PART III: SYNTHESIS

SUMMARY

Wet Deposition

Wet sulfate and nitrate deposition were each no greater than 12 kg ha^{-1} yr^{-1} in all years (1985 through 1994) at all sites and were usually less than 12 kg ha^{-1} yr^{-1}. Excess sulfate (i.e., excluding the estimated sea-salt contribution) was no greater than 10 kg ha^{-1} yr^{-1} in all years at all sites and was usually less than 4 kg ha^{-1} yr^{-1}. Ammonium deposition was less than 5 kg ha^{-1} yr^{-1} in all years at all sites. For comparison, wet sulfate and nitrate deposition in portions of eastern North America exceed 25 and 15 kg ha^{-1} yr^{-1}, respectively (Sisterson, 1991); ammonium deposition is less than about 4 kg ha^{-1} yr^{-1} in almost all parts of eastern North America (Sisterson, 1991).

In some areas where sulfate deposition is highest, such as the northwest coast, much of the sulfate had its origin as sea salt.

In most years, wet nitrate deposition was greater in the SoCAB and the southern Sierra Nevada than in other parts of California.

Deposition uncertainties are less than 20 percent in the SoCAB, which has a large number of monitors; uncertainties can be up to 100 percent in portions of northeastern and southeastern California, where little monitoring has been done.

To facilitate comparison with dry deposition estimates, Table 14 summarizes wet deposition rates for sulfur and nitrogen (as S and N).

Table 14. Multi-year mean annual wet deposition of nitrate, sulfate (not adjusted for sea salt), excess sulfate (adjusted for sea salt), and ammonium by site (kg S or N ha^{-1} yr^{-1}). Years were included only if CI1 and CI3 were at least 75 percent. CADMP and UCSB sites are capitalized. Missing values are shown with periods.

			Species			
Site	Network	No. yrs.	Sulfur	Excess Sulfur	Nitrogen from NO_3^-	Nitrogen from NH_4^+
ALPINE MDWS	UCSB	3	0.60	0.56	0.76	0.71
ANAHEIM	CADMP	9	0.63	0.49	0.43	0.66
ANGORA LK	UCSB	3	0.82	0.76	0.84	0.96
BAKERSFIELD	CADMP	10	0.57	0.55	0.41	0.89
BERKELEY	CADMP	8	1.01	0.71	0.57	0.52
BETHEL ISL	CADMP	10	0.41	0.36	0.42	0.98
Bishop	NADP	1	0.35	0.34	0.16	0.21
Chuchupate	NADP	7	0.41	0.38	0.40	0.24
Davis	NADP	10	0.72	0.64	0.74	1.59
EASTRN BRK LK	UCSB	3	0.36	0.35	0.40	0.39
EL MONTE	CADMP	10	1.09	0.94	0.83	1.22
EMERALD LK	UCSB	3	0.75	0.70	0.75	0.93
ESCONDIDO	CADMP	10	0.77	0.50	0.46	0.51
EUREKA	CADMP	4	1.64	0.68	0.30	0.36
GASQUET	CADMP	9	2.16	0.94	0.49	0.45
Hopland	NADP	14	0.79	0.55	0.49	0.37
Hopland Intercomp	NADP	1	0.52	0.30	0.41	0.27
KAISER PASS	UCSB	2	0.59	0.56	0.58	0.65
LAKE ISABELLA	CADMP	7	0.27	0.25	0.31	0.26
LAKEPORT	CADMP	4	0.56	0.40	0.49	0.74
LINDCOVE	CADMP	3	0.53	0.49	0.88	1.52
LOS ANGELES	CADMP	4	1.34	1.13	0.76	1.45
LYNWOOD	CADMP	10	1.09	0.92	0.54	0.82
MAMMOTH MTN	CADMP	1	0.68	0.65	0.64	0.69
MINERAL KING	UCSB	3	0.56	0.54	0.74	0.92
MMMTH MT/UC	UCSB	3	0.75	0.72	0.75	0.82
MONTAGUE	CADMP	9	0.26	0.25	0.31	0.35
MONTAGUE CL	CADMP	4	0.30	0.29	0.35	0.43
MT WILSON	CADMP	10	0.83	0.73	0.88	0.68
Montague	NADP	9	0.24	0.23	0.28	0.27

Table 14, continued

Site	Network	No. yrs.	Sulfur	Excess Sulfur	Nitrogen from NO_3^-	Nitrogen from NH_4^+
			Species			
NAPA	CADMP	9	1.18	0.93	0.74	0.86
NIPOMO	CADMP	4	0.57	0.37	0.31	0.39
ONION VLLY	UCSB	3	0.46	0.44	0.53	0.55
Organ Pipe Cactus	NADP	13	0.71	0.64	0.40	0.37
PASADENA	CADMP	10	1.26	1.08	1.15	1.18
Palomar Mountain	NADP	4	1.81	1.43	1.16	0.79
QUINCY	CADMP	7	0.63	0.57	0.66	0.54
RESEDA	CADMP	6	0.77	0.67	0.80	0.72
Re Rock Canyon	NADP	6	0.46	0.45	0.56	0.37
SACRAMENTO	CADMP	10	0.73	0.65	0.79	1.80
SACRAMENTO C	CADMP	4	0.65	0.59	0.71	1.91
SALINAS	CADMP	4	0.45	0.28	0.27	0.51
SAN BERNARD	CADMP	10	0.82	0.68	1.03	1.98
SAN JOSE	CADMP	10	0.55	0.40	0.30	0.59
SAN NICOLAS	CADMP	4	0.65	0.20	0.17	0.12
SAN RAFAEL	CADMP	3	1.67	1.22	0.87	1.07
SANTA BARB	CADMP	10	0.70	0.44	0.57	0.34
SEQUOIA ASH	CADMP	10	0.66	0.60	1.12	1.58
SEQUOIA GF	CADMP	9	0.79	0.73	1.14	1.63
SEQUOIA GF C	CADMP	2	0.53	0.49	1.03	1.52
SL	UCSB	3	0.43	0.42	0.47	0.40
SODA SPRINGS	CADMP	9	0.92	0.83	1.01	0.81
SOUTH L TAH	CADMP	10	0.36	0.33	0.39	0.33
SP	UCSB	3	0.55	0.52	0.53	0.52
Sequoia NP-Giant	NADP	10	1.12	1.05	1.11	1.42
Silver Lake Rgr Stn	NADP	7	0.24	0.22	0.24	0.15
Smith Valley	NADP	7	2.33	0.20	0.13	0.75
TANBARK	CADMP	10	0.95	0.81	1.18	0.99
TANBARK COL	CADMP	4	0.80	0.66	0.92	0.86
TP	UCSB	3	0.71	0.67	0.75	0.77
Tanbark Flat	NADP	11	1.25	1.07	1.30	0.91
VICTORVILLE	CADMP	4	0.36	0.34	0.49	0.51
YOSEMITE	CADMP	8	0.60	0.56	0.83	0.86
Yosemite Ntnl Park	NADP	5	1.14	1.06	1.05	0.96

Dry Deposition

This project has produced estimates of dry-deposition fluxes at 10 sites in California. These estimates will help improve our understanding of the magnitude of dry deposition. However, it is important to recognize that the calculations are limited in numerous important respects and that they could likely be improved over time with additional effort. The dry-deposition flux estimates are subject to uncertainties of approximately 50 percent.

Estimated deposition of HNO_3 at the 10 sites ranges from 1 to 86 kg ha^{-1} yr^{-1}. At the urban sites, HNO_3 deposition accounts for about 30 to 80 percent of the deposition of oxidized nitrogen species and 20 to 70 percent of the total nitrogen deposition.

To facilitate comparison with wet deposition fluxes, Figure 25 shows estimates for total sulfur and nitrogen dry deposition expressed as sulfur (S) and nitrogen (N). At most sites, the annual rate of deposition of HNO_3 exceeds the rates of all other species (Fremont, Gasquet, and Long Beach are the exceptions). Expressed in terms of N (or on a molar basis), the rates of particulate ammonium deposition (not shown) are generally comparable to those of particulate nitrate deposition. The annual rates of deposition of oxidized nitrogen species at the three rural sites are about one-tenth to one-half as great as the values reported by Meyers et al. (1991), which ranged from 1.5 to 4.6 kg N ha^{-1} for sites in the eastern United States. However, the deposition rates calculated for the rural CADMP sites are quite uncertain because many of the measurements were below the limits of quantification. The deposition rates at Azusa, Bakersfield, Long Beach, and Los Angeles exceed those reported by Meyers et al. (1991) by factors of 2 to 17.

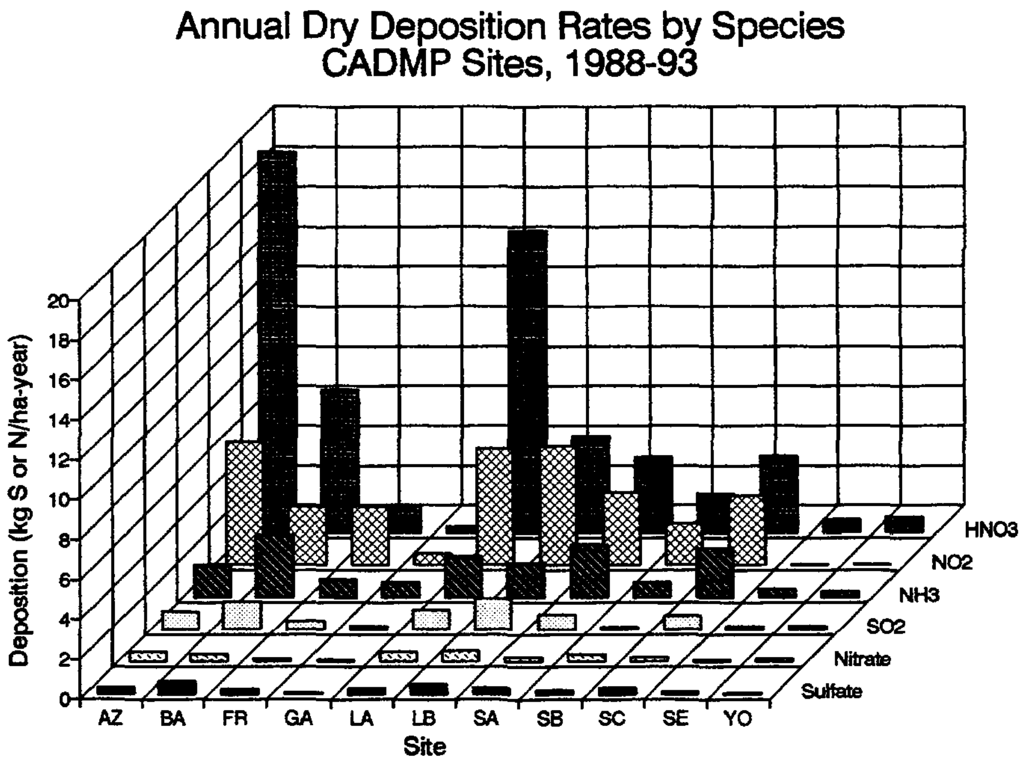

Figure 25. Annual dry deposition rates for sulfate, nitrate, SO_2, NH_3, NO_2, and HNO_3 at 11 CADMP sites, averaged over the period 1988-93. The rates are expressed as kg N or S ha^{-1} yr^{-1}.

Comparison of Wet and Dry Deposition

Six of the 10 dry-deposition sites are collocated with wet-deposition monitors. The sites at Azusa, Fremont, downtown Los Angeles, and Long Beach are not collocated with wet-deposition monitors. For purposes of comparison, we paired these four sites with the precipitation sites at El Monte, San Jose, Pasadena, and Lynwood. Of the 10 locations with paired wet- and dry-deposition data, three are nonurban (Gasquet, Yosemite, and Sequoia).

At the three nonurban sites (Gasquet, Yosemite, and Sequoia), wet nitrate and nonseasalt-sulfate deposition approximately equalled (within 0.7 kg ha^{-1} $yr^{-1)}$ dry deposition of oxidized nitrogen and sulfur species (see Figure 26). The multi-year average sum of wet and dry deposition at these three sites were 1-2 kg N ha^{-1} yr^{-1} (from oxidized species), 1-2 kg S ha^{-1} yr^{-1}, and 1-2 kg N ha^{-1} yr^{-1} (from reduced species).

At the seven urban sites, dry sulfur deposition [SO_2 and particulate sulfate (pSO_4^{2-})] was approximately 1 to 3 times the magnitude of wet sulfur deposition; dry deposition of oxidized nitrogen species [HNO_3, NO_2, and particulate nitrate (pNO_3^-)] at the urban sites ranged from about 10 to 30 times the magnitude of wet nitrate deposition (see Figure 27). At all sites, dry deposition of reduced nitrogen species [ammonia (NH_3) and particulate ammonium (pNH_4^+)] was about a factor of 2 greater than wet ammonium deposition. The multi-year average sum of wet and dry deposition at these seven sites were 5-30 kg N ha^{-1} yr^{-1} (from oxidized species), 1-3 kg S ha^{-1} yr^{-1}, and 1-4 kg N ha^{-1} yr^{-1} (from reduced species).

Comparison of Deposition and Emissions Estimates

In this section, we compare our dry-deposition flux estimates to emission estimates. Emission densities of NO_x (as kg ha^{-1} yr^{-1} N) were obtained from California Air Resources Board, Technical Support Division (1990) and converted to units of kg N ha^{-1} yr^{-1}. Although several pieces of evidence suggest that emissions of volatile organic compounds (VOCs) may typically be underestimated by a factor of 2 (e.g., Fujita et al., 1992), NO_x emission estimates are generally thought to be more accurate. The emission estimates were available for either counties or air basins. We delineated areas of approximately equal sizes, which ranged in size from one to nine counties. For each site, these areas were:

- Azusa: South Coast Air Basin
- Fremont: San Francisco Bay Area Air Basin
- Los Angeles: South Coast Air Basin
- Long Beach: South Coast Air Basin
- Bakersfield: Kern County
- Sacramento: Sacramento County plus six neighboring counties (Contra Costa, Sacramento Valley portion of Placer, Solano, San Joaquin, Sutter, and Yolo).
- Santa Barbara: South Central Coast Air Basin

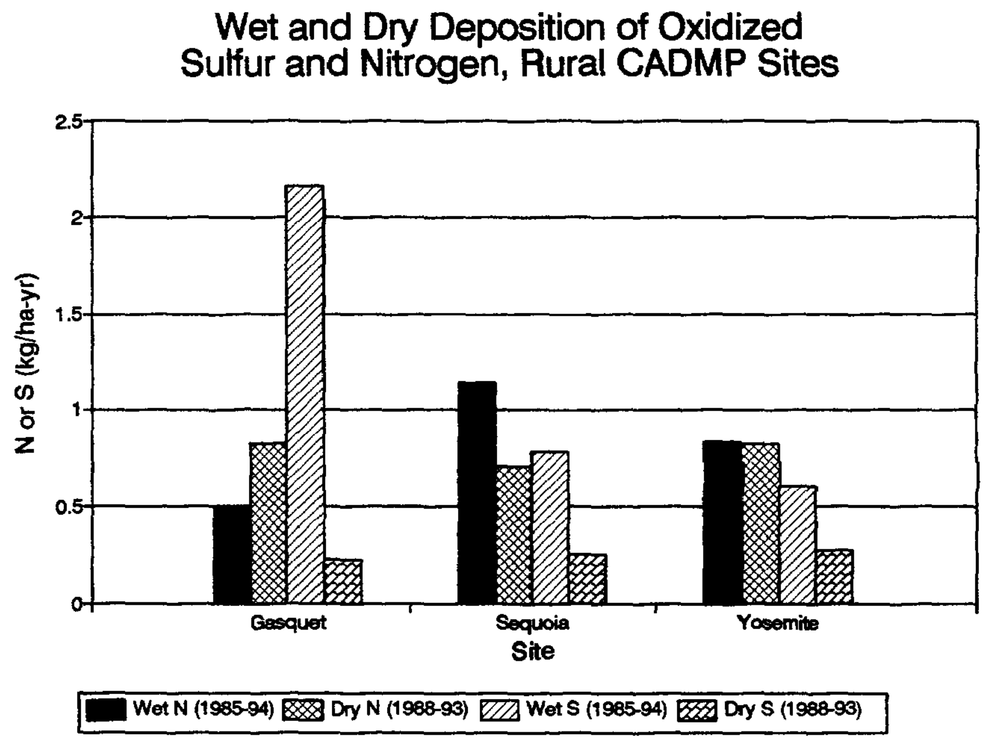

Figure 26. Wet and dry deposition of oxidized sulfur and nitrogen species at 3 rural CADMP sites. The averaging periods were 1985-94 for wet deposition and 1988-93 for dry deposition. All rates are expressed as kg N or S ha^{-1} yr^{-1}.

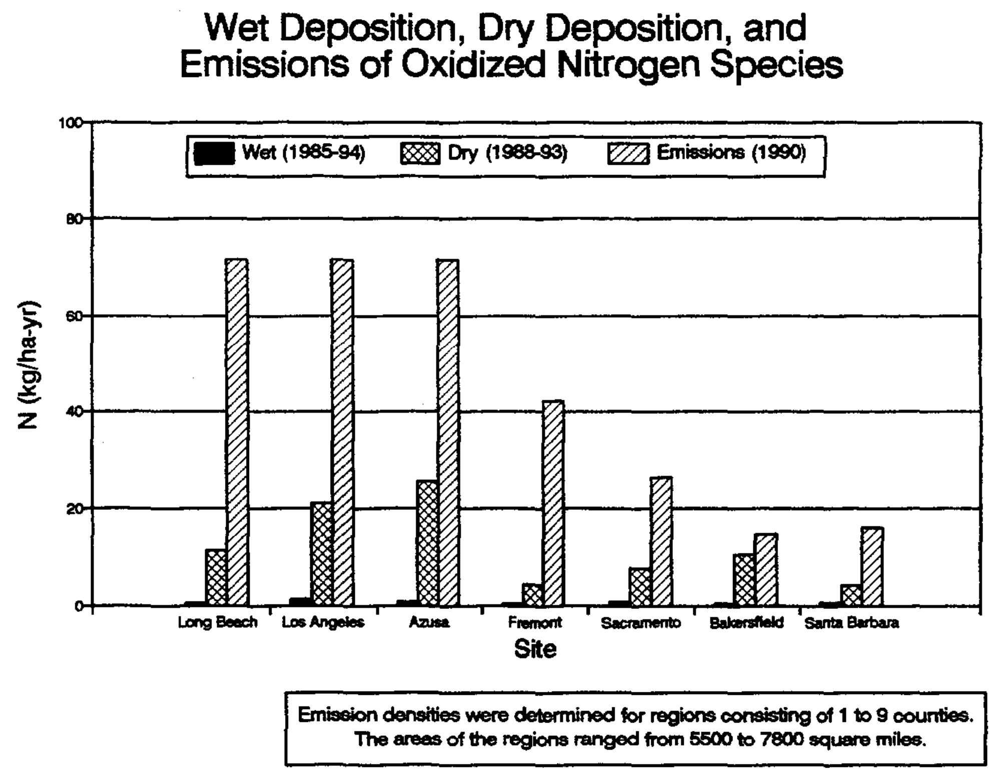

Figure 27. Wet deposition, dry deposition, and emission rates of oxidized nitrogen species at 6 urban CADMP sites. The averaging periods were 1985-94 for wet deposition and 1988-93 for dry deposition. Emission rates are for 1990. All rates are expressed as kg N ha^{-1} yr^{-1}.

As shown in Figure 27, the calculated rates of deposition of oxidized nitrogen species at the South Coast Air Basin (SoCAB) stations range from 16 to 37 percent of rate of emissions of NO_x within the SoCAB. The sum of wet plus dry nitrogen deposition rates at Fremont is about 11 percent of the NO_x emissions rate occurring within the San Francisco Bay area. However, since Fremont does not experience the highest peak ozone concentrations in the Bay area, concentrations of photochemical reaction products (including HNO_3) may be greater at other locations within the Bay area, implying that deposition rates in parts of the Bay area may also be greater than those calculated for Fremont. The estimated nitrogen deposition rates at Bakersfield and Sacramento are about 76 and 32 percent, respectively, of the emissions rates of Kern County and the area around Sacramento County. Transport of NO_x from upwind areas could account in part for the relatively large ratio of deposition to emissions at Bakersfield.

LIMITATIONS

Wet-deposition flux estimates are based on data obtained using a proven monitoring technique and a reasonably dense network of stations. The most significant source of potential bias is underestimation of precipitation amounts in alpine regions. The uncertainties in our regionalized estimates of wet deposition vary spatially and among chemical species; they are typically in the range of 20 to 50 percent for the species and areas of greatest interest. In contrast, both the measurements and the model used to calculate dry deposition are subject to potentially large uncertainties. At present, questions remain regarding the accuracy of the denuder difference HNO_3 concentrations. Moreover, the expected uncertainties in dry deposition flux estimates calculated according to the inferential method are on the order of 50 percent.

RECOMMENDATIONS

We offer the following recommendations for consideration:

1. Particular effort should be devoted to resolving the questions pertaining to accurate measurement of nitric acid. At many locations, it is the largest component of total nitrogen deposition. Therefore, accurate measurement is critical.

2. Comparison of results obtained from application of the inferential method and from micrometeorological studies would be highly desirable. Lacking such a comparison, we cannot evaluate the accuracies of the calculated deposition amounts.

3. If analyses of dry-deposition trends are of interest, they should be carried out for the ambient air concentrations, rather than the calculated dry-deposition fluxes, because many uncertainties are introduced in the process of calculating fluxes. For the urban locations, where dry deposition fluxes are many times the magnitude of wet deposition, trends in dry deposition may serve as a surrogate for trends in total deposition. At rural locations, where wet and dry deposition fluxes are of comparable magnitudes, consideration should be given to co-analyzing the time trends in wet and dry deposition.

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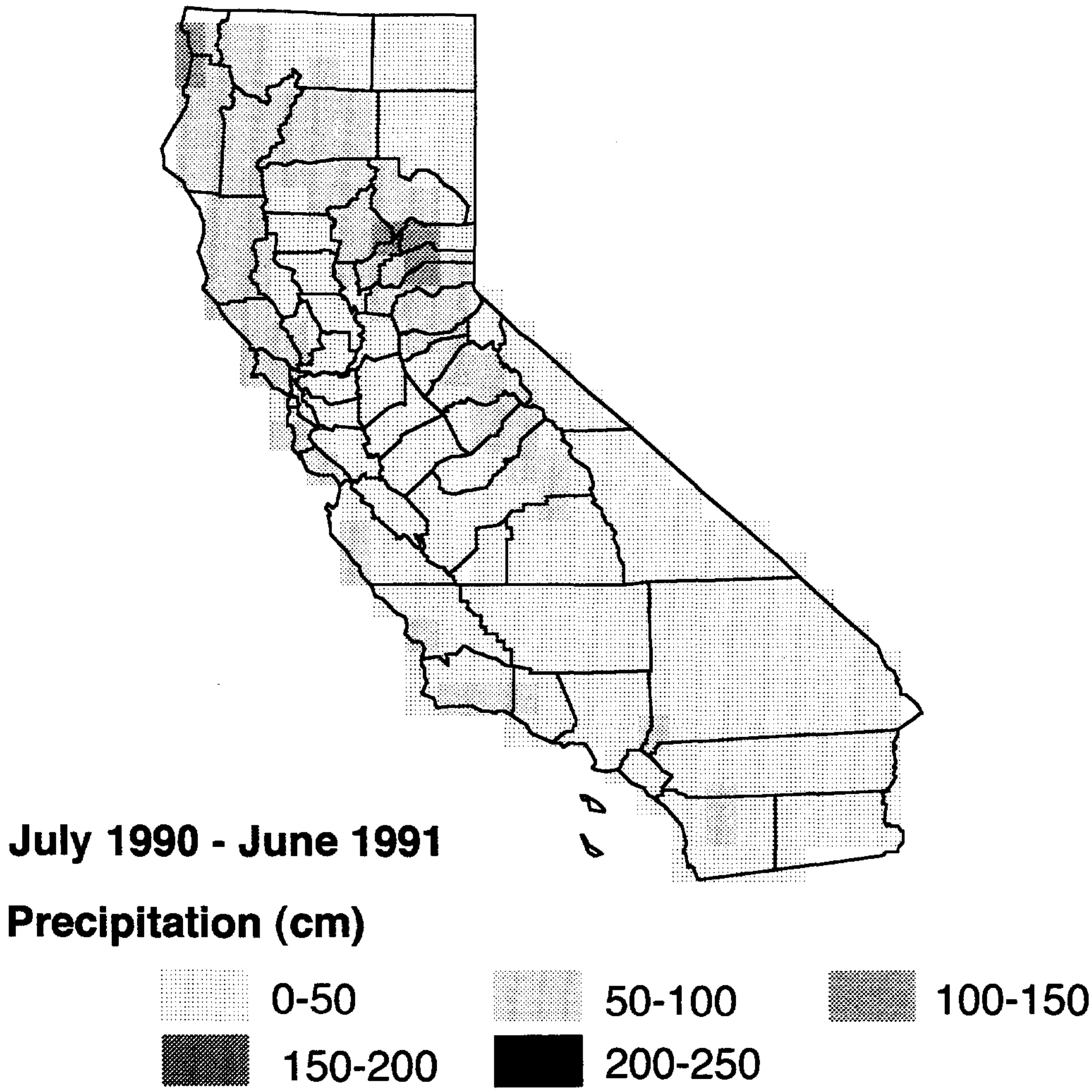
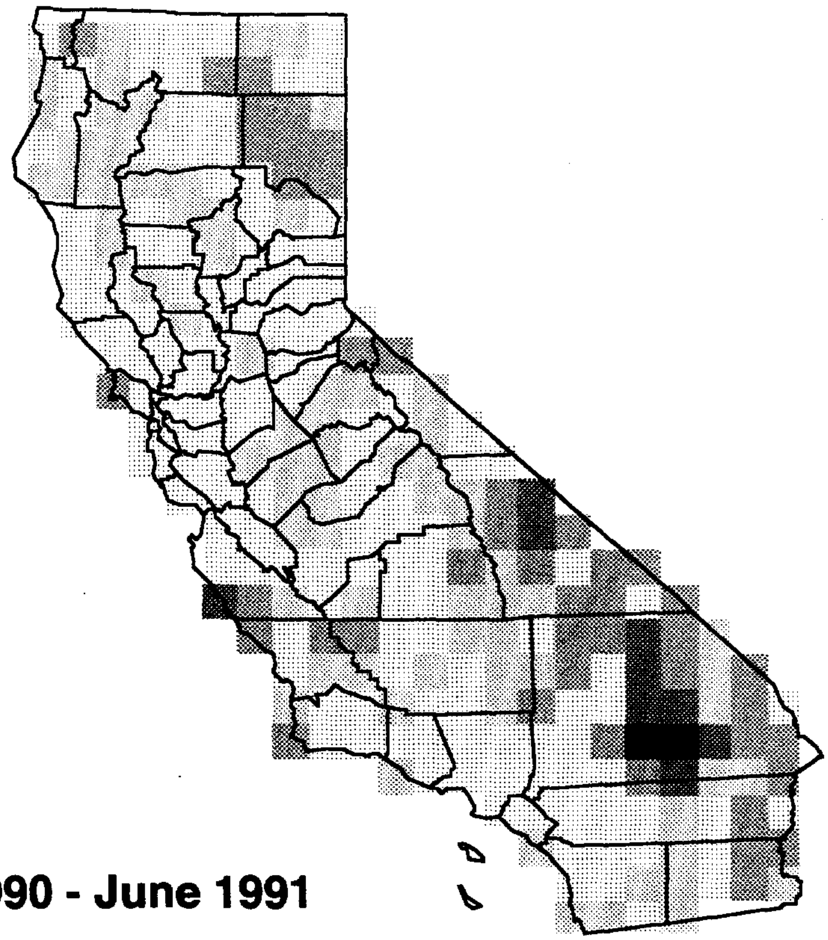
APPENDIX A: DEPOSITION AND UNCERTAINTY MAPS FOR PRECIPITATION AND PRECIPITATION CHEMISTRY

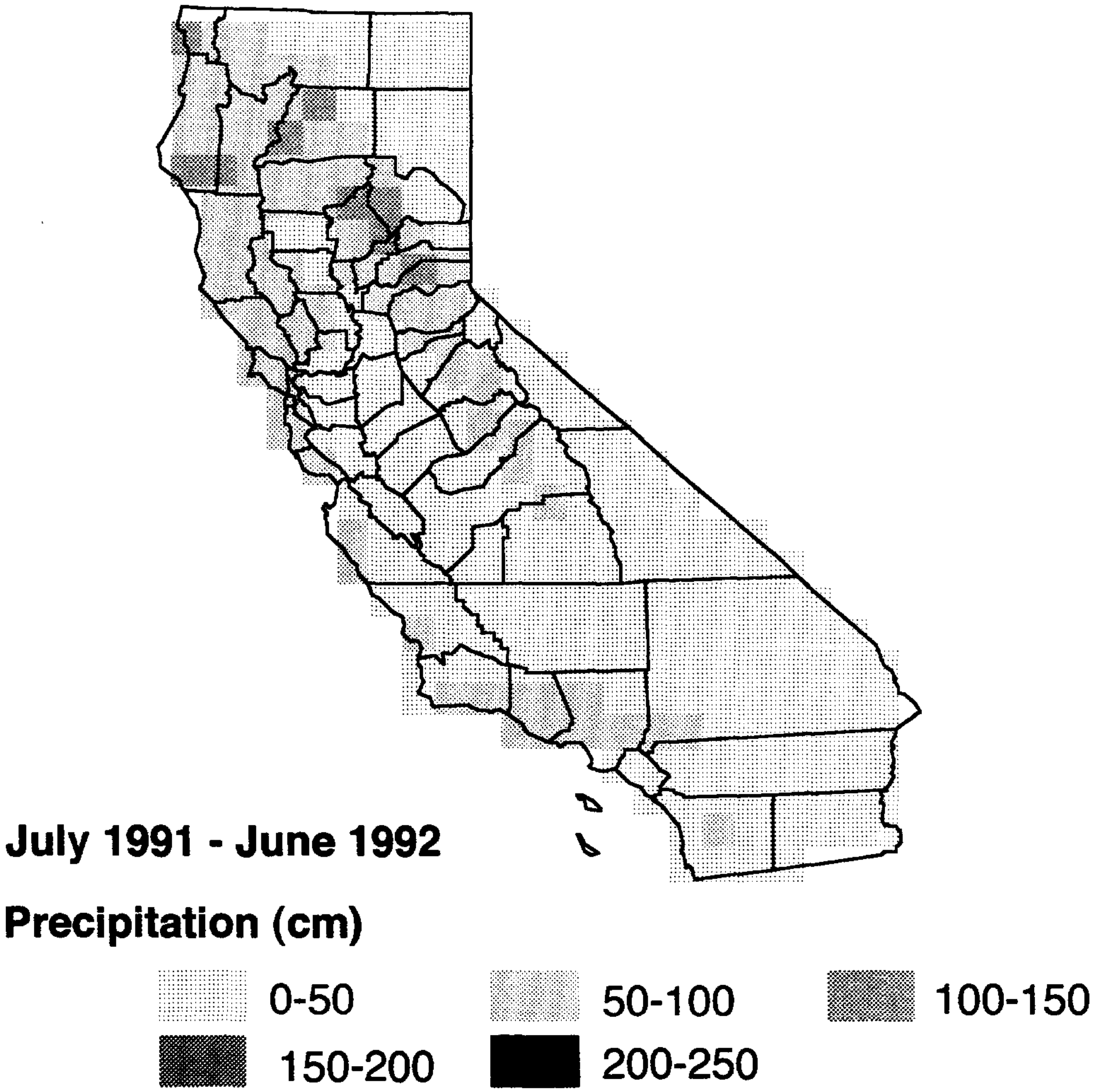

July 1990 - June 1991
Precipitation (cm)
0-50
50-100
100-150
150-200
200-250



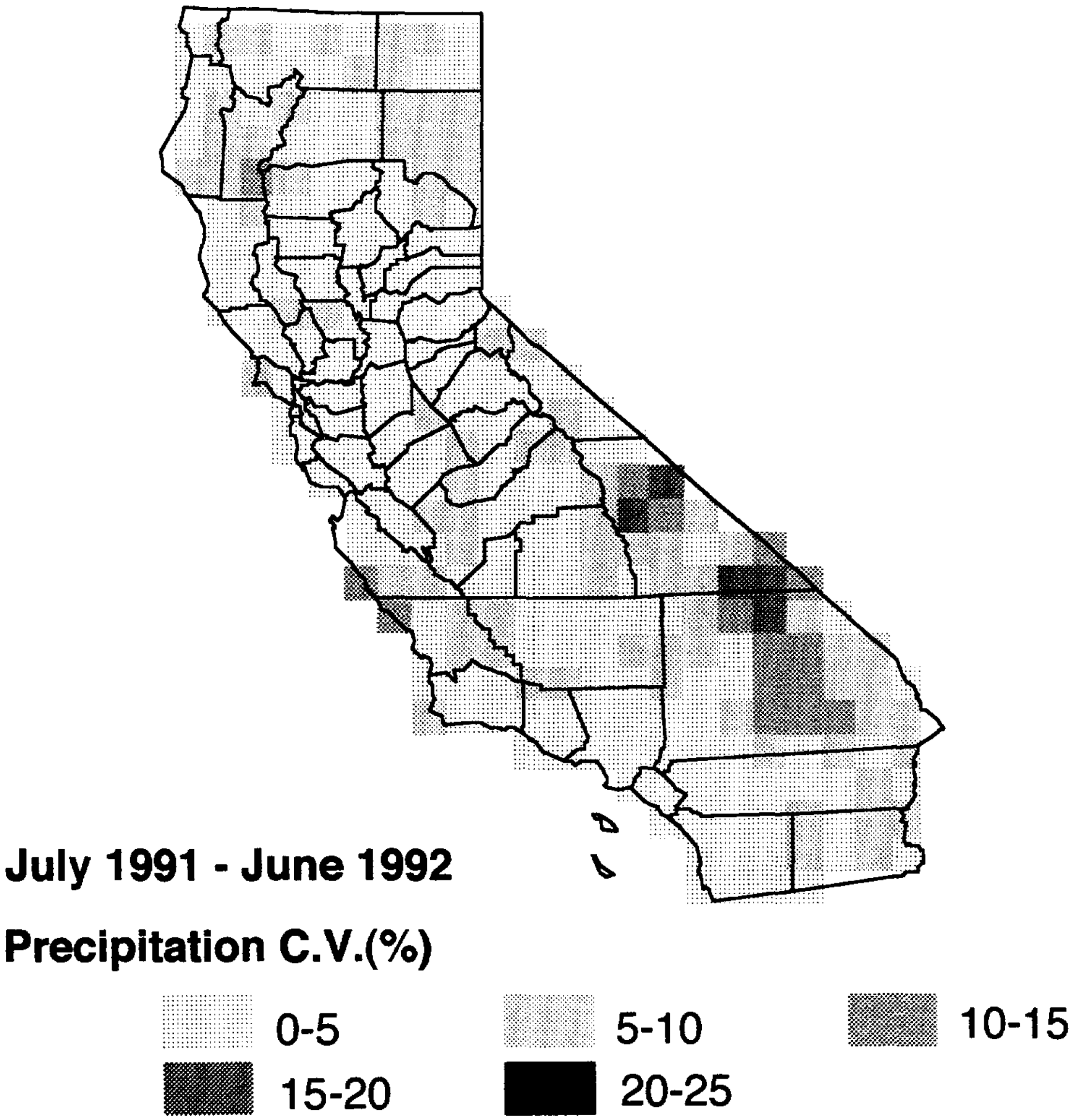
July 1990 - June 1991

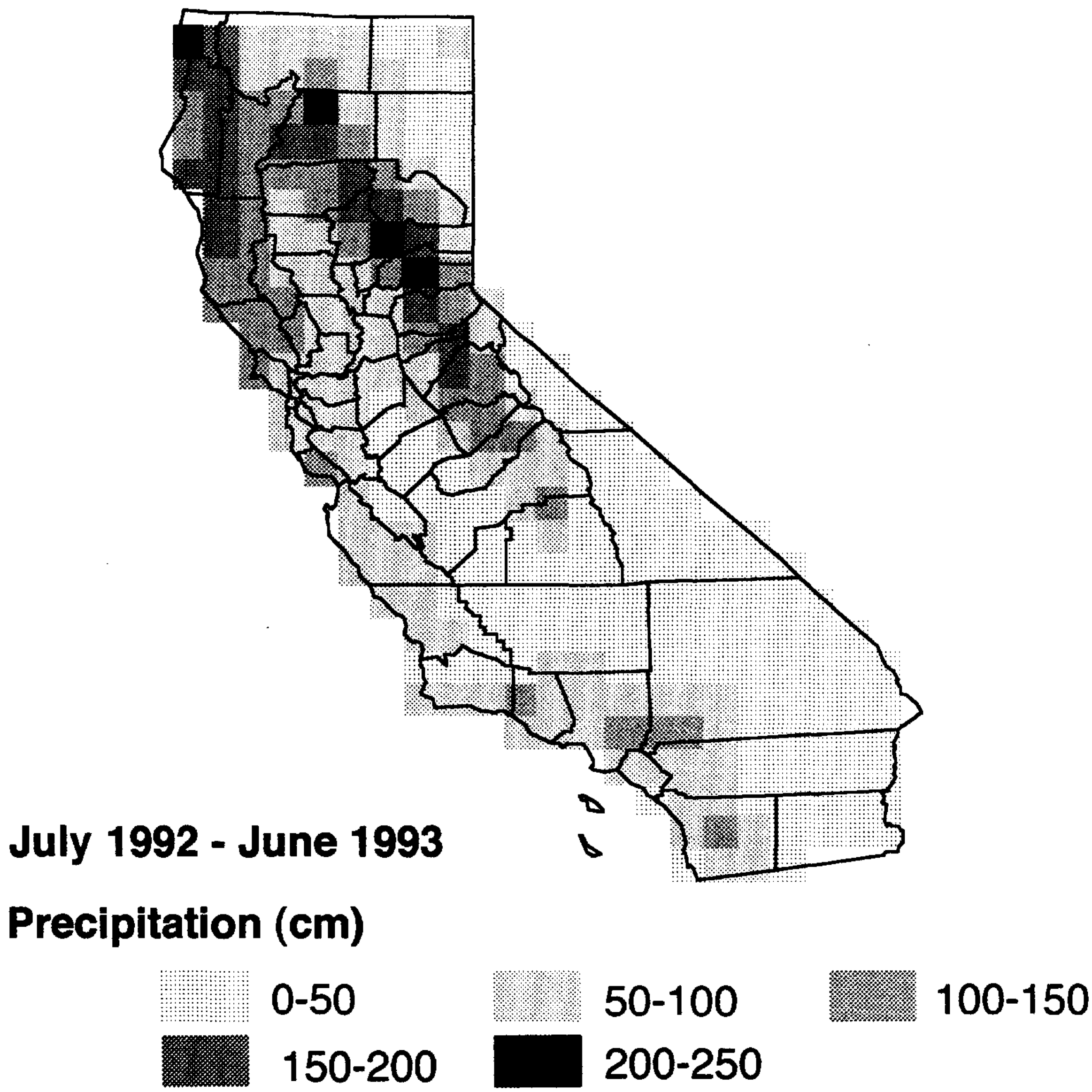
Precipitation C.V.(%)

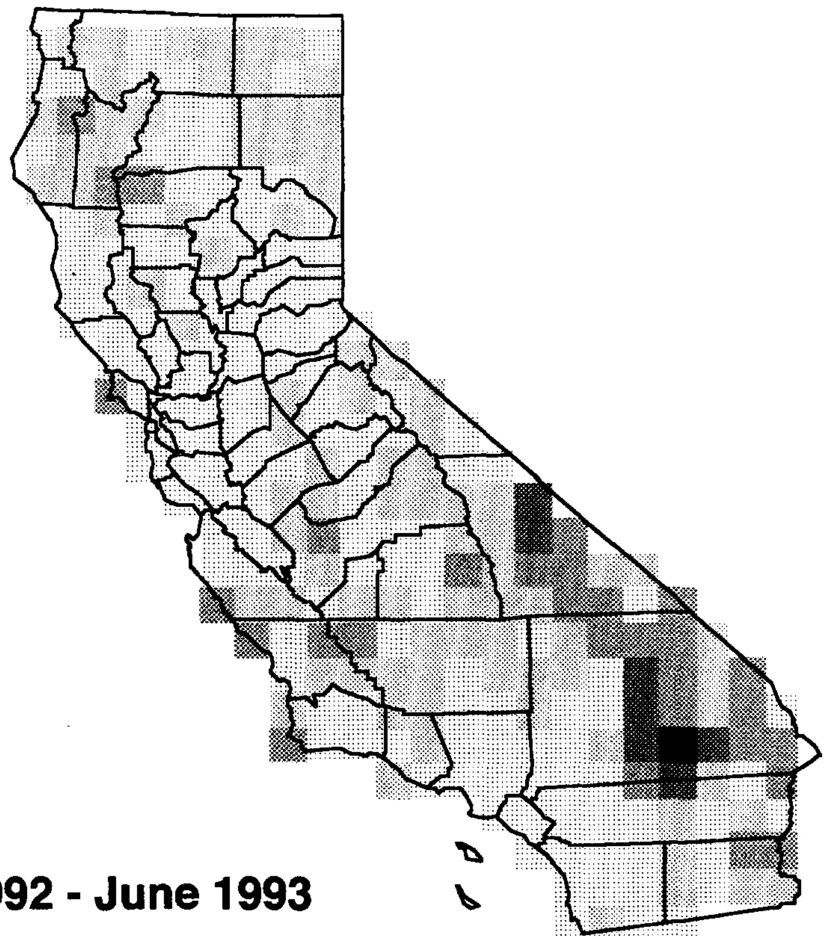
0-5 | 5-10 | 10-15
15-20 | 20-25



July 1991 - June 1992
Precipitation (cm)
0-50
50-100
100-150
150-200
200-250


July 1991 - June 1992
Precipitation C.V.(%)
0-5
5-10
10-15
15-20
20-25


July 1992 - June 1993
Precipitation (cm)
0-50
50-100
100-150
150-200
200-250



July 1992 - June 1993

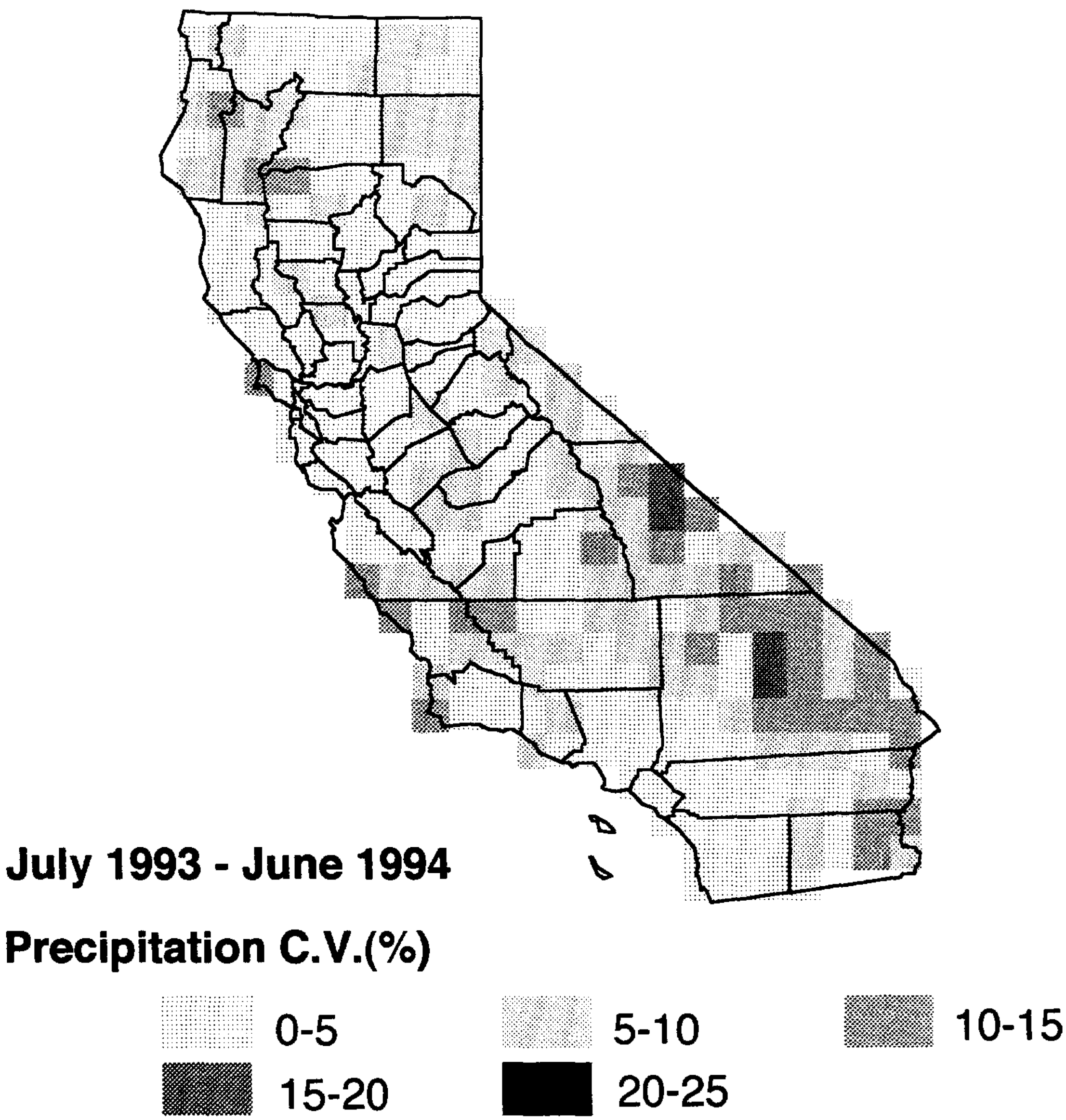
Precipitation C.V.(%)

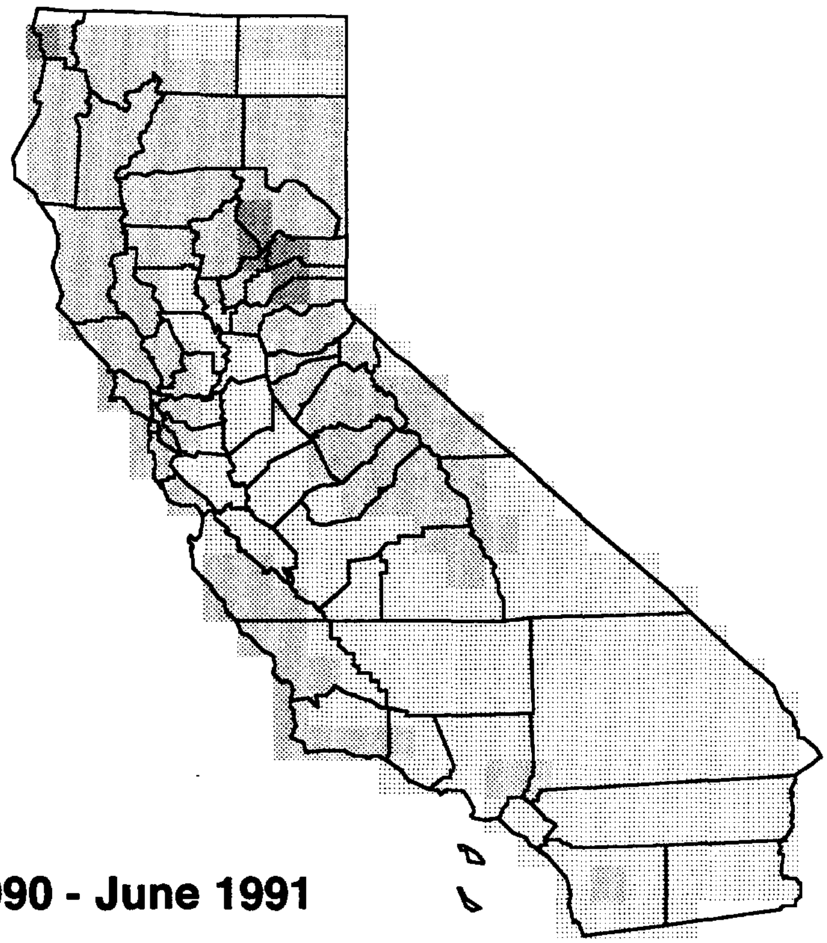
0-5
5-10
10-15
15-20
20-25

July 1993 - June 1994

Precipitation (cm)

