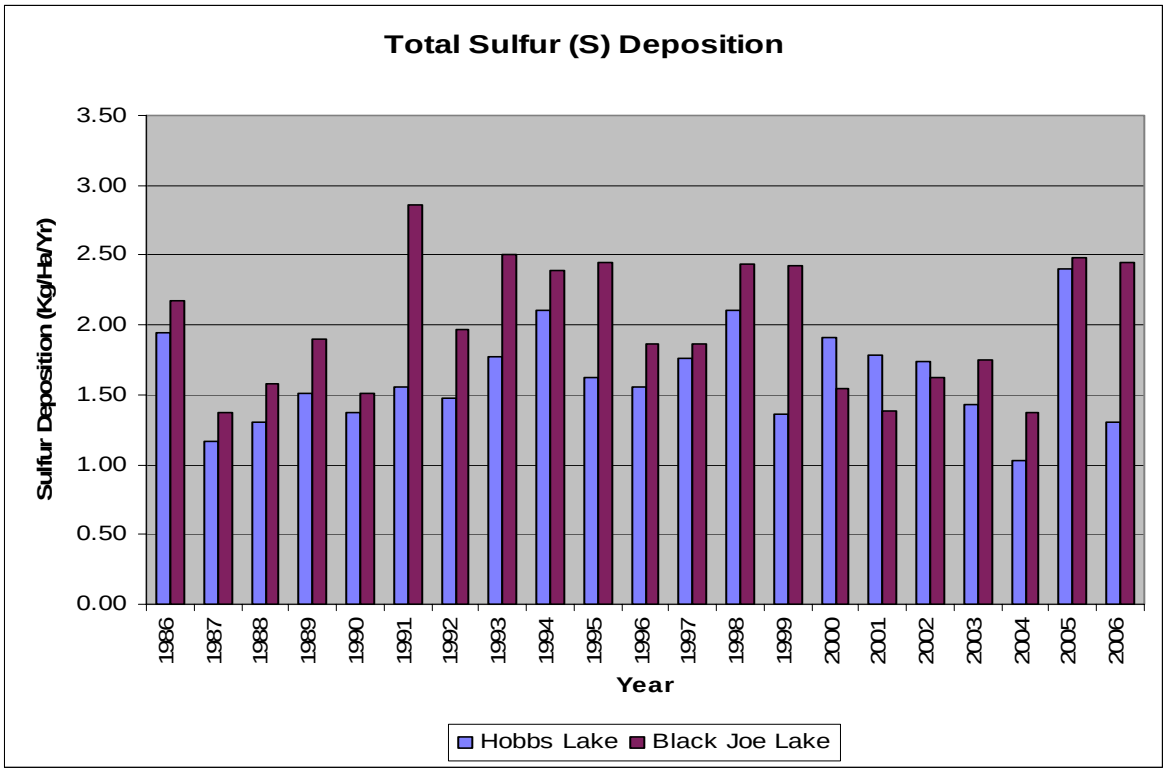
NOTE: NH4 concentrations were not calculated prior to 2006.



Black Joe Lake NH4 Monthly Weighted Concentrations (mg/l)

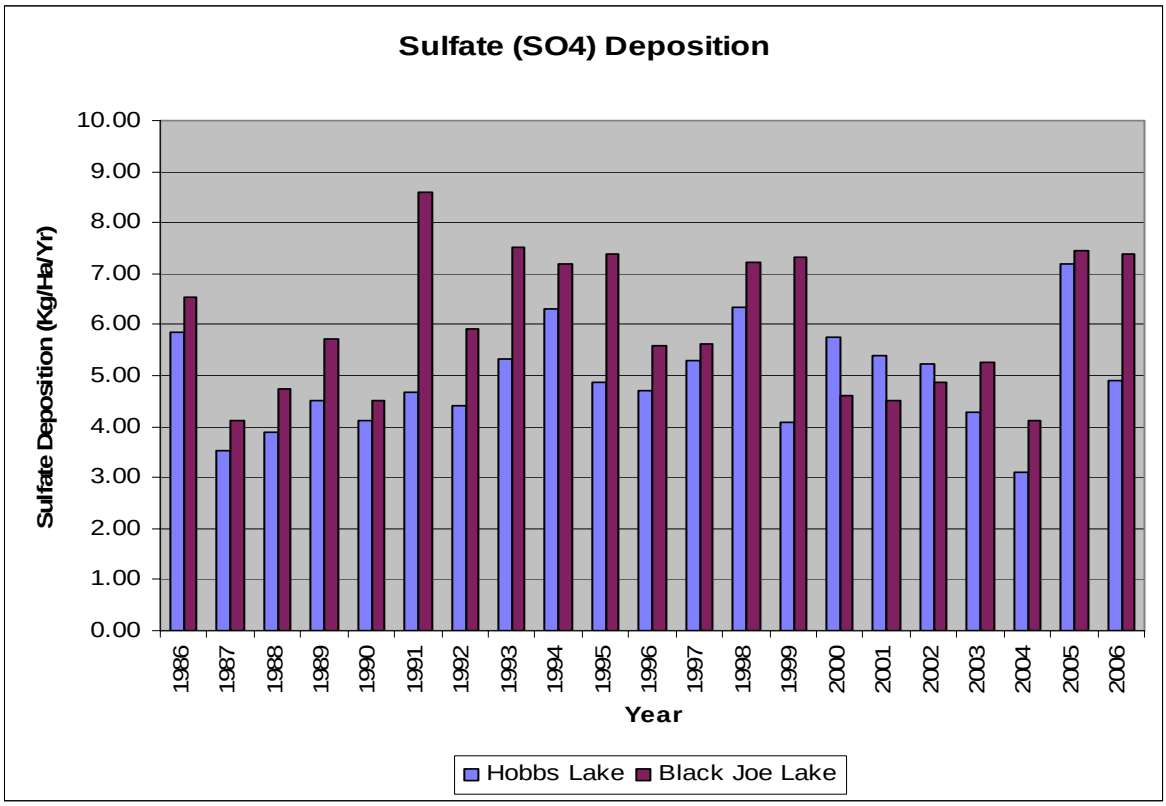
	2006
January	0.041
February	0.116
March	0.209
April	0.232
May	0.268
June	0.793
July	0.702
August	0.912
September	0.173
October	0.180
November	0.134
December	0.074
Average	0.320

NOTE: NH4 concentrations were not calculated prior to 2006.