0-50
50-100
100-150
150-200
200-250

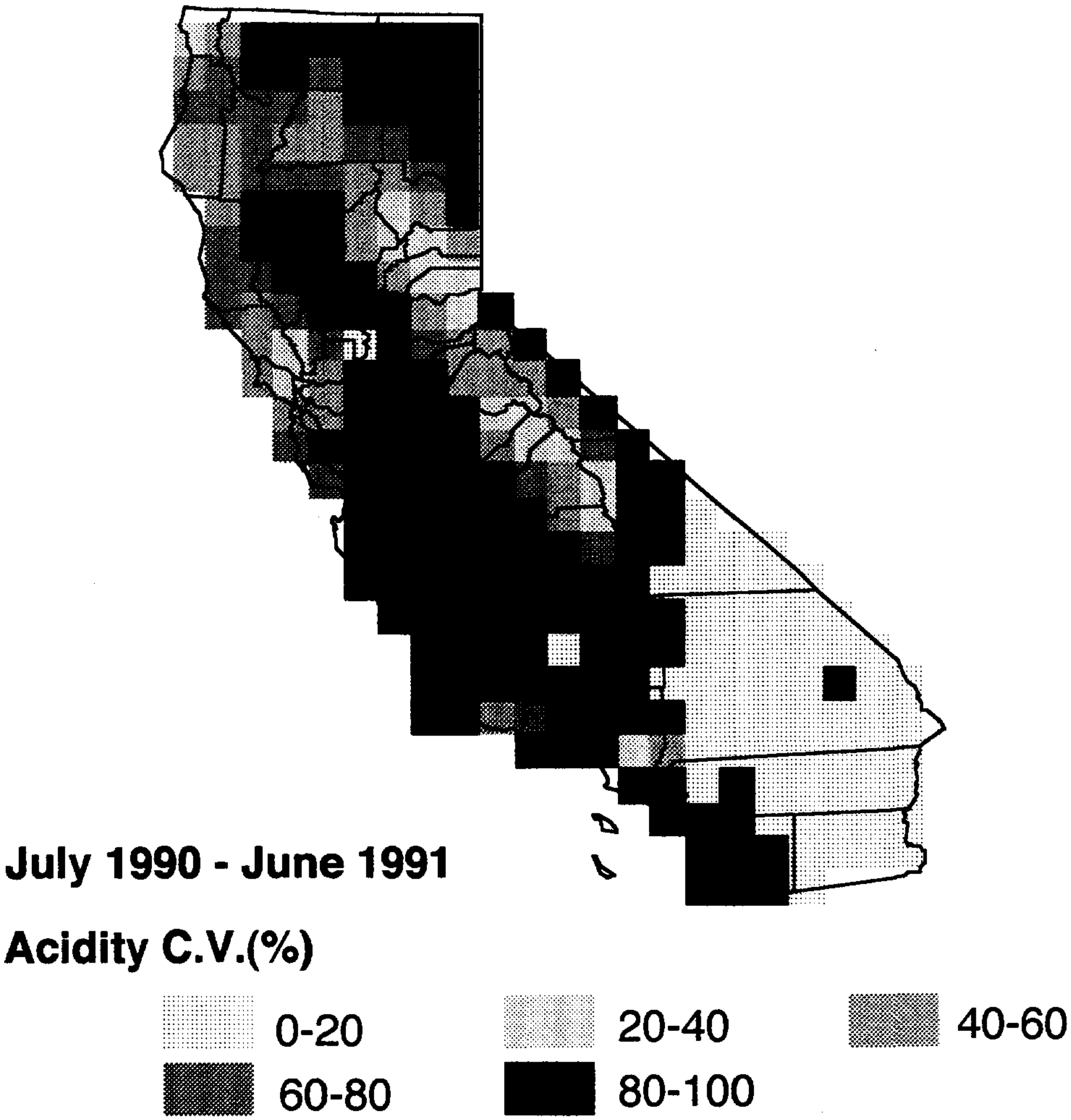

July 1993 - June 1994
Precipitation C.V.(%)
0-5
5-10
10-15
15-20
20-25

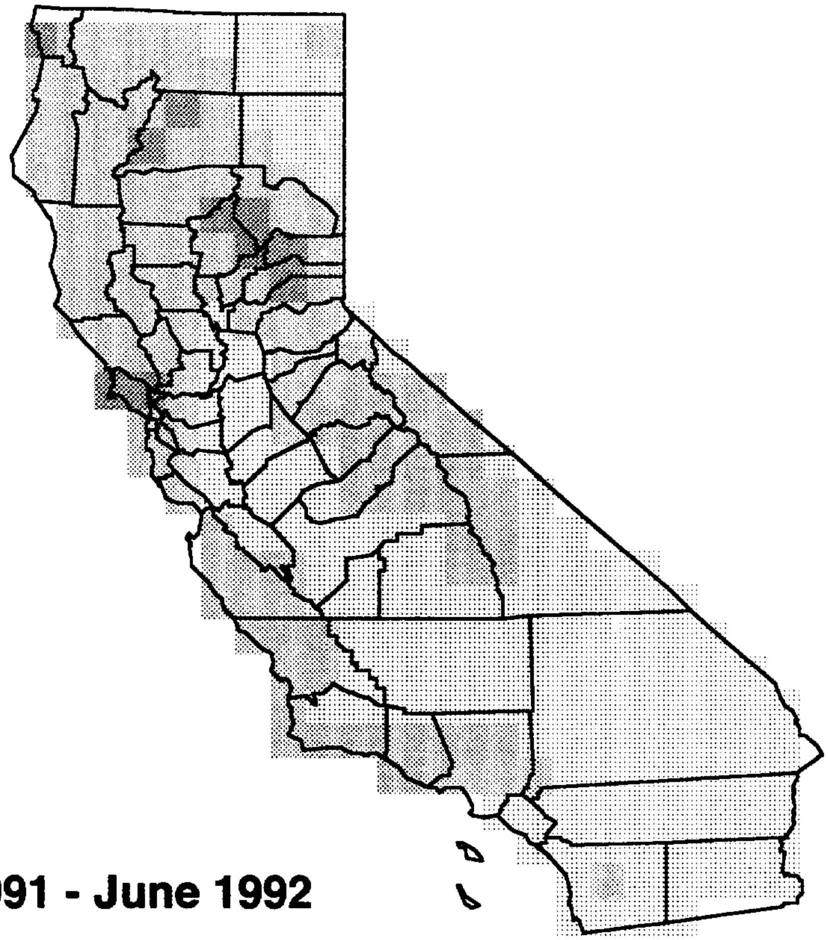


July 1990 - June 1991

Acidity (g/ha)

-10-10
10-30
30-50
50-70
70-90

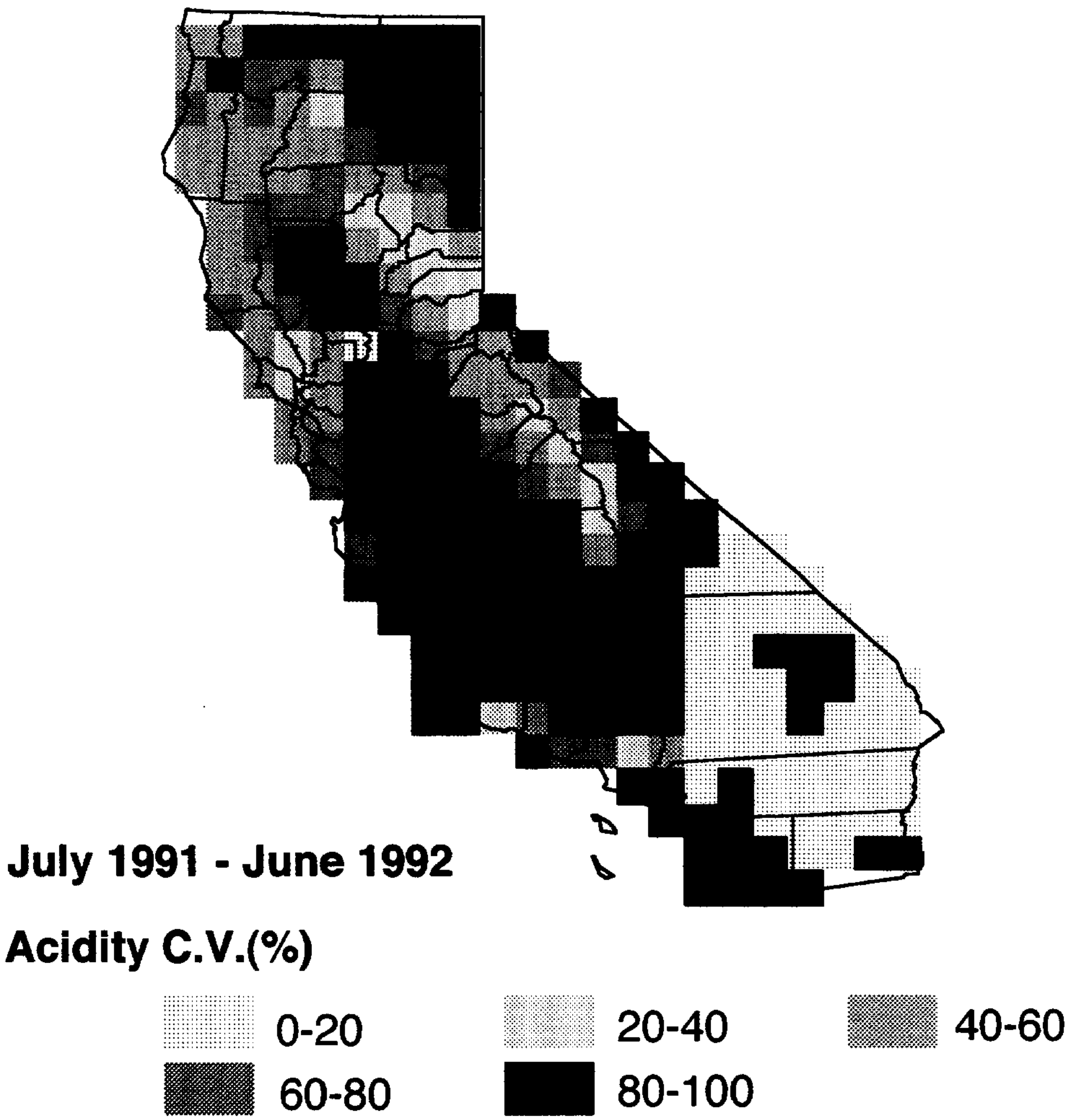

July 1990 - June 1991
Acidity C.V.(%)
0-20
20-40
40-60
60-80
80-100

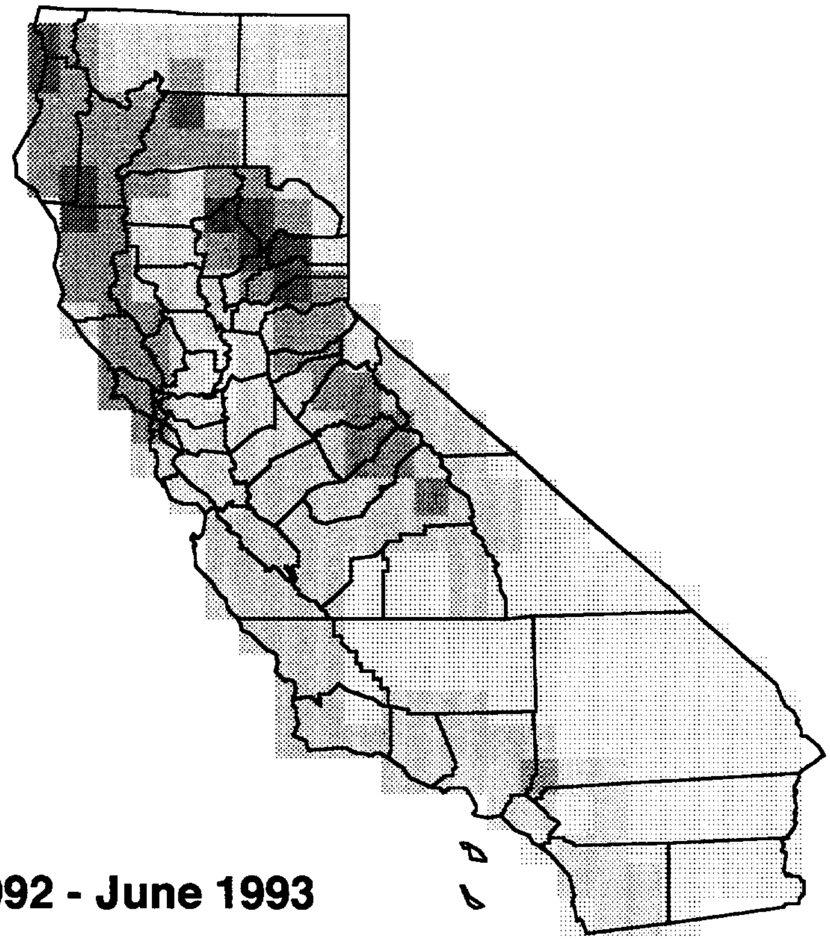


July 1991 - June 1992

Acidity (g/ha)

-10-10
10-30
30-50
50-70
70-90


July 1991 - June 1992
Acidity C.V.(%)
0-20
20-40
40-60
60-80
80-100

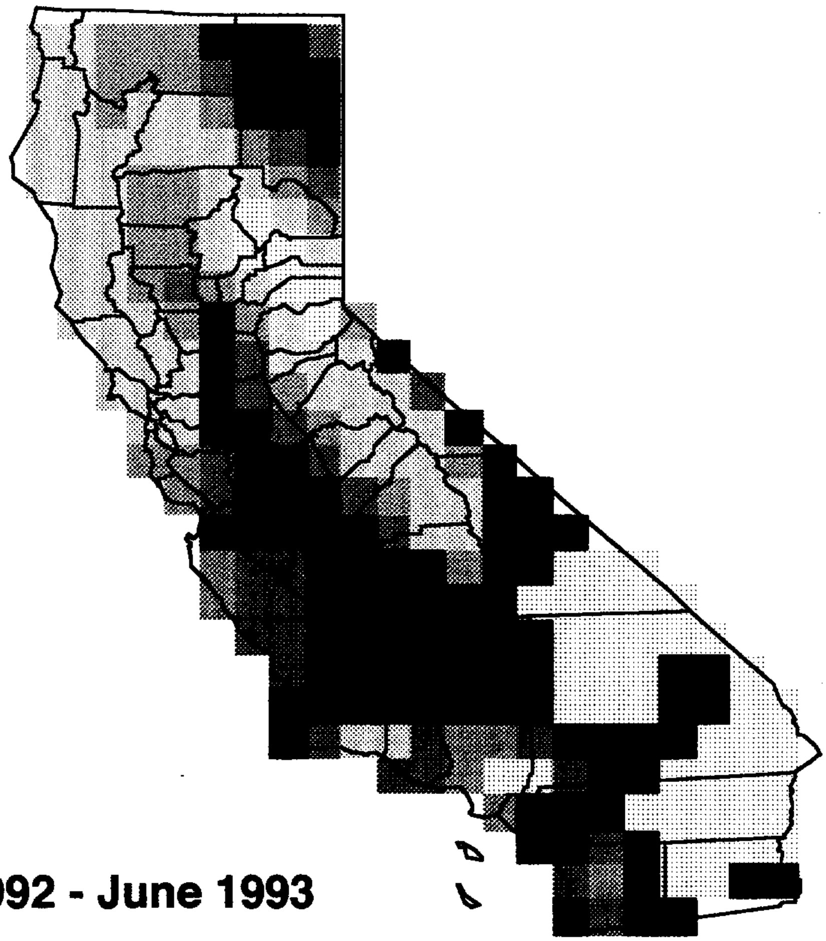


July 1992 - June 1993

Acidity (g/ha)

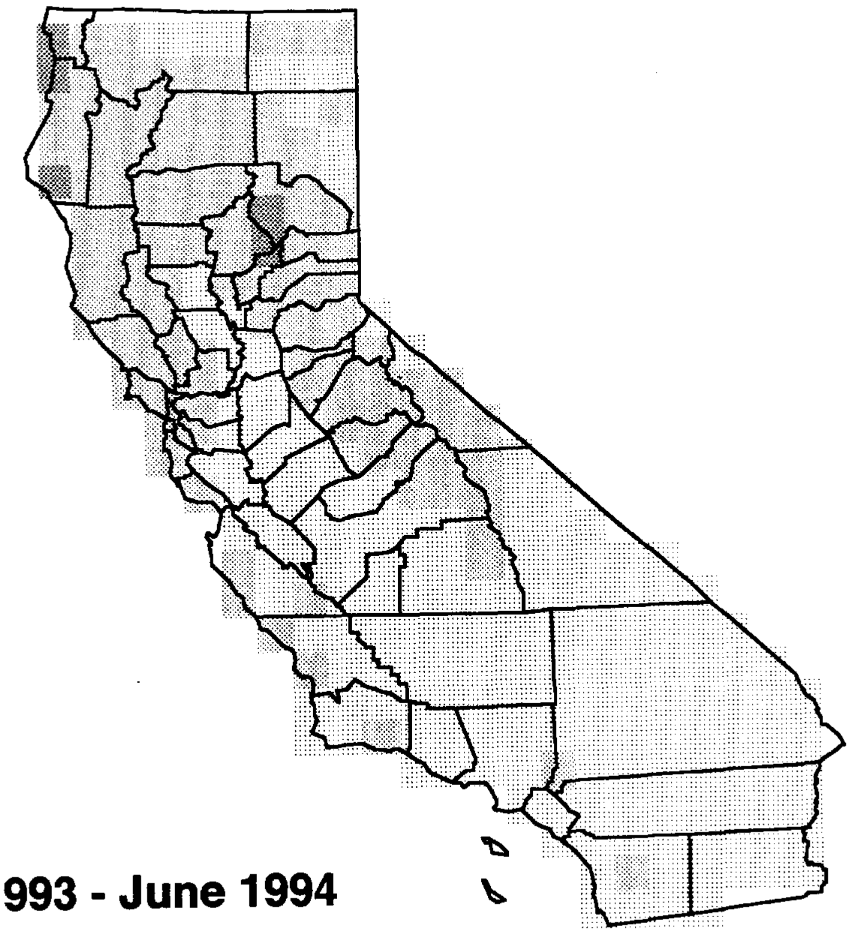
-10-10   10-30   30-50

50-70   70-90



July 1992 - June 1993

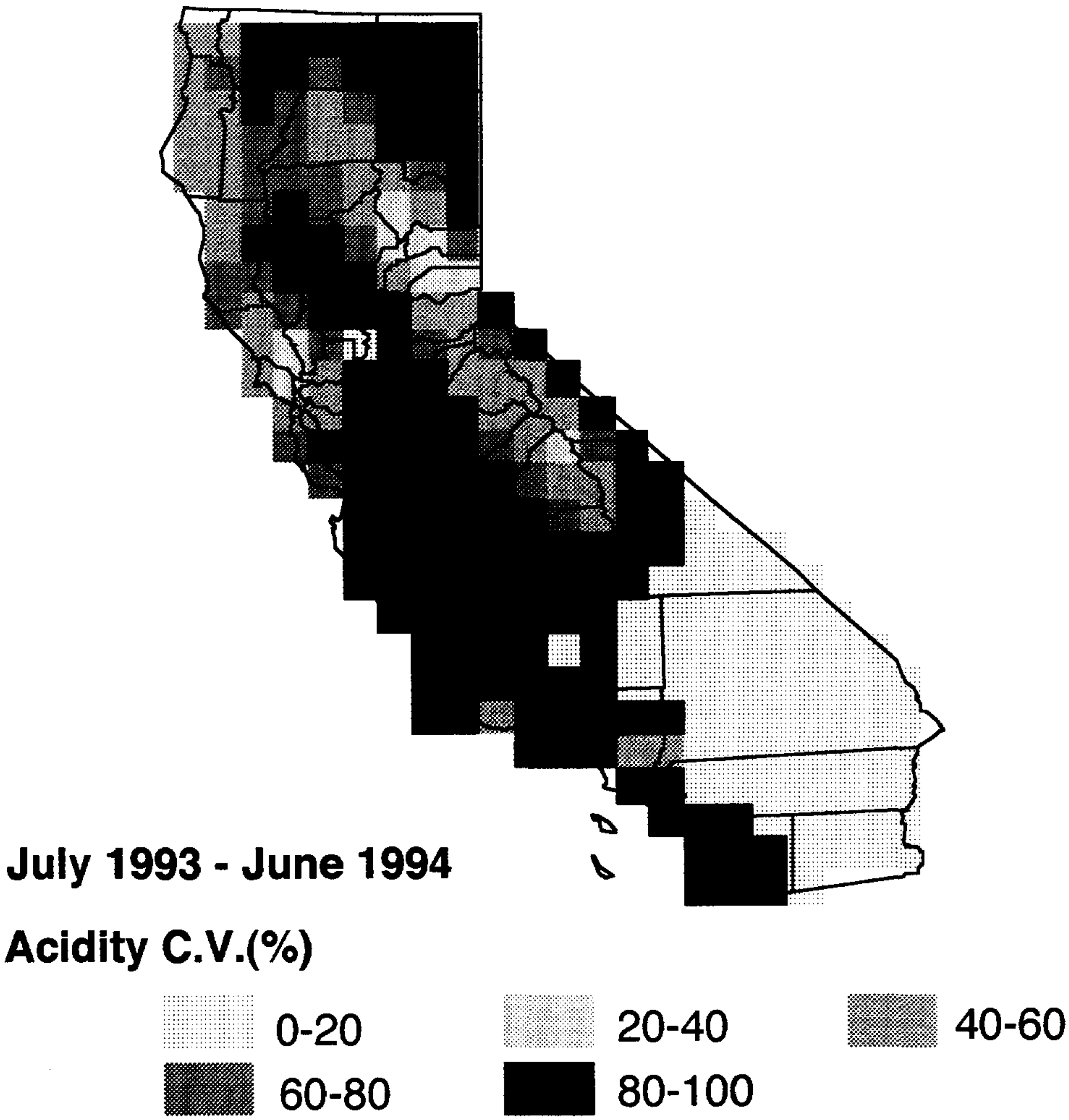
Acidity C.V.(%)



July 1993 - June 1994

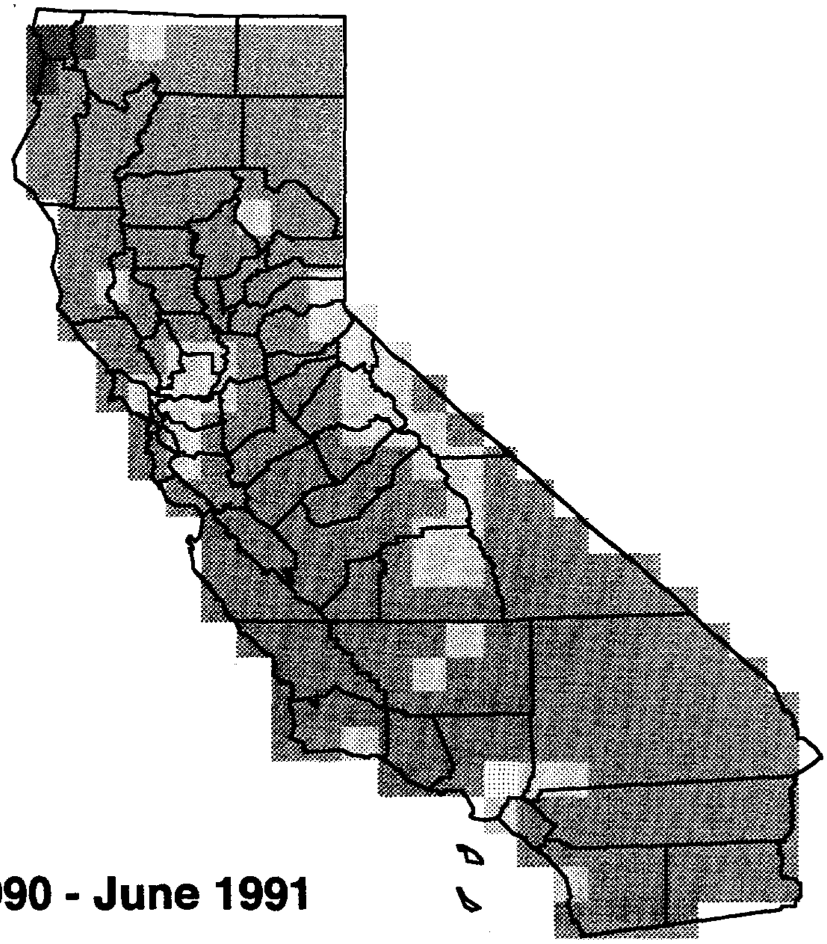
Acidity (g/ha)

-10-10
10-30
30-50
50-70
70-90


July 1993 - June 1994
Acidity C.V.(%)
0-20
20-40
40-60
60-80
80-100

July 1990 - June 1991

Ammonium (kg/ha)



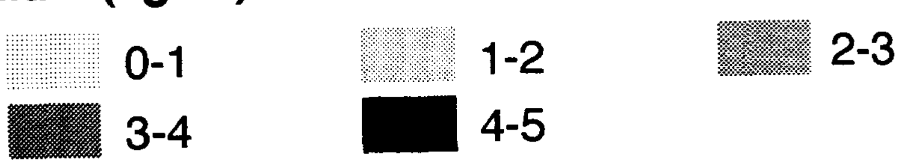
July 1990 - June 1991

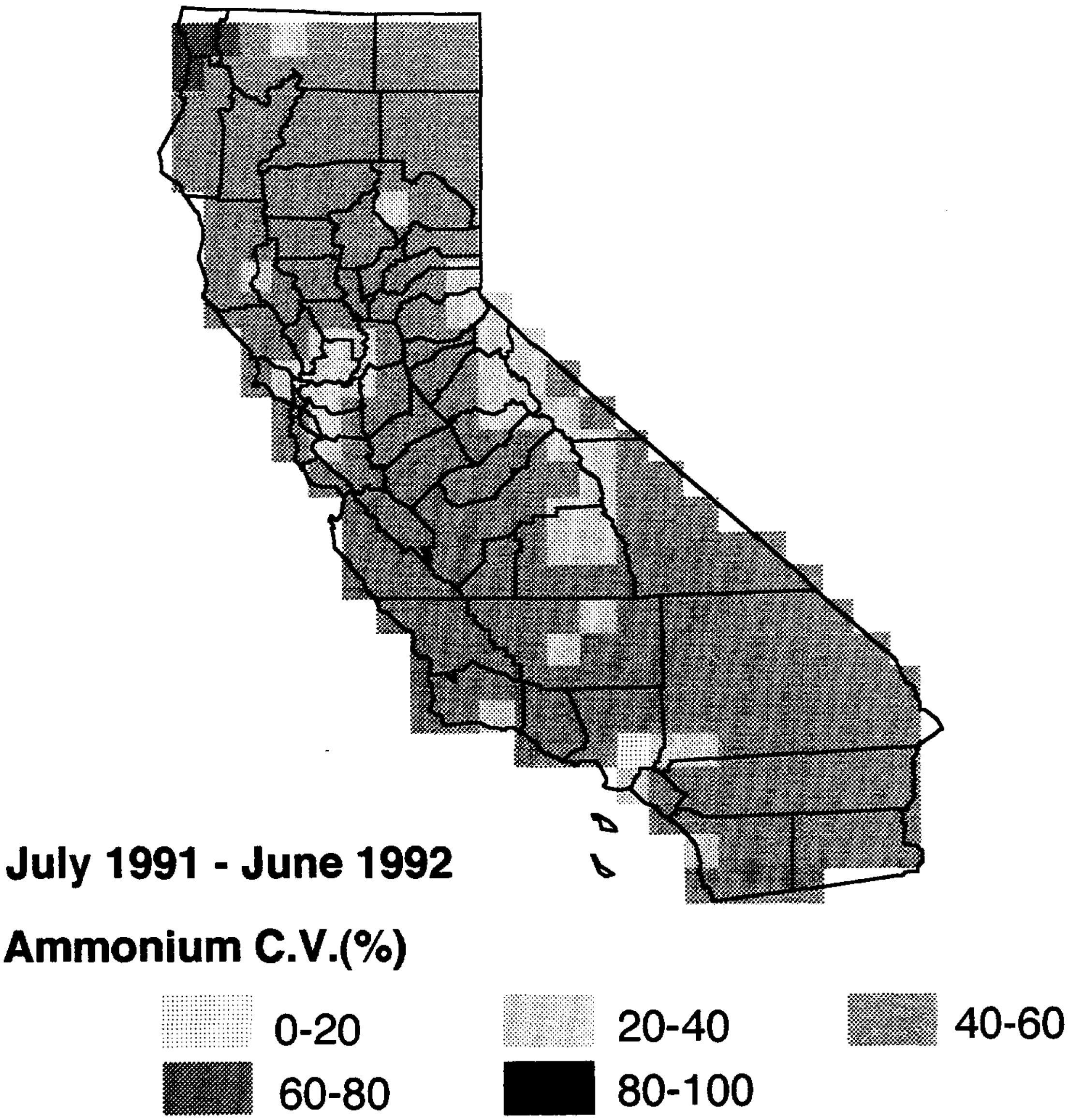
Ammonium C.V.(%)

0-20 20-40 40-60
60-80 80-100

July 1991 - June 1992

Ammonium (kg/ha)

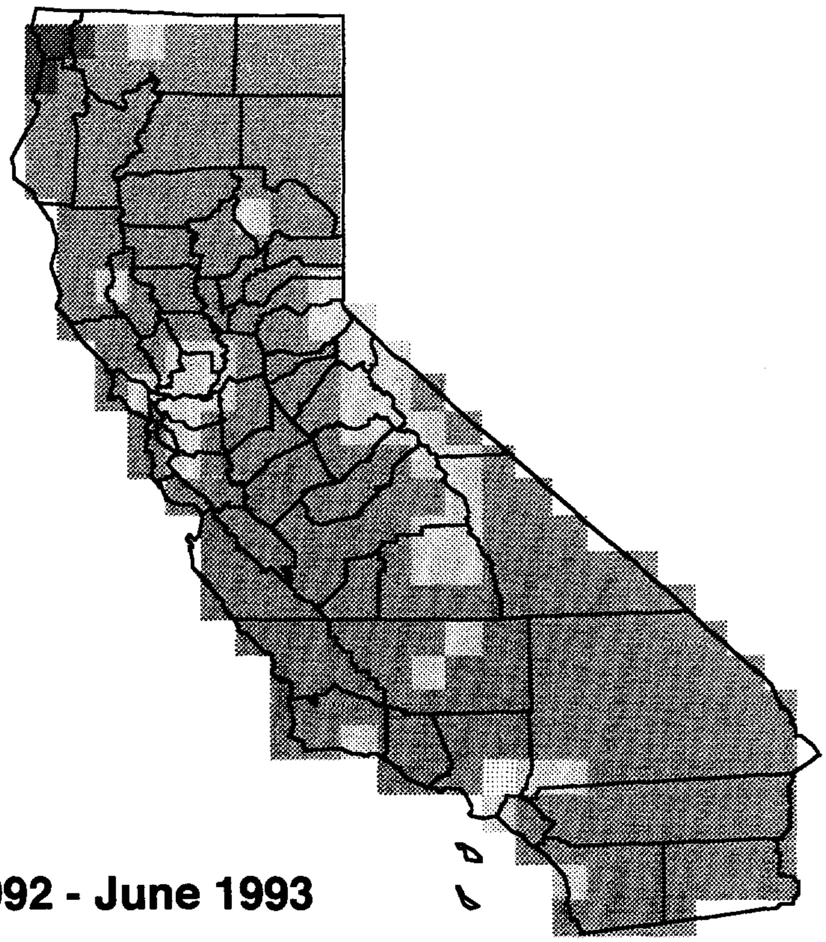



July 1991 - June 1992
Ammonium C.V.(%)
0-20
20-40
40-60
60-80
80-100

July 1992 - June 1993

Ammonium (kg/ha)

0-1
1-2
2-3
3-4
4-5



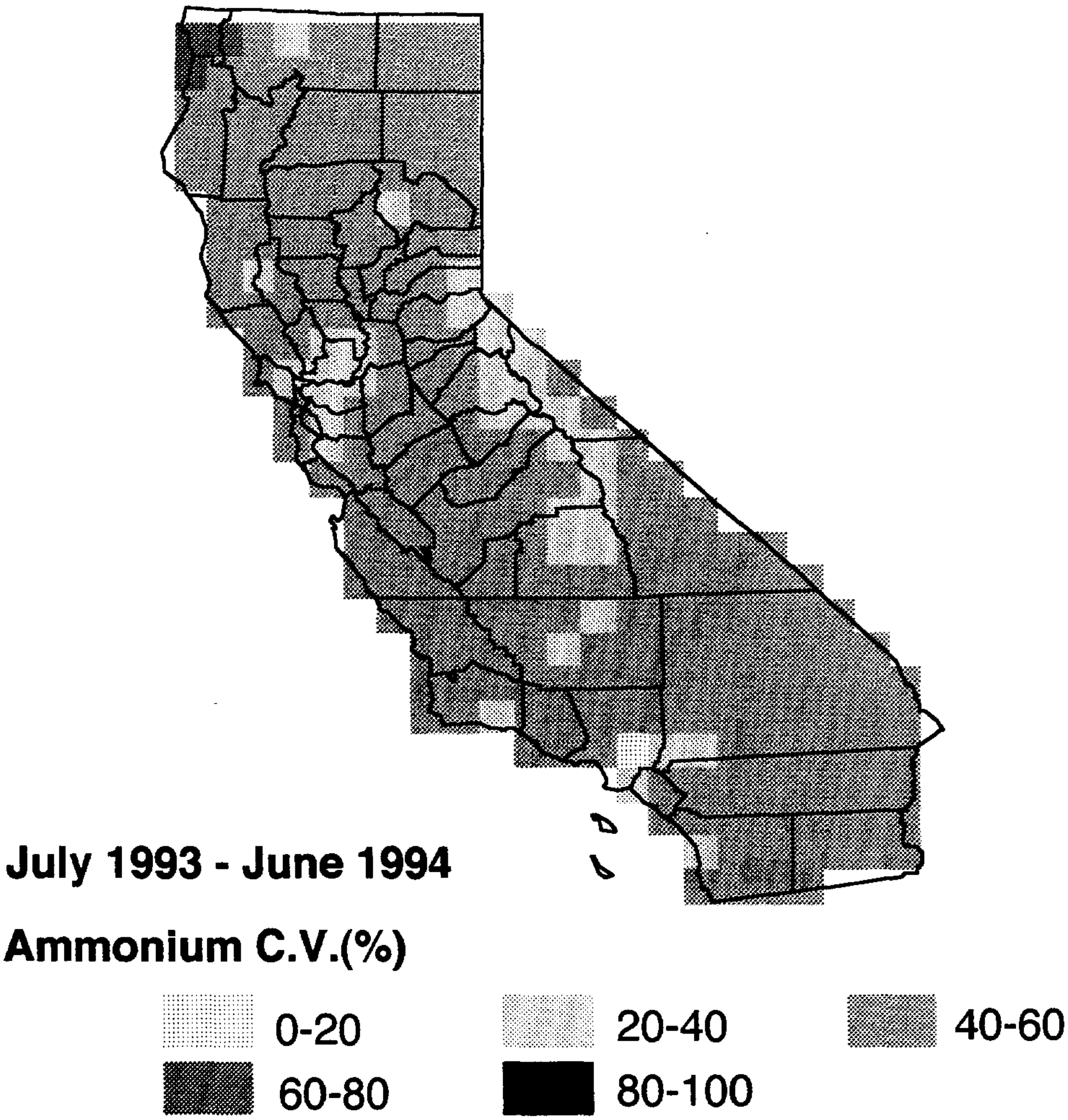
July 1992 - June 1993

Ammonium C.V.(%)

July 1993 - June 1994

Ammonium (kg/ha)

0-1
1-2
2-3
3-4
4-5

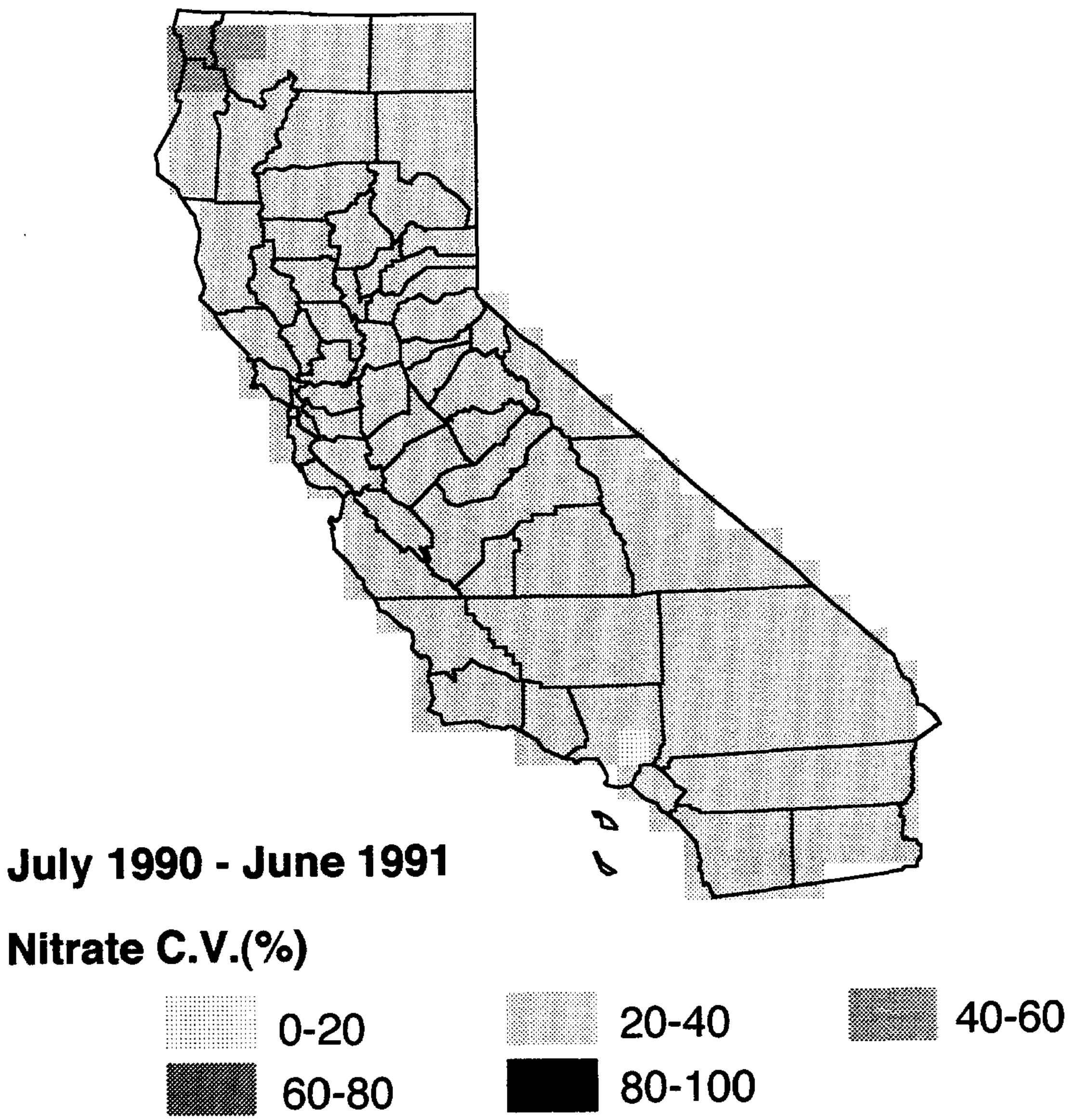

July 1993 - June 1994
Ammonium C.V.(%)
0-20
20-40
40-60
60-80
80-100

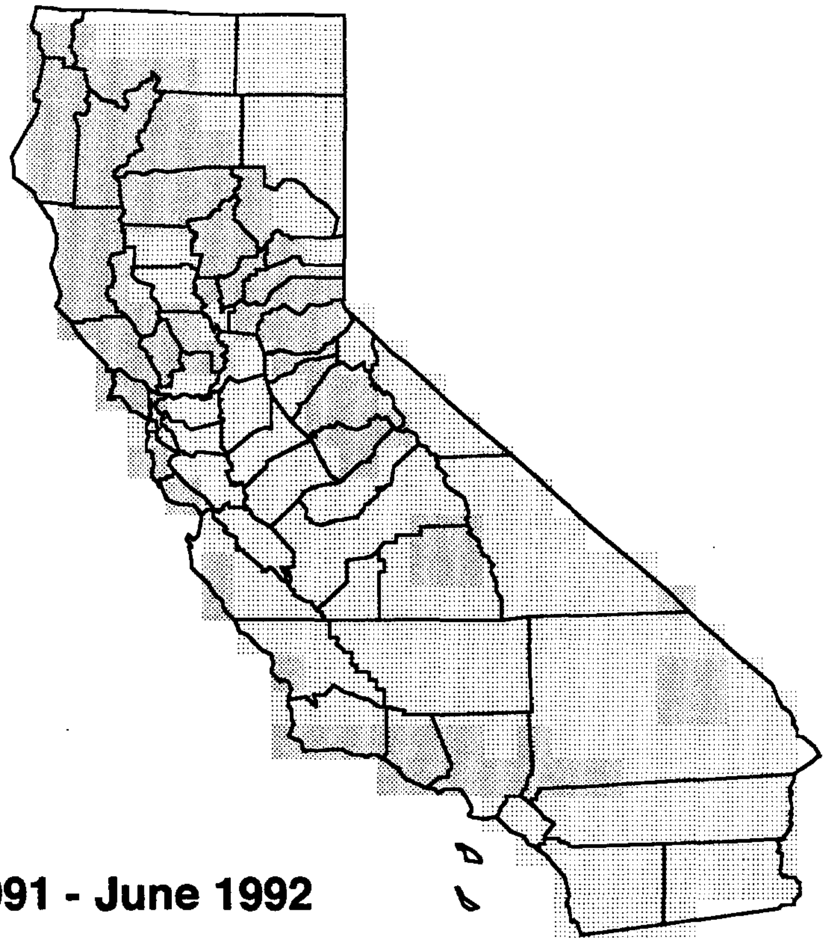
July 1990 - June 1991

Nitrate (kg/ha)

0-2 2-4 4-6

6-8 8-10

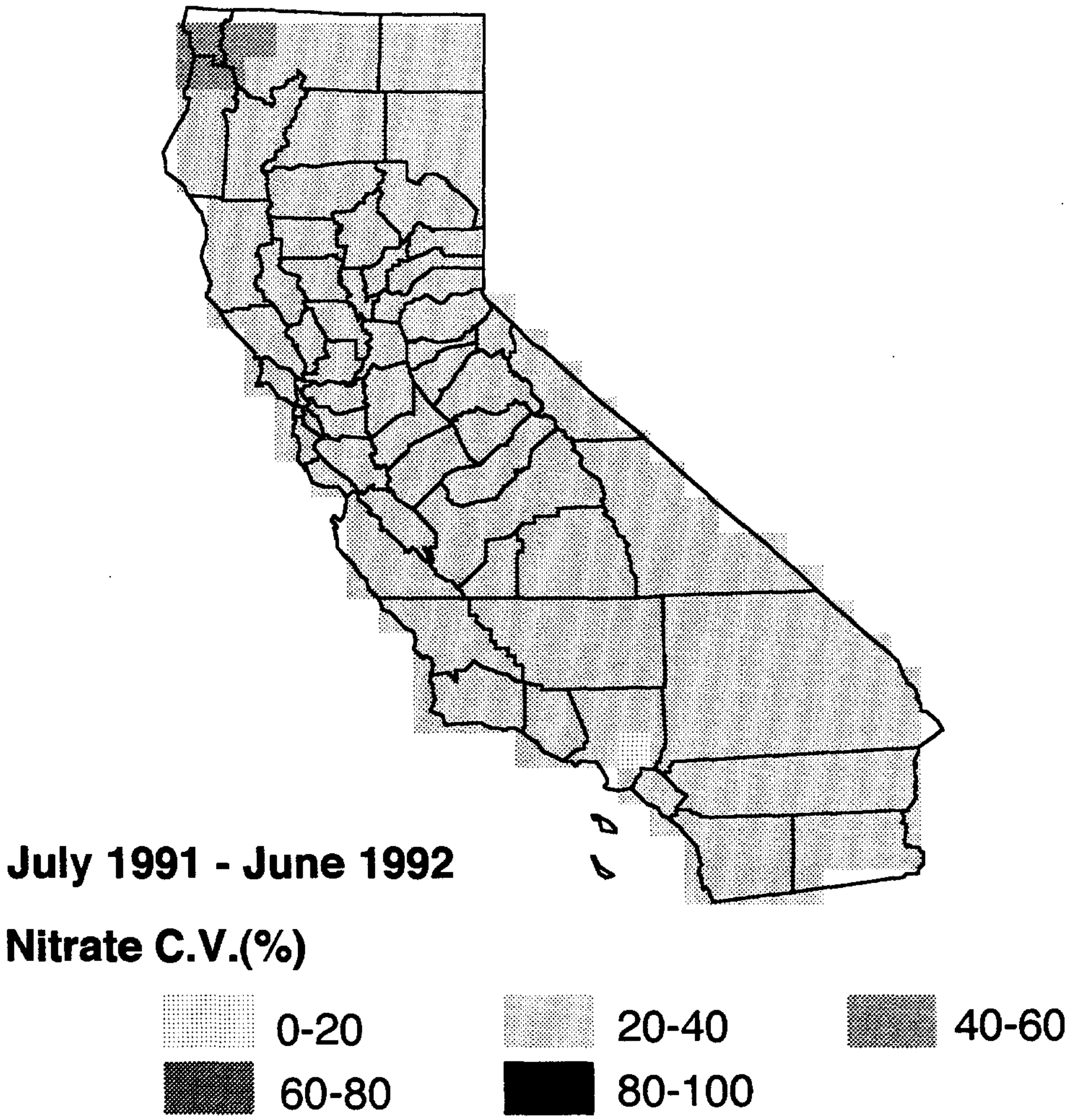

July 1990 - June 1991
Nitrate C.V.(%)
0-20
20-40
40-60
60-80
80-100

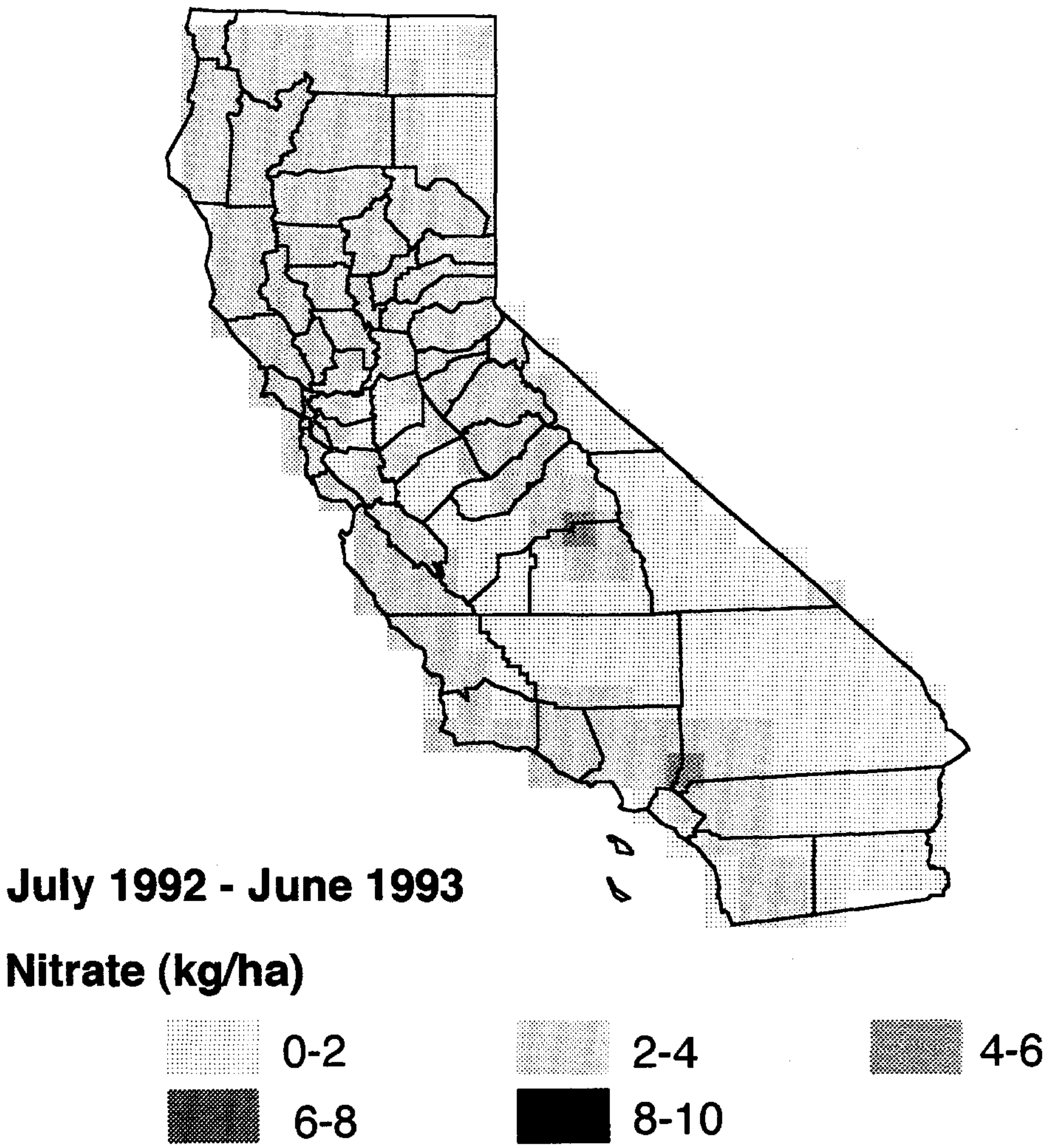


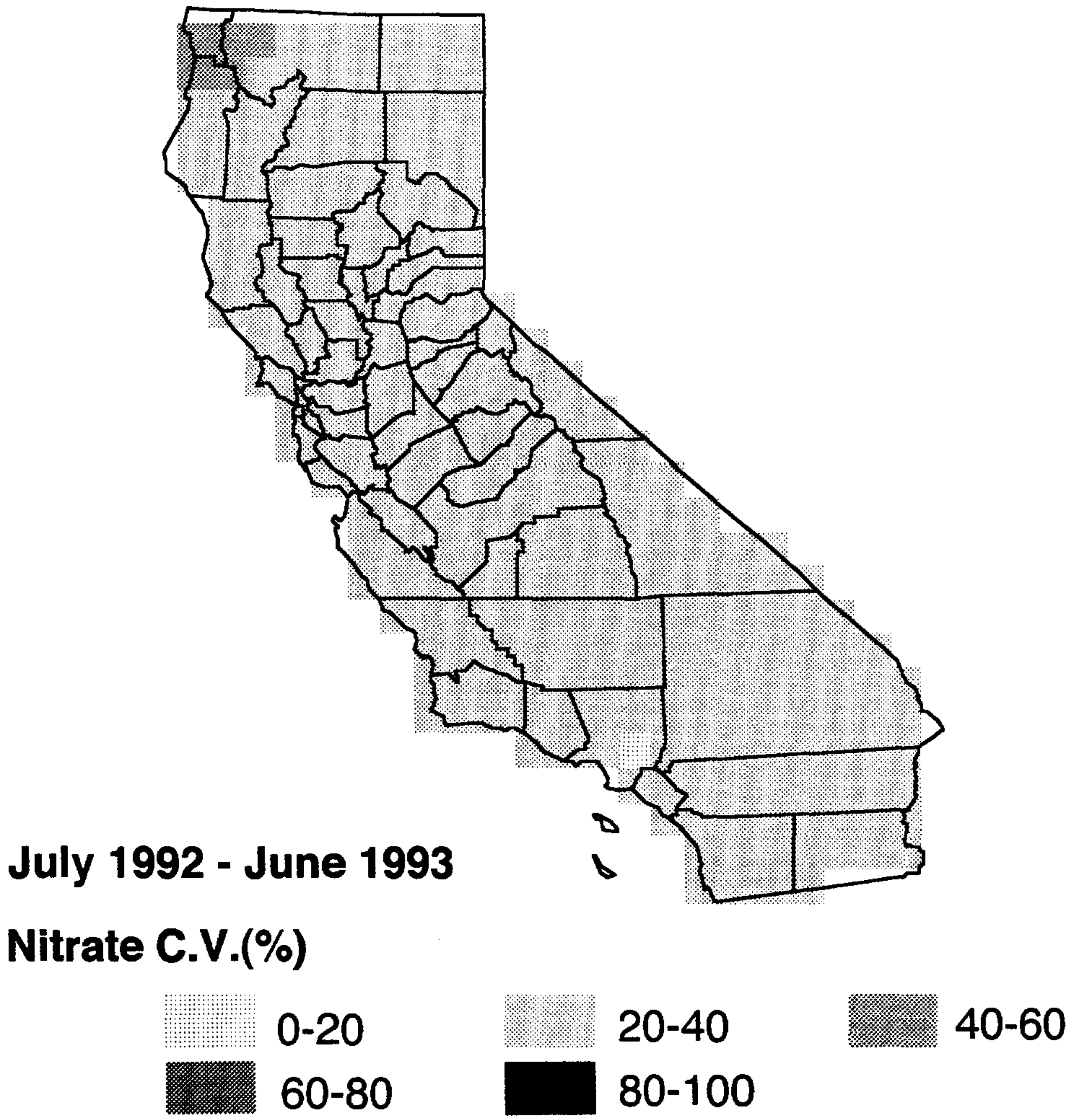
July 1991 - June 1992

Nitrate (kg/ha)

0-2 2-4 4-6 6-8 8-10

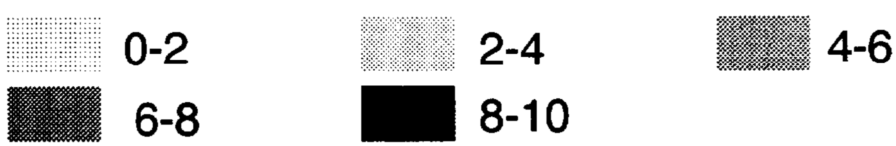

July 1991 - June 1992
Nitrate C.V.(%)
0-20
20-40
40-60
60-80
80-100

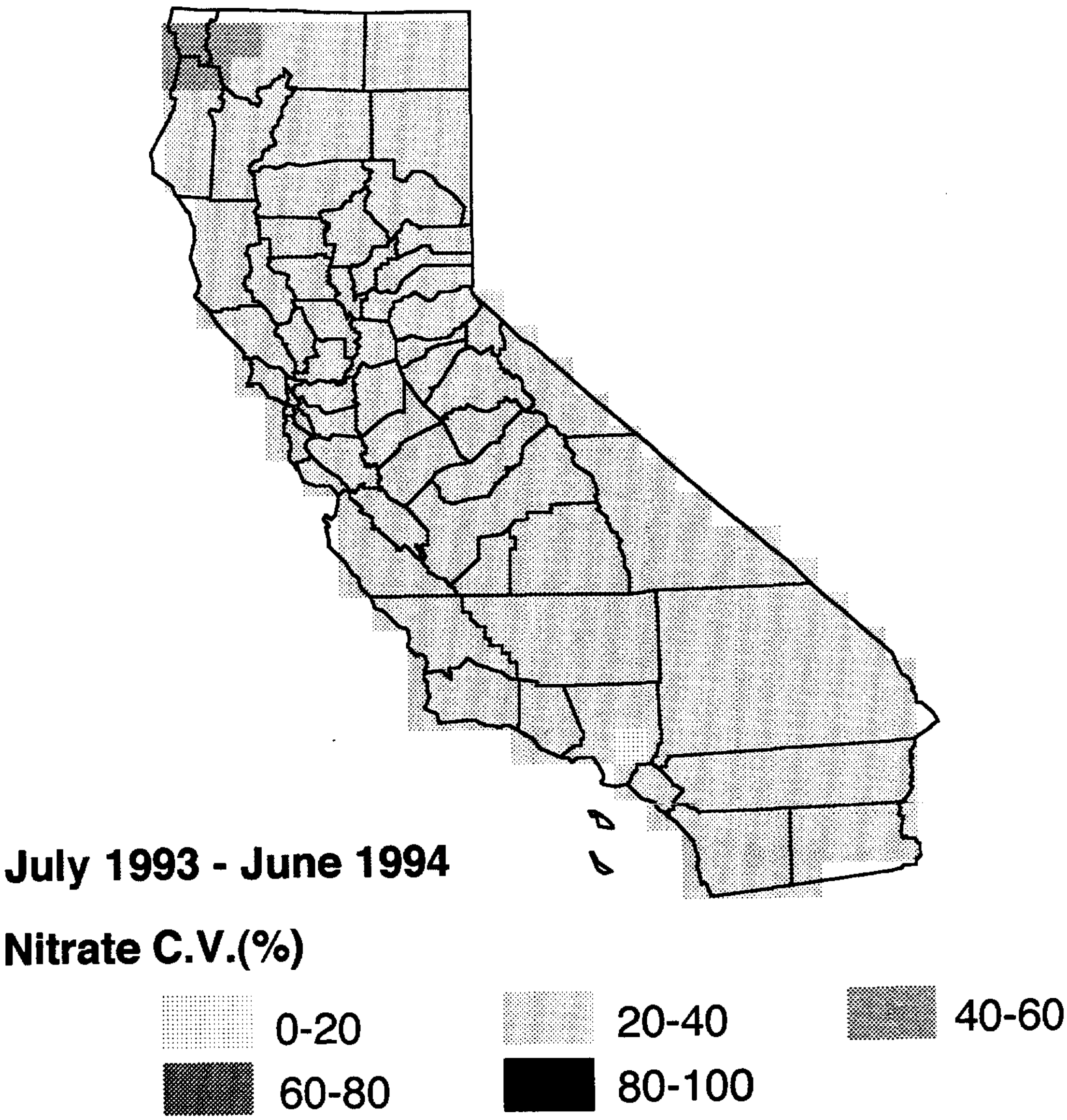

July 1992 - June 1993
Nitrate (kg/ha)
0-2
2-4
4-6
6-8
8-10


July 1992 - June 1993
Nitrate C.V.(%)
0-20
20-40
40-60
60-80
80-100

July 1993 - June 1994

Nitrate (kg/ha)




July 1993 - June 1994
Nitrate C.V.(%)
0-20
20-40
40-60
60-80
80-100

July 1990 - June 1991

Sulfate (kg/ha)

0-2
2-4
4-6
6-8
8-10

July 1990 - June 1991

Sulfate C.V.(%)

0-20
20-40
40-60
60-80
80-100

July 1991 - June 1992

Sulfate (kg/ha)

July 1991 - June 1992

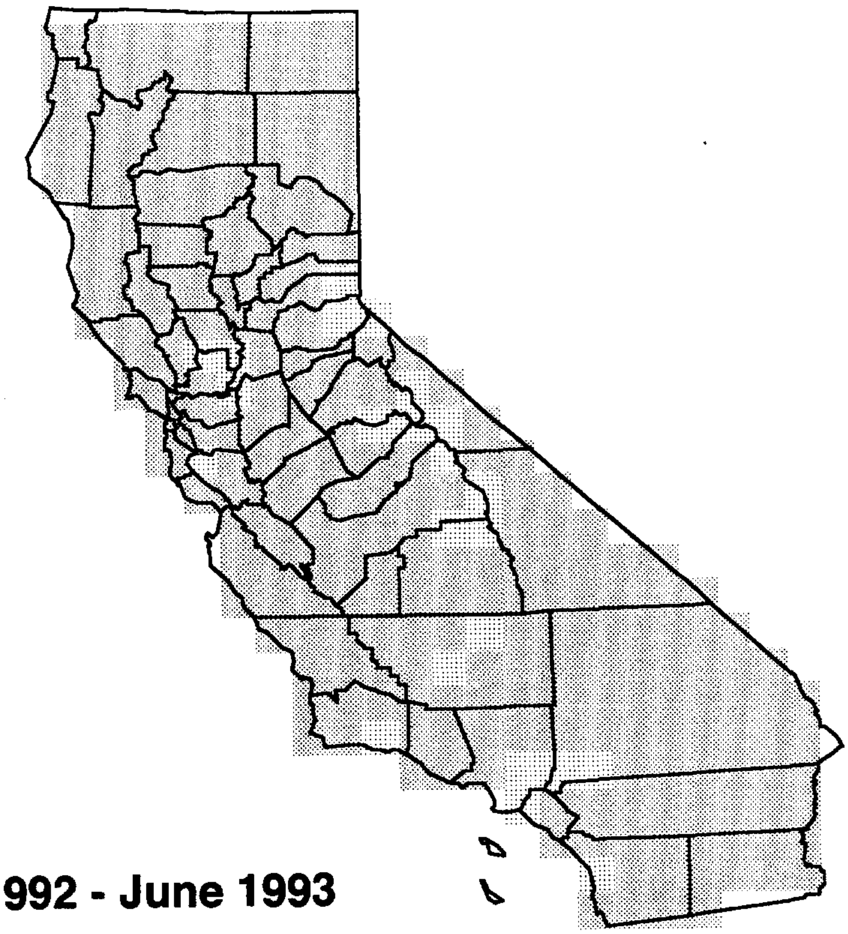
Sulfate C.V.(%)

0-20	20-40
40-60	60-80
80-100	

July 1992 - June 1993

Sulfate (kg/ha)

0-2	2-4	4-6
6-8	8-10	



July 1992 - June 1993

Sulfate C.V.(%)

0-20 20-40 40-60

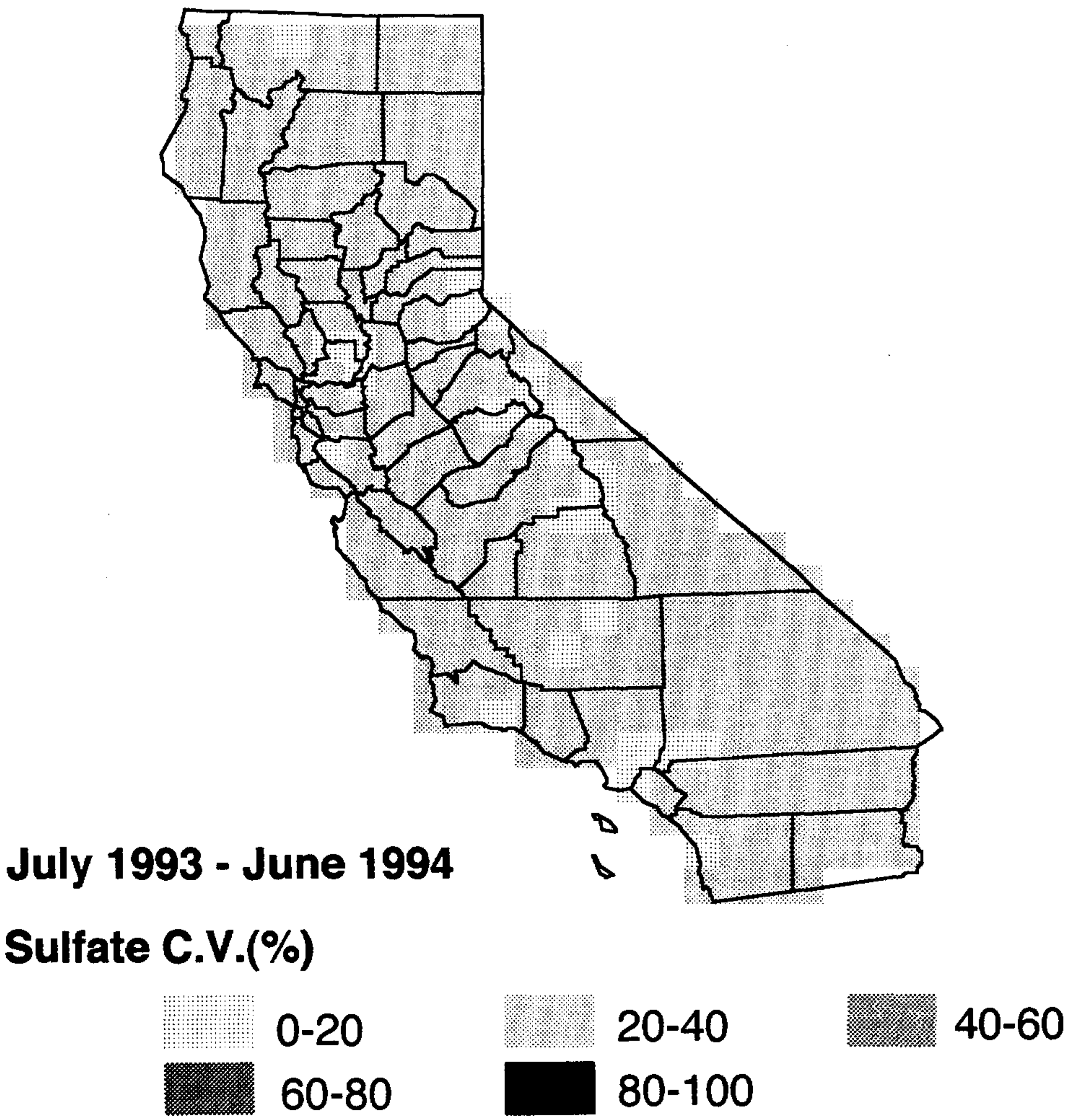
60-80 80-100

July 1993 - June 1994

Sulfate (kg/ha)

0-2 2-4 4-6

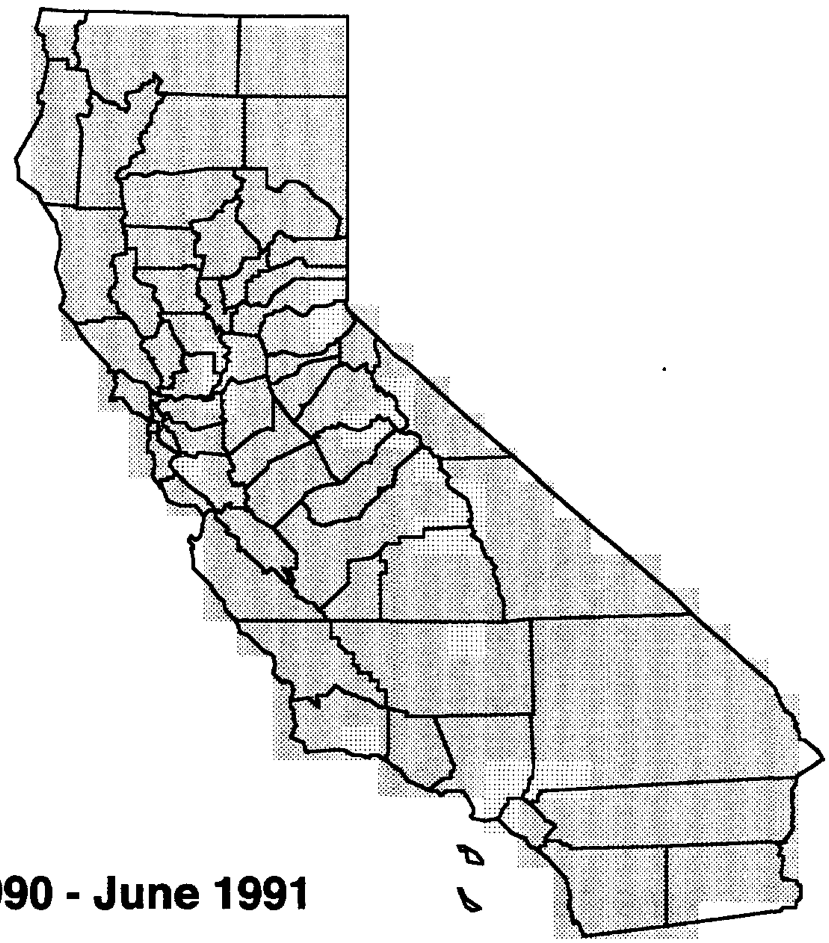
6-8 8-10


July 1993 - June 1994
Sulfate C.V.(%)
0-20
20-40
40-60
60-80
80-100

July 1990 - June 1991

Excess Sulfate (kg/ha)

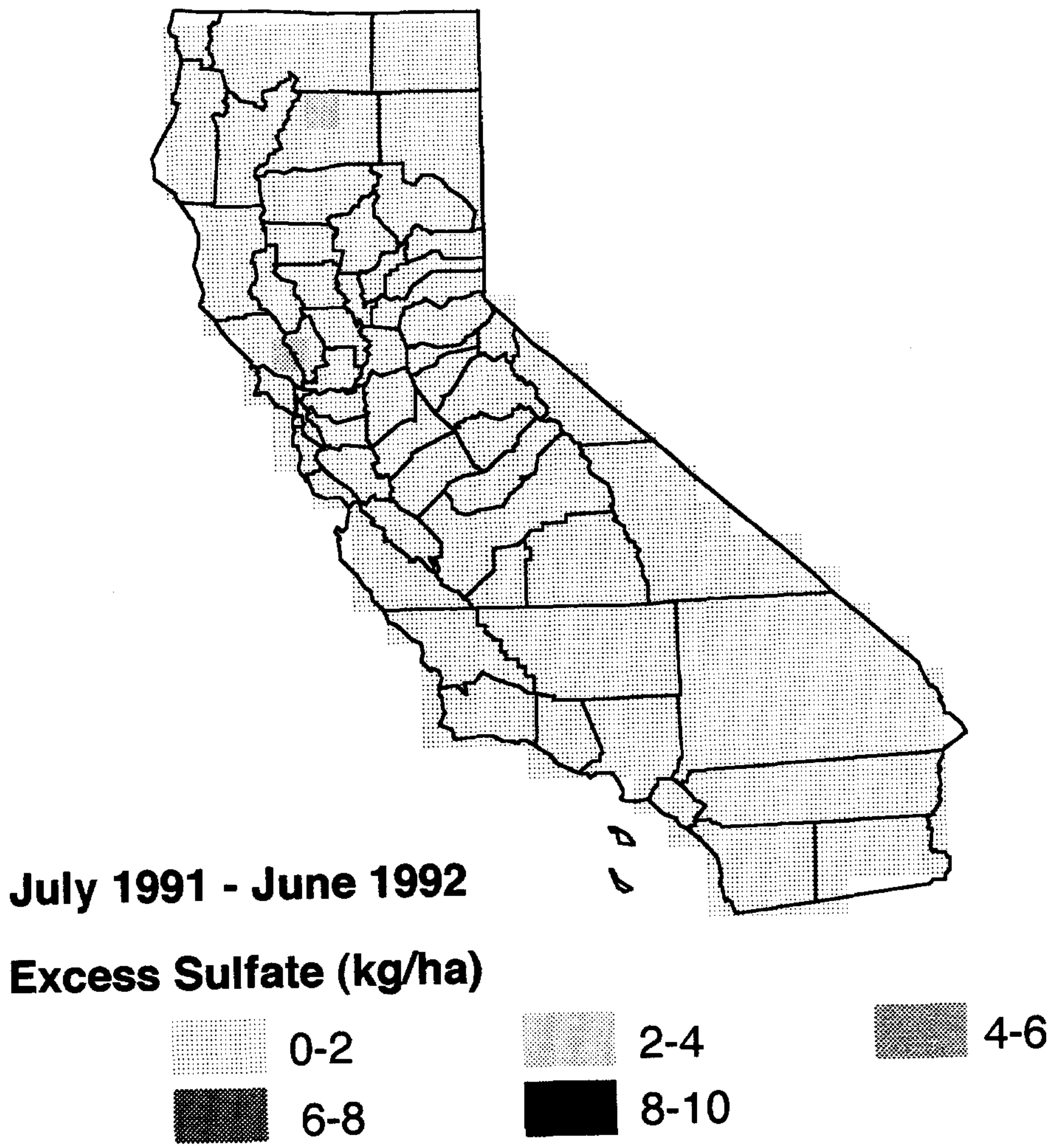
0-2
2-4
4-6
6-8
8-10

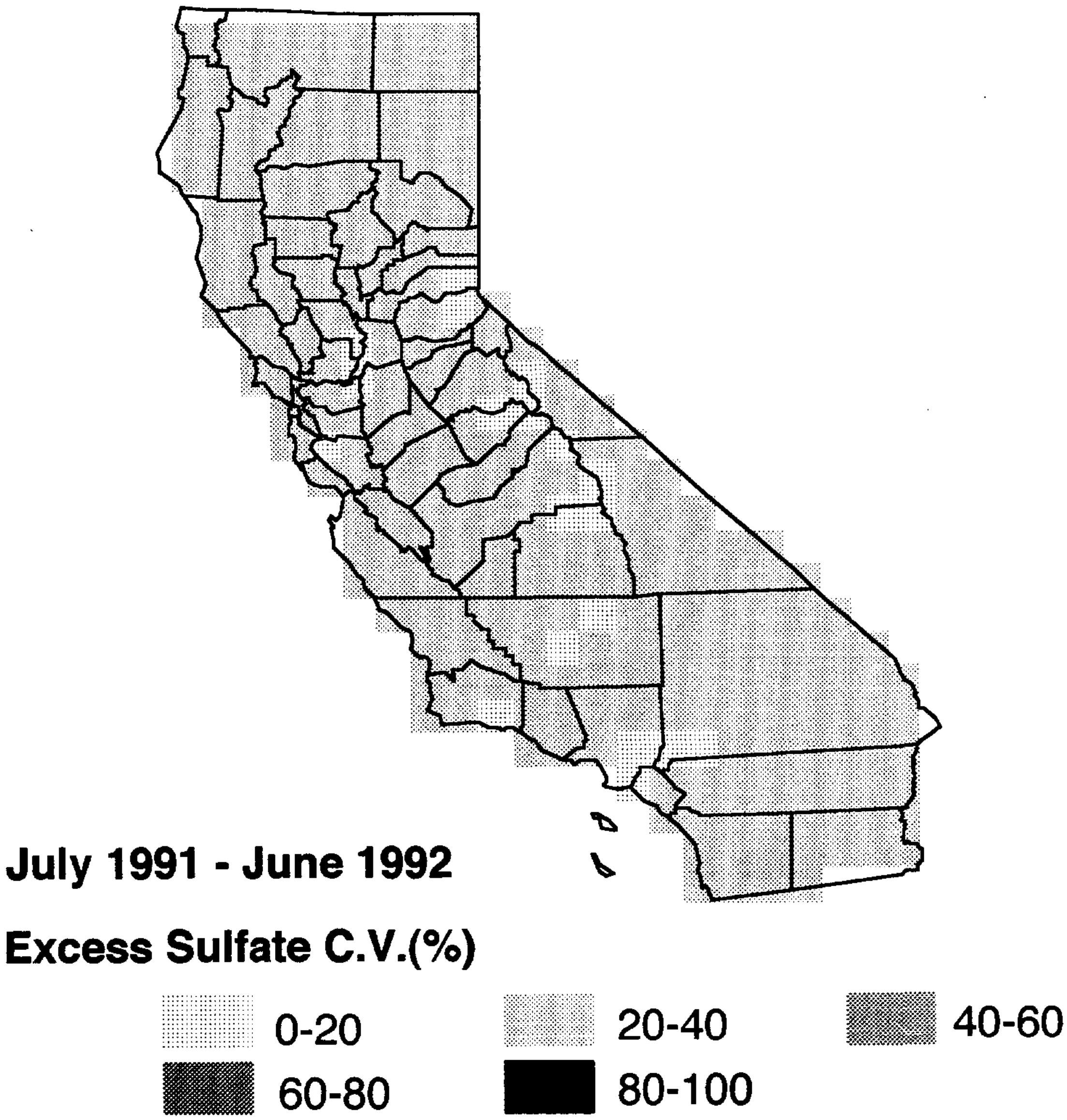


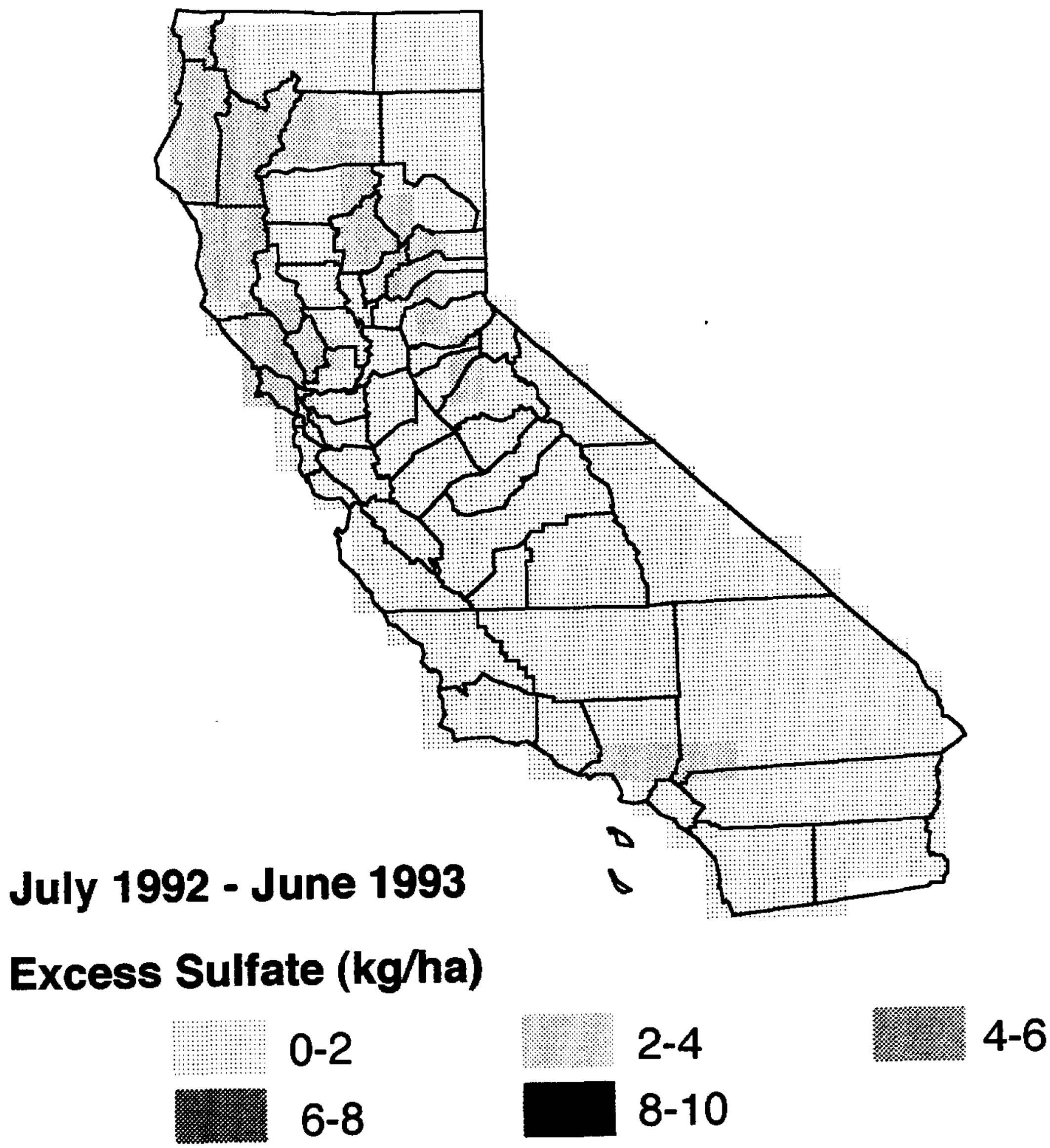
July 1990 - June 1991

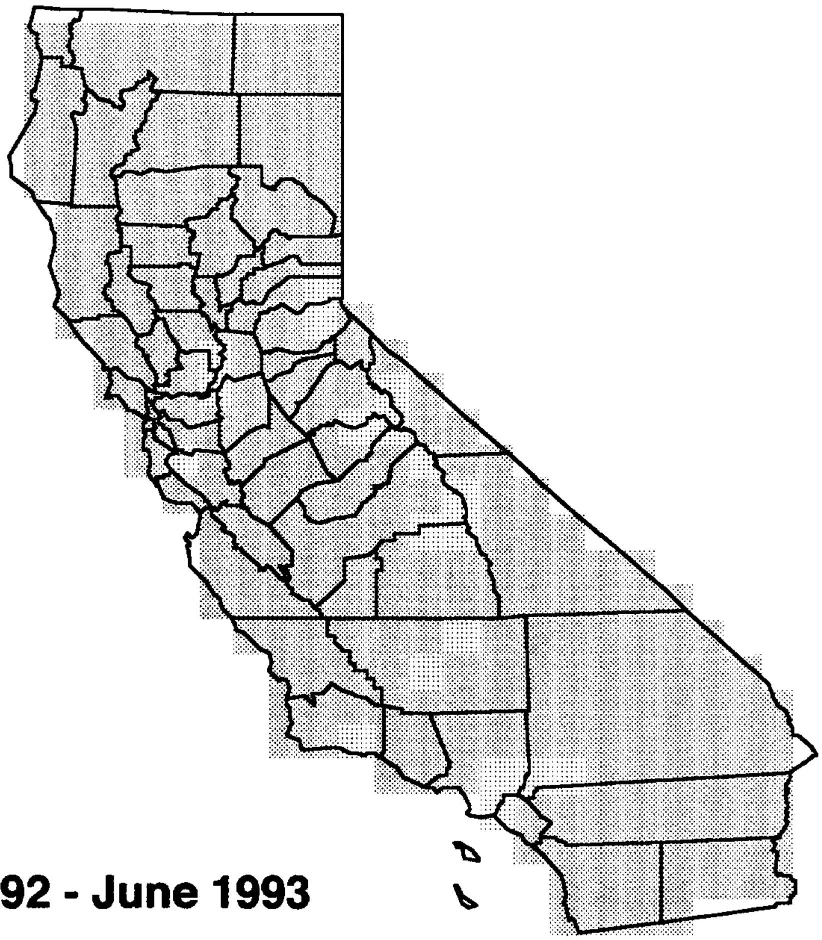
Excess Sulfate C.V.(%)

0-20
20-40
40-60
60-80
80-100


July 1991 - June 1992
Excess Sulfate (kg/ha)
0-2
2-4
4-6
6-8
8-10


July 1991 - June 1992
Excess Sulfate C.V.(%)
0-20
20-40
40-60
60-80
80-100


July 1992 - June 1993
Excess Sulfate (kg/ha)
0-2
2-4
4-6
6-8
8-10



July 1992 - June 1993

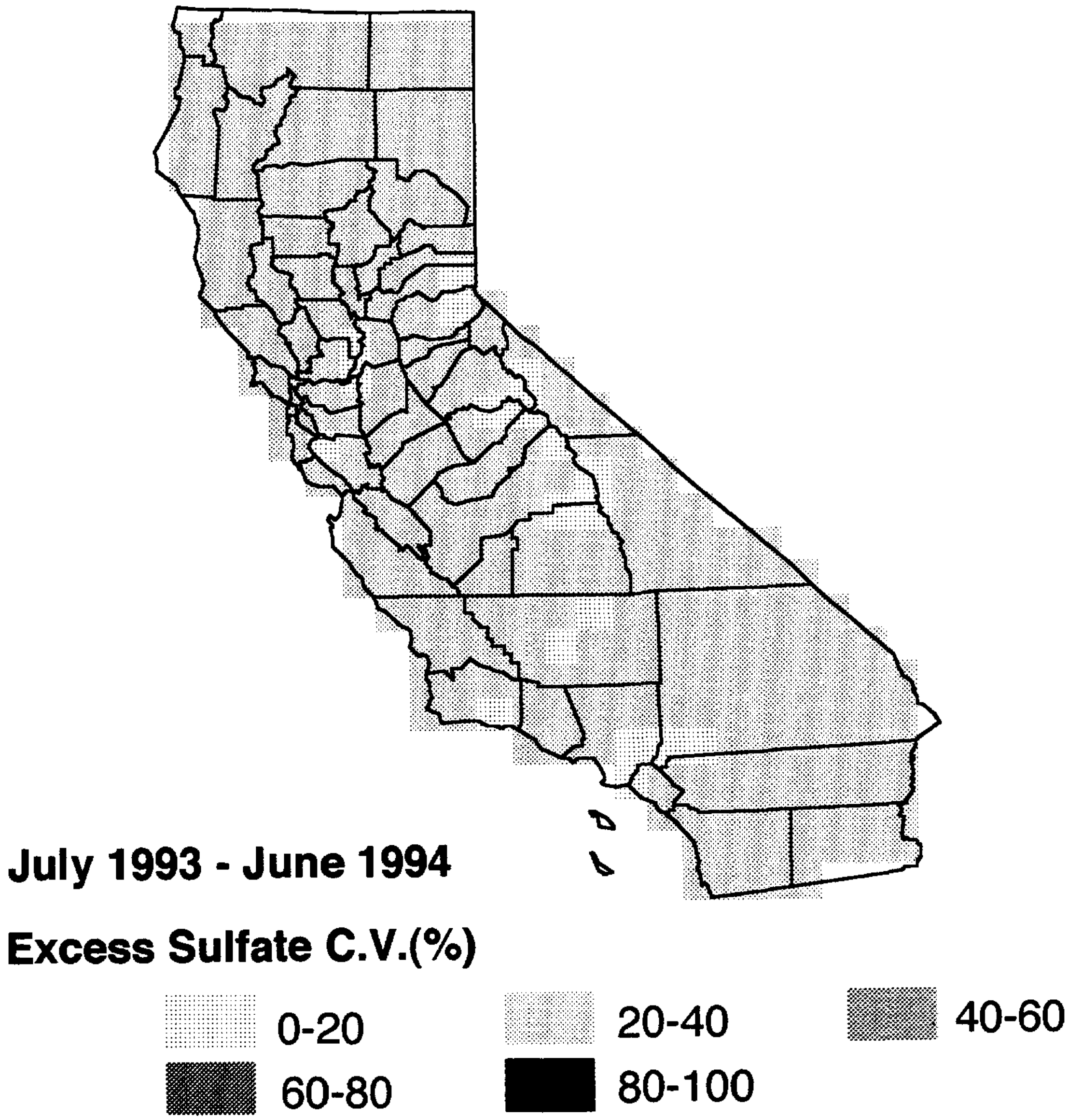
Excess Sulfate C.V.(%)

0-20
20-40
40-60
60-80
80-100

July 1993 - June 1994

Excess Sulfate (kg/ha)

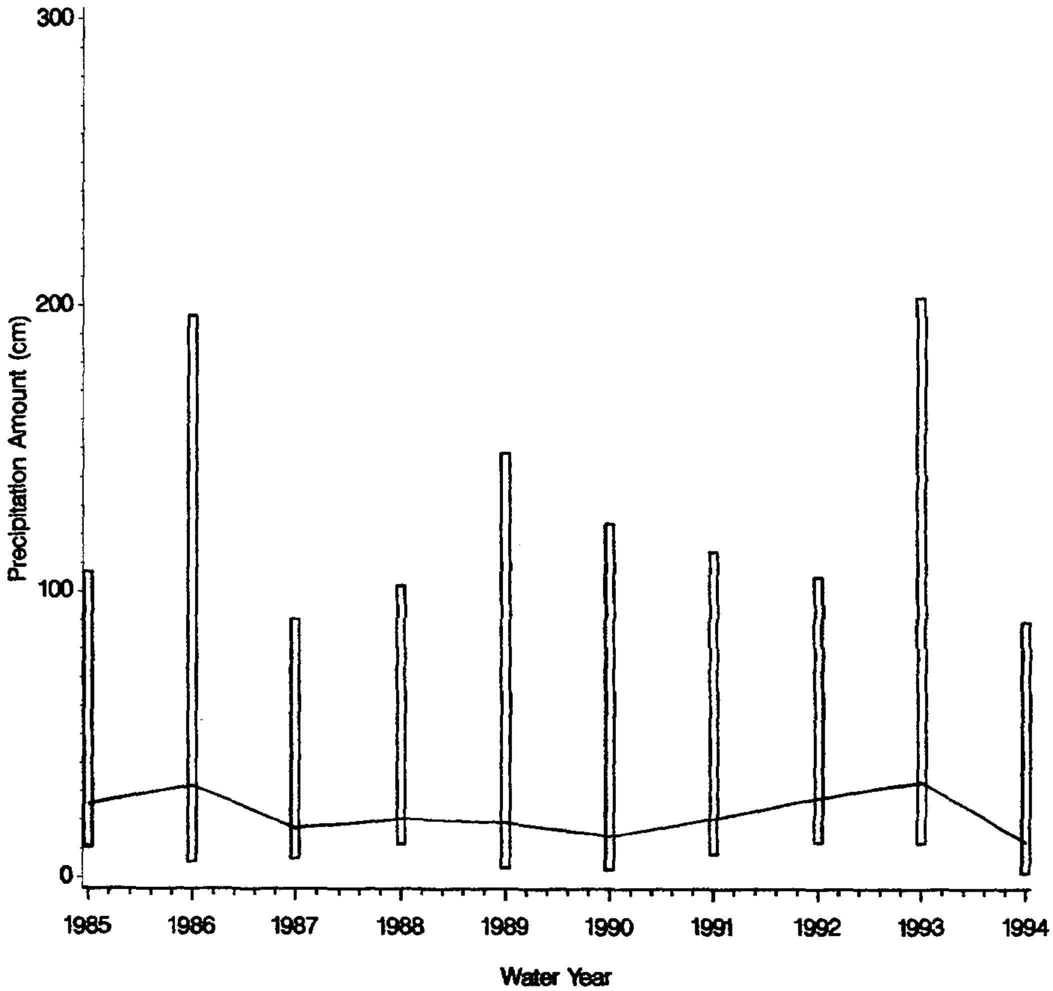
0-2 2-4 4-6
6-8 8-10

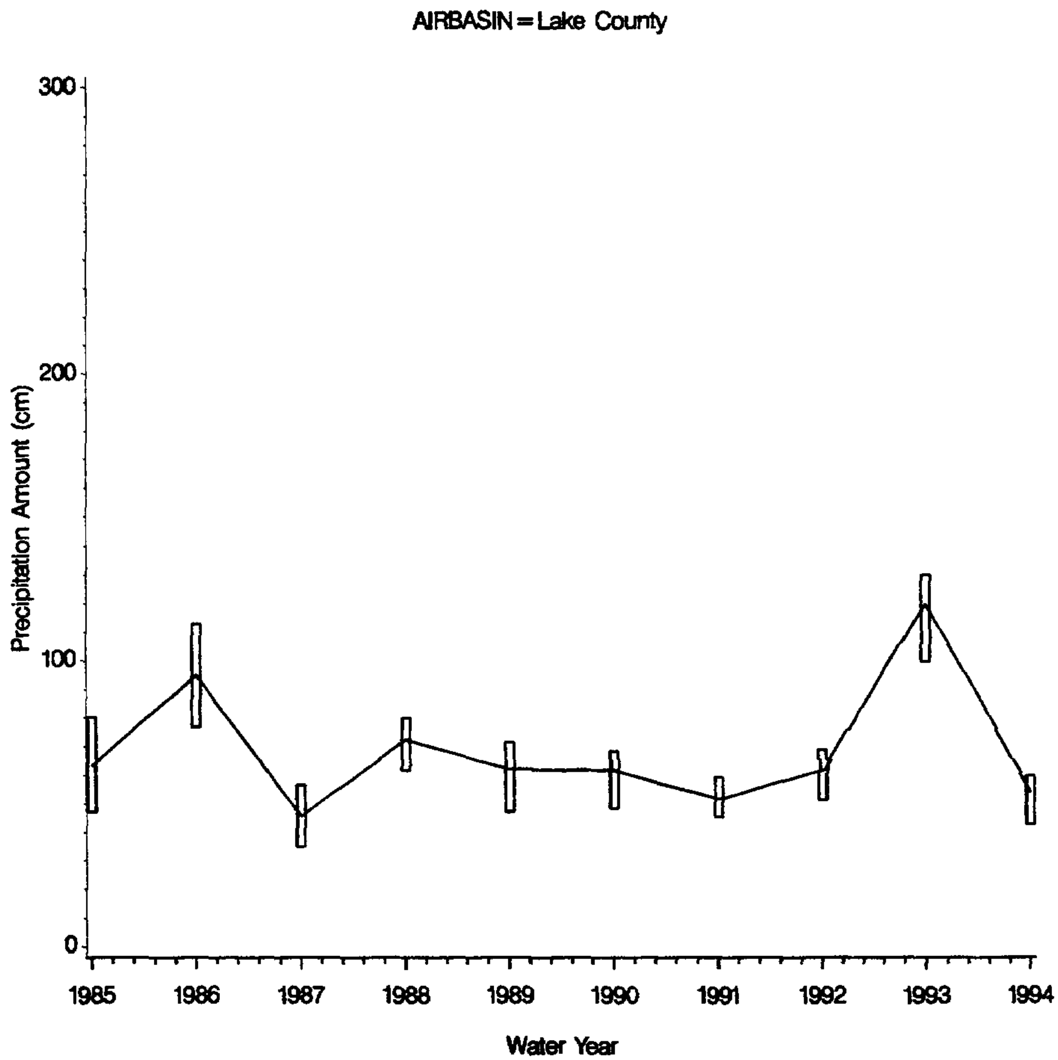

July 1993 - June 1994
Excess Sulfate C.V.(%)
0-20
20-40
40-60
60-80
80-100

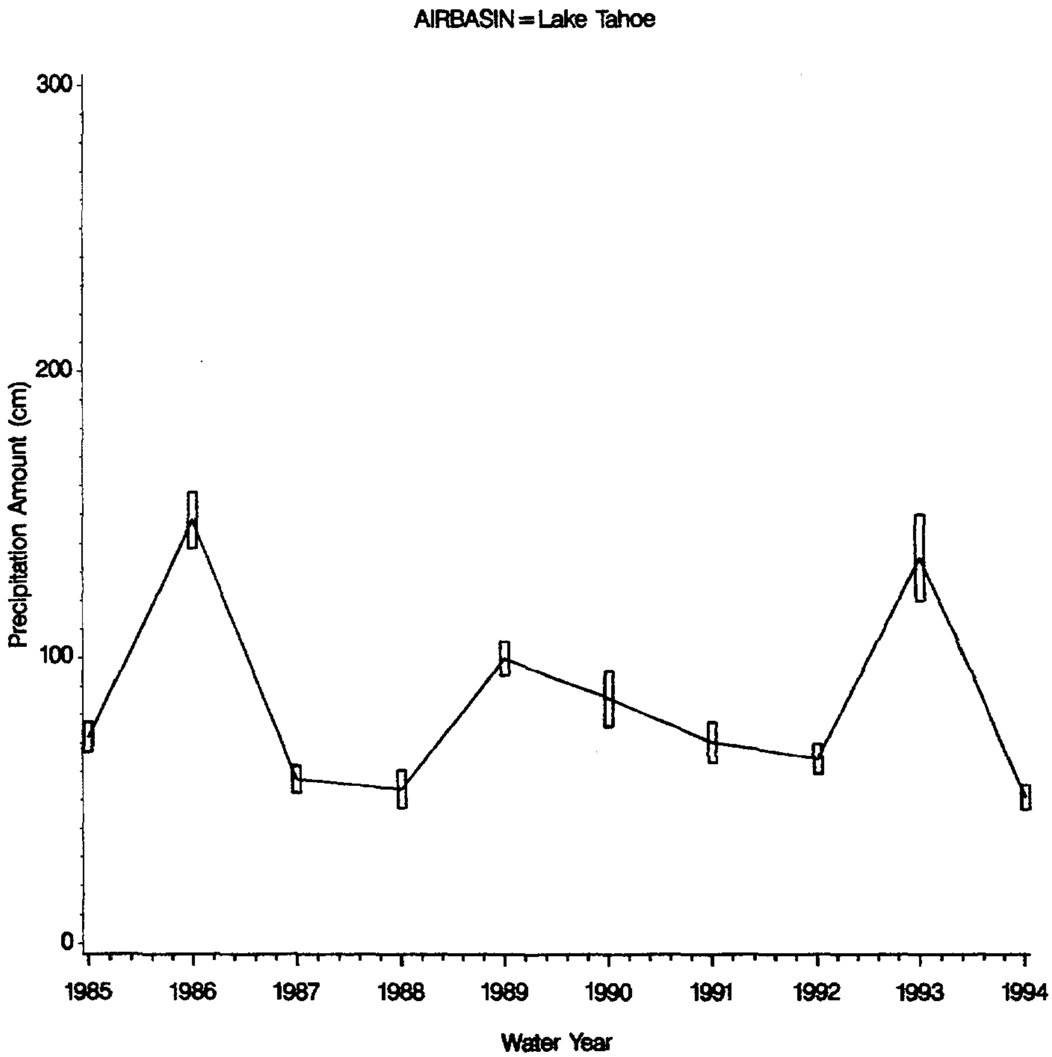
APPENDIX B: TIME SERIES PLOTS OF MEAN PRECIPITATION AMOUNT AND WET DEPOSITION FLUXES FOR EACH AIR BASIN

The figures shown in this appendix are time series plots of precipitation amount and wet deposition fluxes for each air basin, derived from the maps shown in Appendix A and from corresponding maps from earlier water years (Blanchard and Michaels, 1994). The minimum, mean, and maximum grid-cell averages are shown for each year.