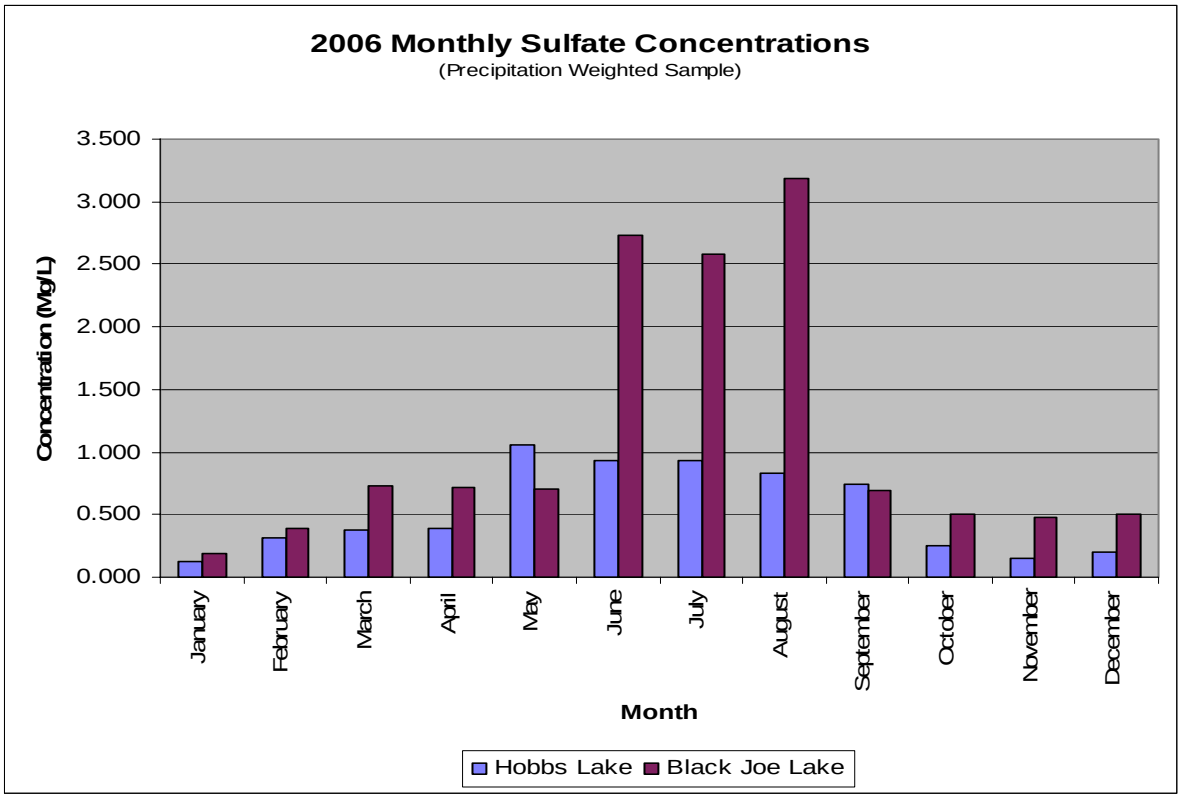
Sulfur Deposition (Kg/Ha/Yr)

Year	Hobbs Lake	Black Joe Lake
1986	1.94	2.17
1987	1.17	1.37
1988	1.30	1.58
1989	1.51	1.90
1990	1.37	1.51
1991	1.56	2.86
1992	1.47	1.97
1993	1.77	2.50
1994	2.10	2.39
1995	1.62	2.45
1996	1.56	1.86
1997	1.76	1.87
1998	2.11	2.44
1999	1.36	2.43
2000	1.91	1.54
2001	1.79	1.38
2002	1.74	1.62
2003	1.43	1.75
2004	1.03	1.37
2005	2.40	2.48
2006	1.30	2.45
Average	1.63	1.99



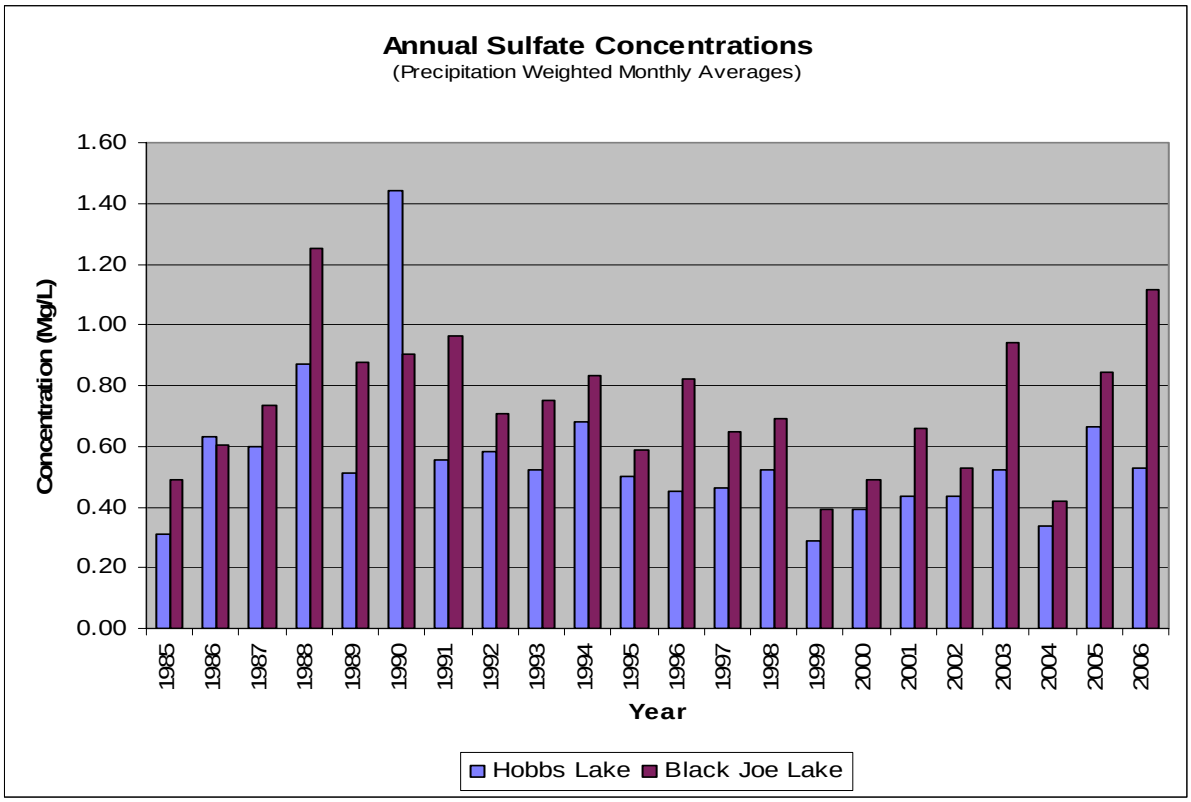
Sulfate Deposition (Kg/Ha/Yr)

Year	Hobbs Lake	Black Joe Lake
1986	5.84	6.52
1987	3.52	4.11
1988	3.90	4.73
1989	4.52	5.71
1990	4.12	4.52
1991	4.67	8.60
1992	4.42	5.91
1993	5.33	7.52
1994	6.30	7.19
1995	4.87	7.37
1996	4.69	5.58
1997	5.29	5.61
1998	6.35	7.23
1999	4.08	7.31
2000	5.74	4.62
2001	5.39	4.51
2002	5.24	4.87
2003	4.29	5.26
2004	3.09	4.113
2005	7.20	7.462
2006	4.89	7.37
Average	4.94	6.01