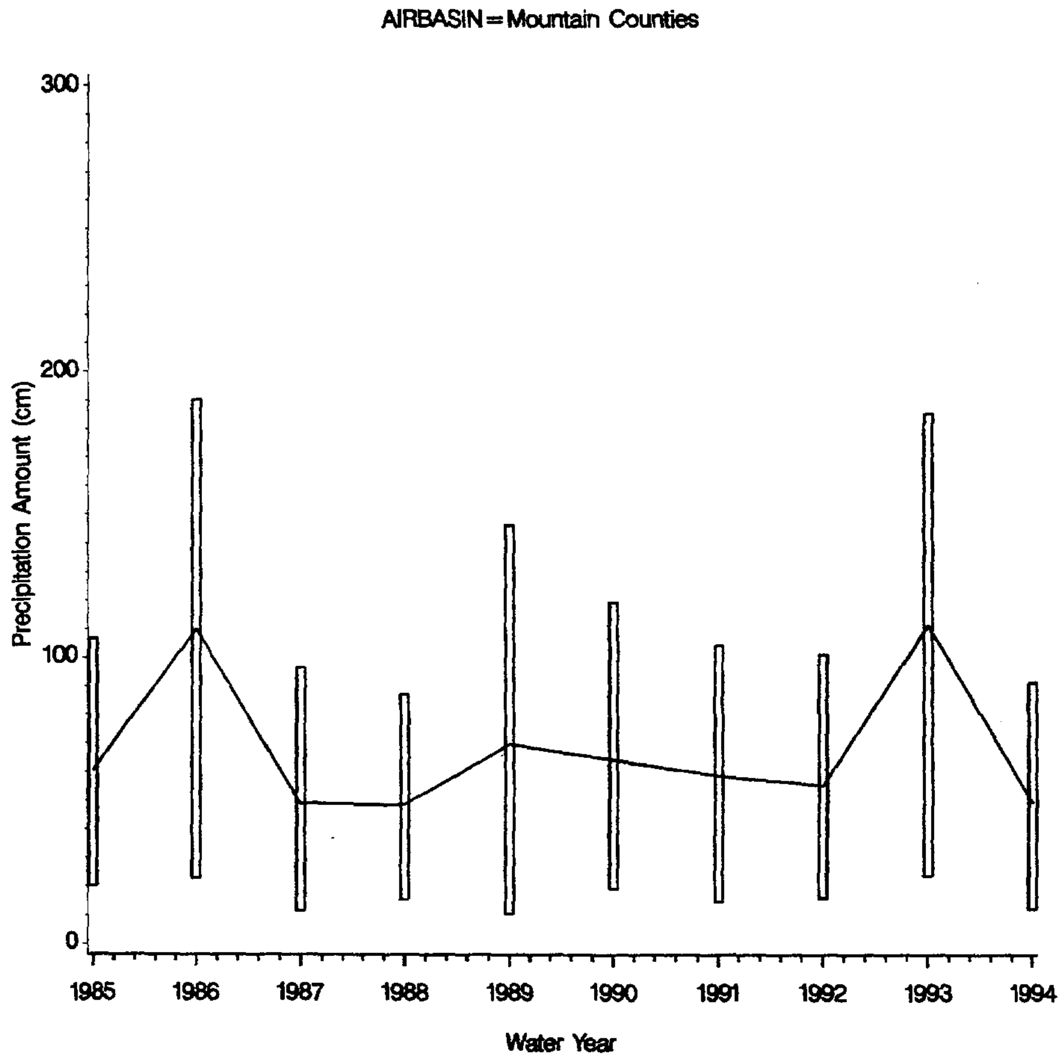
AIRBASIN=Great Basin Valleys

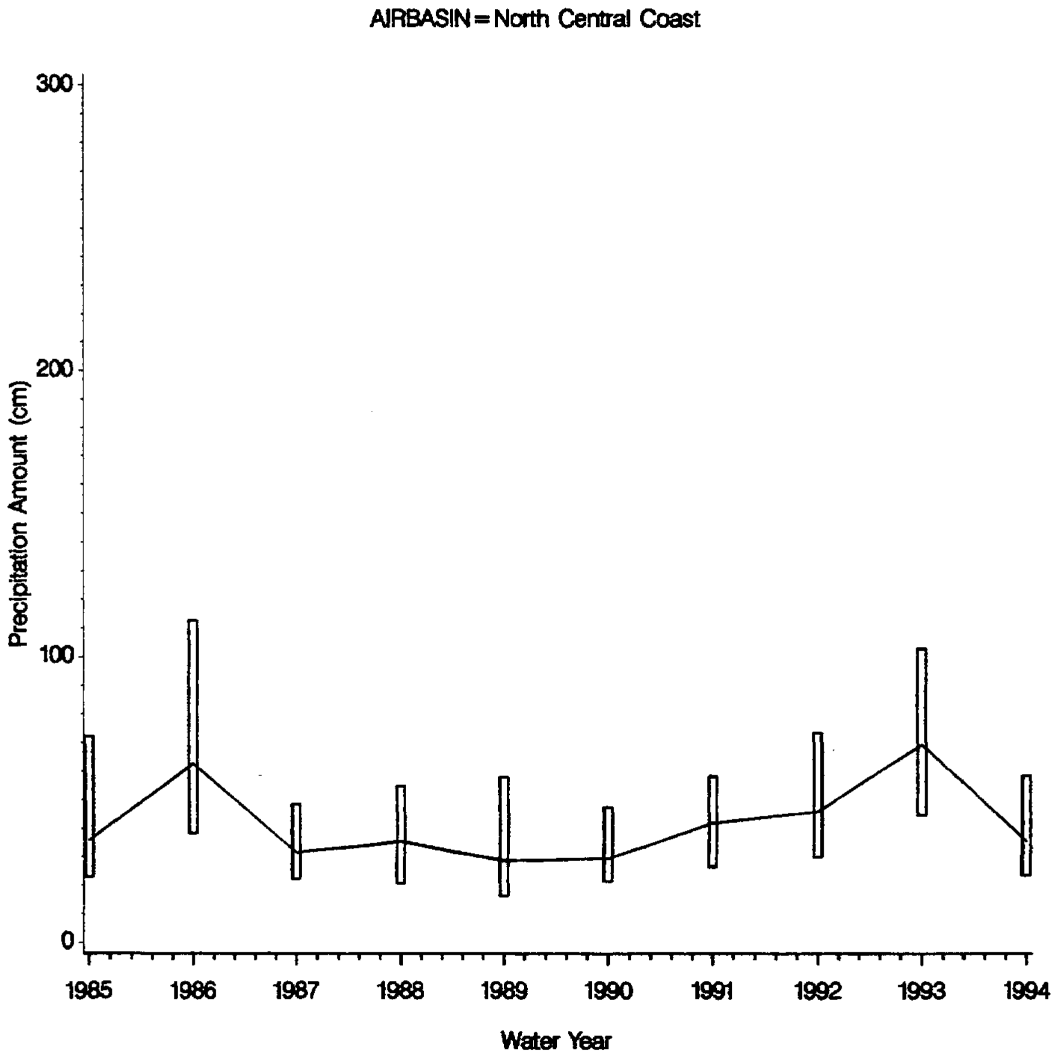



AIRBASIN = Lake County
Precipitation Amount (cm)
300
200
100
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

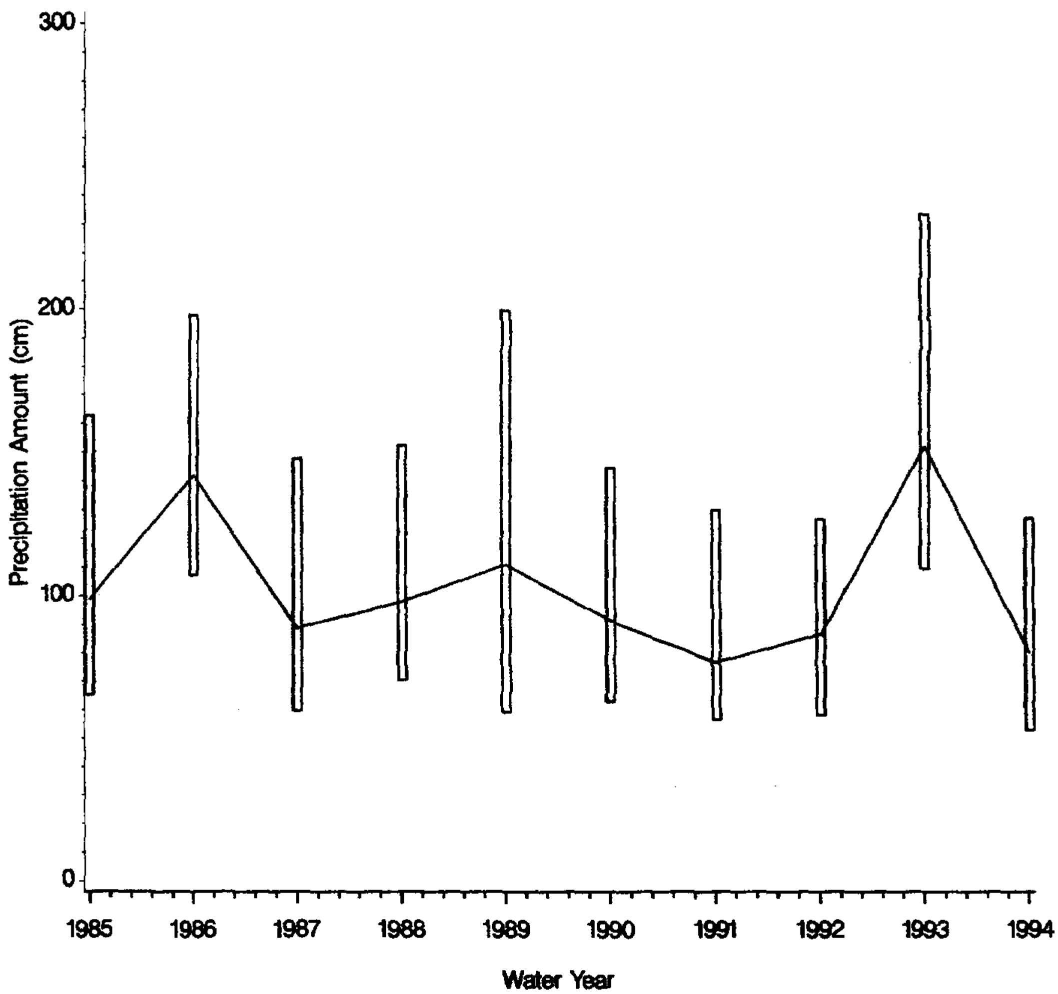


AIRBASIN = Lake Tahoe
300
200
100
0
Precipitation Amount (cm)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

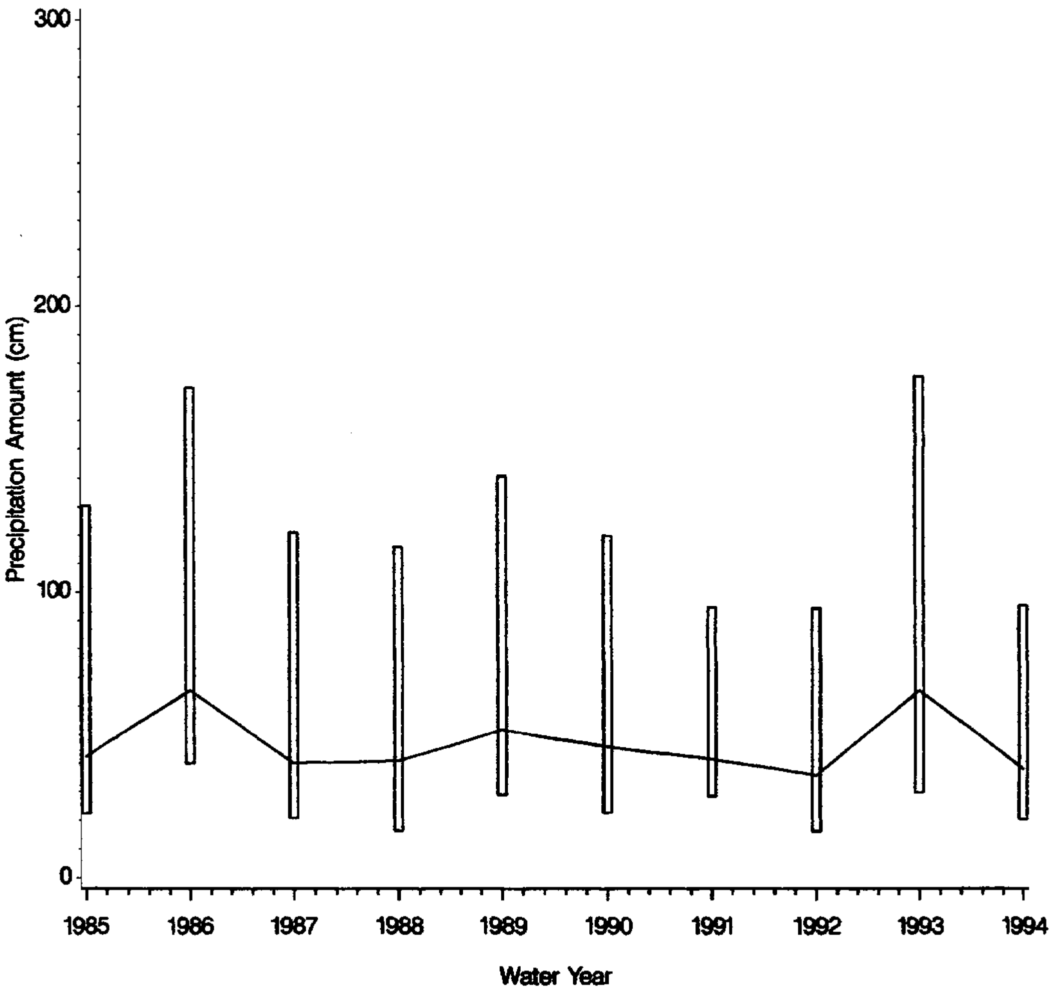

AIRBASIN=Mountain Counties
300
200
100
0
Precipitation Amount (cm)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

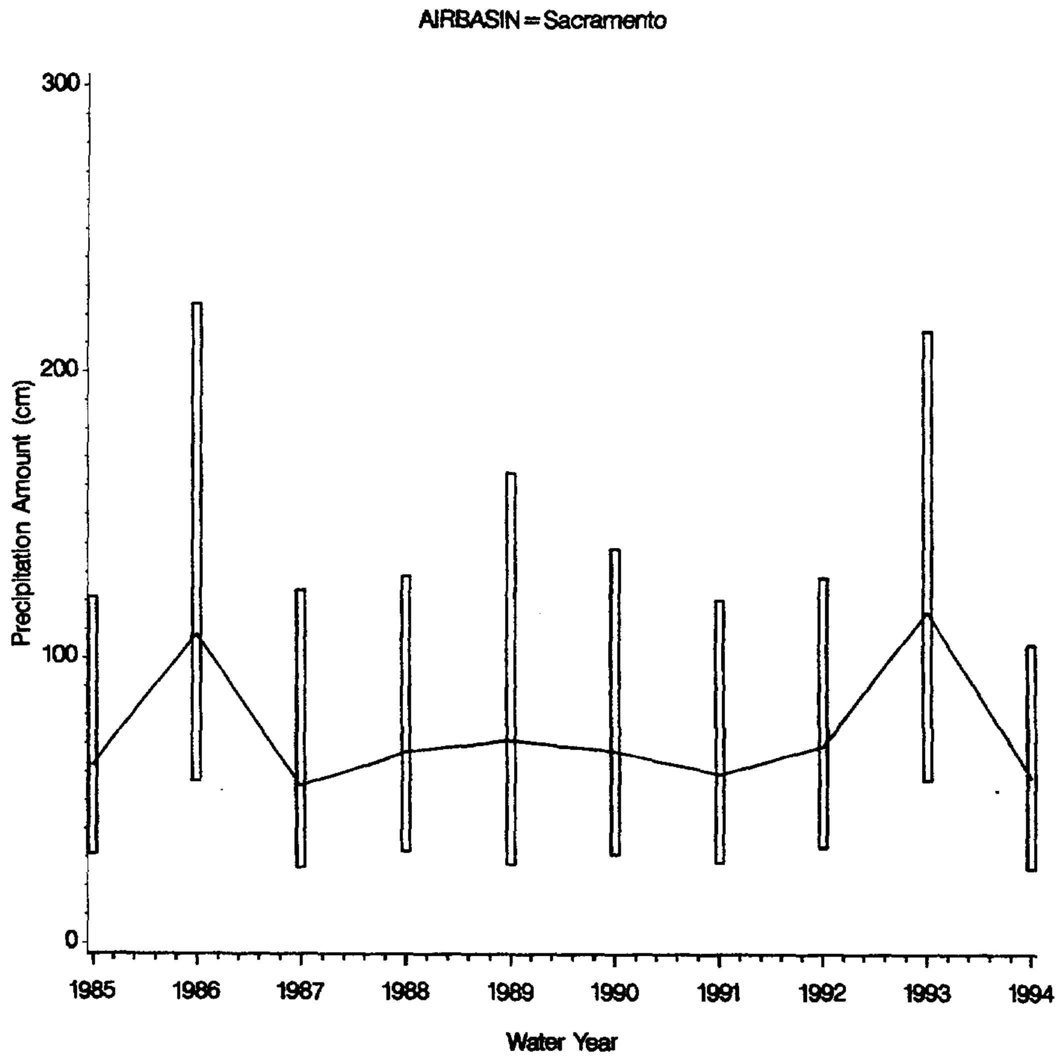

AIRBASIN=North Central Coast
300
200
100
0
Precipitation Amount (cm)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

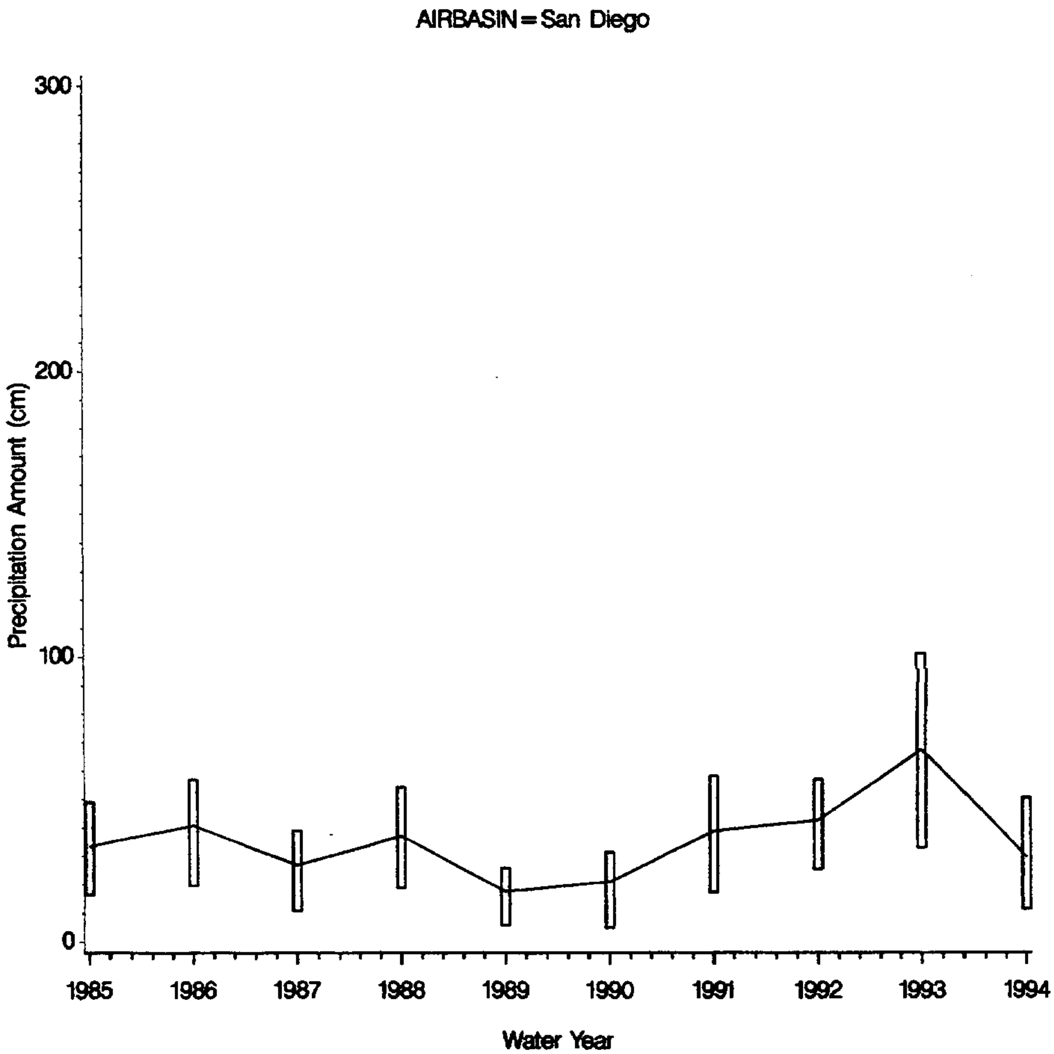
AIRBASIN = North Coast

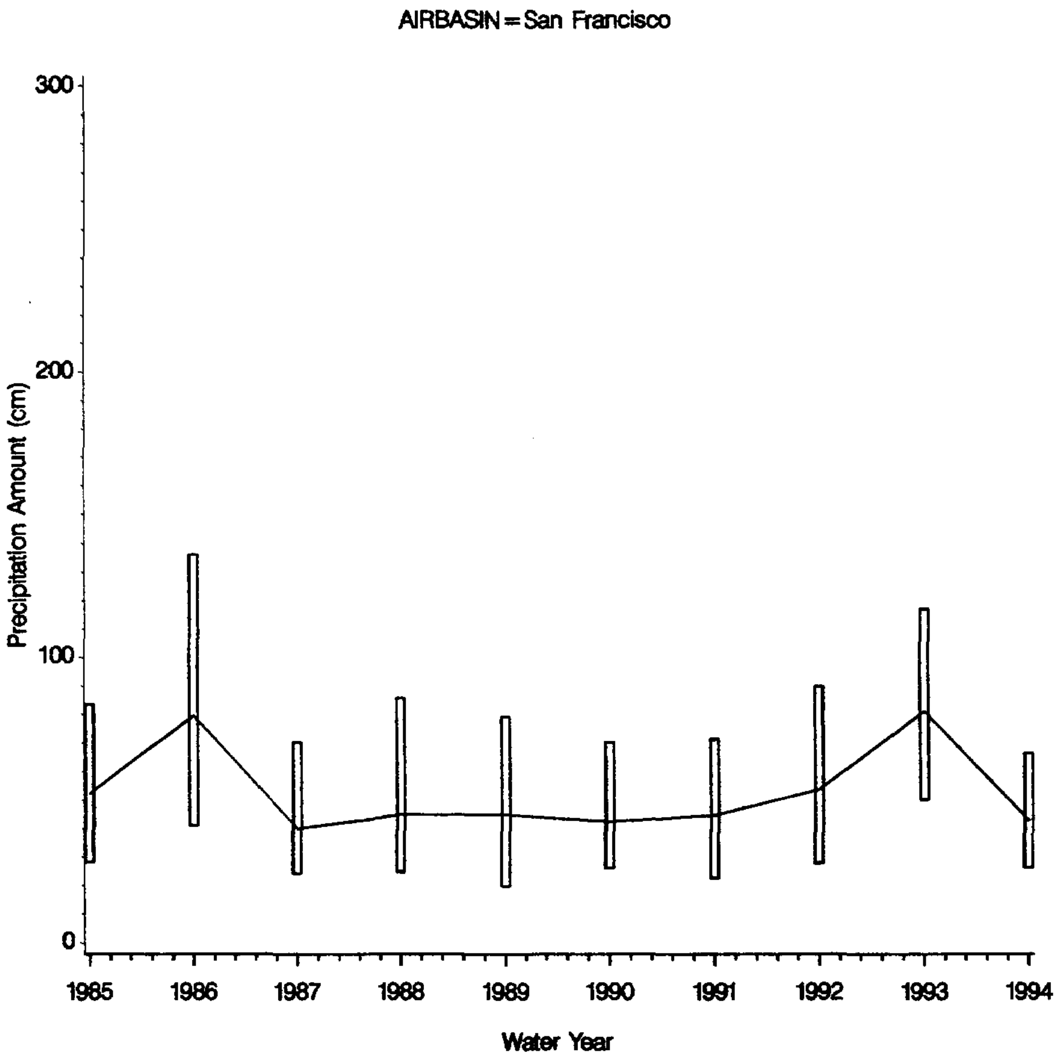


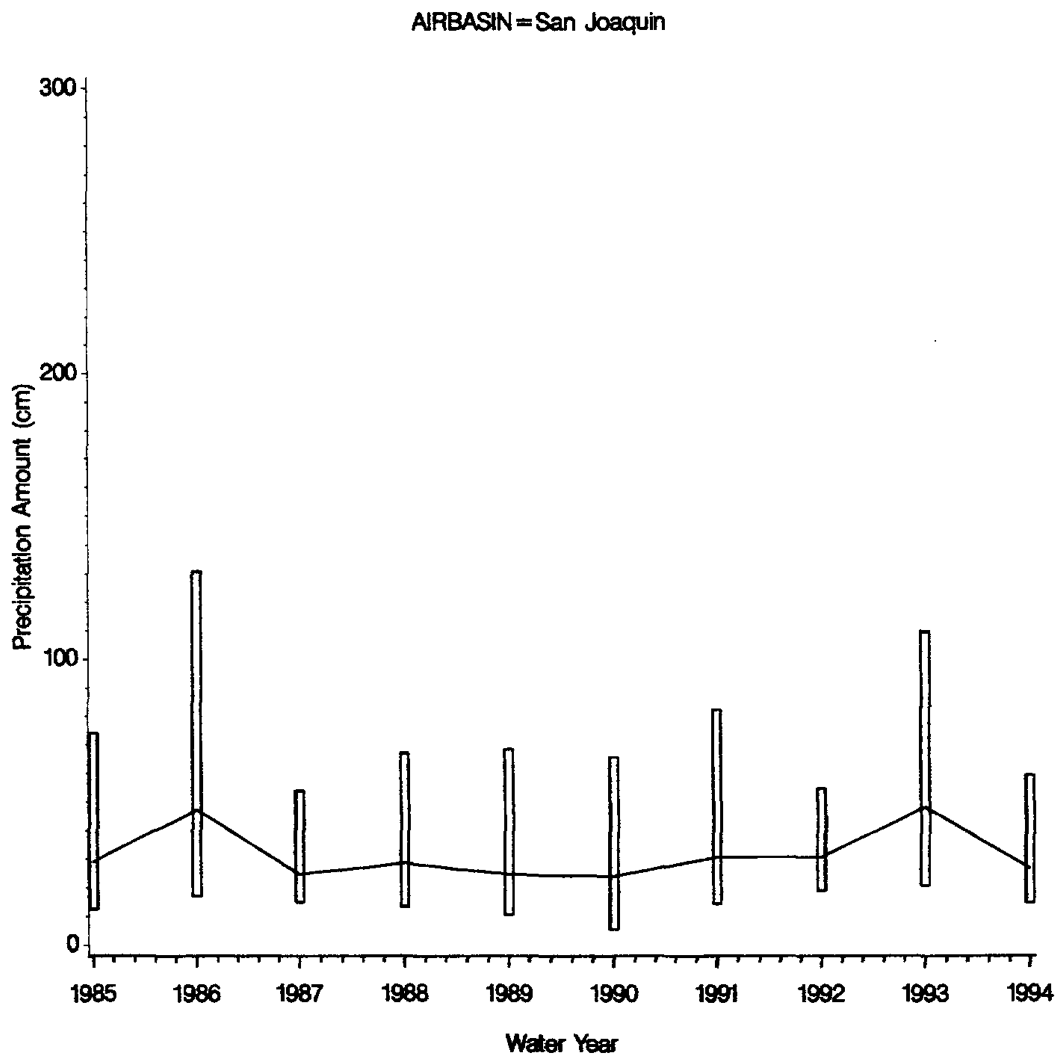
AIRBASIN = Northeast Plateau

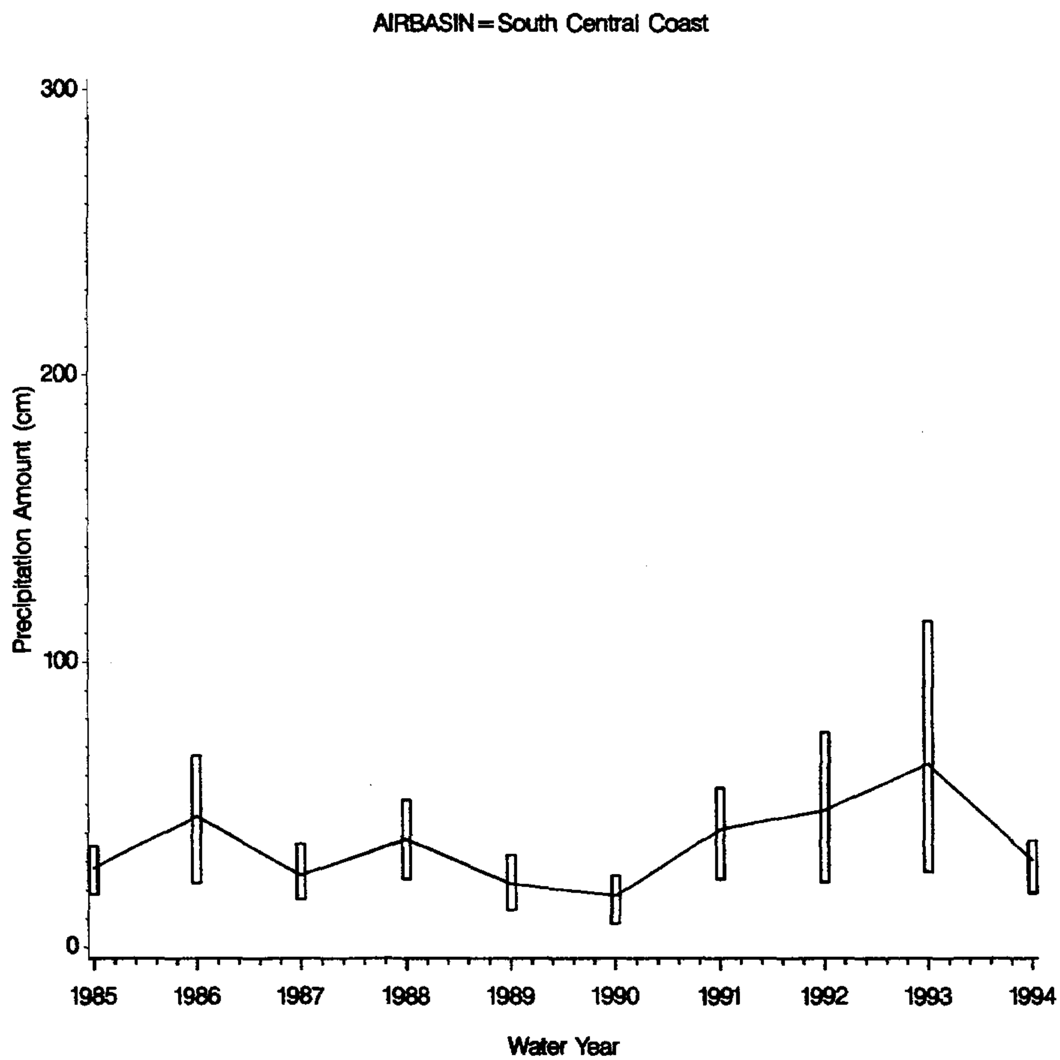



AIRBASIN=Sacramento
300
200
100
0
Precipitation Amount (cm)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

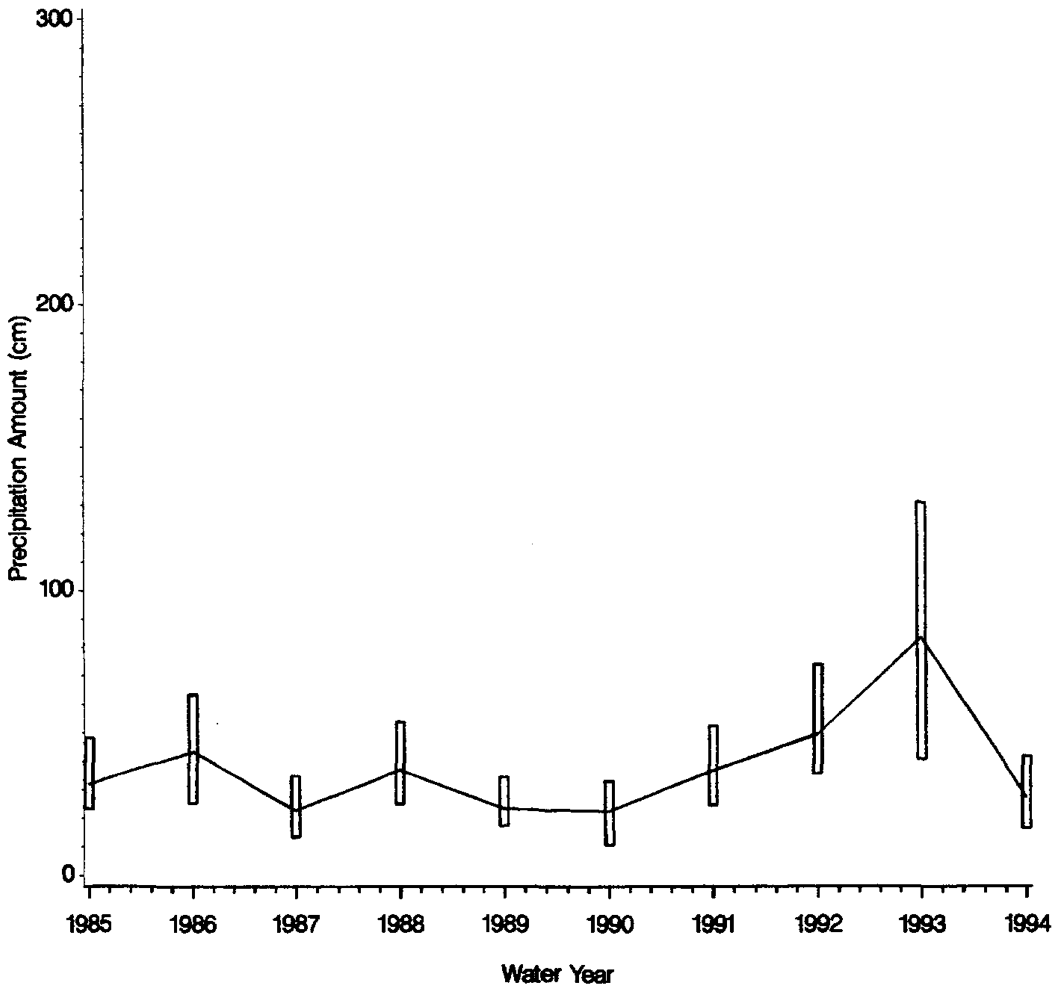

AIRBASIN=San Diego
Precipitation Amount (cm)
300
200
100
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=San Francisco
Precipitation Amount (cm)
300
200
100
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

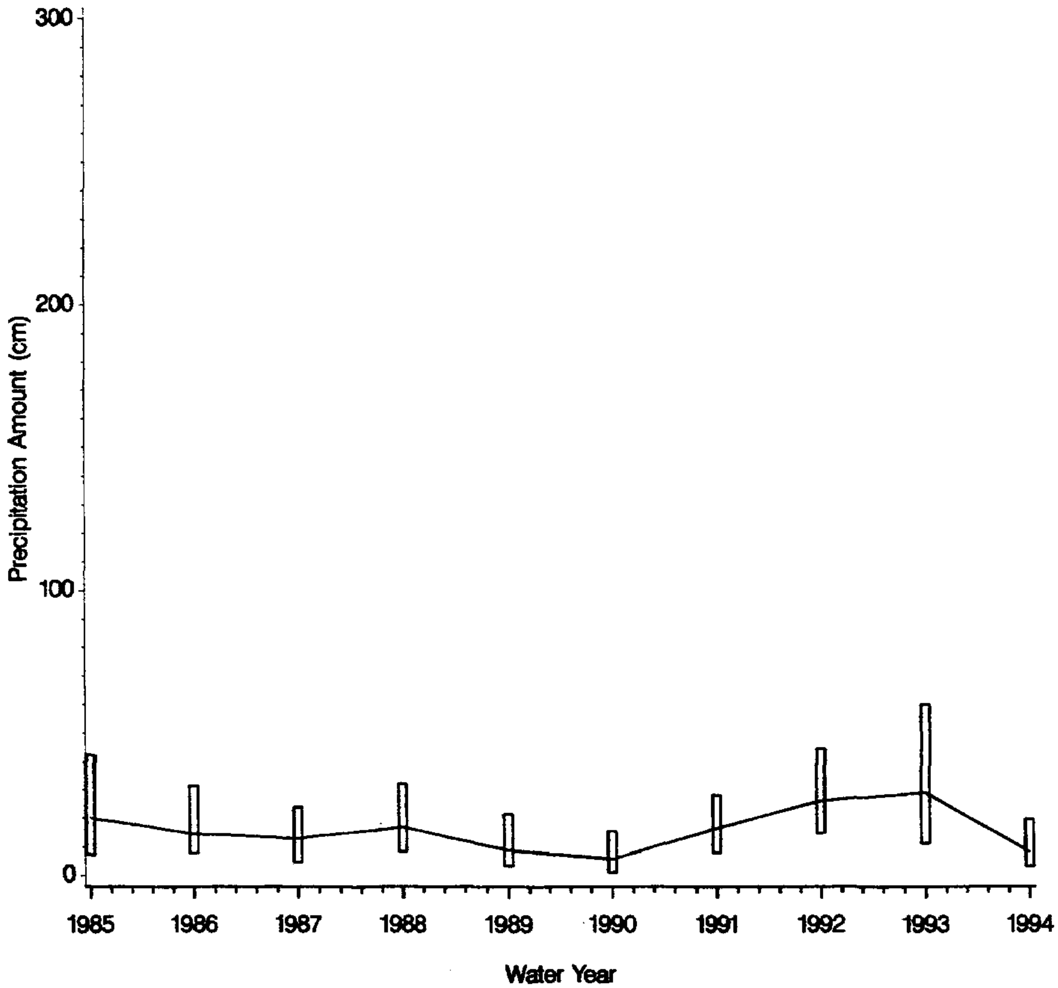

AIRBASIN=San Joaquin
300
200
100
0
Precipitation Amount (cm)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

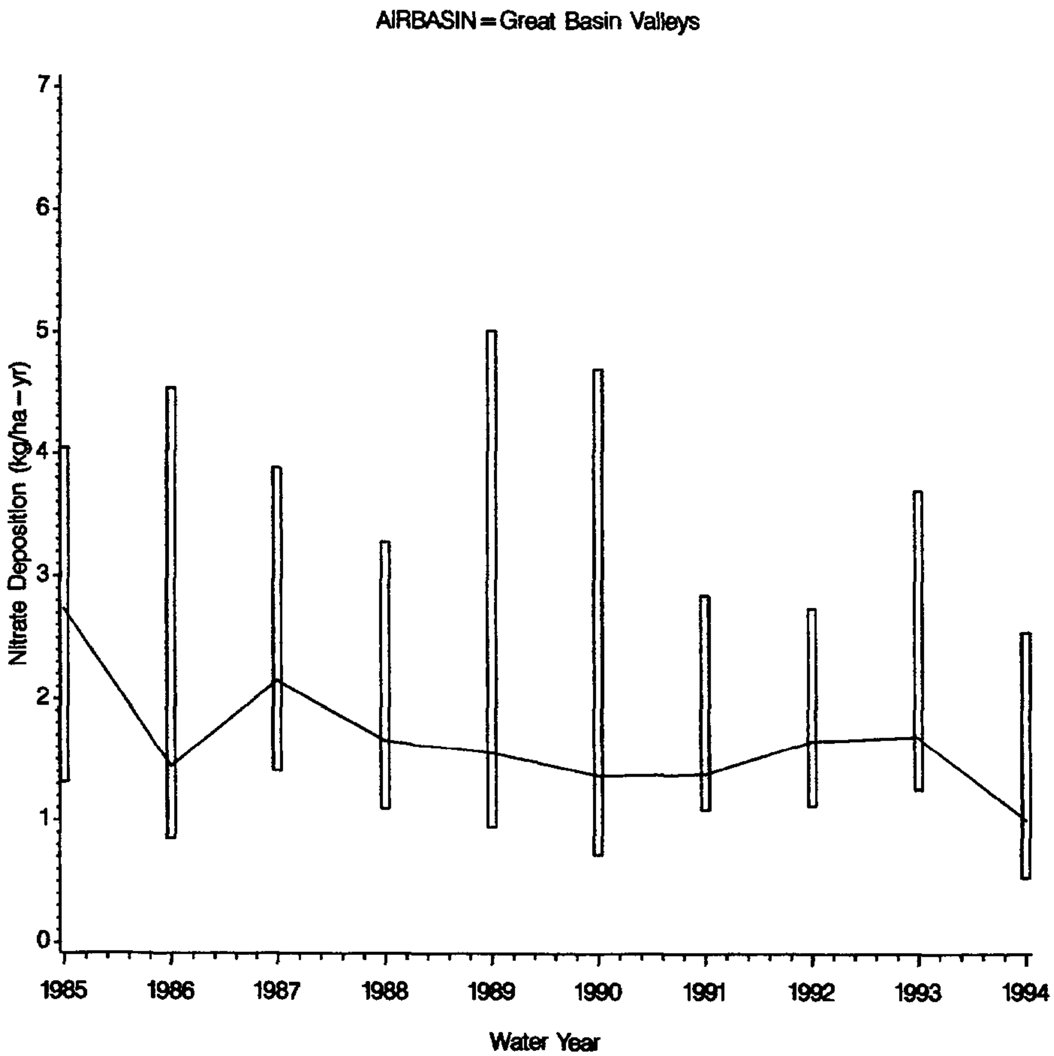

AIRBASIN=South Central Coast
Precipitation Amount (cm)
300
200
100
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=South Coast