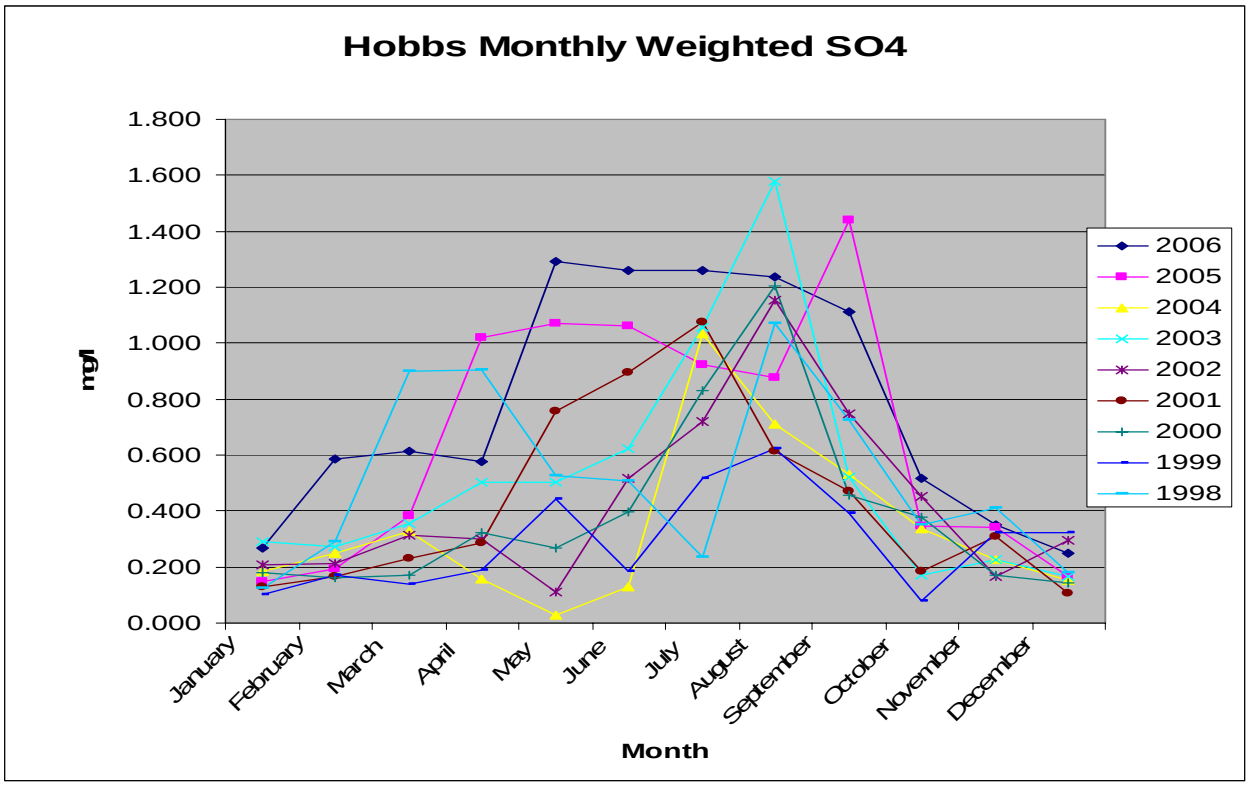
2006 Monthly Sulfate Concentrations of Precipitation (Mg/L)

Month	Hobbs Lake	Black Joe Lake
January	0.121	0.189
February	0.312	0.390
March	0.372	0.732
April	0.396	0.720
May	1.063	0.701
June	0.936	2.737
July	0.935	2.575
August	0.834	3.189
September	0.741	0.691
October	0.253	0.503
November	0.157	0.483
December	0.202	0.502
Average	**0.527**	**1.118**