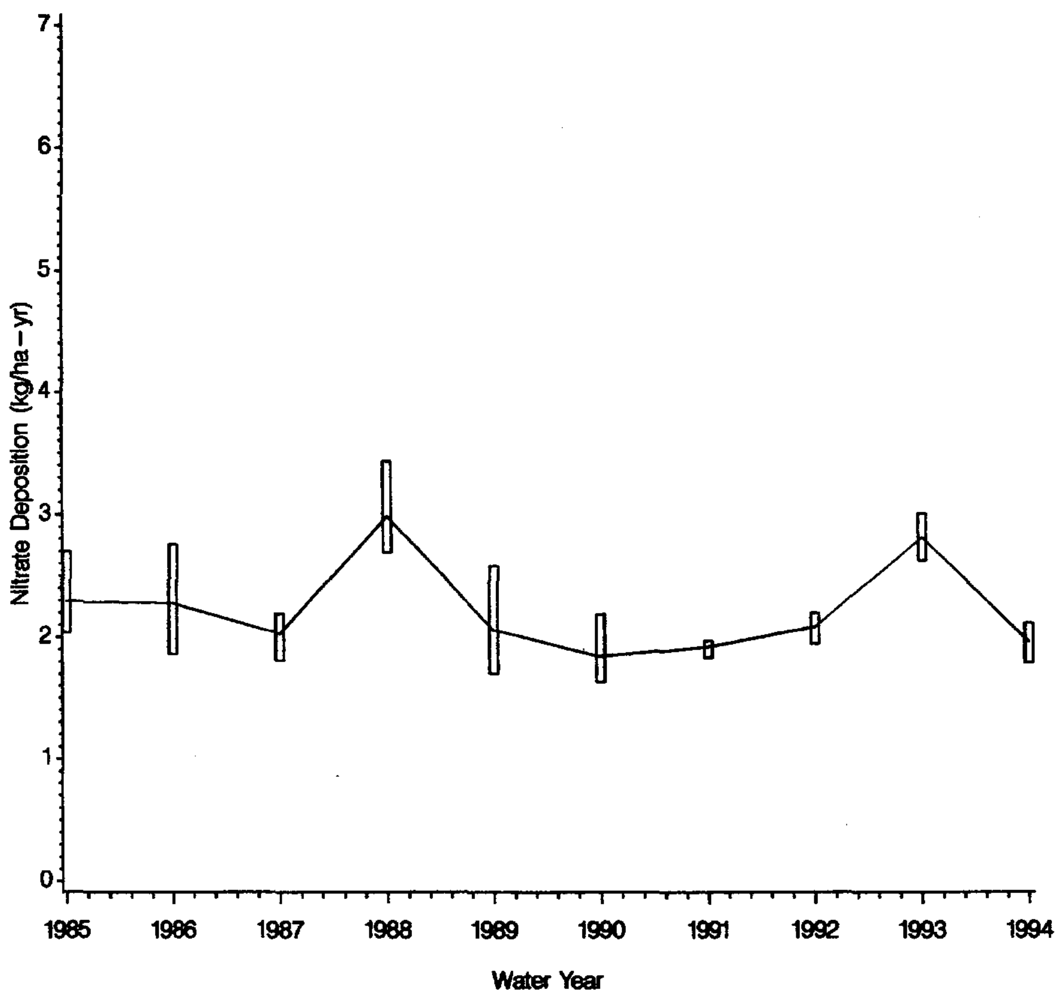


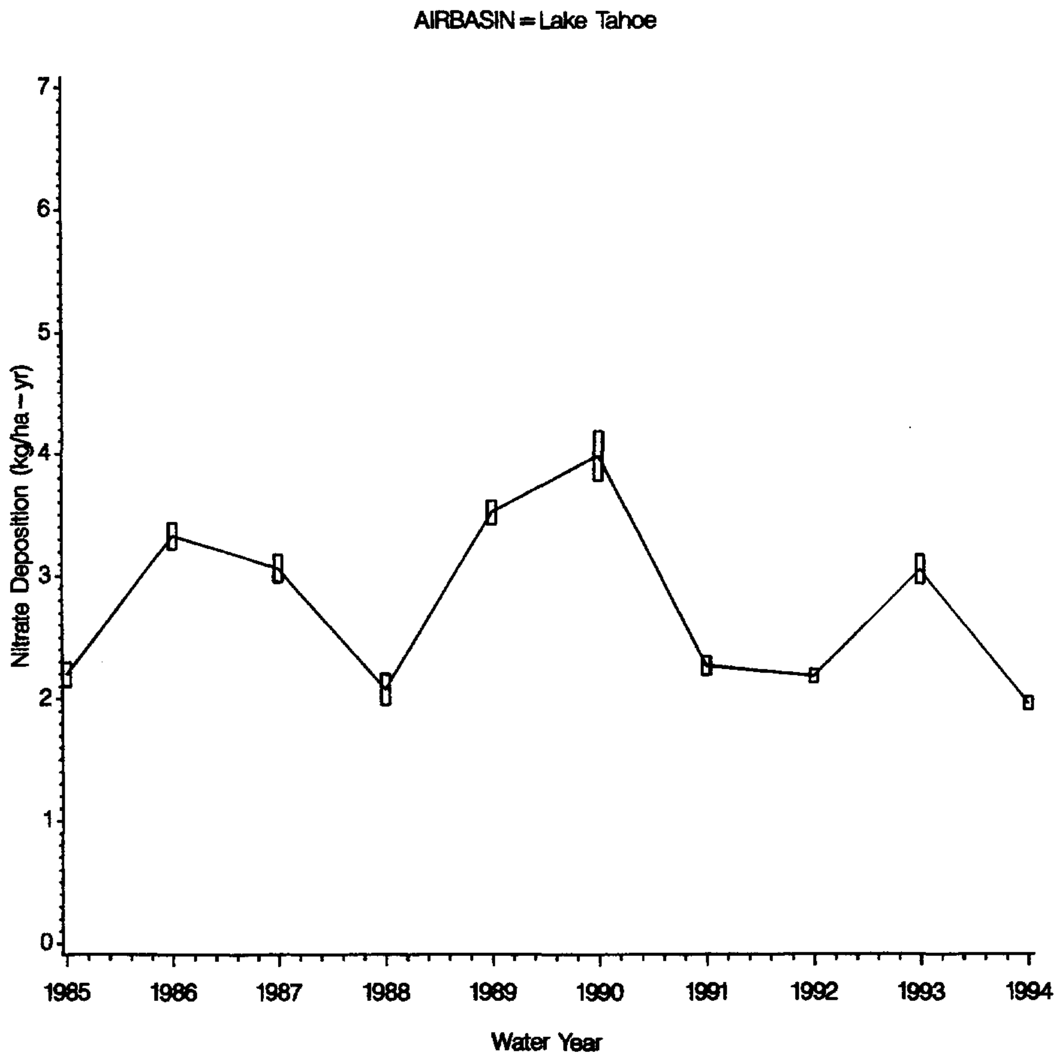
AIRBASIN = South East Desert

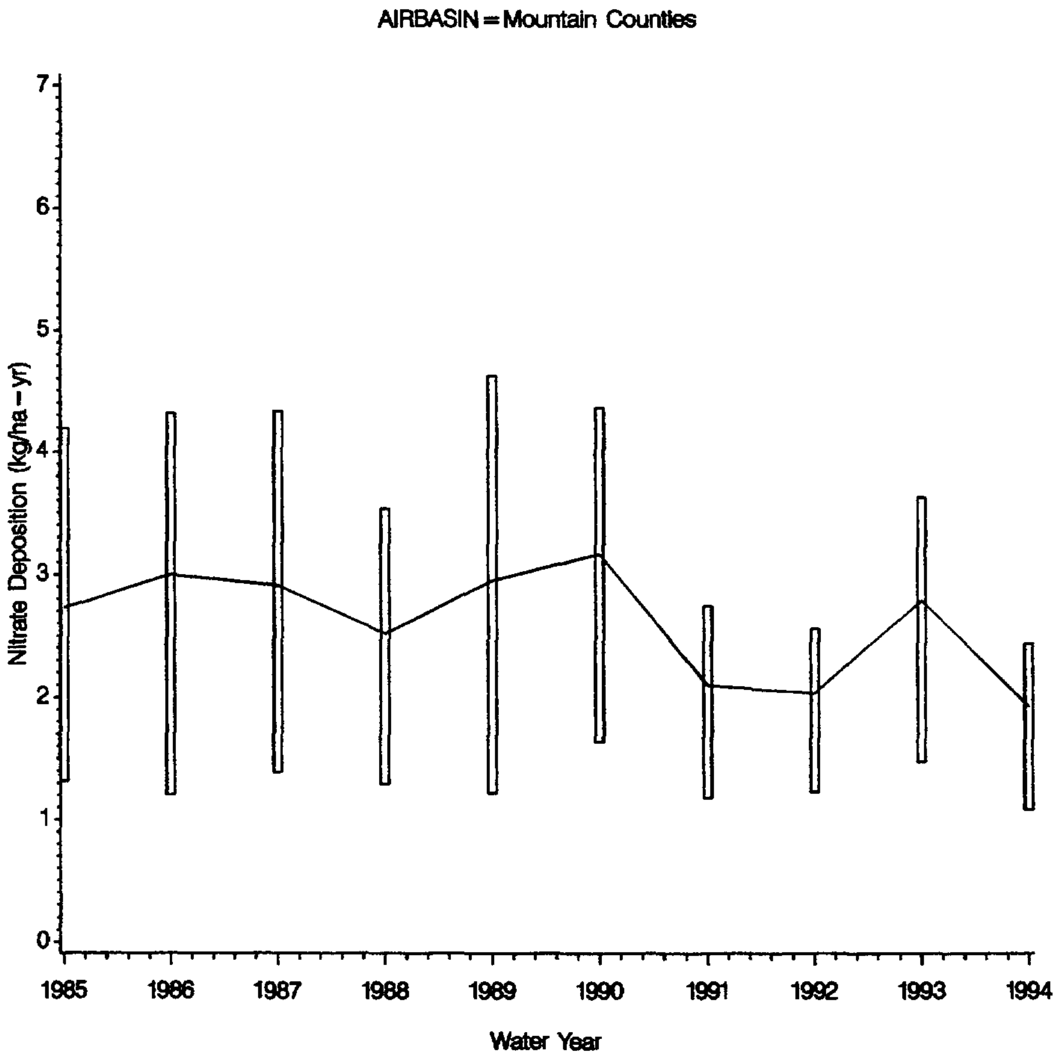


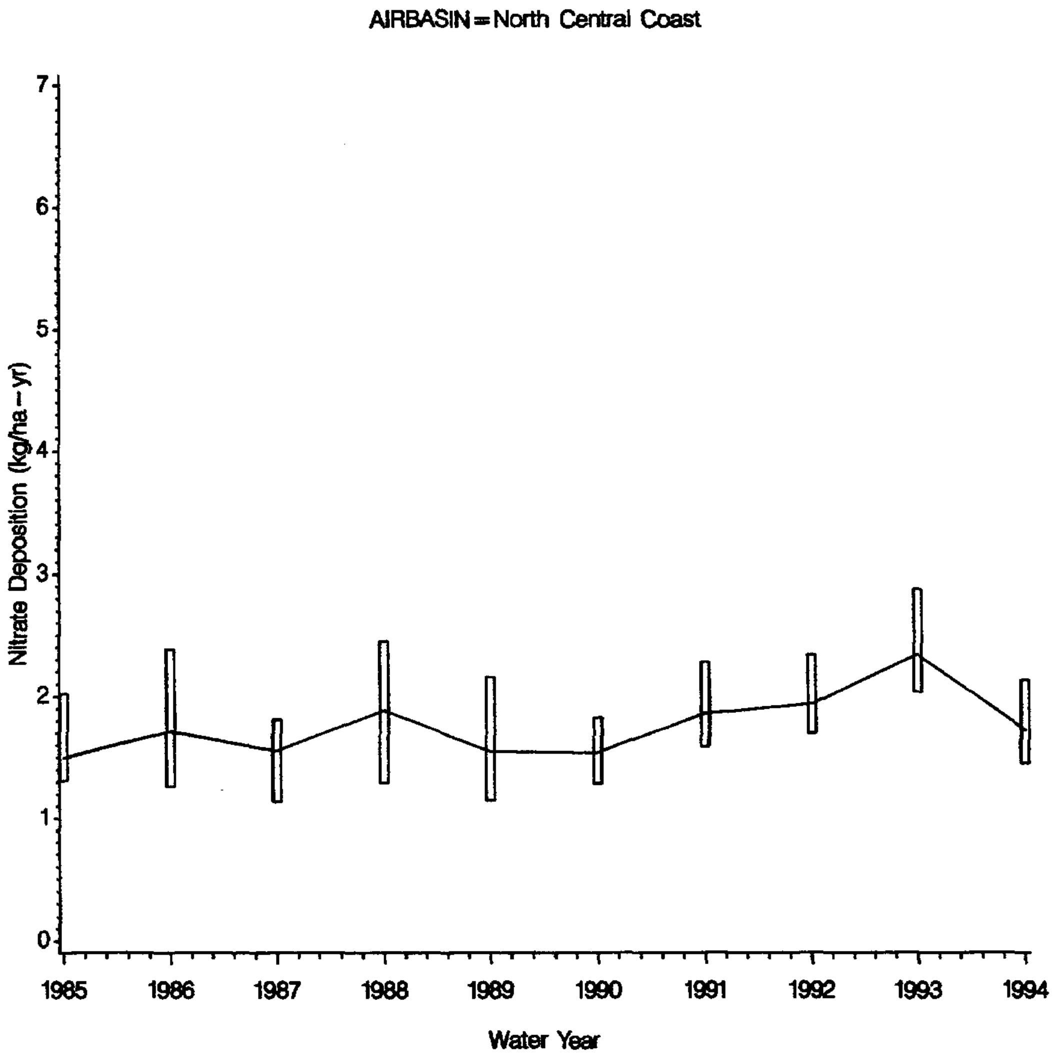

AIRBASIN=Great Basin Valleys
Nitrate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

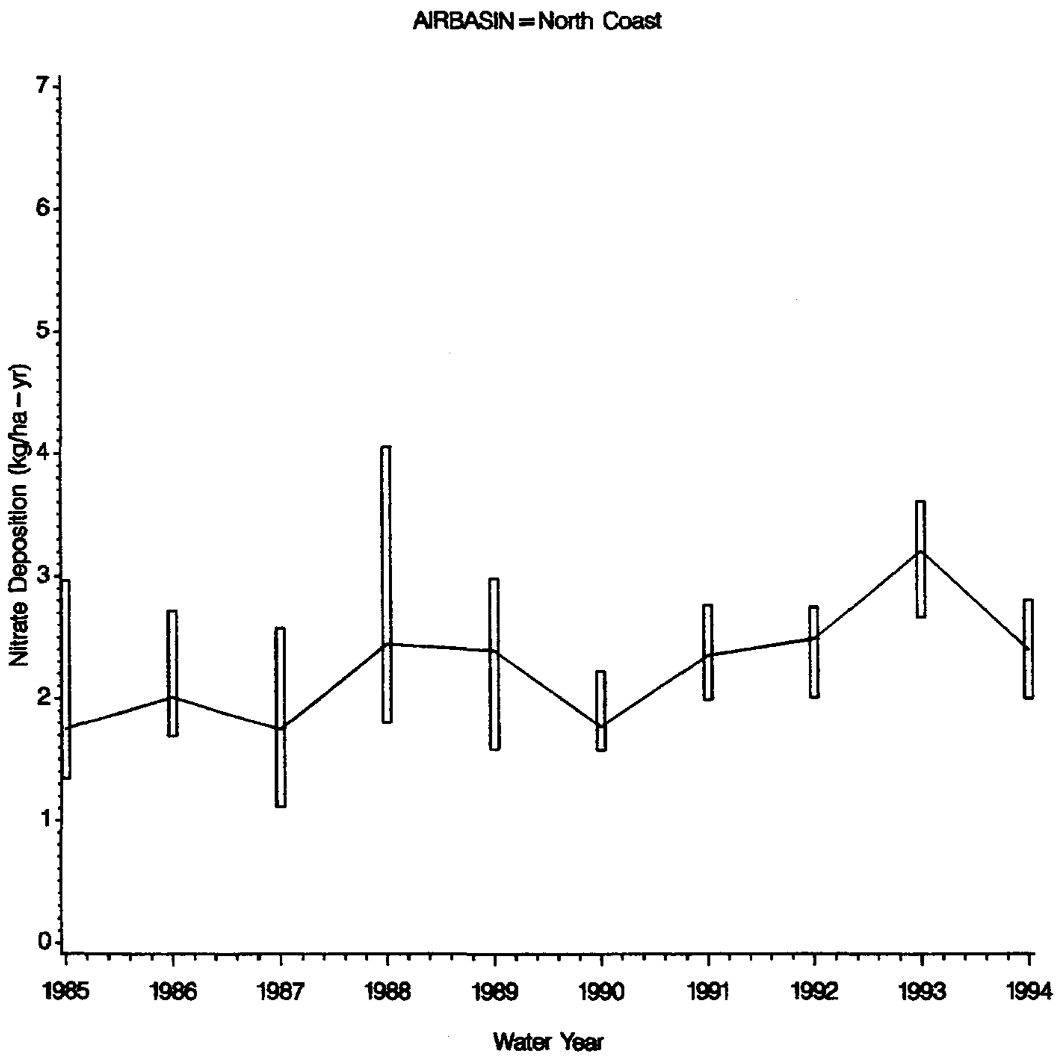
AIRBASIN=Lake County



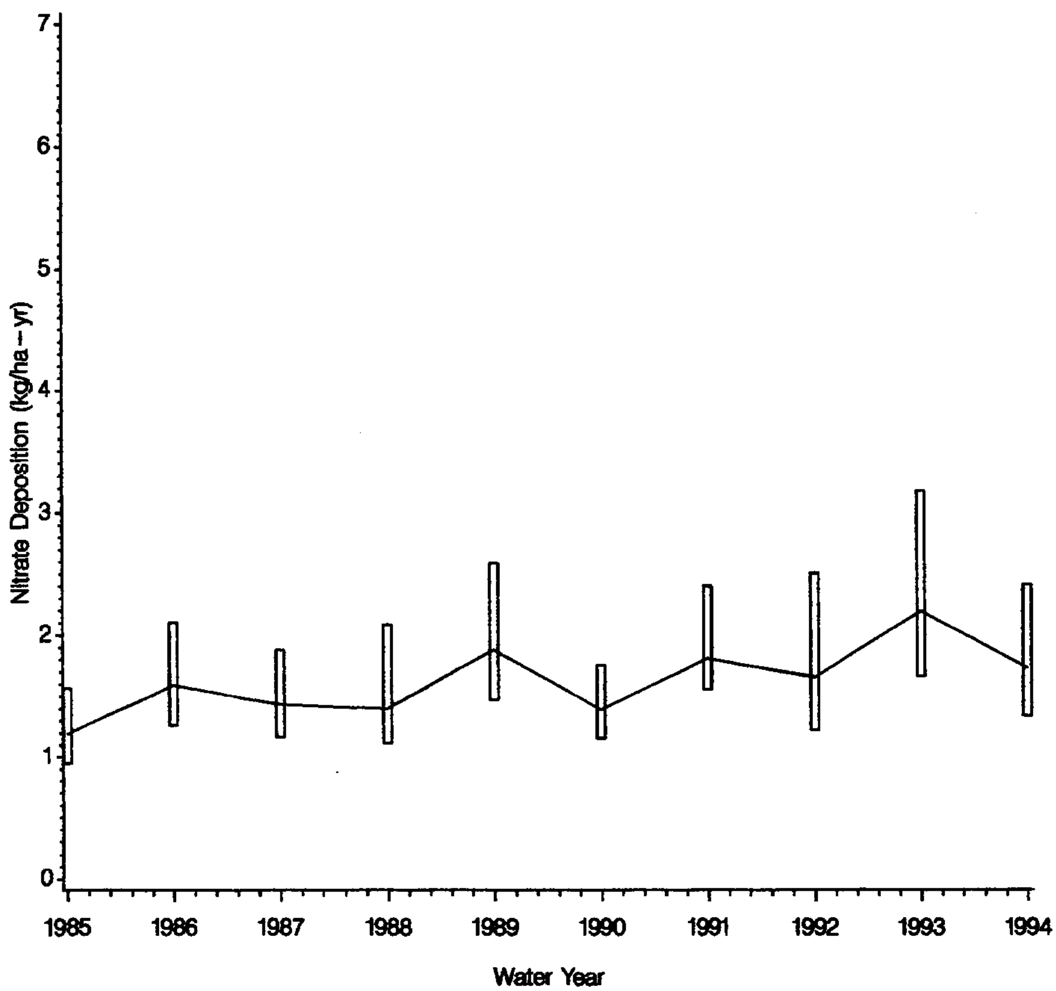

AIRBASIN = Lake Tahoe
Nitrate Deposition (kg/ha - yr)
0
1
2
3
4
5
6
7
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

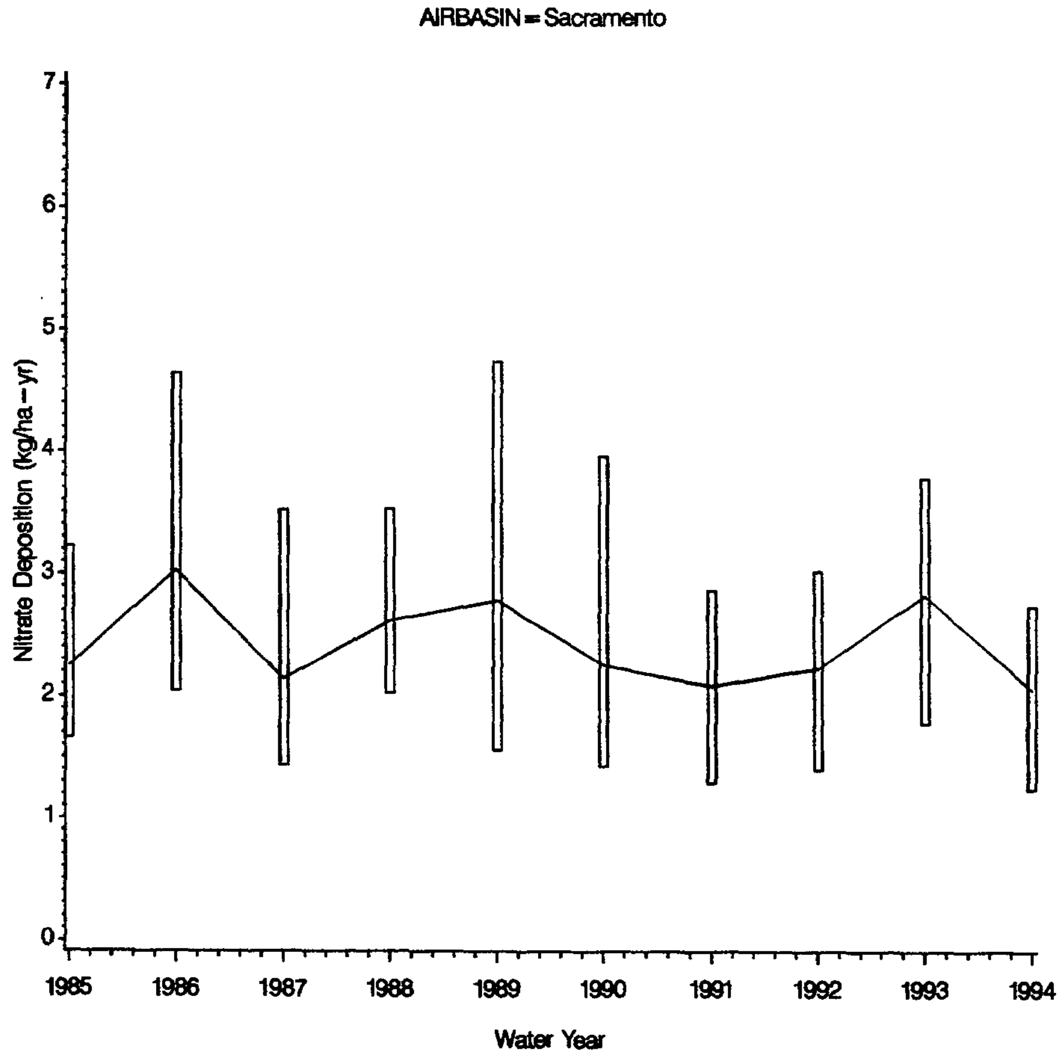

AIRBASIN=Mountain Counties
Nitrate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=North Central Coast
Nitrate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

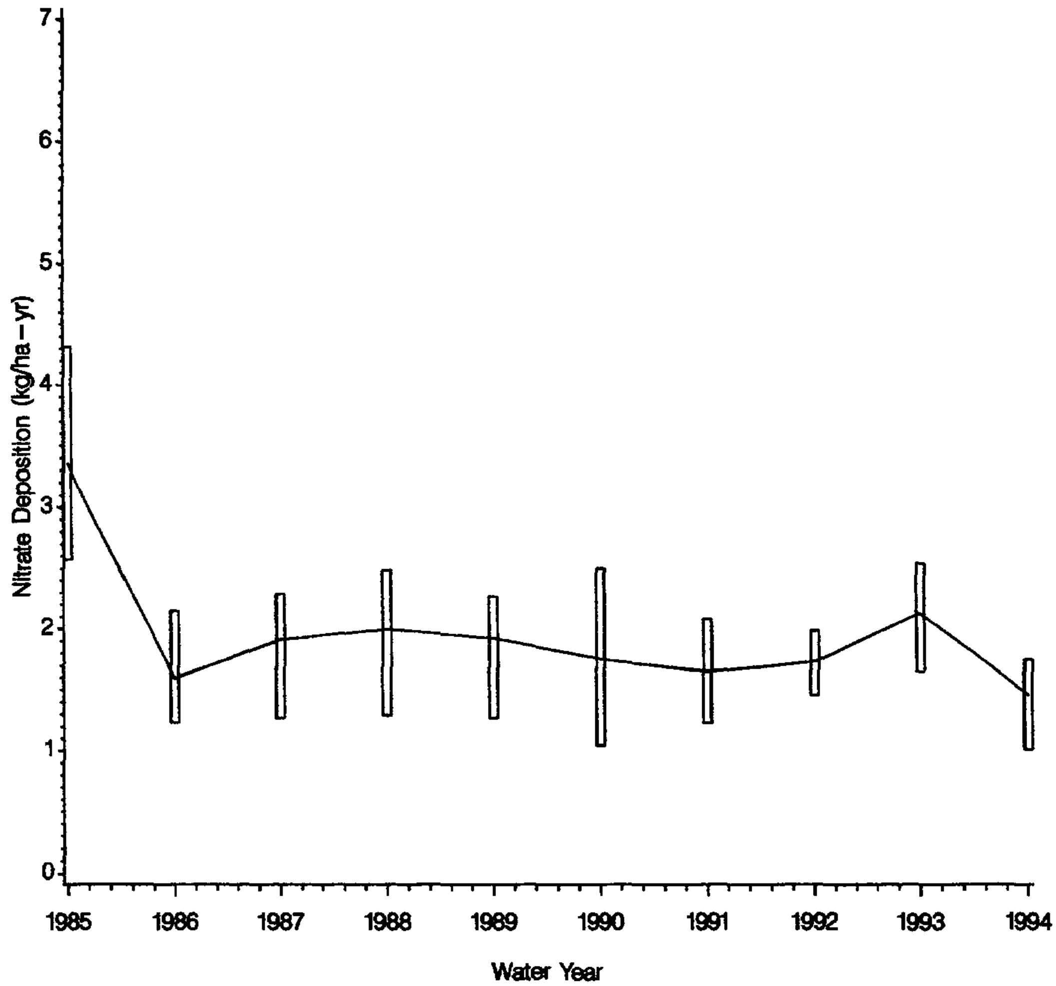

AIRBASIN=North Coast
Nitrate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=Northeast Plateau

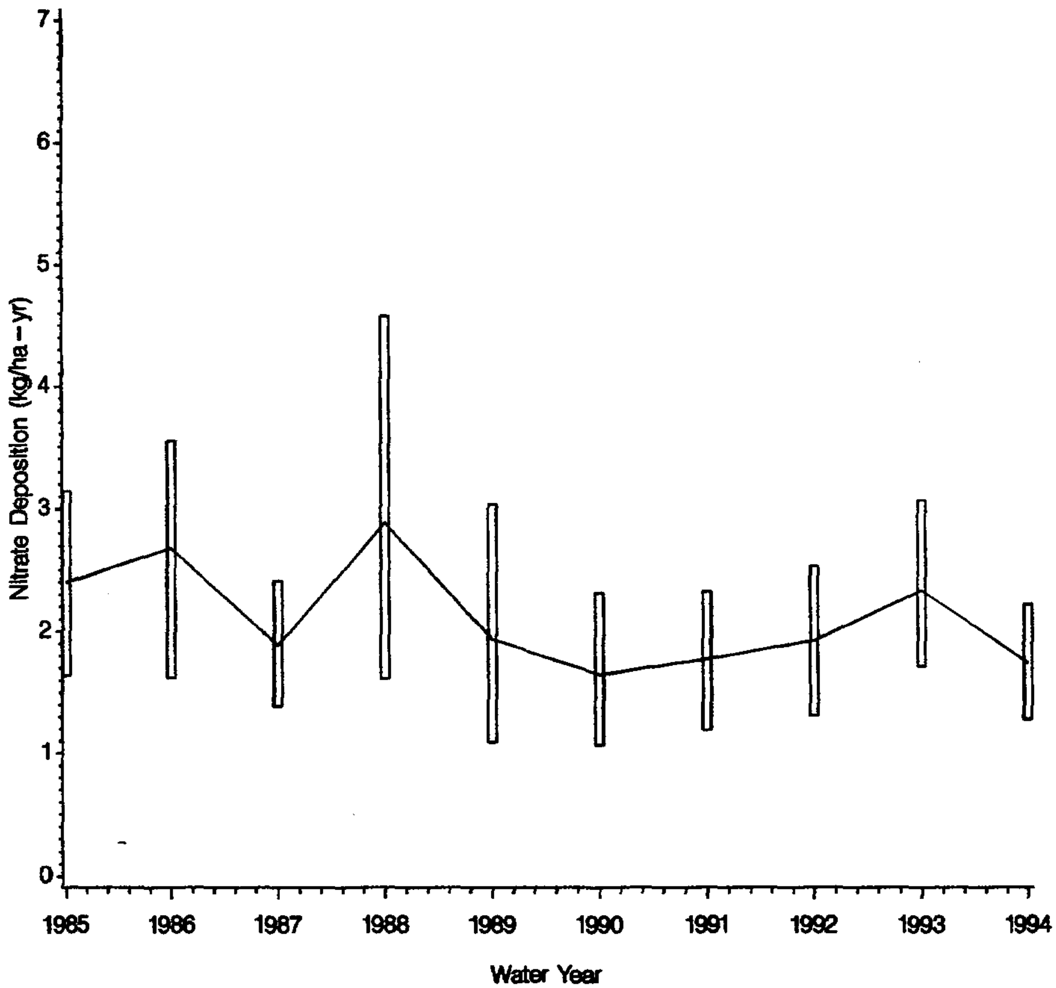



AIRBASIN = Sacramento
7
6
5
4
3
2
1
0
Nitrate Deposition (kg/ha-yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

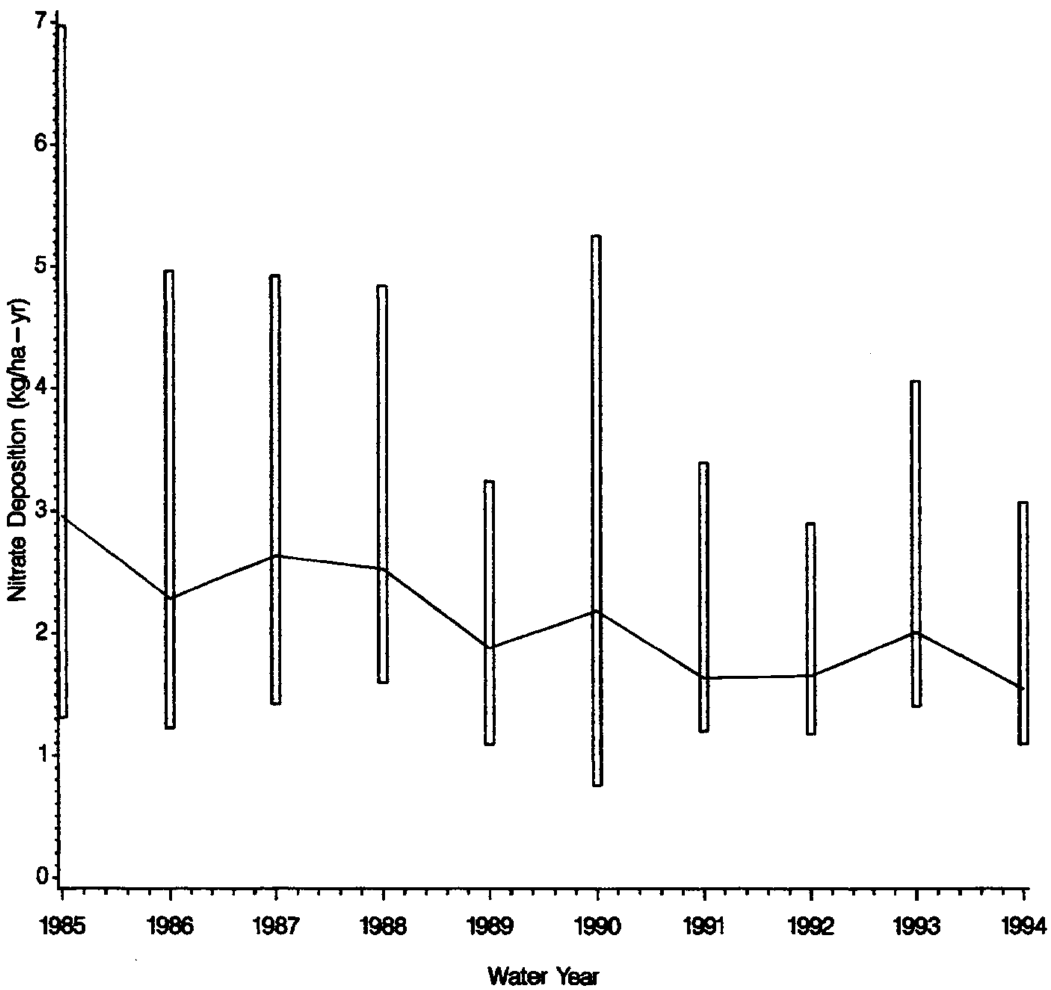
AIRBASIN=San Diego



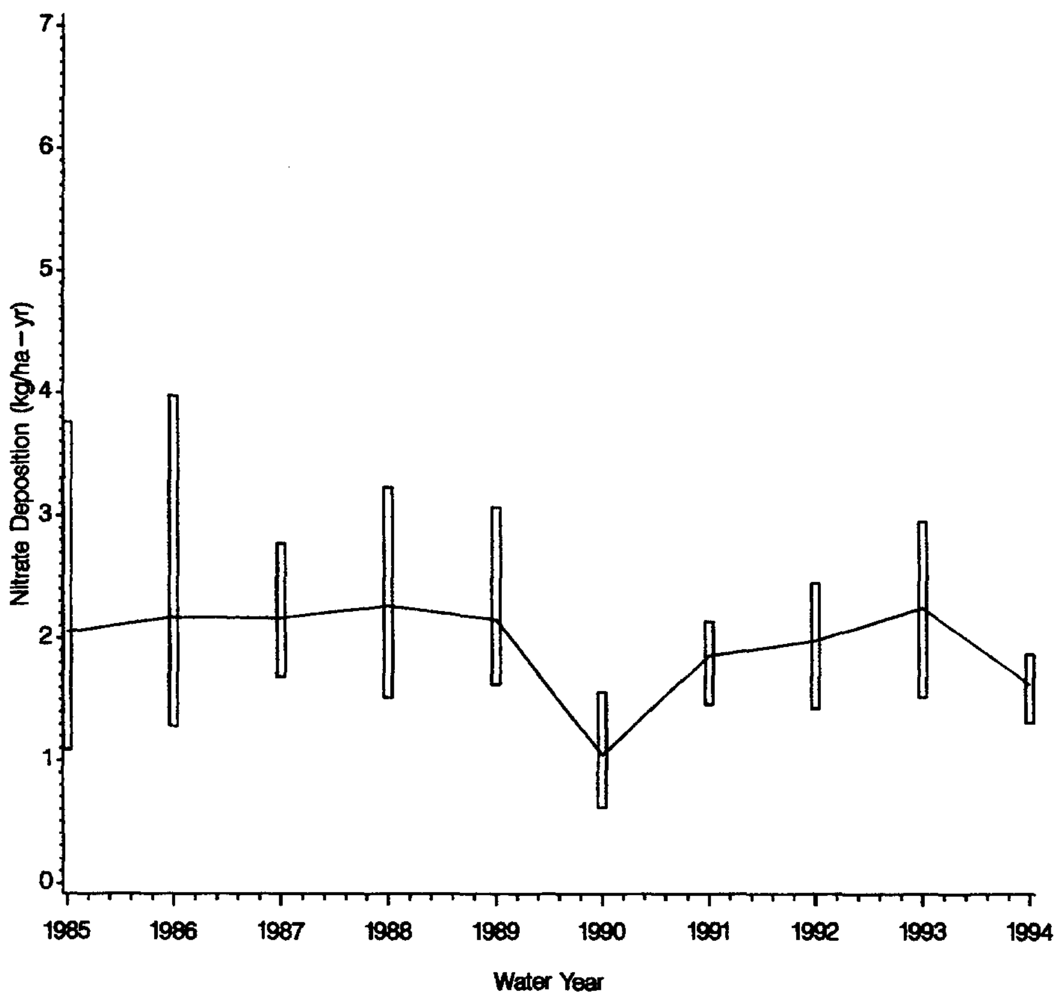
AIRBASIN = San Francisco



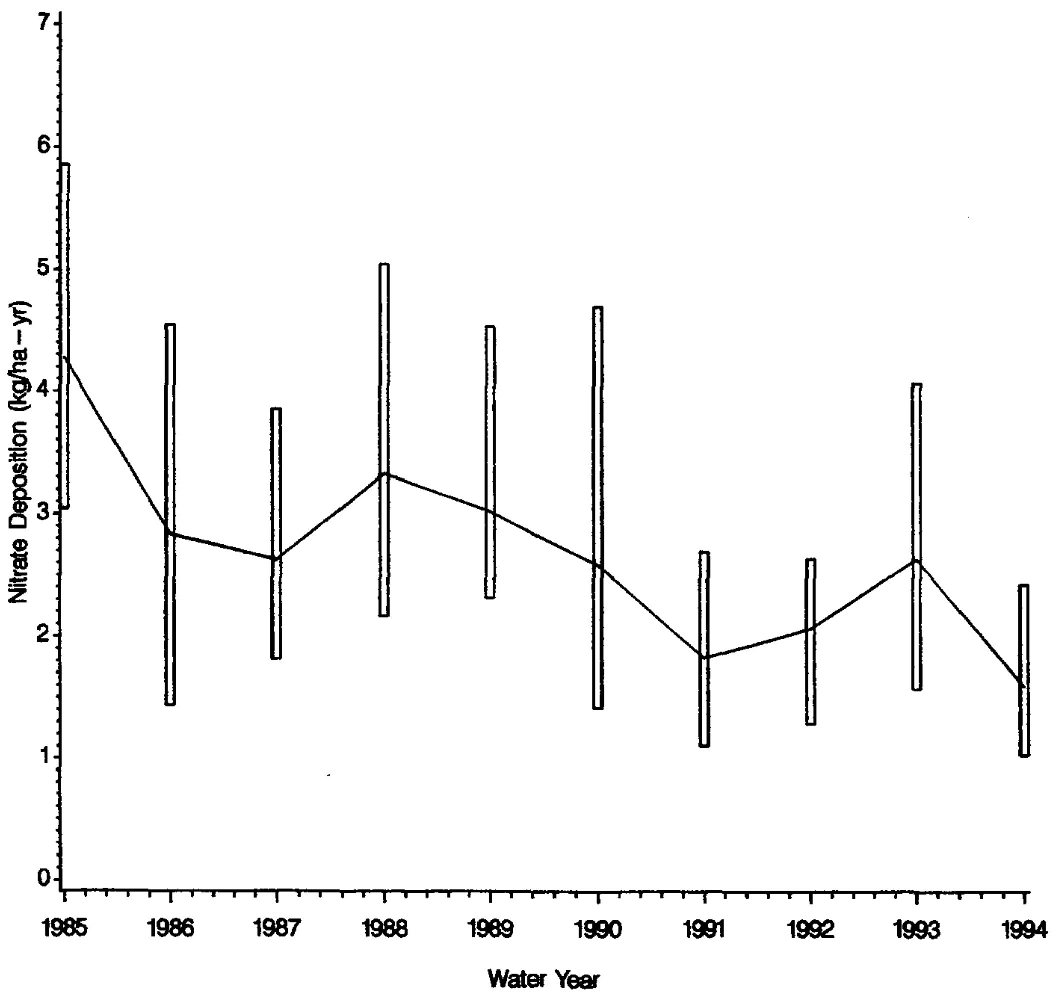
AIRBASIN = San Joaquin



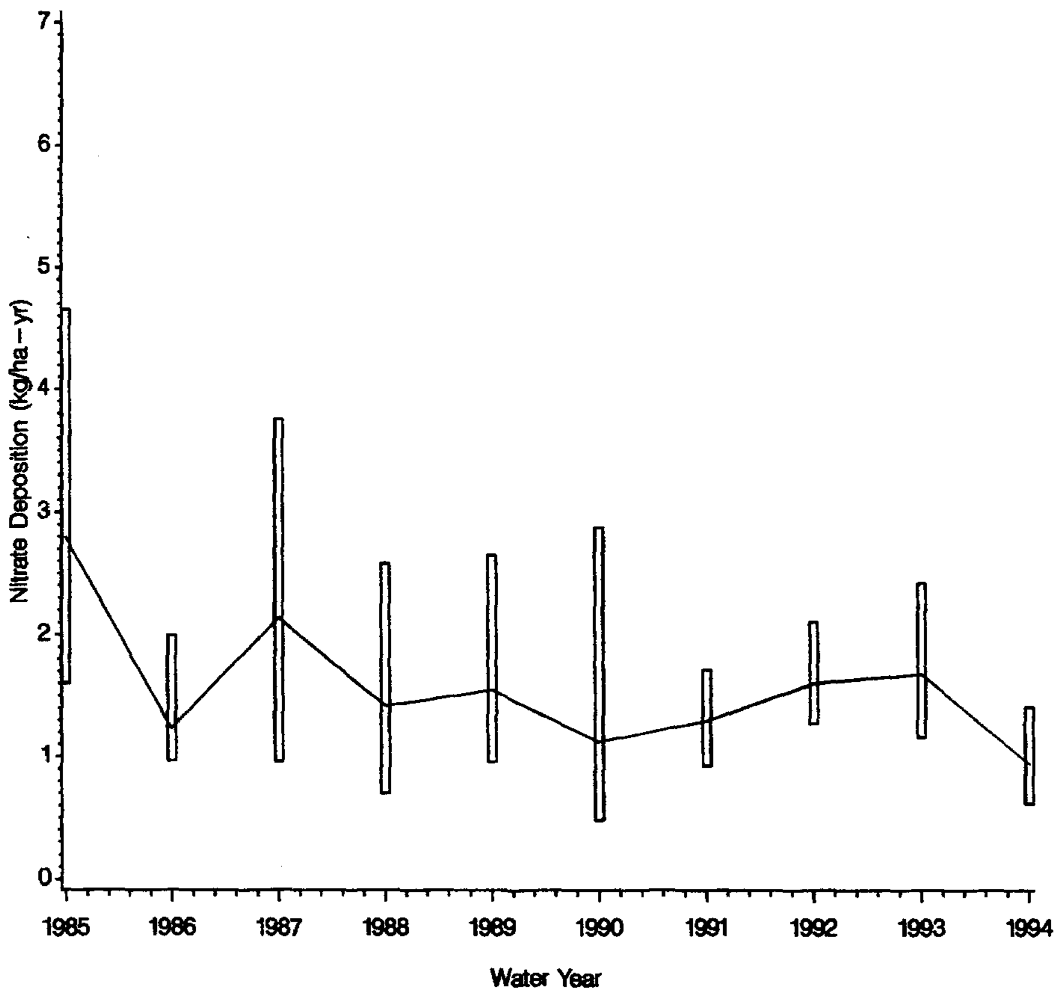
AIRBASIN = South Central Coast

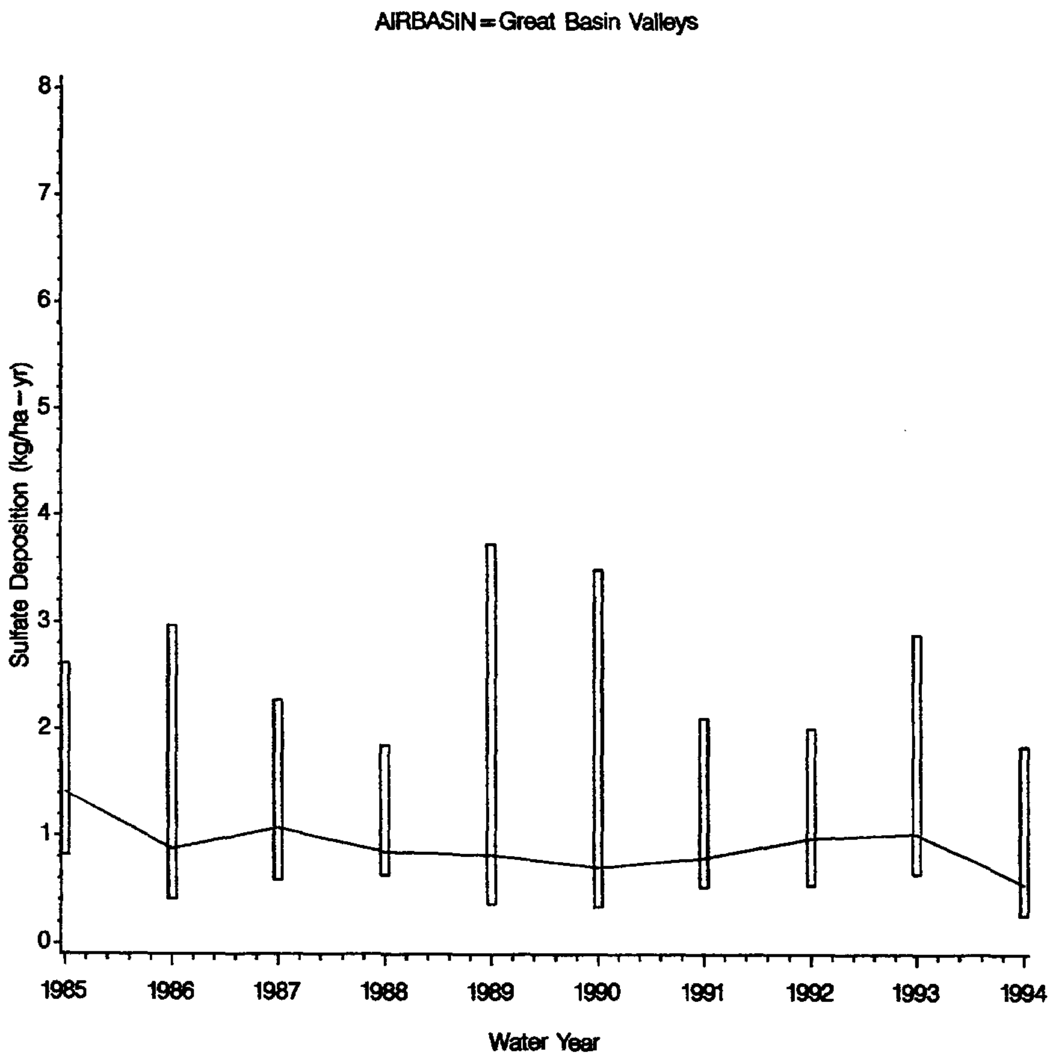


AIRBASIN=South Coast

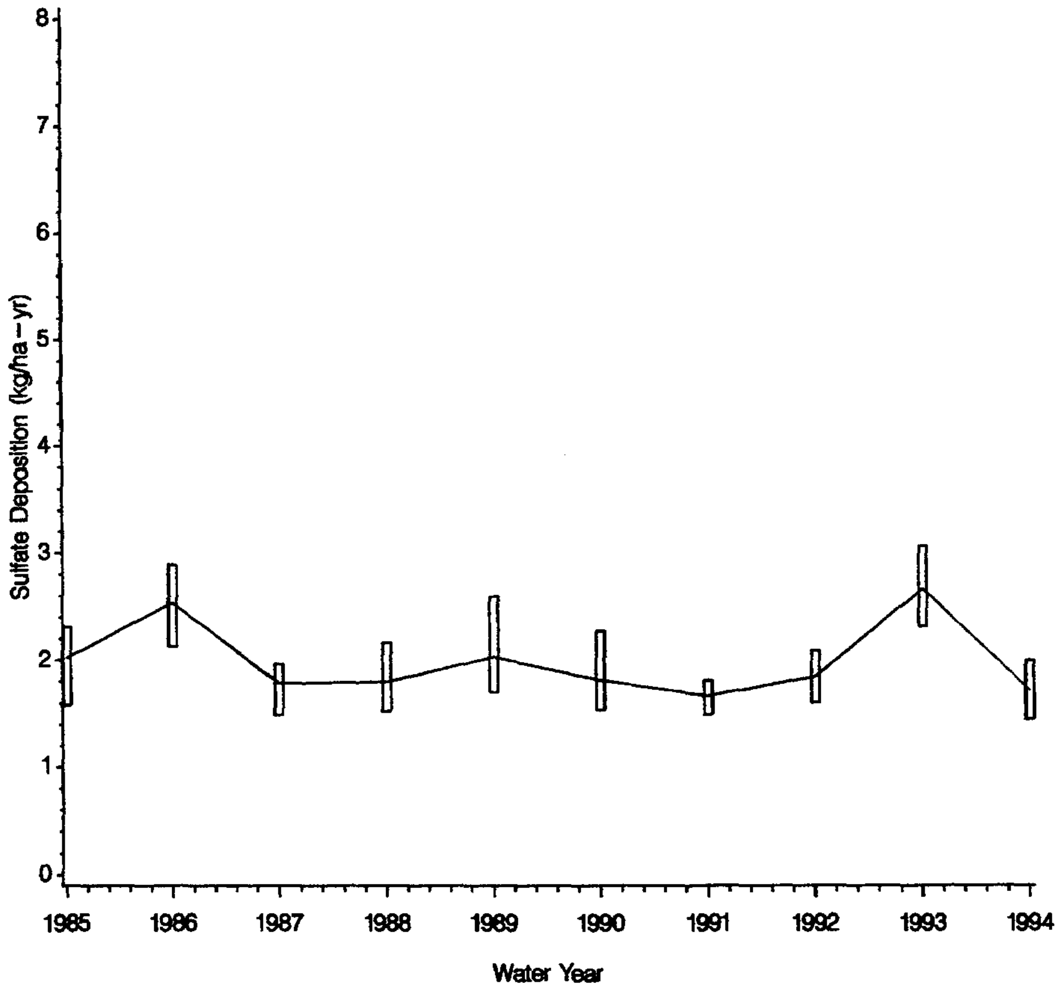


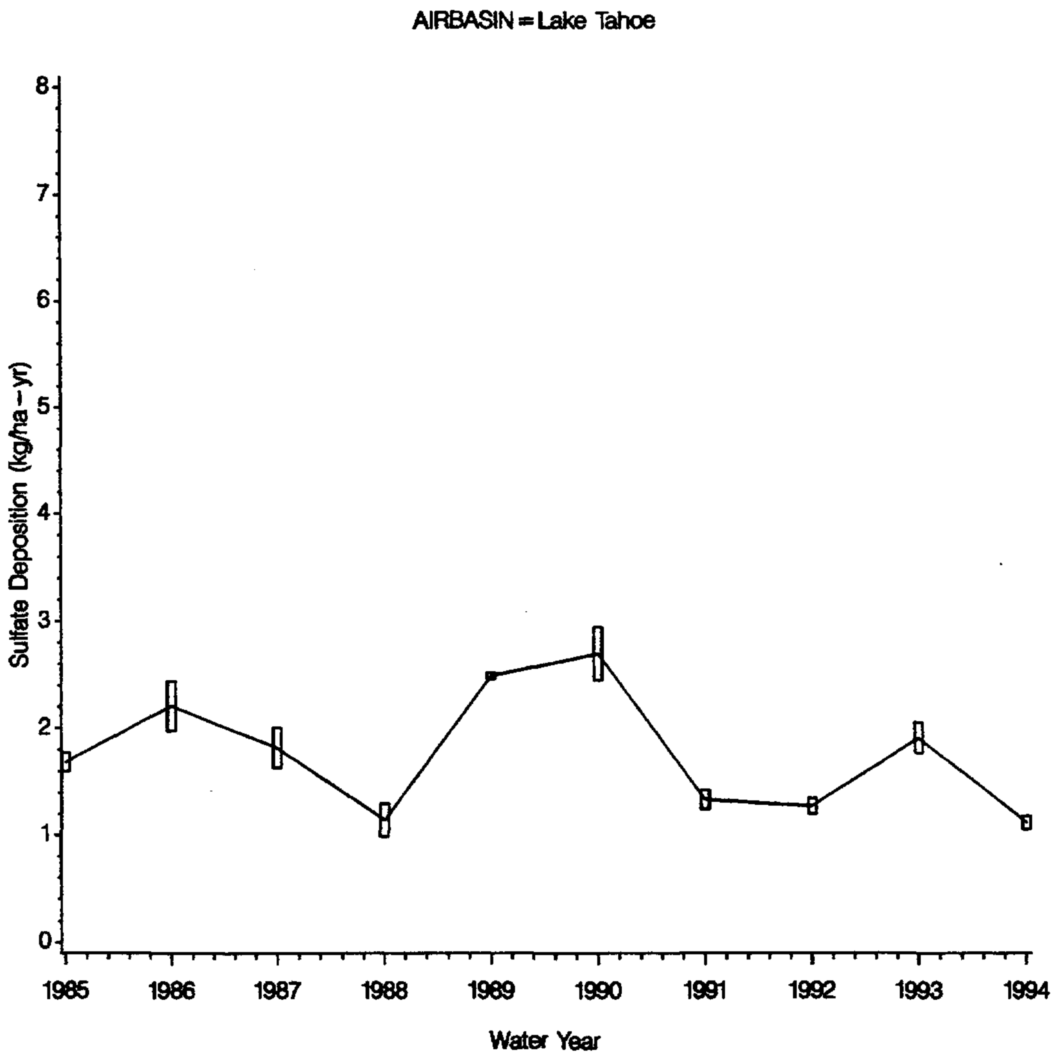
AIRBASIN=South East Desert



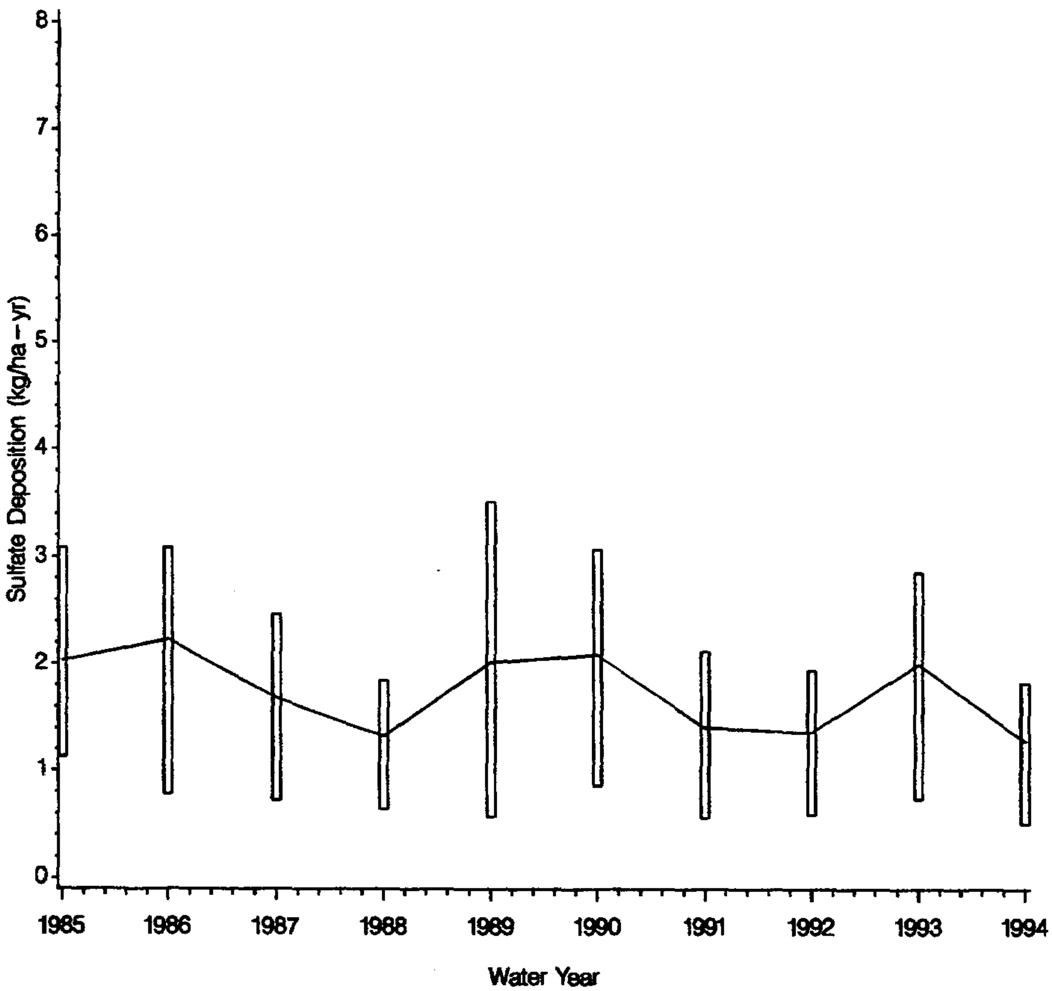

AIRBASIN=Great Basin Valleys
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN = Lake County