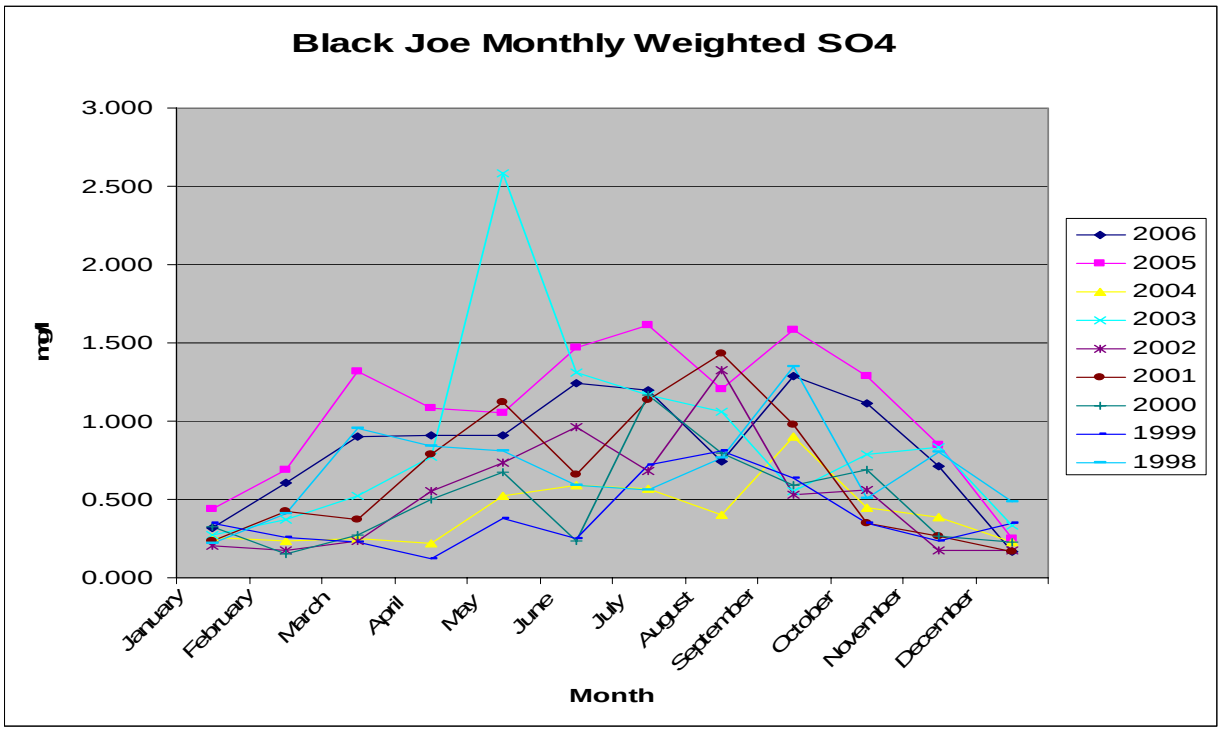
Annual Sulfate Concentrations (Precipitation Weighted Monthly Averages) (Mg/L)

	Hobbs Lake	Black Joe Lake
1985	0.31	0.49
1986	0.63	0.61
1987	0.60	0.73
1988	0.87	1.25
1989	0.51	0.88
1990	1.44	0.90
1991	0.55	0.96
1992	0.58	0.71
1993	0.52	0.75
1994	0.68	0.83
1995	0.50	0.59
1996	0.45	0.82
1997	0.46	0.65
1998	0.52	0.69
1999	0.29	0.39
2000	0.39	0.49
2001	0.44	0.66
2002	0.43	0.53
2003	0.52	0.94
2004	0.34	0.42
2005	0.66	0.84
2006	0.53	1.12



Hobbs Lake SO4 Monthly Weighted Concentrations (mg/l)

	2006	2005	2004	2003	2002	2001	2000	1999	1998
January	0.269	0.148	0.185	0.293	0.208	0.128	0.181	0.101	0.126
February	0.586	0.194	0.249	0.272	0.211	0.167	0.160	0.171	0.290
March	0.616	0.384	0.329	0.354	0.314	0.229	0.169	0.137	0.900
April	0.579	1.020	0.155	0.503	0.300	0.286	0.322	0.190	0.904
May	1.291	1.072	0.028	0.503	0.110	0.758	0.269	0.441	0.527
June	1.260	1.060	0.130	0.622	0.517	0.896	0.395	0.186	0.510
July	1.260	0.922	1.034	1.055	0.722	1.074	0.831	0.518	0.235
August	1.235	0.876	0.709	1.579	1.156	0.616	1.203	0.625	1.070
September	1.113	1.438	0.533	0.523	0.749	0.469	0.456	0.391	0.726
October	0.518	0.344	0.335	0.172	0.453	0.186	0.379	0.078	0.353
November	0.353	0.341	0.224	0.226	0.167	0.307	0.173	0.323	0.410
December	0.249	0.168	0.152	0.168	0.297	0.104	0.144	0.324	0.179
Average	**0.777**	**0.664**	**0.339**	**0.523**	**0.434**	**0.435**	**0.390**	**0.290**	**0.519**



Black Joe Lake Monthly Weighted Concentrations (mg/l)