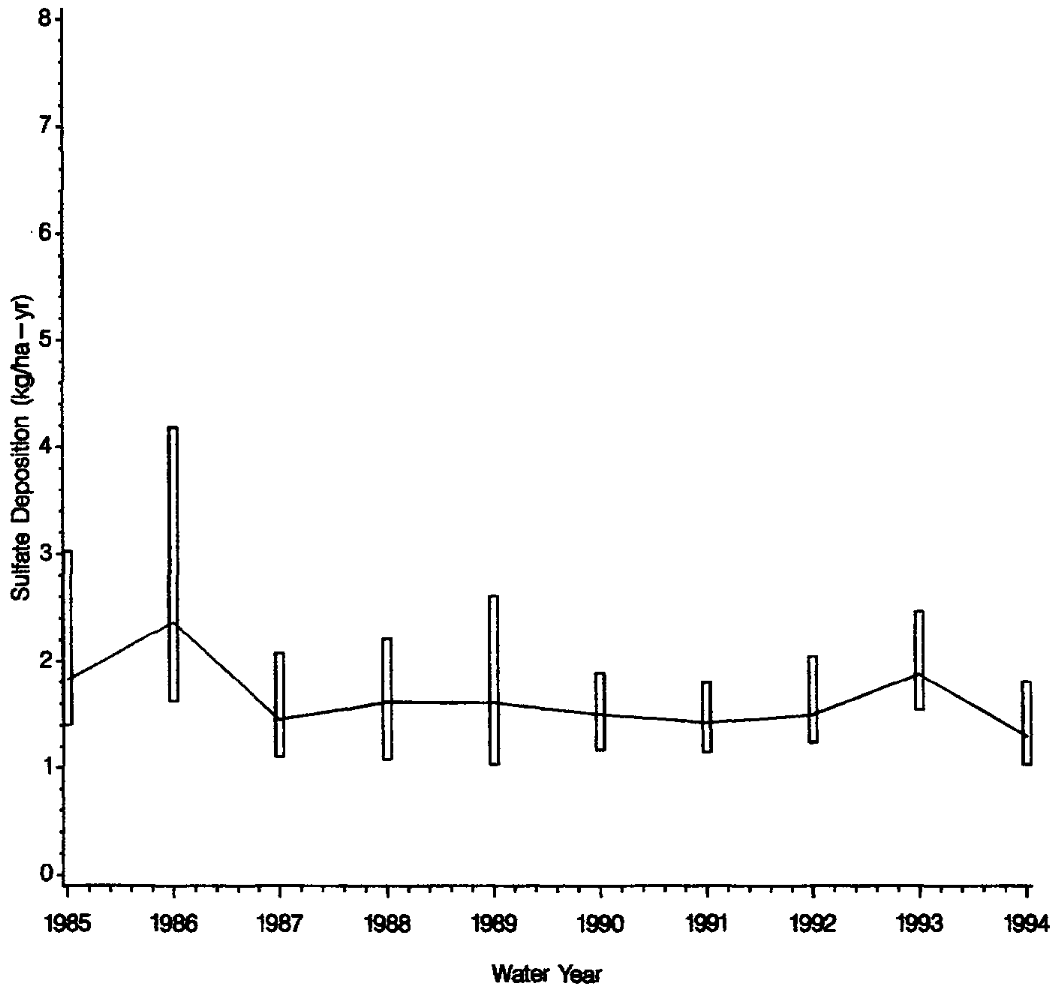



AIRBASIN = Lake Tahoe
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

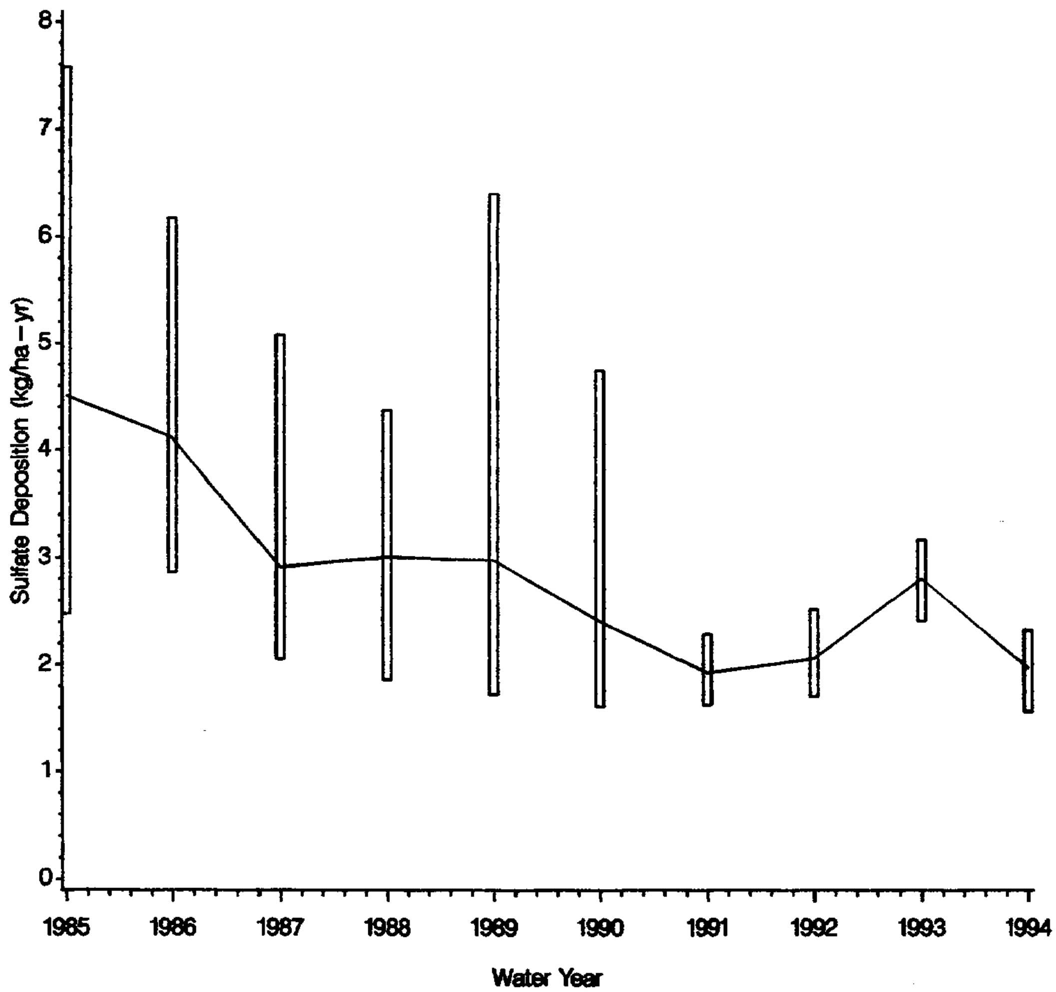
AIRBASIN = Mountain Counties

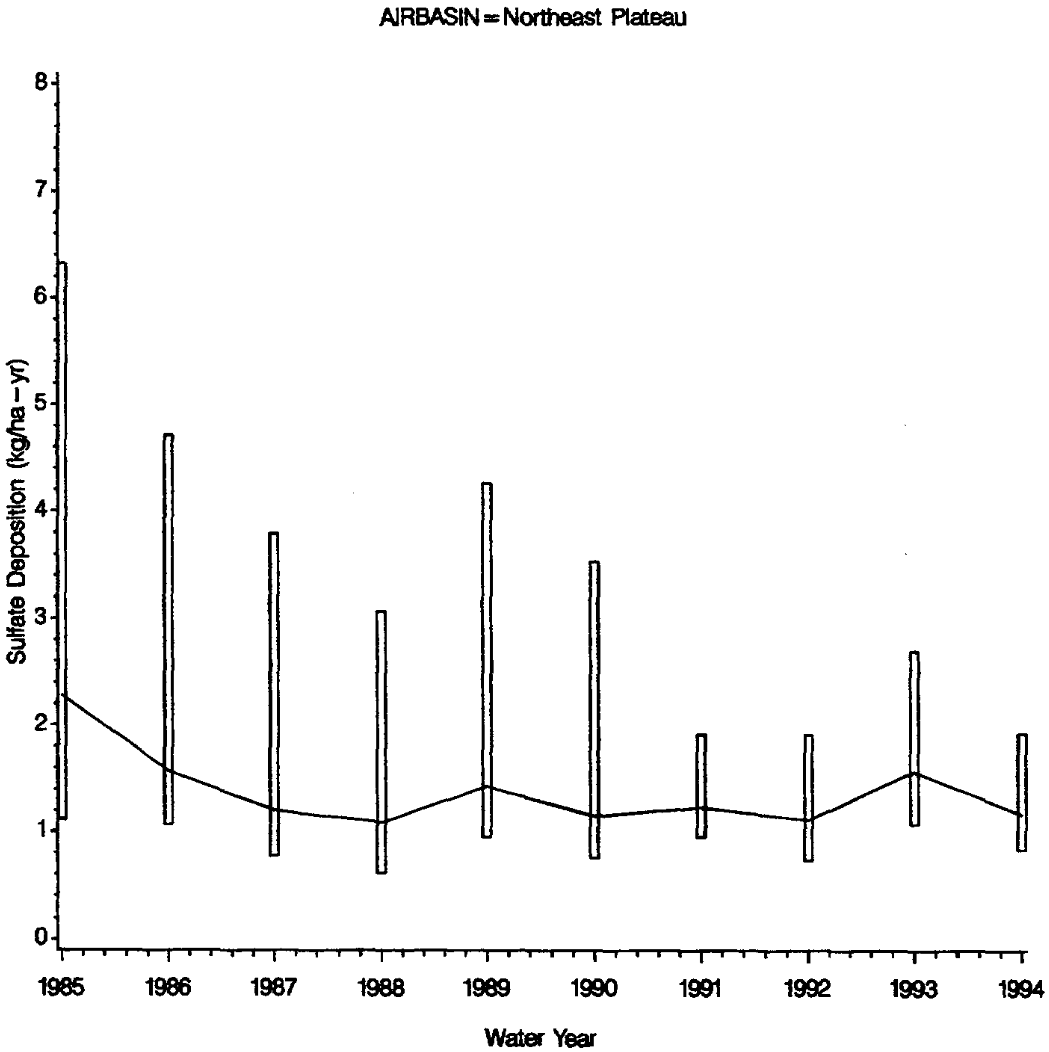


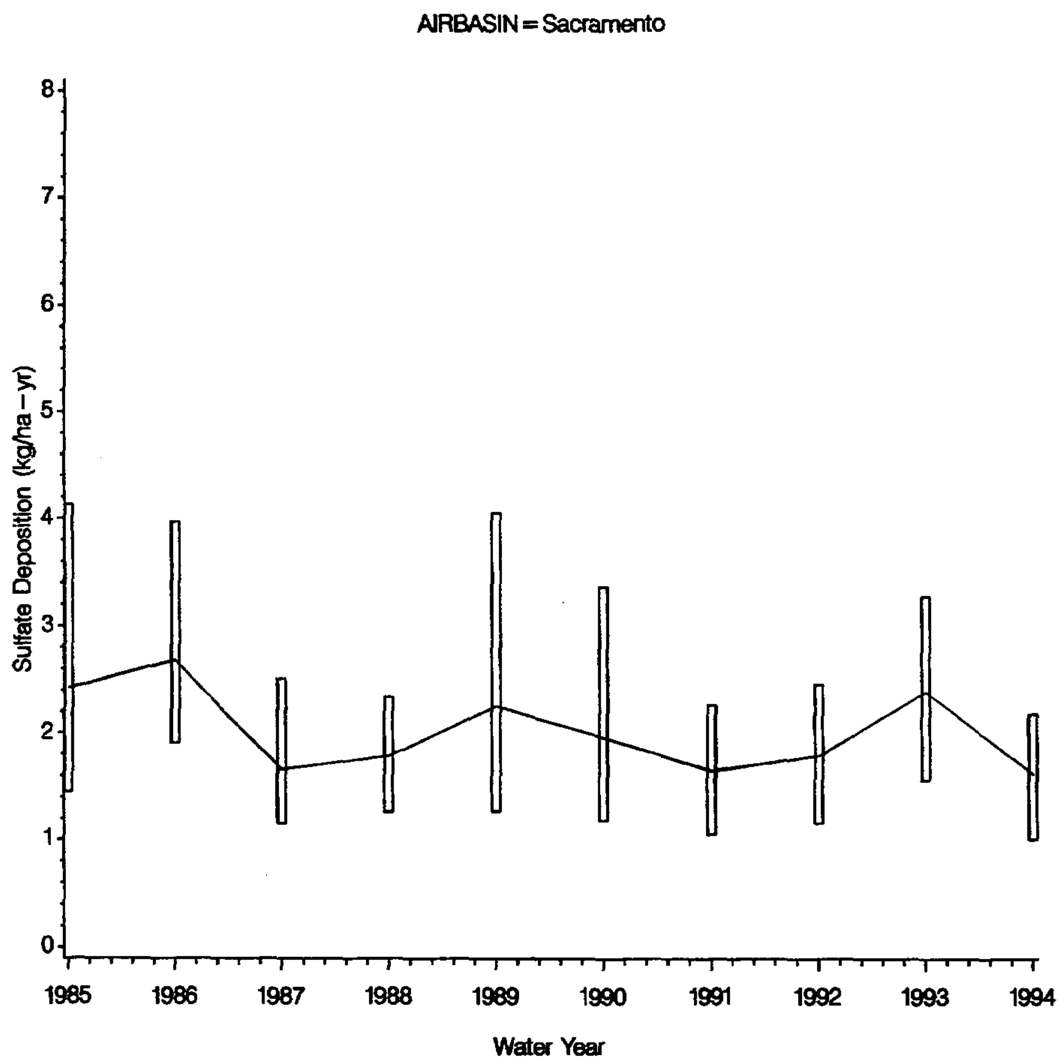
AIRBASIN = North Central Coast



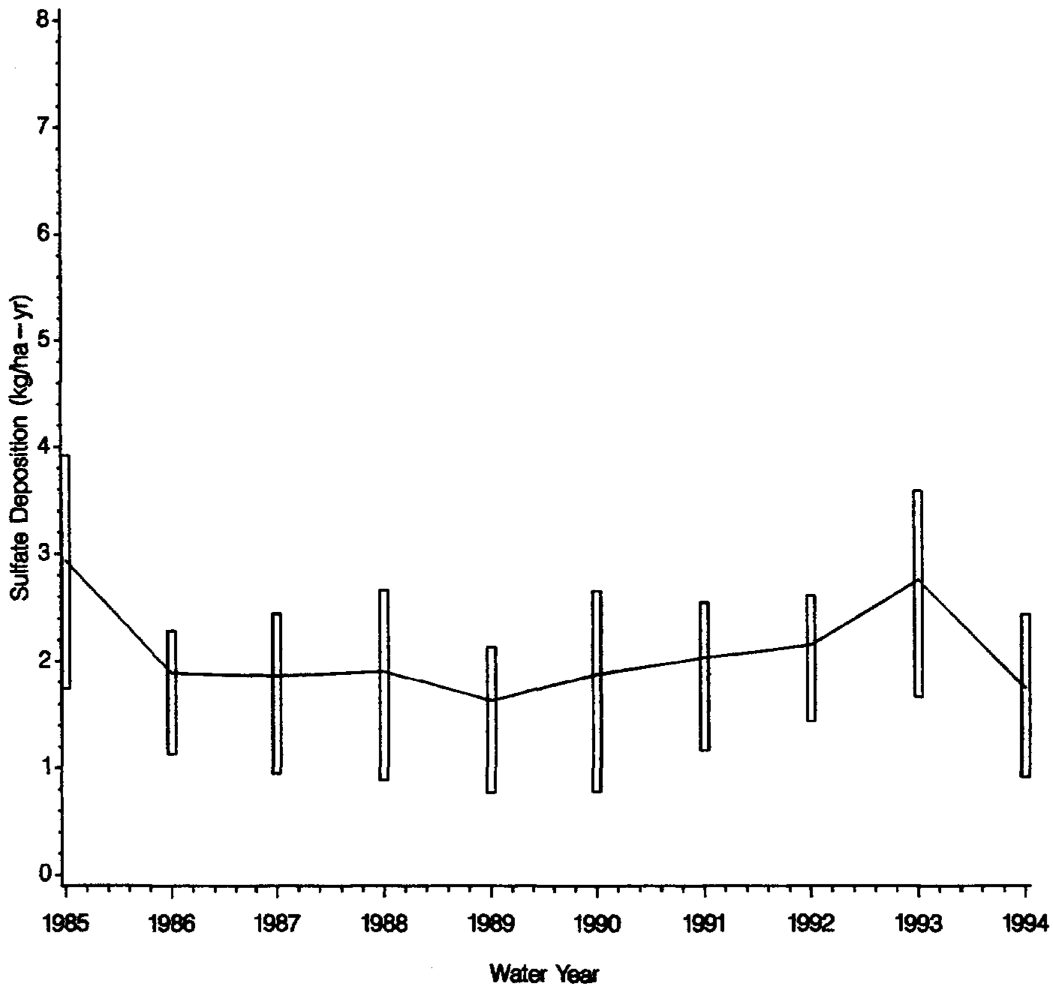
AIRBASIN = North Coast

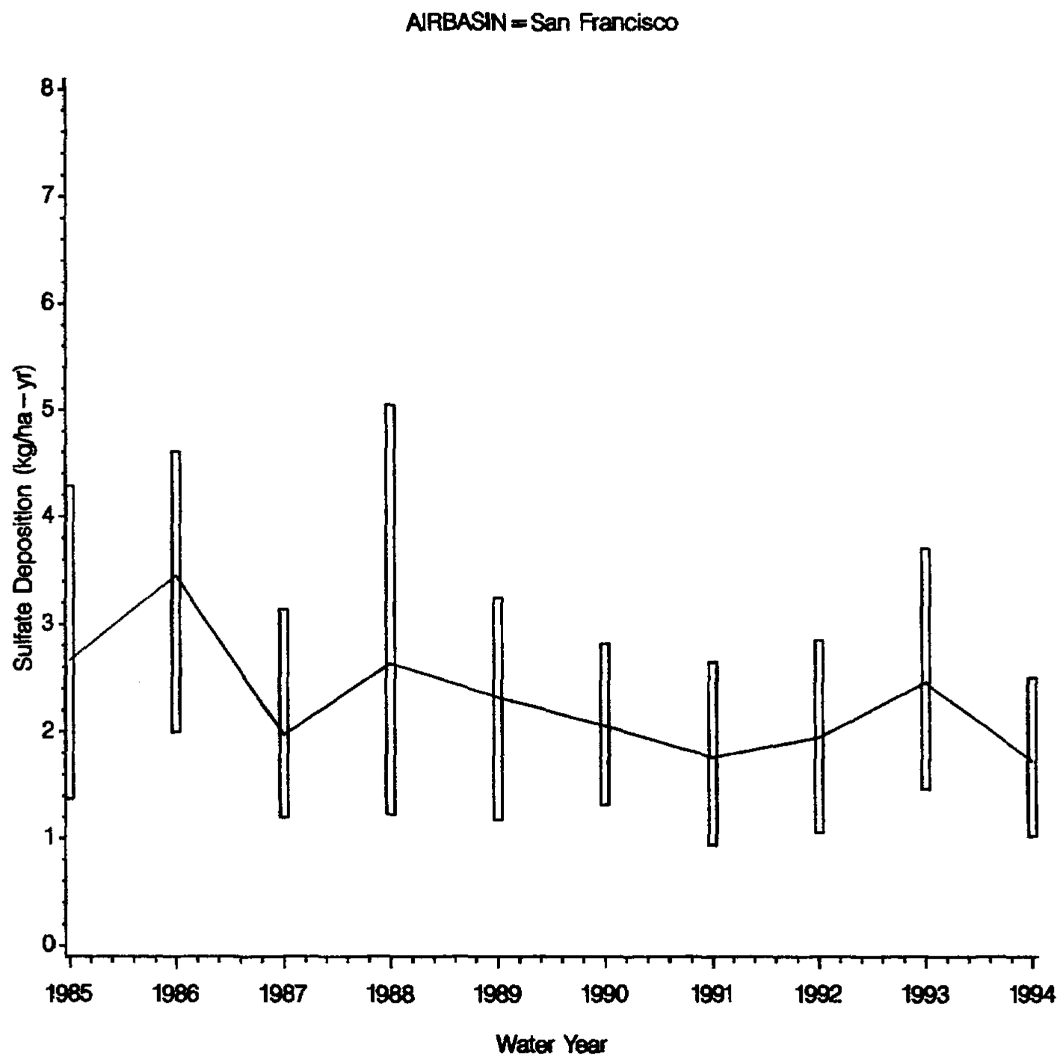



AIRBASIN=Northeast Plateau
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

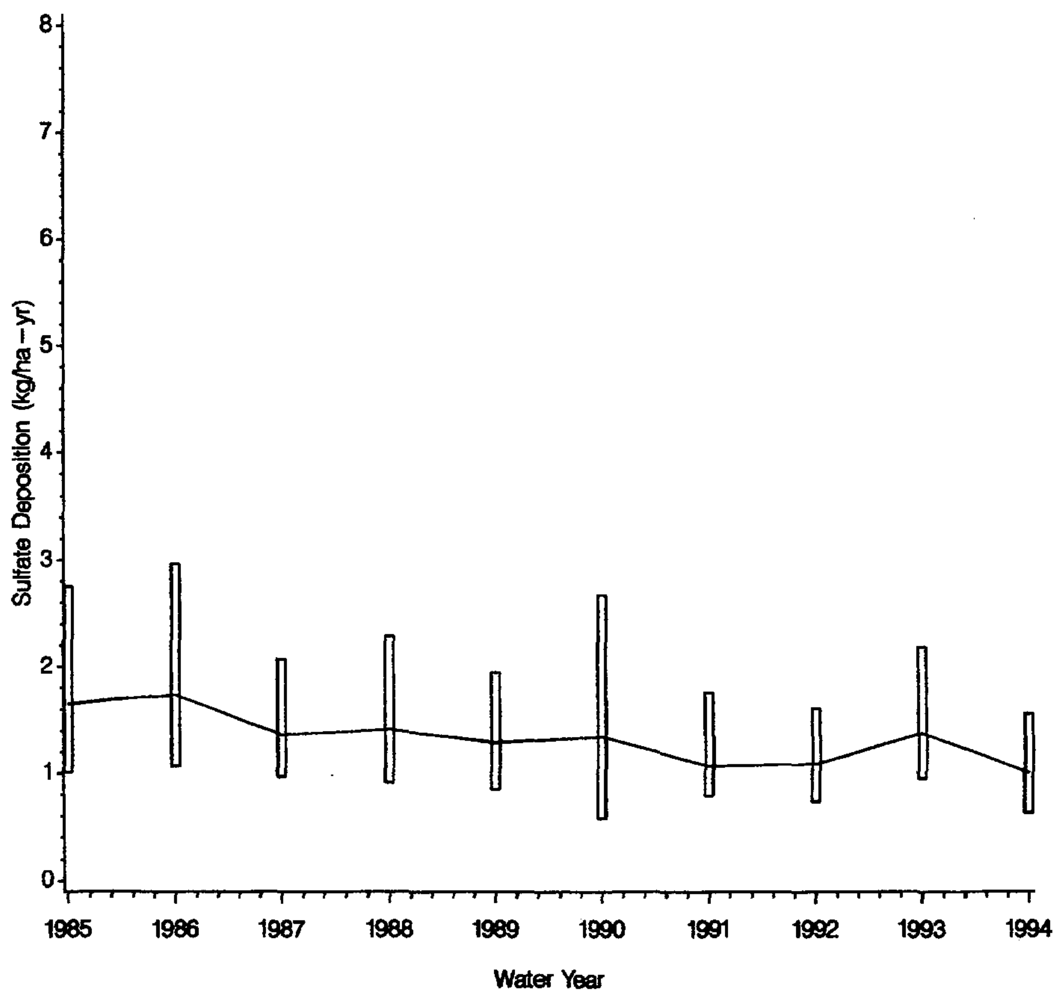

AIRBASIN = Sacramento
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

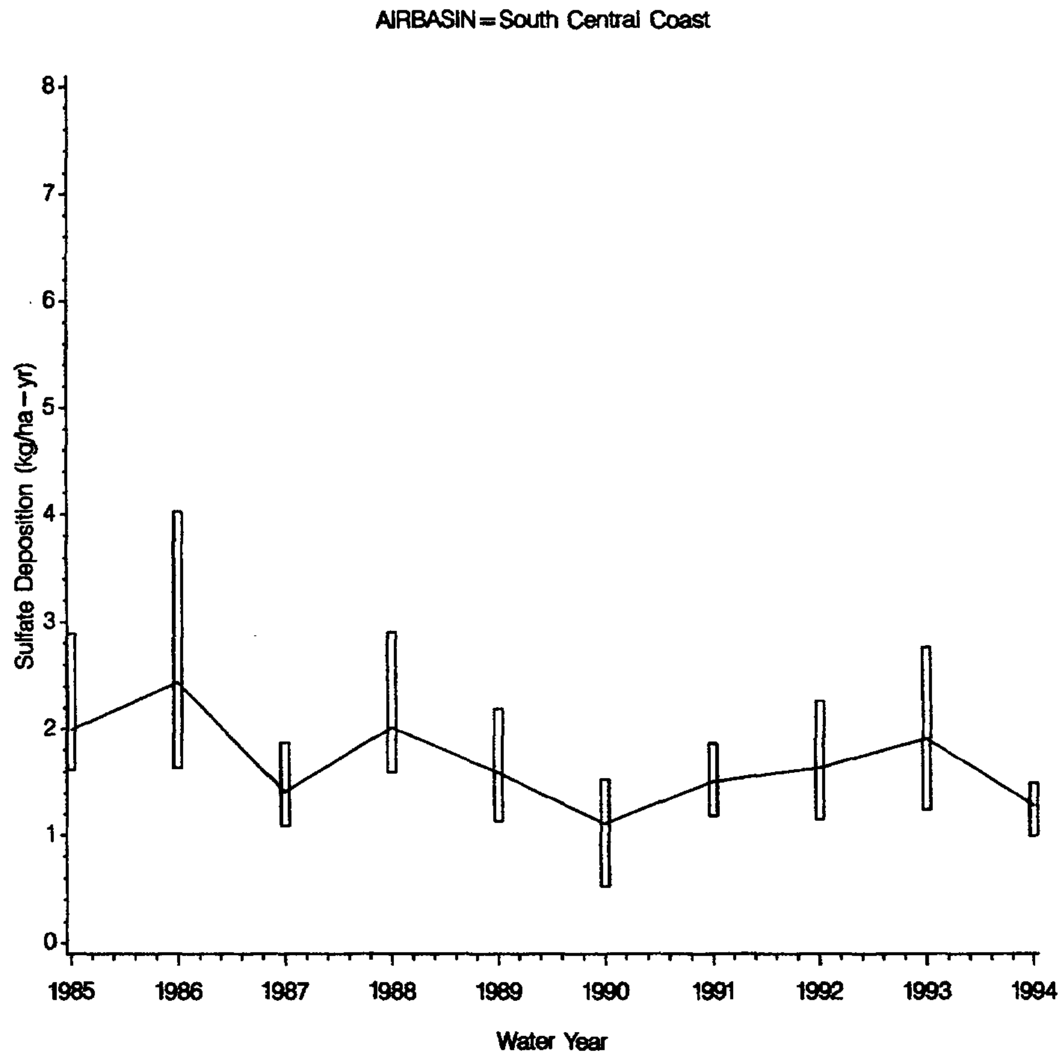
AIRBASIN=San Diego

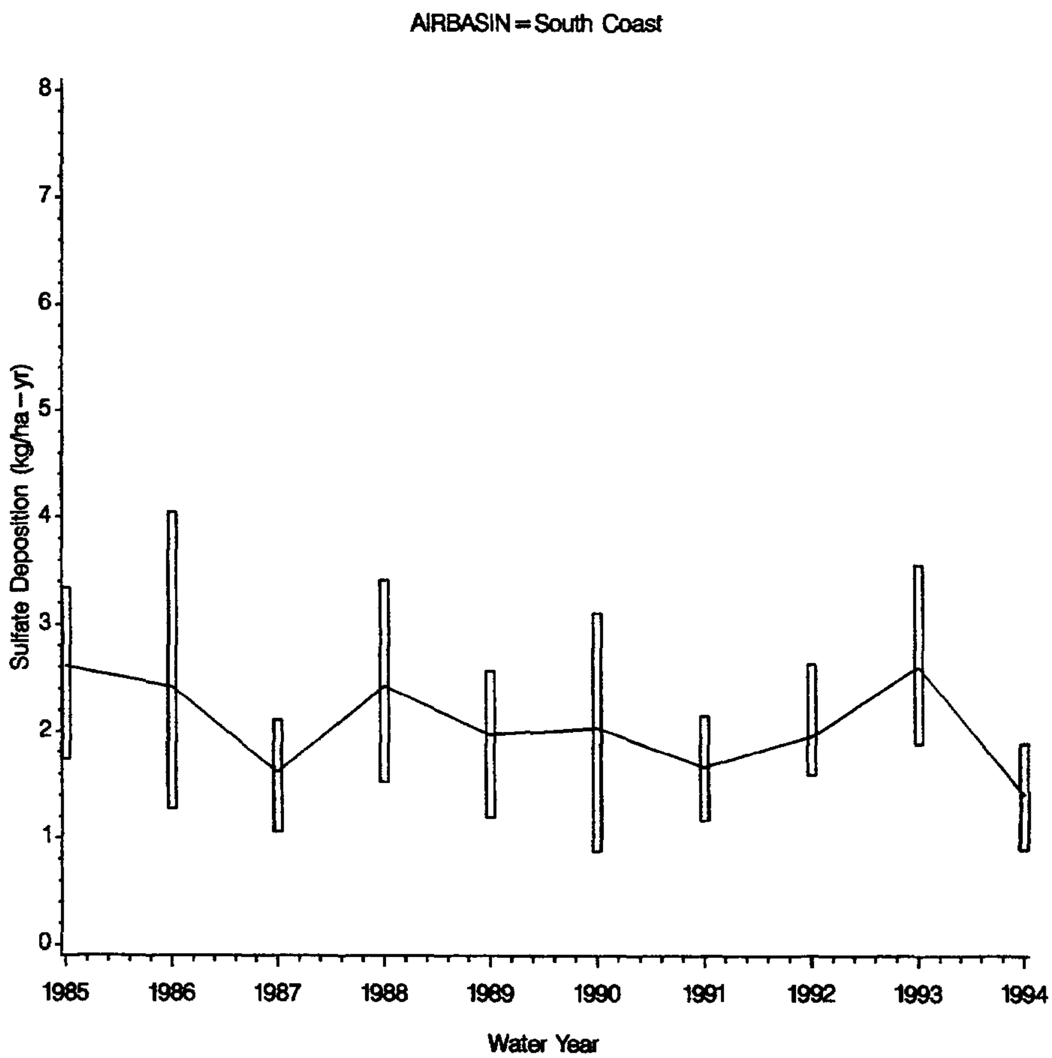



AIRBASIN=San Francisco
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=San Joaquin

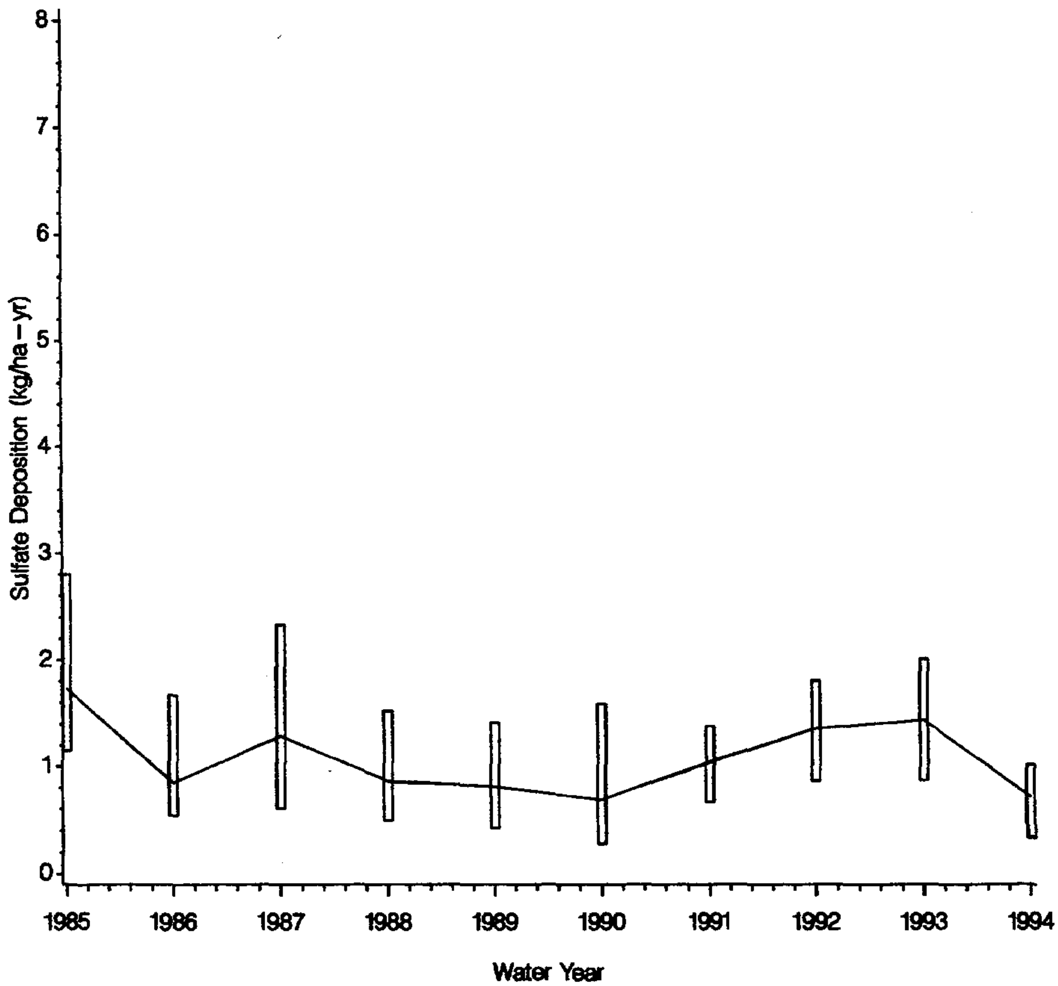


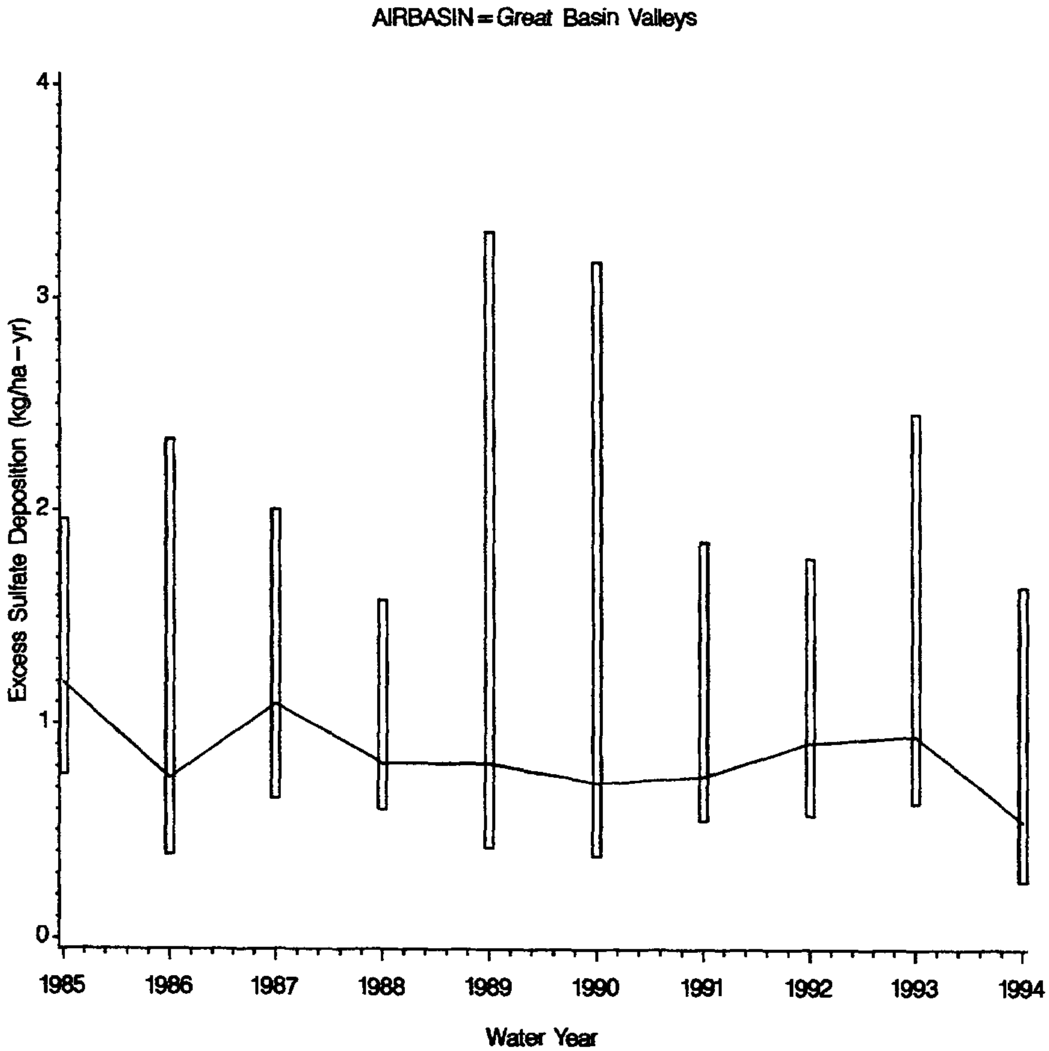

AIRBASIN=South Central Coast
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year



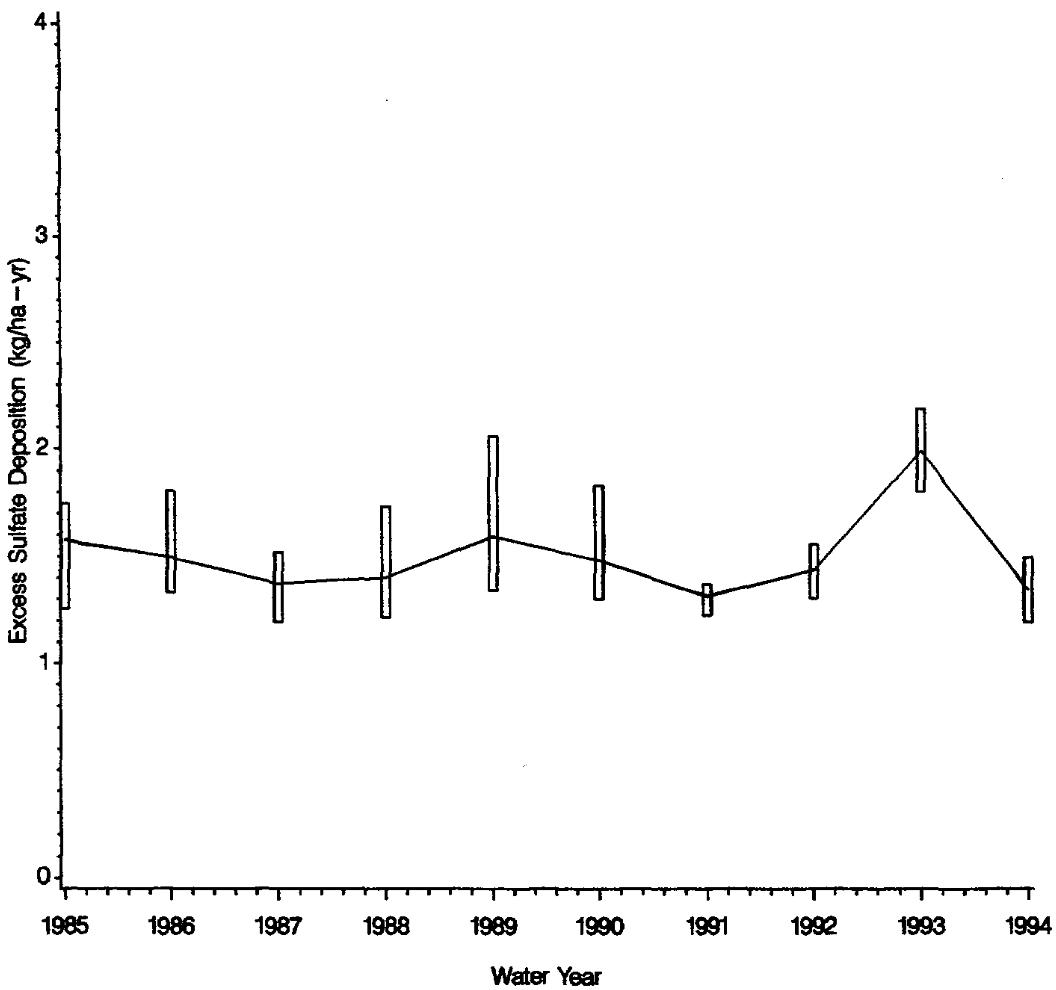
AIRBASIN=South Coast
Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
5
6
7
8
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=South East Desert

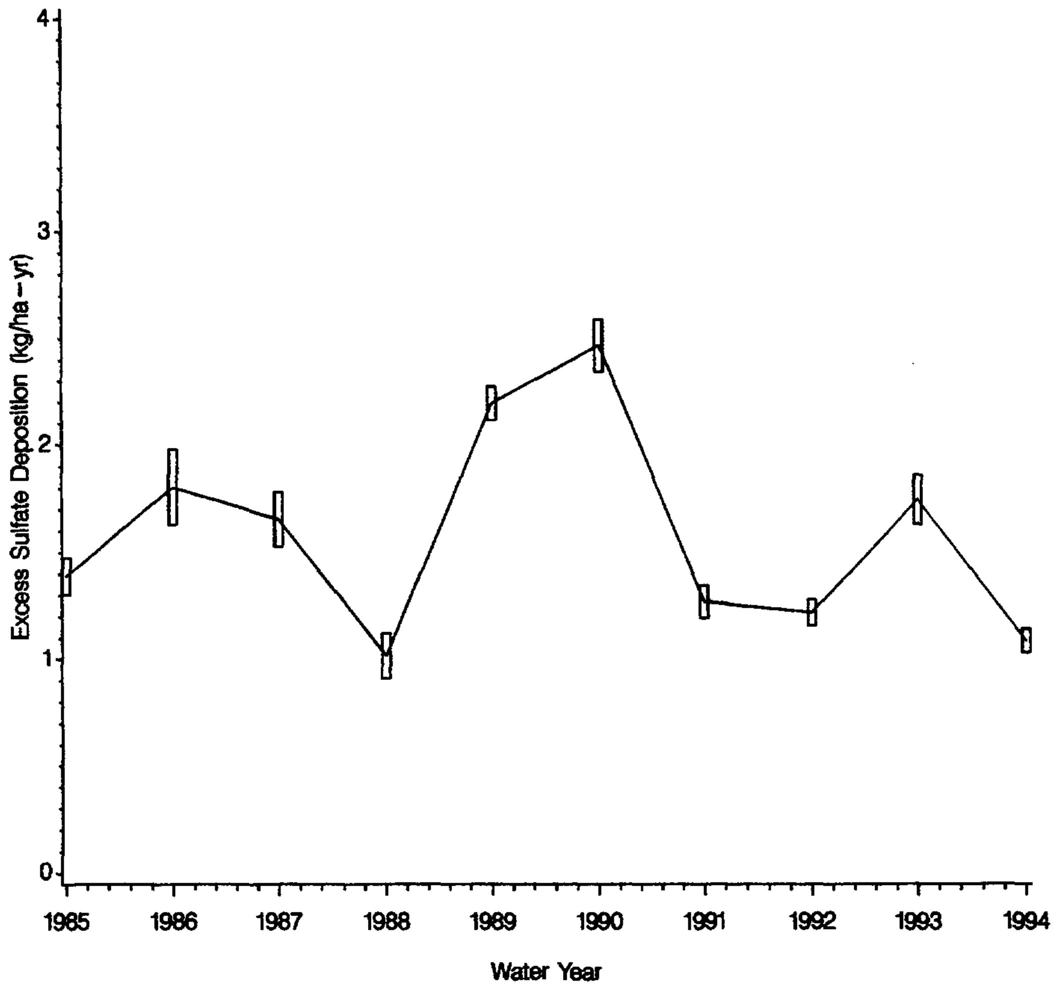


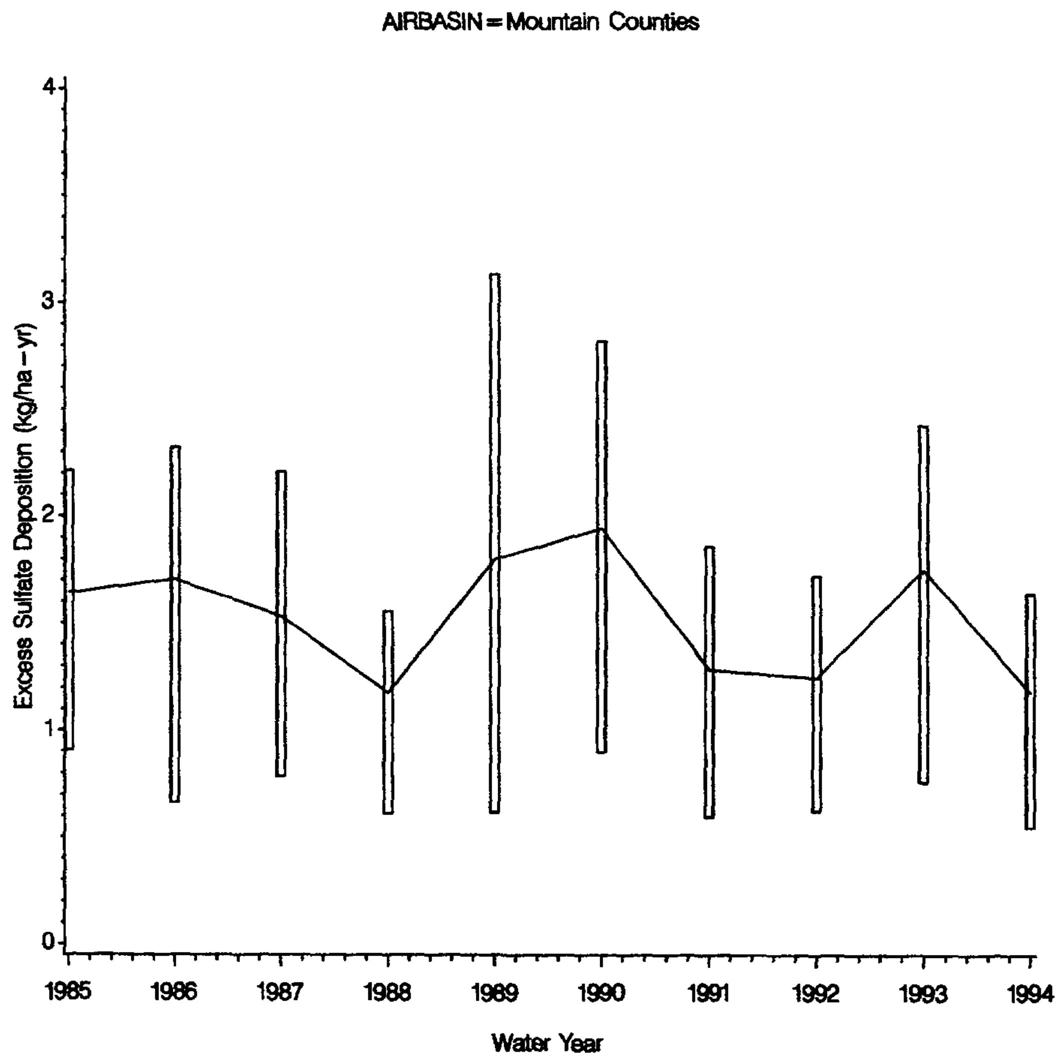

AIRBASIN=Great Basin Valleys
Excess Sulfate Deposition (kg/ha-yr)
4
3
2
1
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

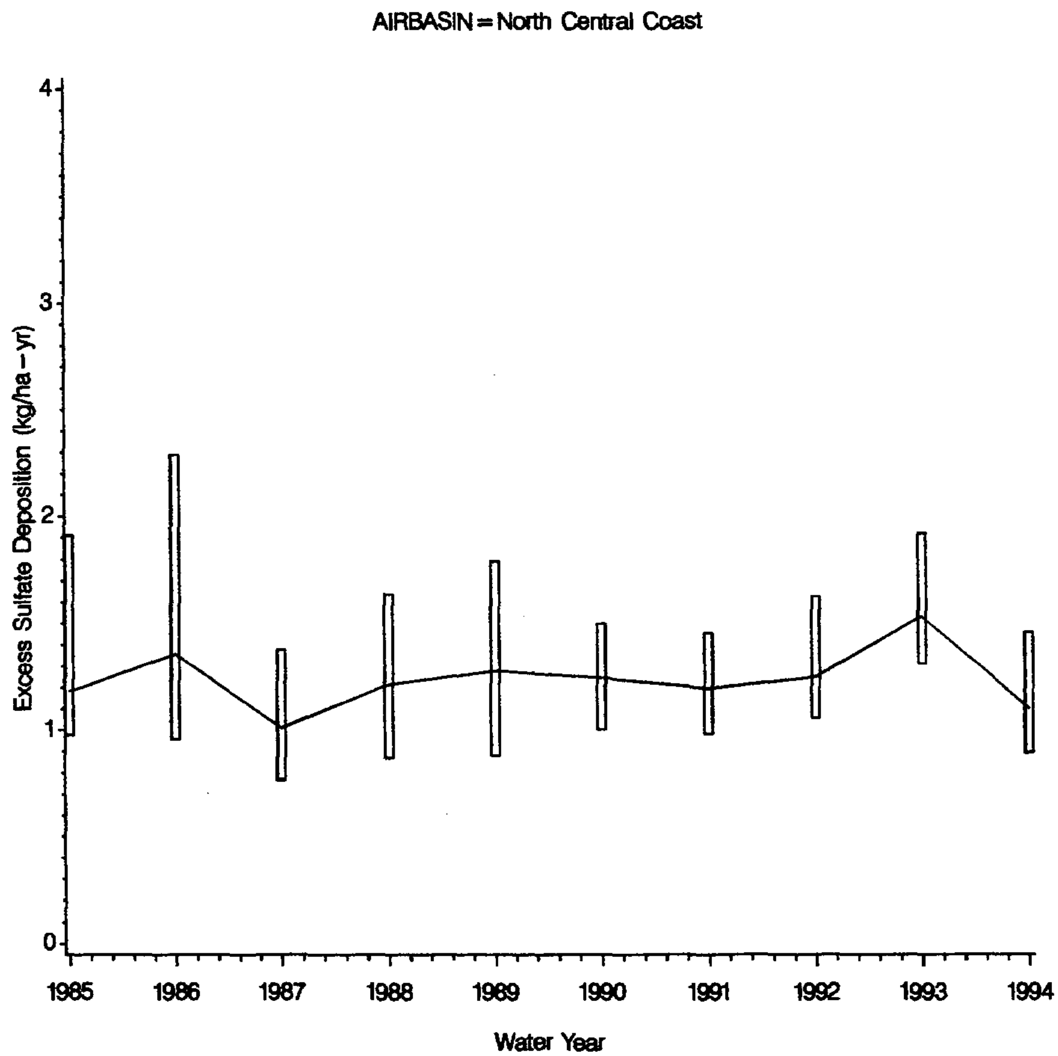
AIRBASIN = Lake County

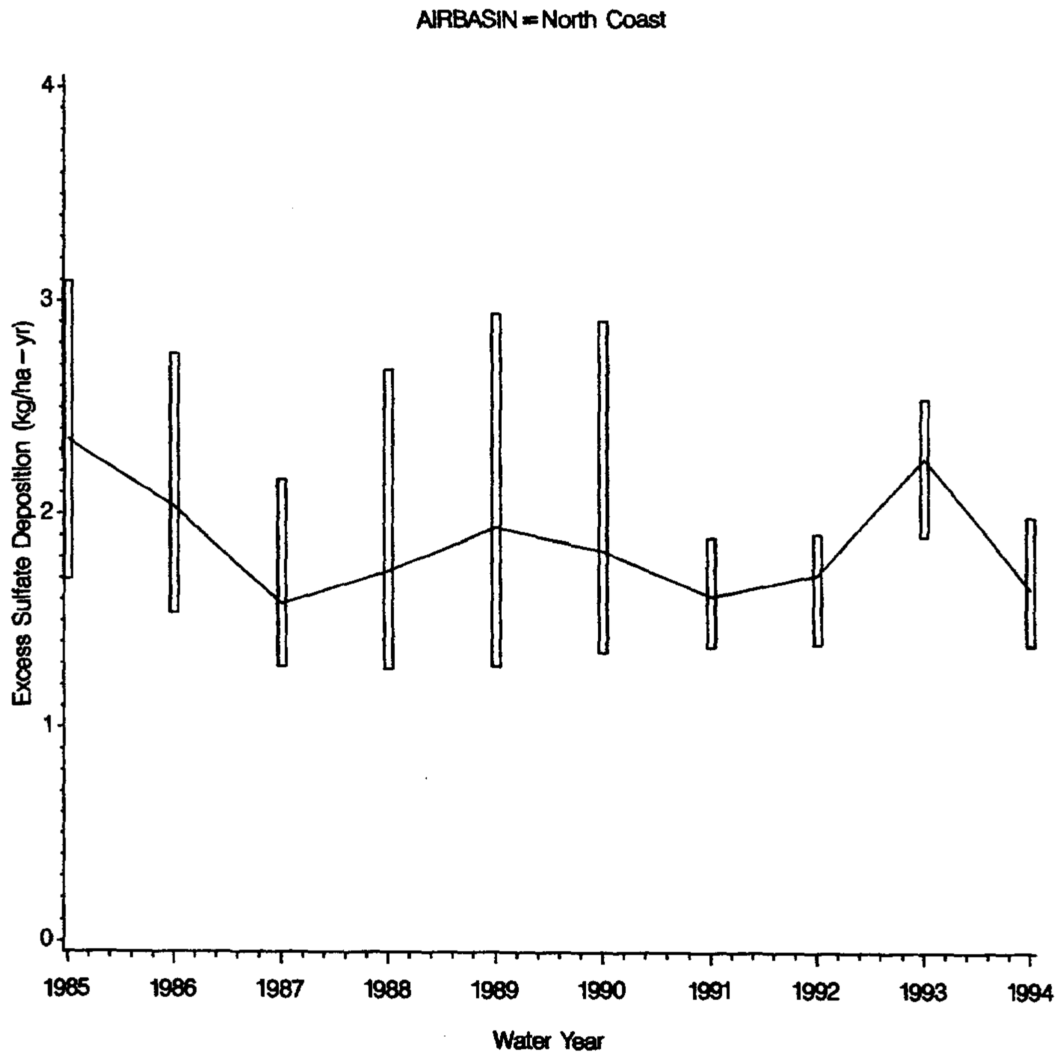


AIRBASIN = Lake Tahoe

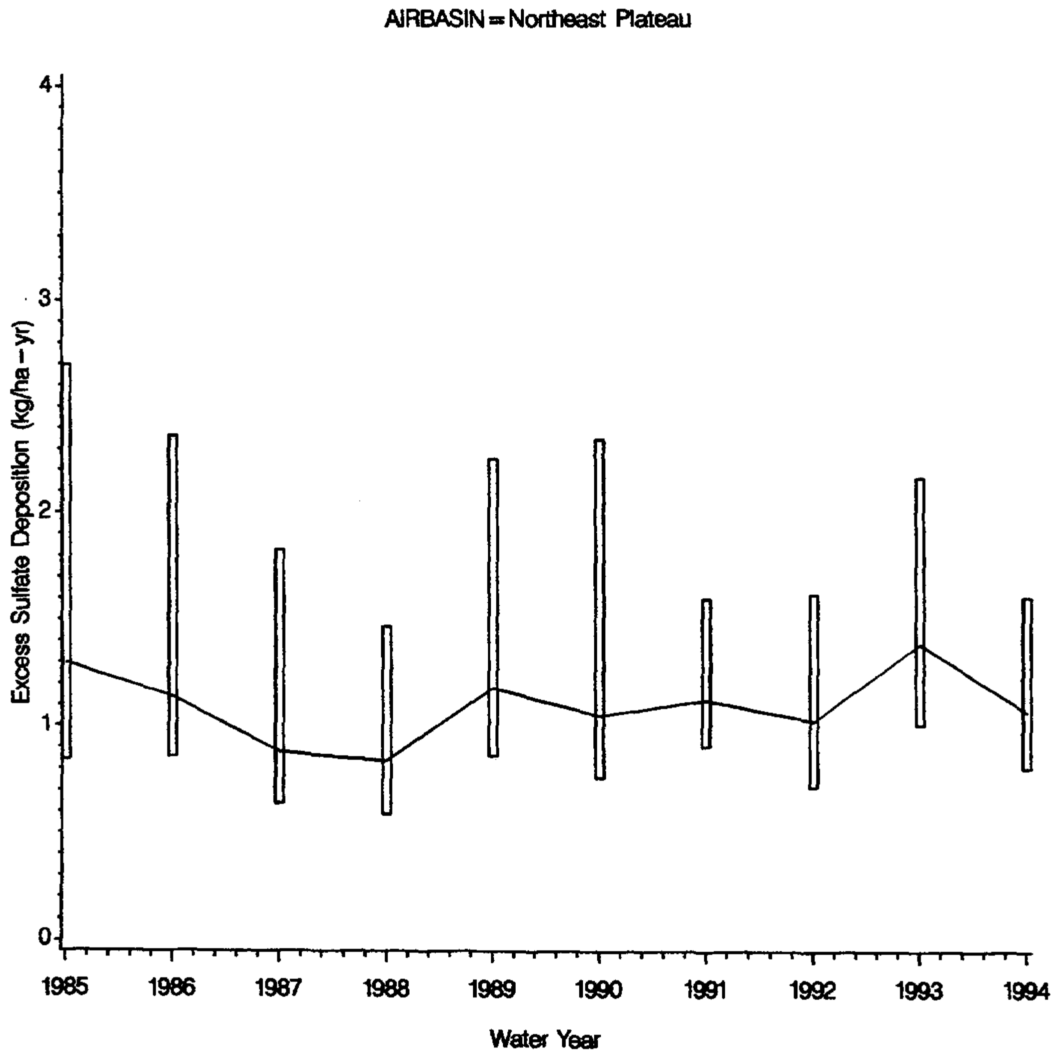


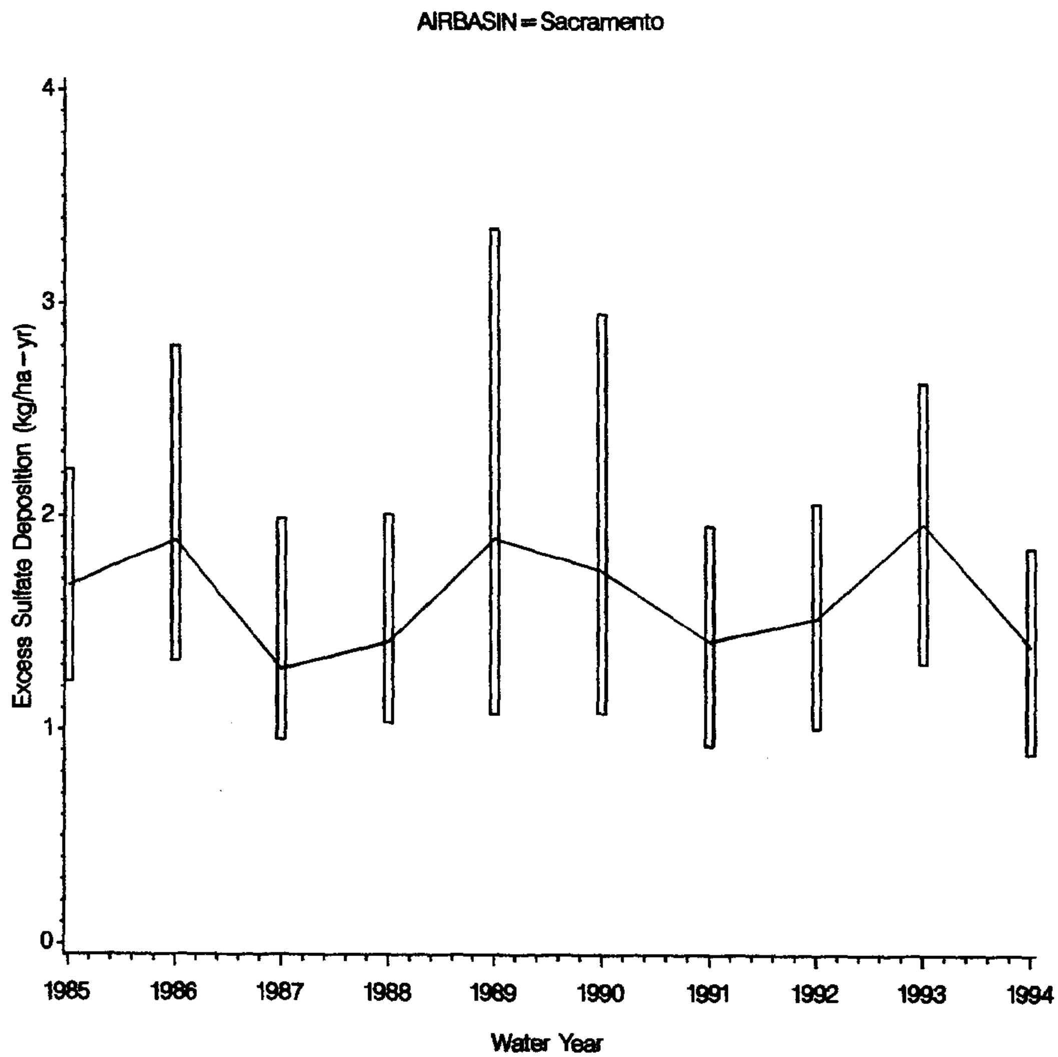

AIRBASIN=Mountain Counties
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=North Central Coast
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

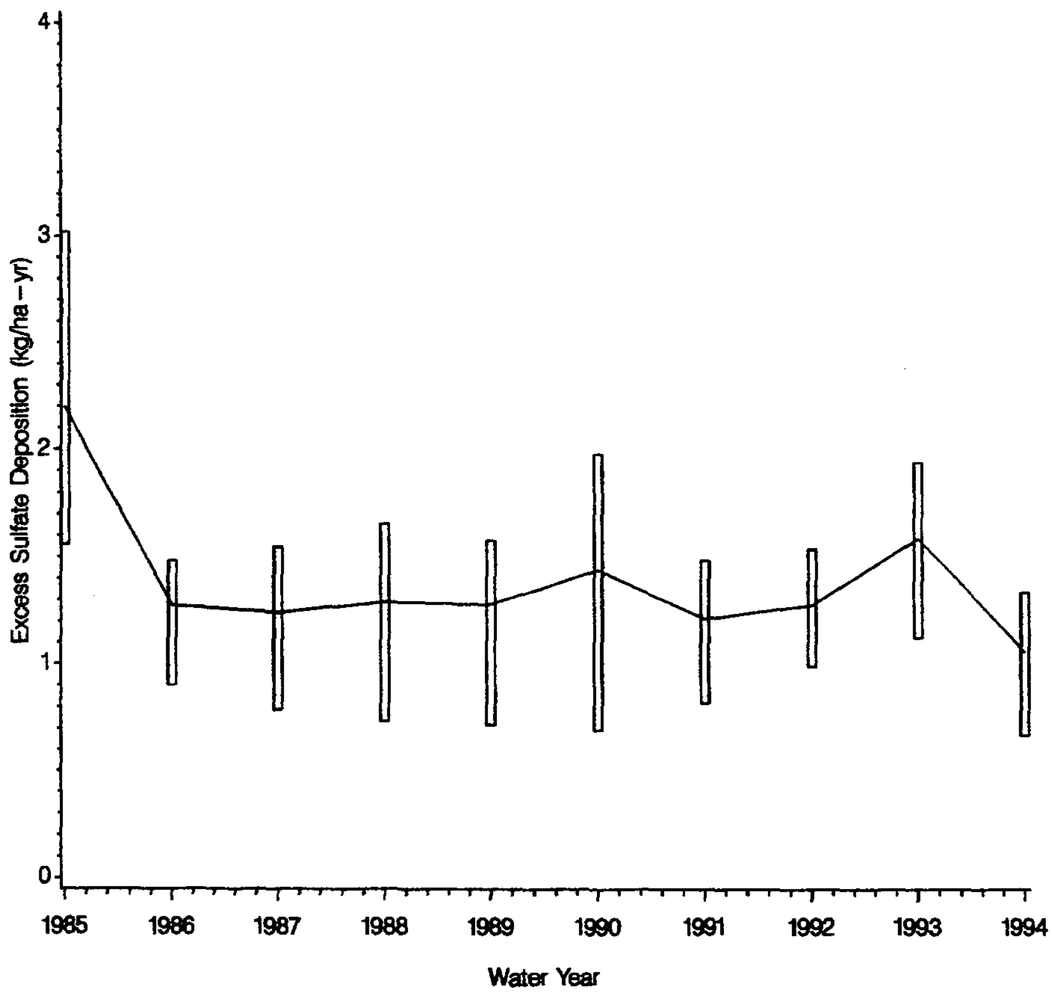


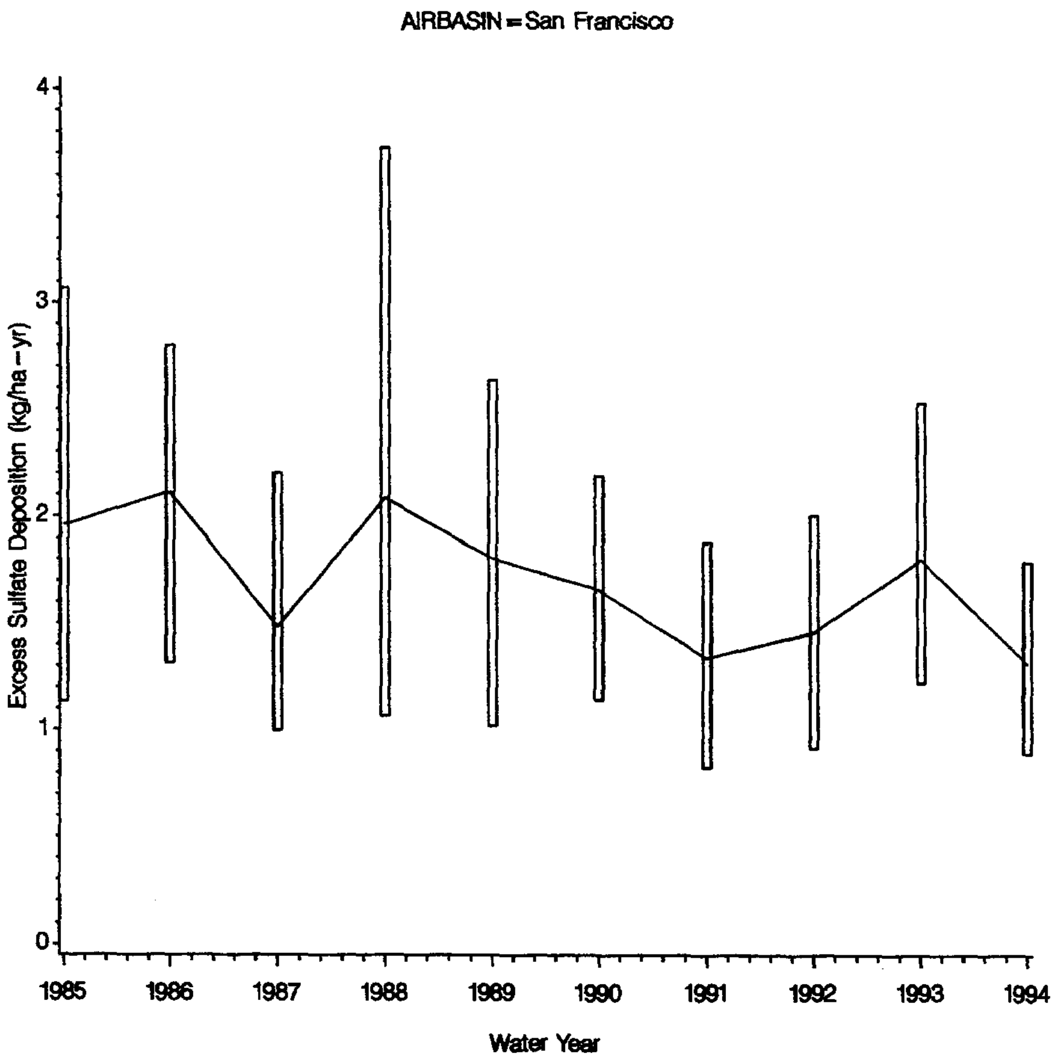
AIRBASIN = North Coast
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN = Northeast Plateau
Excess Sulfate Deposition (kg/ha - yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

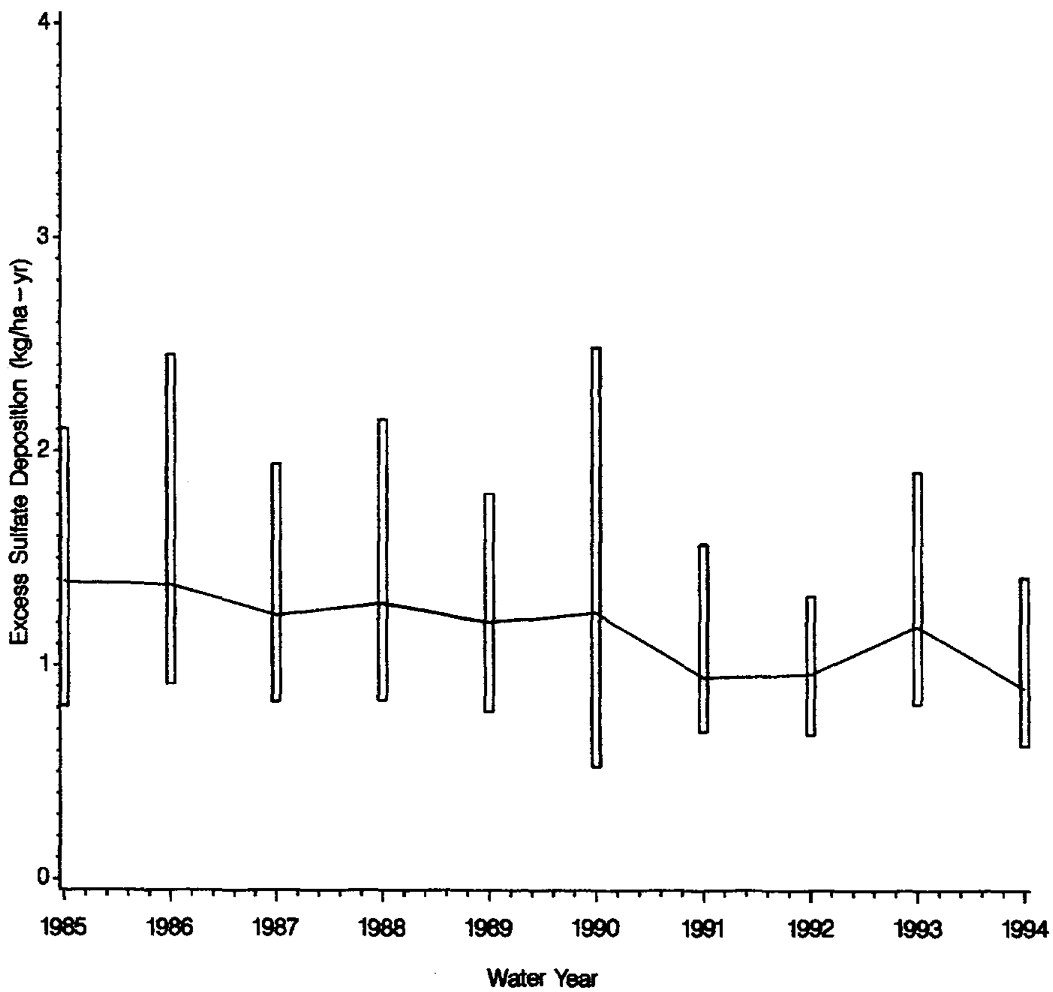

AIRBASIN=Sacramento
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

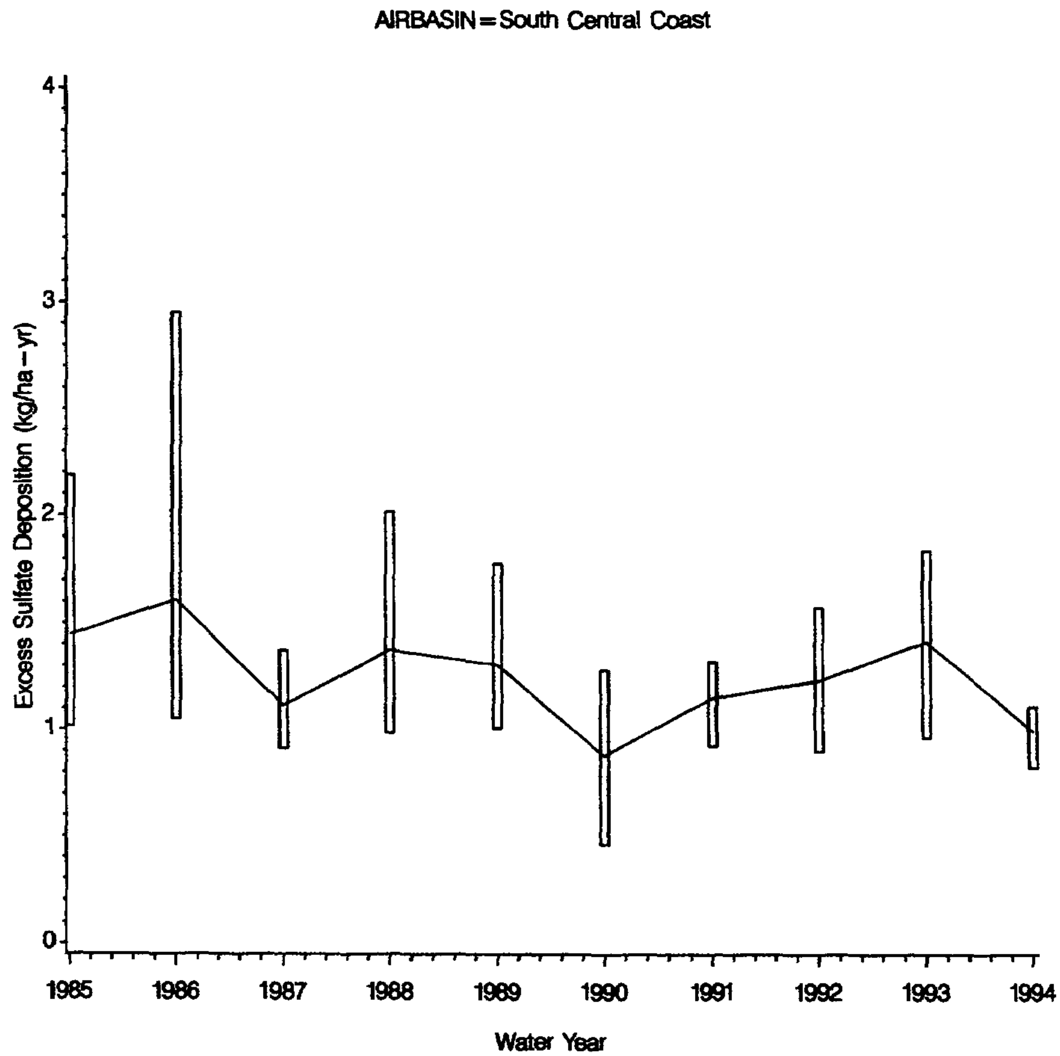
AIRBASIN=San Diego



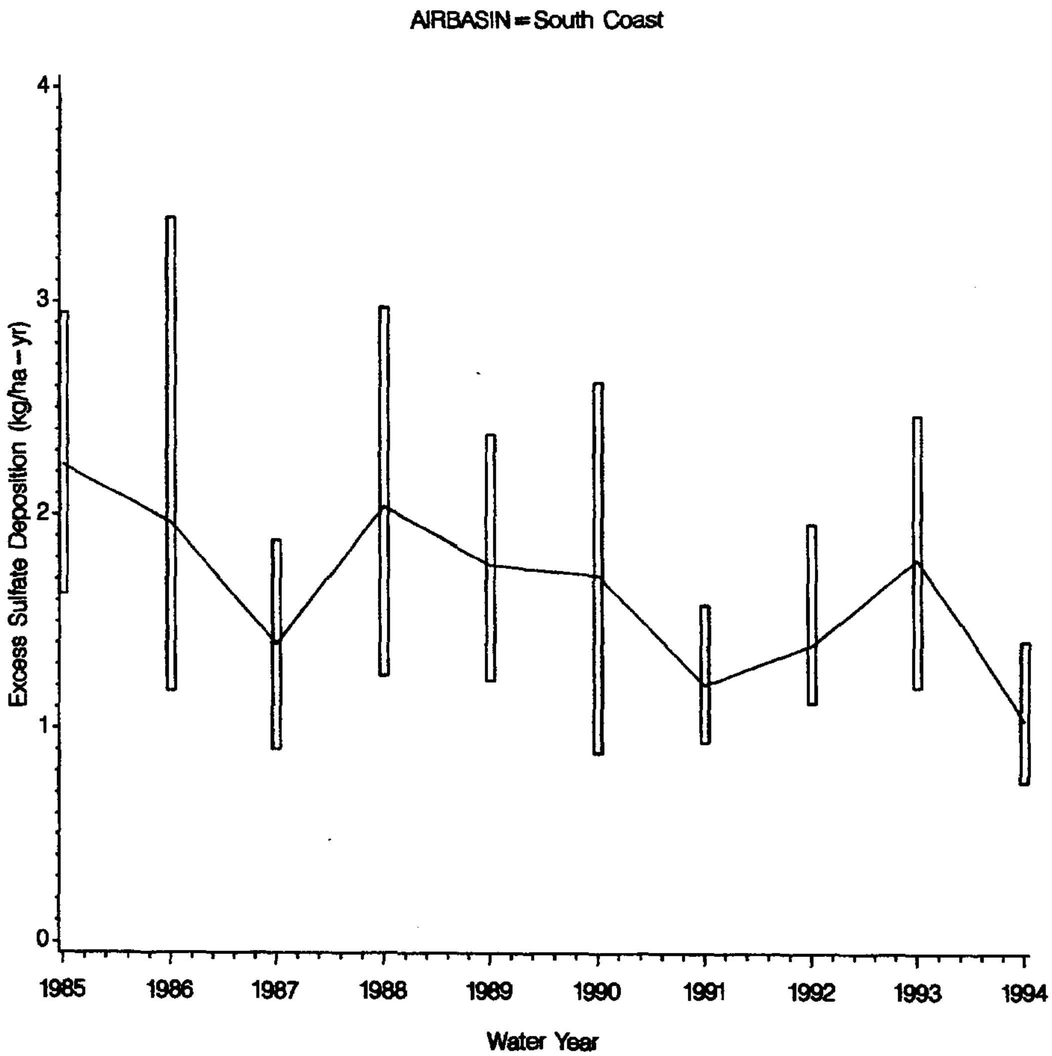

AIRBASIN=San Francisco
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

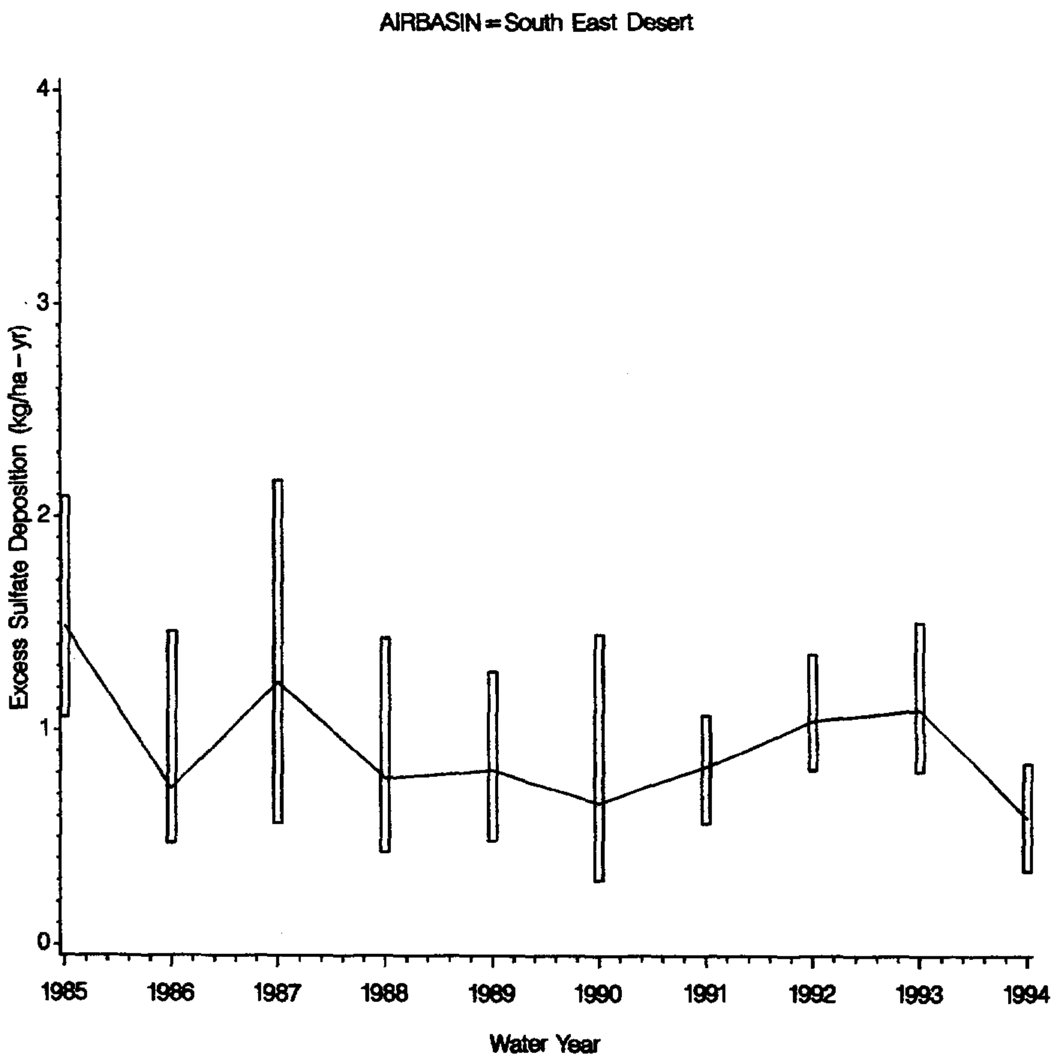
AIRBASIN=San Joaquin

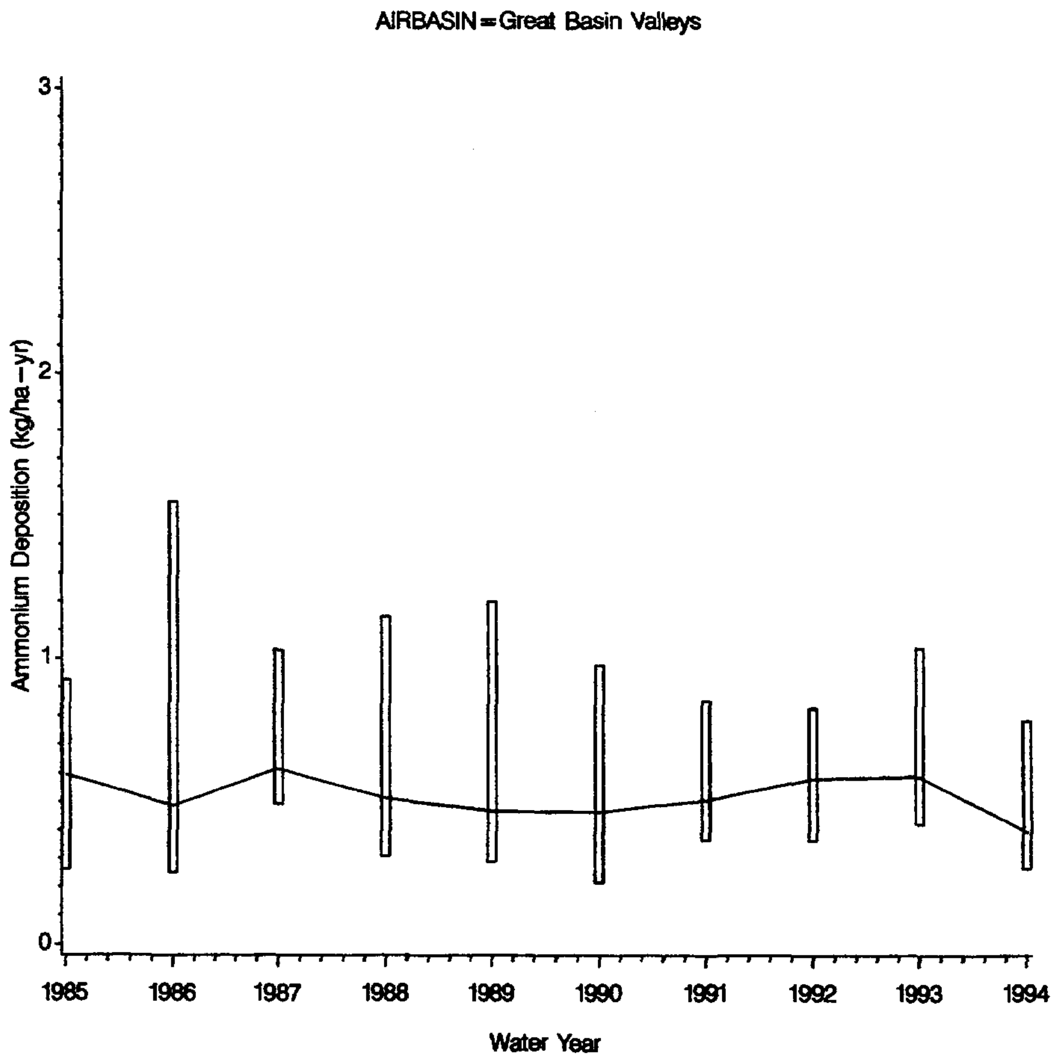




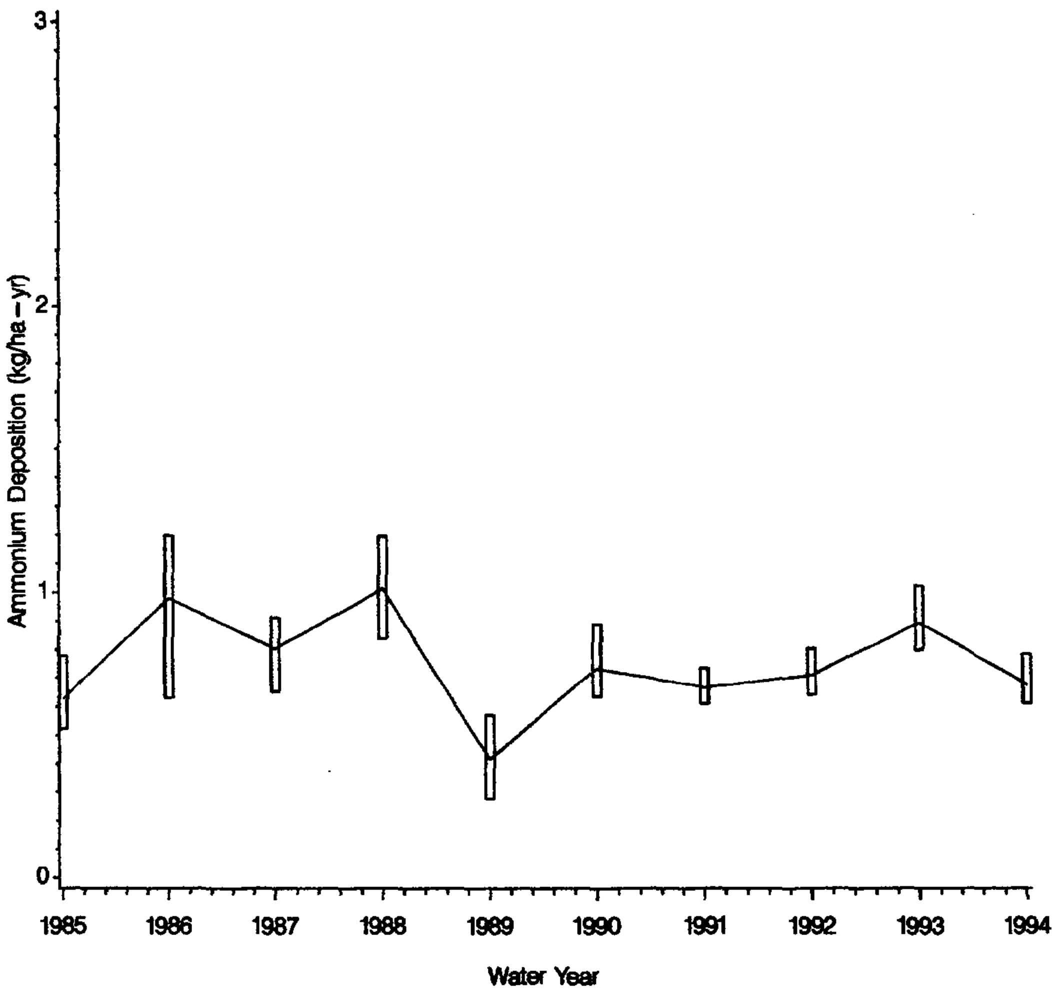
AIRBASIN=South Central Coast
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=South Coast
Excess Sulfate Deposition (kg/ha-yr)
4
3
2
1
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

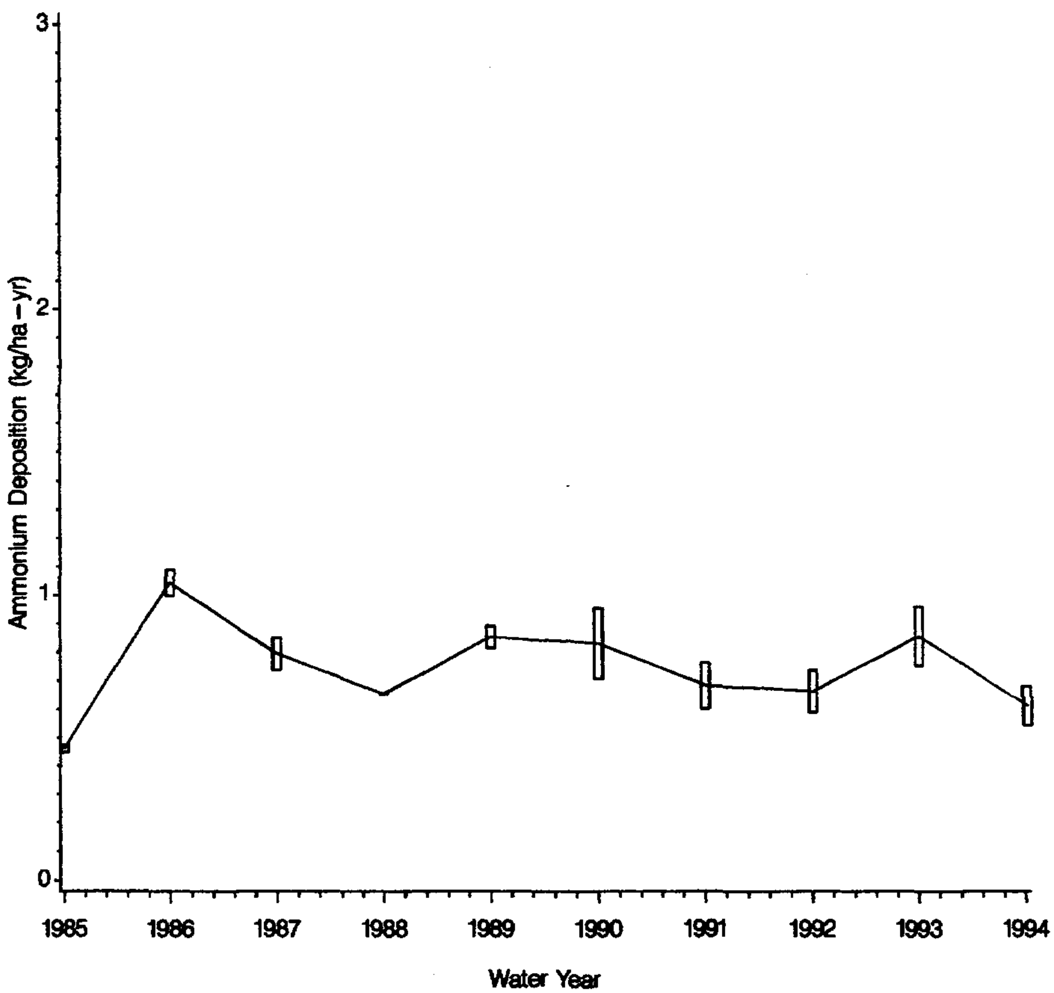

AIRBASIN=South East Desert
Excess Sulfate Deposition (kg/ha-yr)
0
1
2
3
4
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