	2006	2005	2004	2003	2002	2001	2000	1999	1998
January	0.321	0.438	0.260	0.270	0.204	0.233	0.323	0.352	0.218
February	0.608	0.693	0.238	0.368	0.172	0.426	0.148	0.260	0.410
March	0.899	1.316	0.248	0.522	0.237	0.369	0.271	0.228	0.954
April	0.908	1.085	0.219	0.774	0.552	0.786	0.501	0.120	0.842
May	0.910	1.053	0.520	2.585	0.738	1.124	0.675	0.377	0.810
June	1.245	1.473	0.590	1.310	0.962	0.660	0.237	0.249	0.589
July	1.198	1.611	0.565	1.165	0.683	1.140	1.169	0.723	0.559
August	0.740	1.208	0.405	1.064	1.328	1.433	0.795	0.812	0.763
September	1.290	1.587	0.905	0.551	0.530	0.978	0.592	0.635	1.345
October	1.111	1.287	0.446	0.791	0.561	0.352	0.690	0.348	0.508
November	0.710	0.848	0.387	0.836	0.176	0.266	0.265	0.234	0.800
December	0.165	0.251	0.226	0.331	0.178	0.167	0.224	0.345	0.483
Average	**0.842**	**1.071**	**0.417**	**0.881**	**0.527**	**0.661**	**0.491**	**0.390**	**0.690**

2006 Bulk Deposition Data Summary Methods

1. Field note comparison: Results from RMS were checked against field notes for correct dates, times, volumes and field laboratory pH and conductivity values and corrected as necessary.

2. Phosphate screening: Samples were screened for phosphate values over .02 Mg/L indicating possible contamination by bird feces which could skew chemical results. Chemical concentrations from the sample period before and after the period of concern were averaged and substituted for contaminated sample concentrations. There were four samples from Black Joe, and four from Hobbs that had PO4 greater than .02 mg/l. These samples were not used in the analysis. Three consecutive samples from each site were affected (Hobbs June 26 to august 17th, and Black Joe from June 29 to August 25). Data from an associated duplicate, split or data averaged from pre and post periods were used to correct for this contamination. Averaging the samples from before and after the 3 consecutive sample periods in which the contamination occured, homoginize the data likely giving lower deposition values.

3. Duplicate and split samples: Following the Wind River Bulk Deposition QA/QC plan, occasional snow samples were split into two samples, to be analyzed separately. On the Hubbard Brook collector sites side by side duplicate samples were collected during the rainfall season. Volumes from duplicate samples and concentrations of duplicates and splits were compared. Field notes for each duplicate or split were checked for any indication that results from one or the other should be disregarded for any reason. If so, the suspect split or duplicate was eliminated from the final data set. For other QA/QC samples with volumes within 20% and chemical concentrations within 15%, an average of the concentrations from the duplicate or split was used for the final data set.

4) Small/missing samples: There was no sample (precipitation) at Hobbs for the sampling period of July 13 to 28, and no sample at Black Joe for the sample period of July 17 to 31. There were no small samples at either site worth noting.

5. Precipitation calculations: Efficiency of precipitation collection varies by the type of collector and location. Snow collection efficiency factors have been determined for each site by comparison with snow core transects. The Hobbs Lake site is considered to be 61% effective at catching snowfall. The Black Joe Lake site is considered to be 41% effective. From prior research, the Hubbard Brook collectors at both sites are assumed to be 95% effective at capturing rainfall. Precipitation is calculated by dividing the measures sample volume by the efficiency factor, then dividing the corrected volume by the area of the collector opening to yield precipitation in centimeters. Because it is impossible to predict rain versus snowfall in the spring and fall, both the snow and Hubbard Brooks collectors are used during these periods. For the final data set, precipitation from both types of collectors were compared and concentrations and volumes from the collector which was more efficient were used.

6) Deposition calculations: To calculate deposition for the calendar year 2006, sample volumes from periods beginning in 2005 or ending in 2007 were prorated by the number of days in each year to estimate precipitation and thus deposition within 2006.

7) Lost Sample: There were no lost samples for 2006.