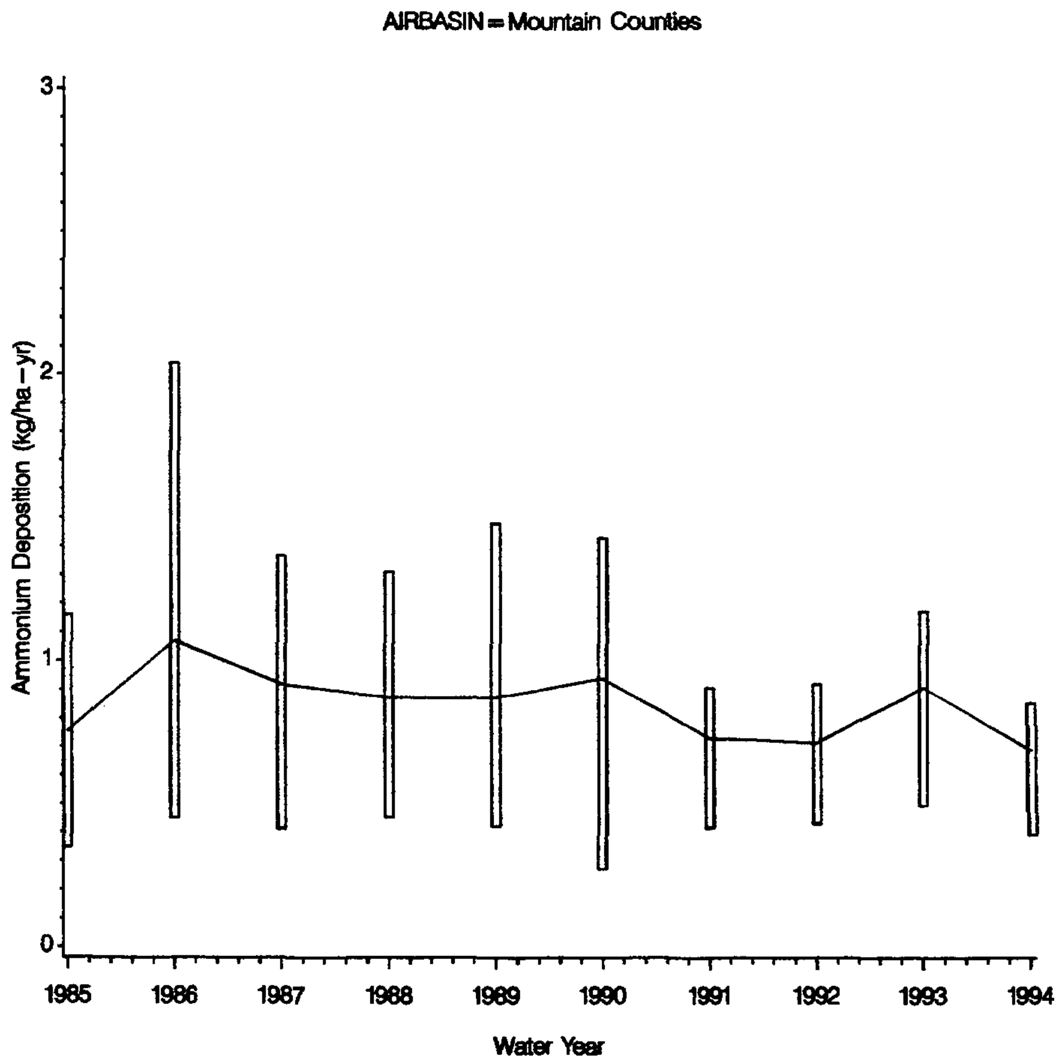

AIRBASIN=Great Basin Valleys
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

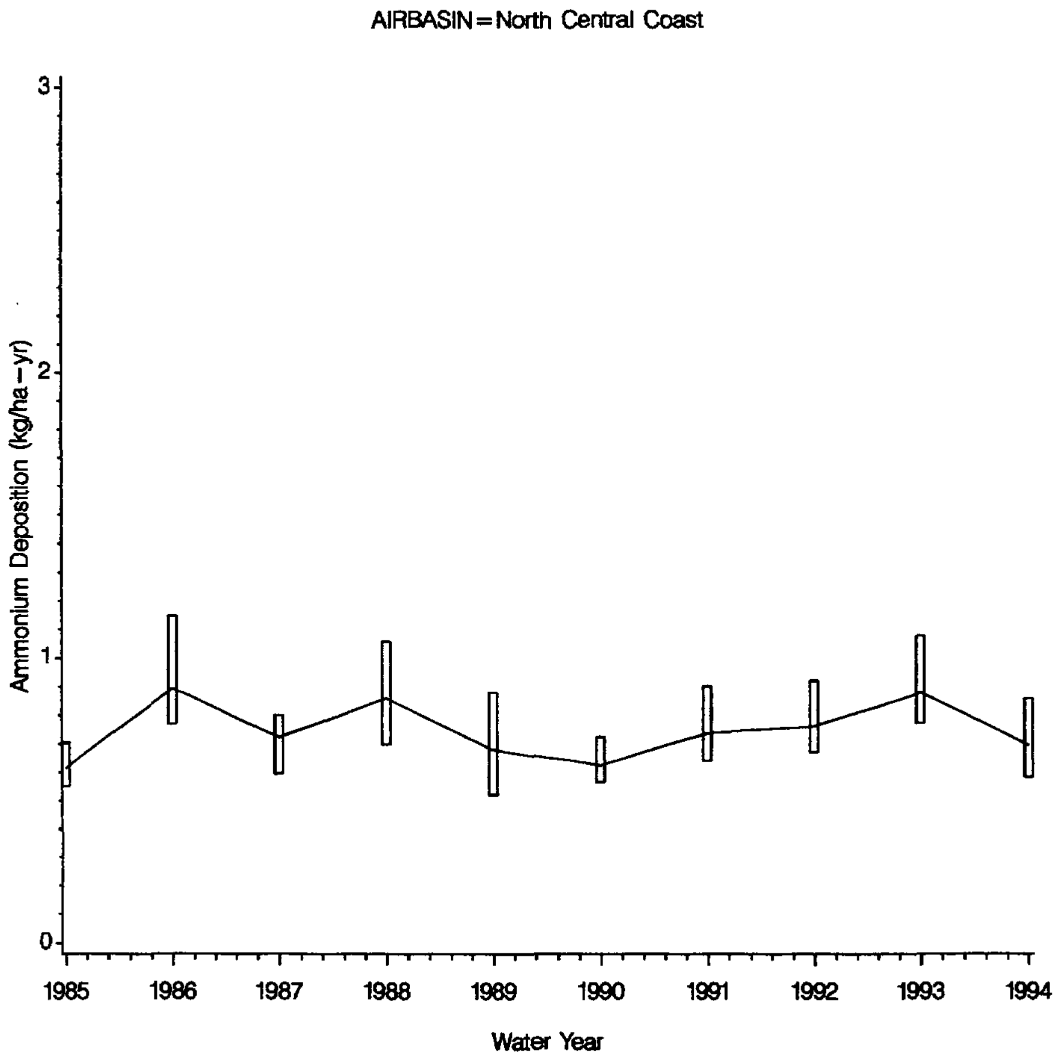
AIRBASIN=Lake County

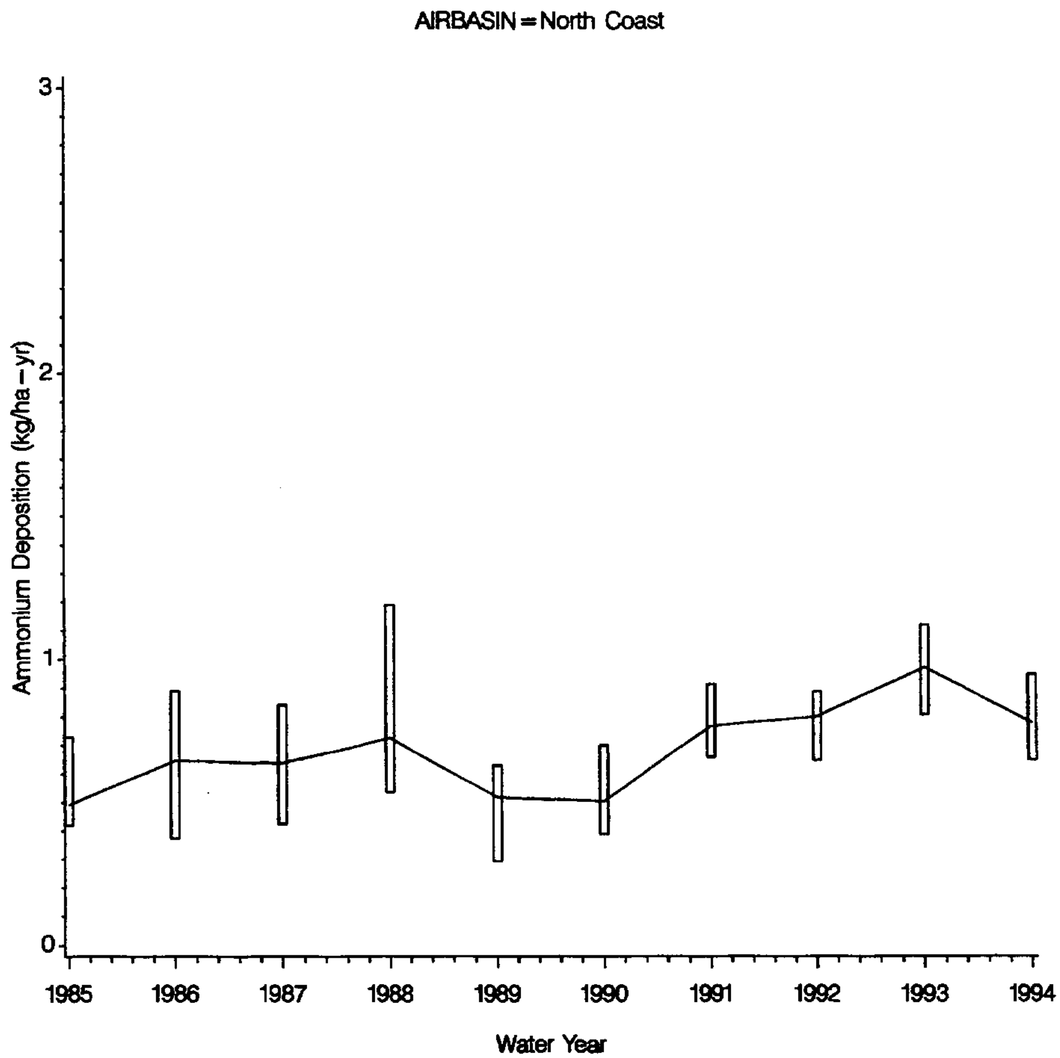


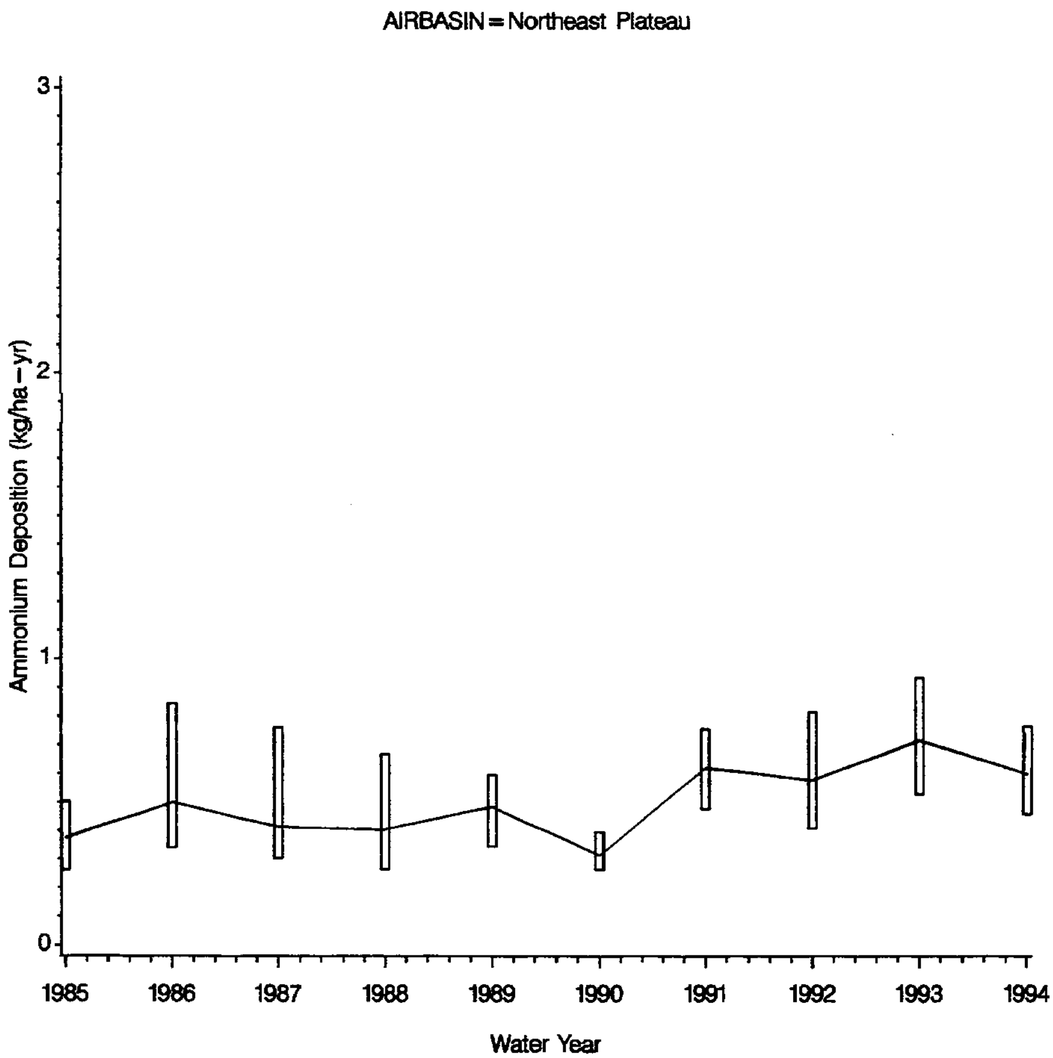
AIRBASIN=Lake Tahoe

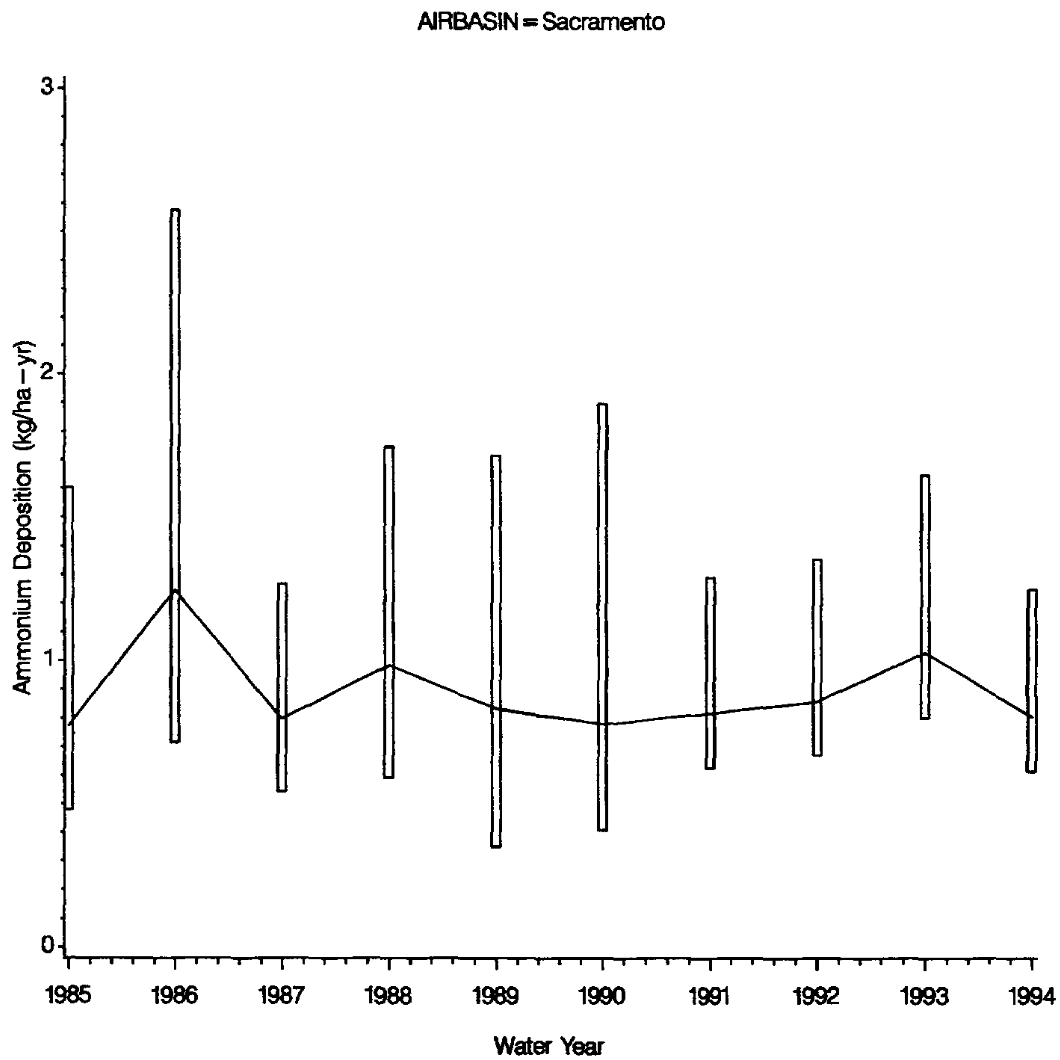


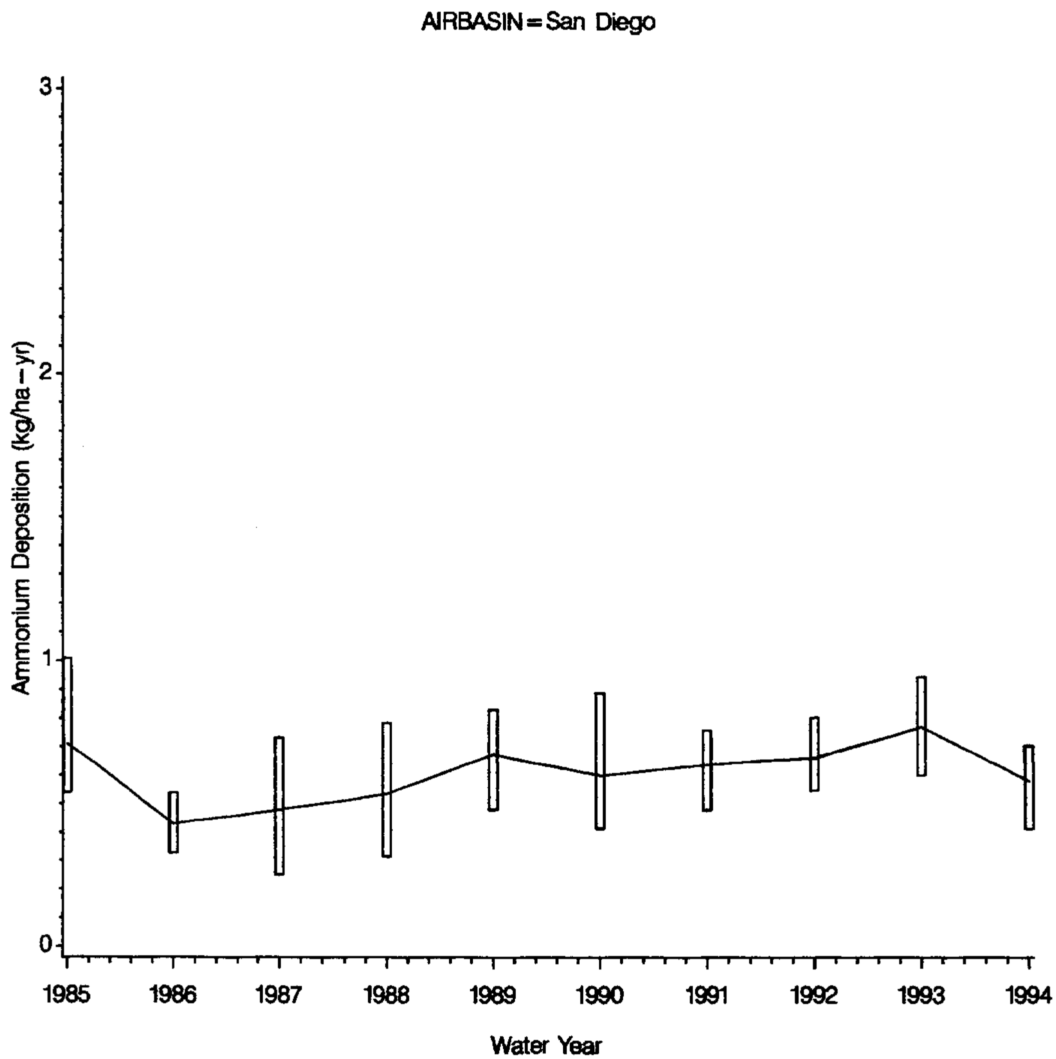

AIRBASIN=Mountain Counties
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

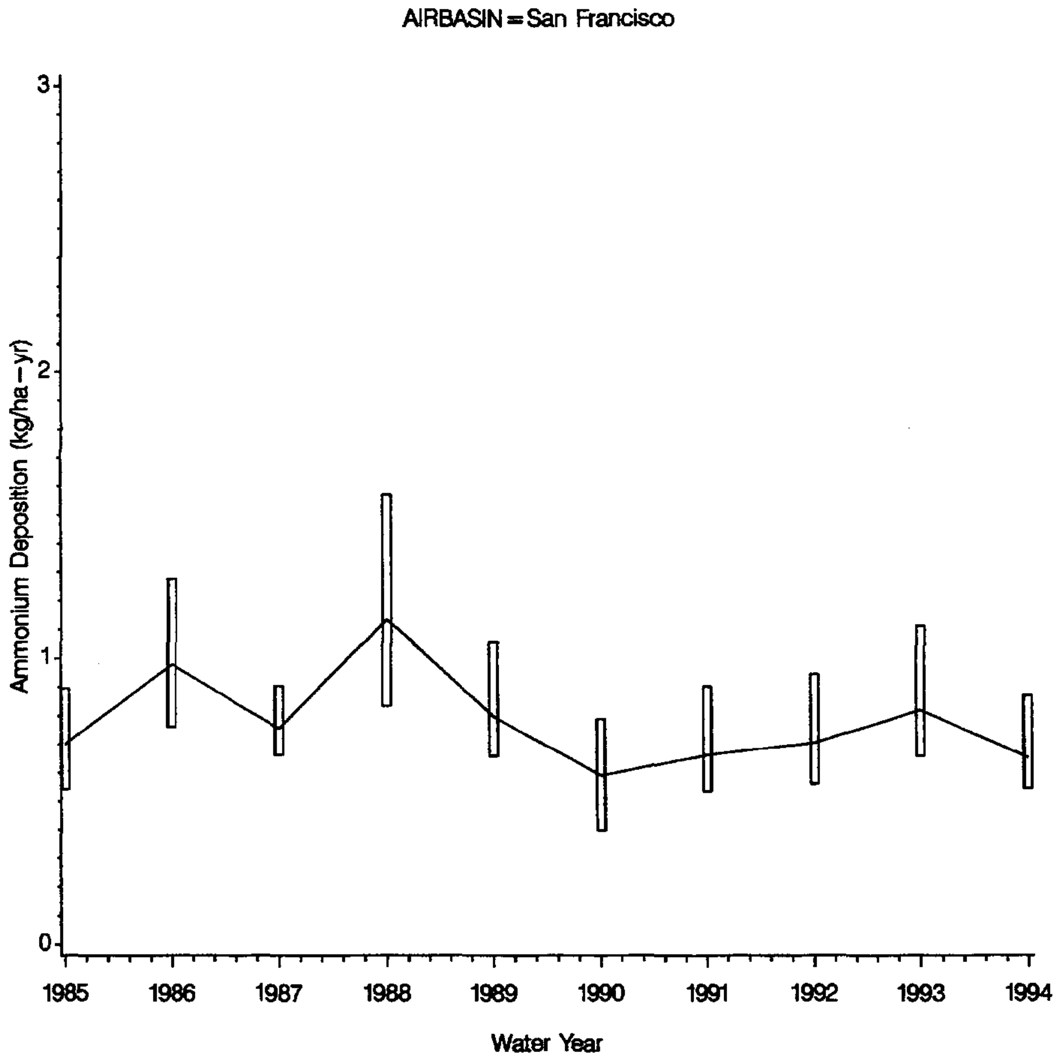

AIRBASIN=North Central Coast
Ammonium Deposition (kg/ha-yr)
3
2
1
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

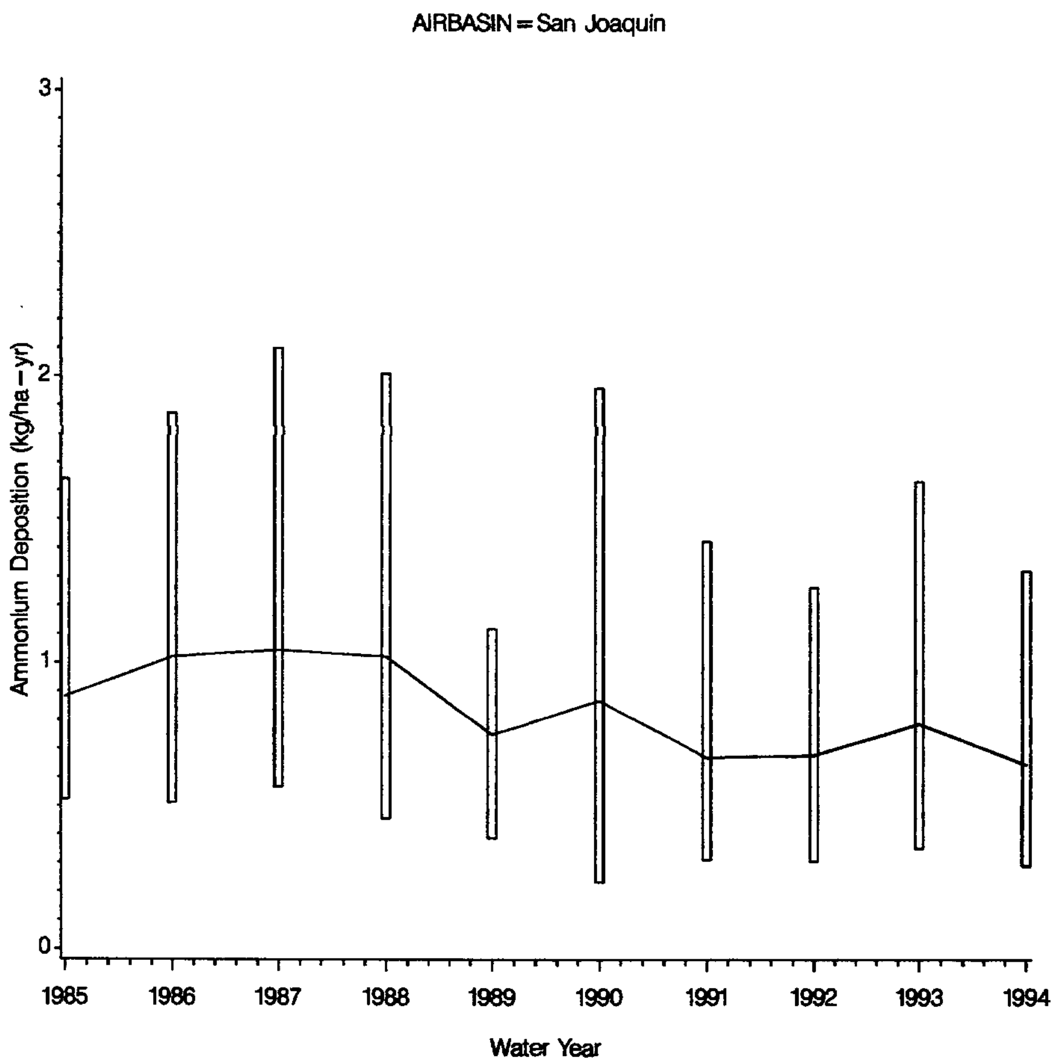

AIRBASIN=North Coast
3
2
1
0
Ammonium Deposition (kg/ha-yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

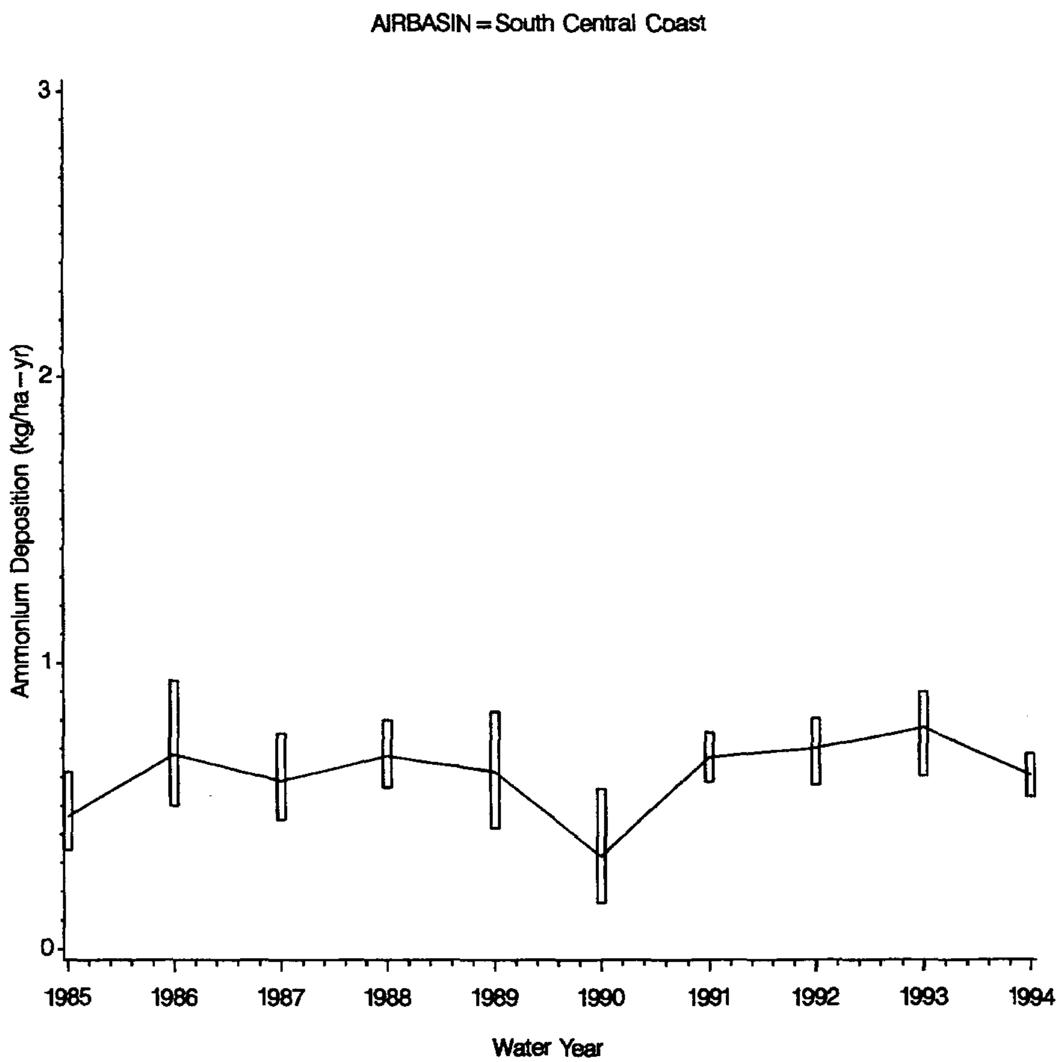

AIRBASIN = Northeast Plateau
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

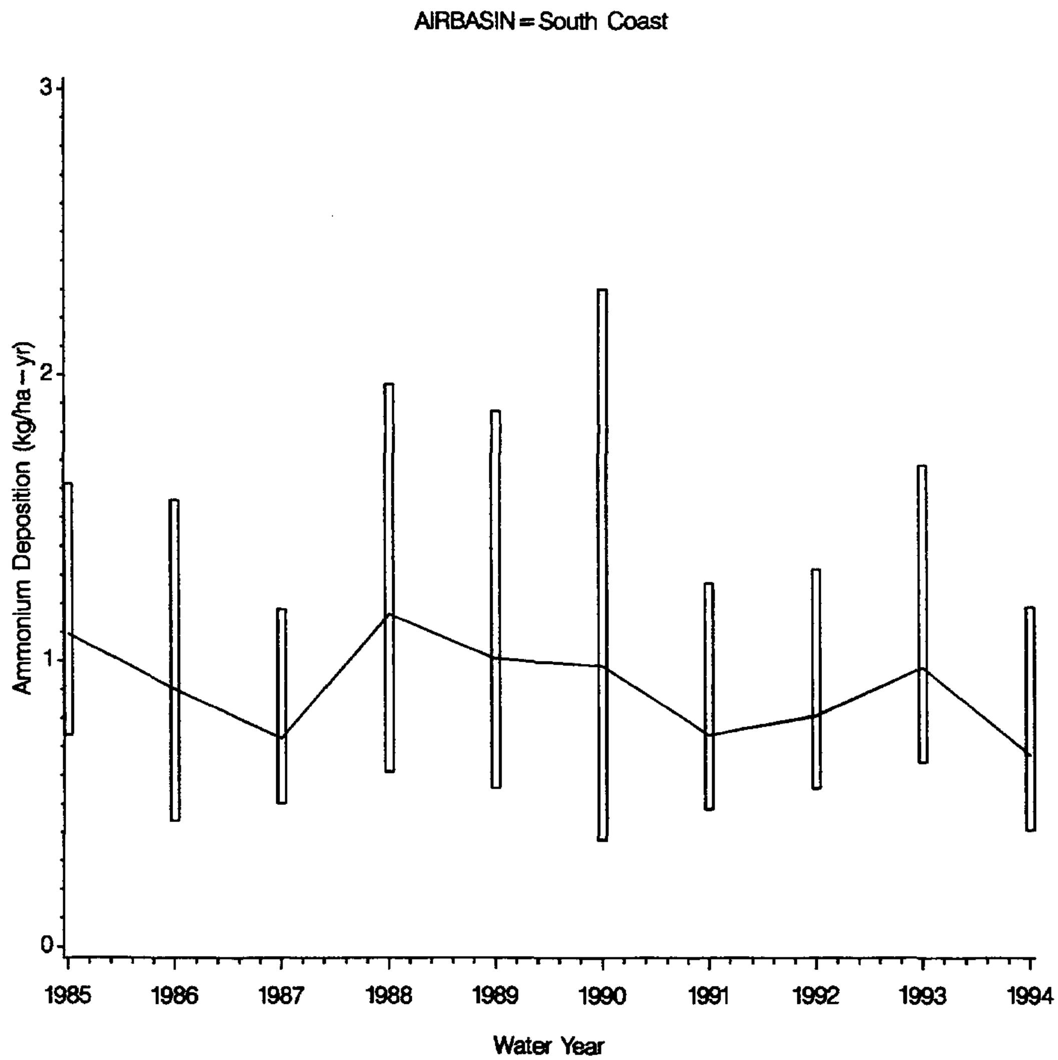

AIRBASIN = Sacramento
3
2
1
0
Ammonium Deposition (kg/ha – yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=San Diego
3
2
1
0
Ammonium Deposition (kg/ha-yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

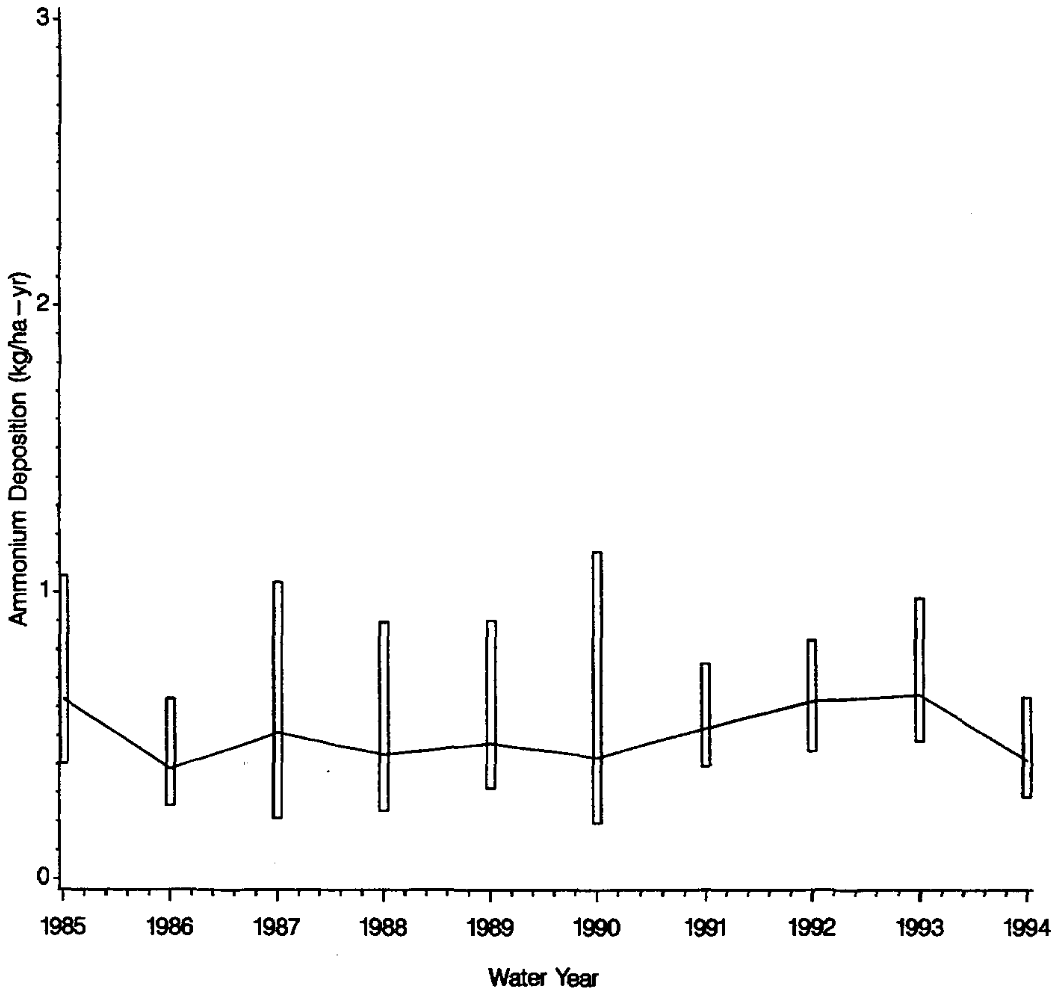

AIRBASIN=San Francisco
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

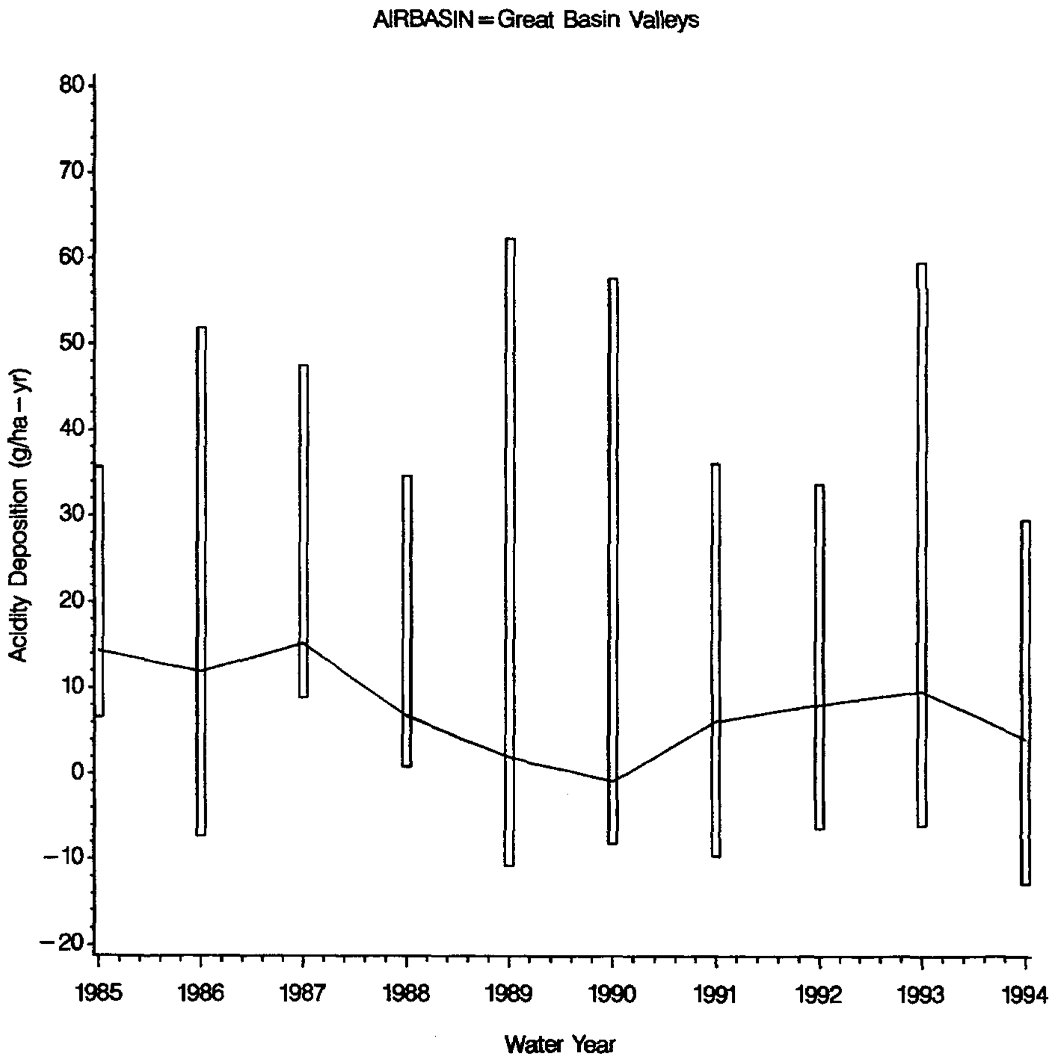

AIRBASIN=San Joaquin
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=South Central Coast
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

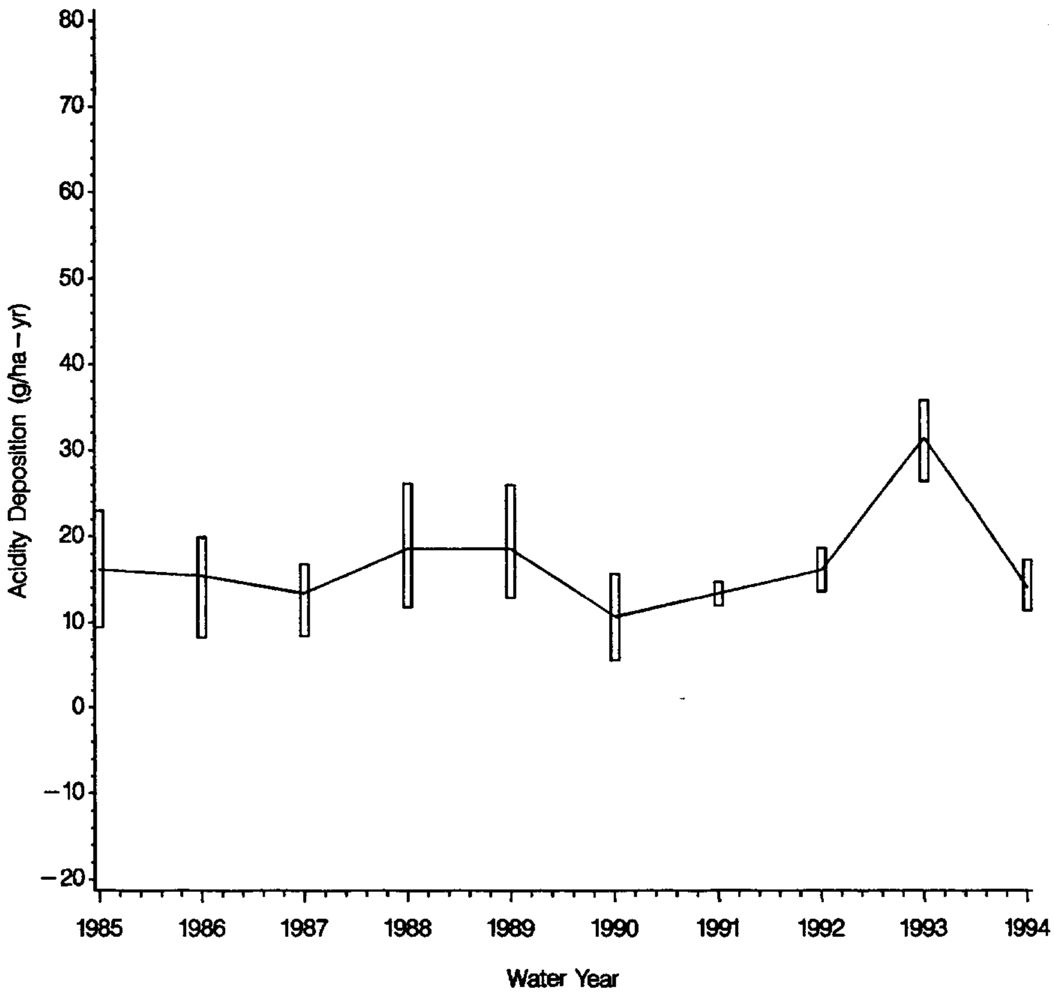

AIRBASIN=South Coast
Ammonium Deposition (kg/ha-yr)
0
1
2
3
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

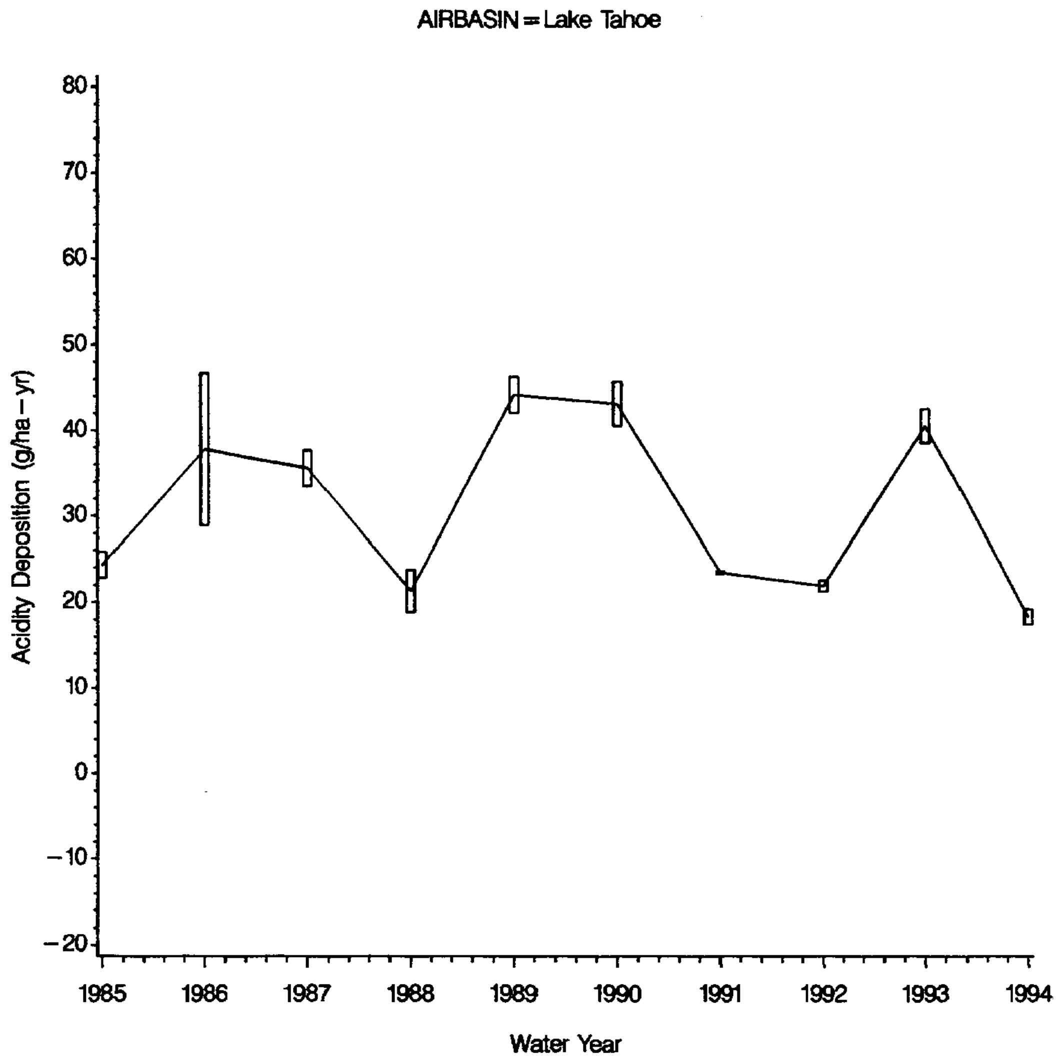
AIRBASIN=South East Desert



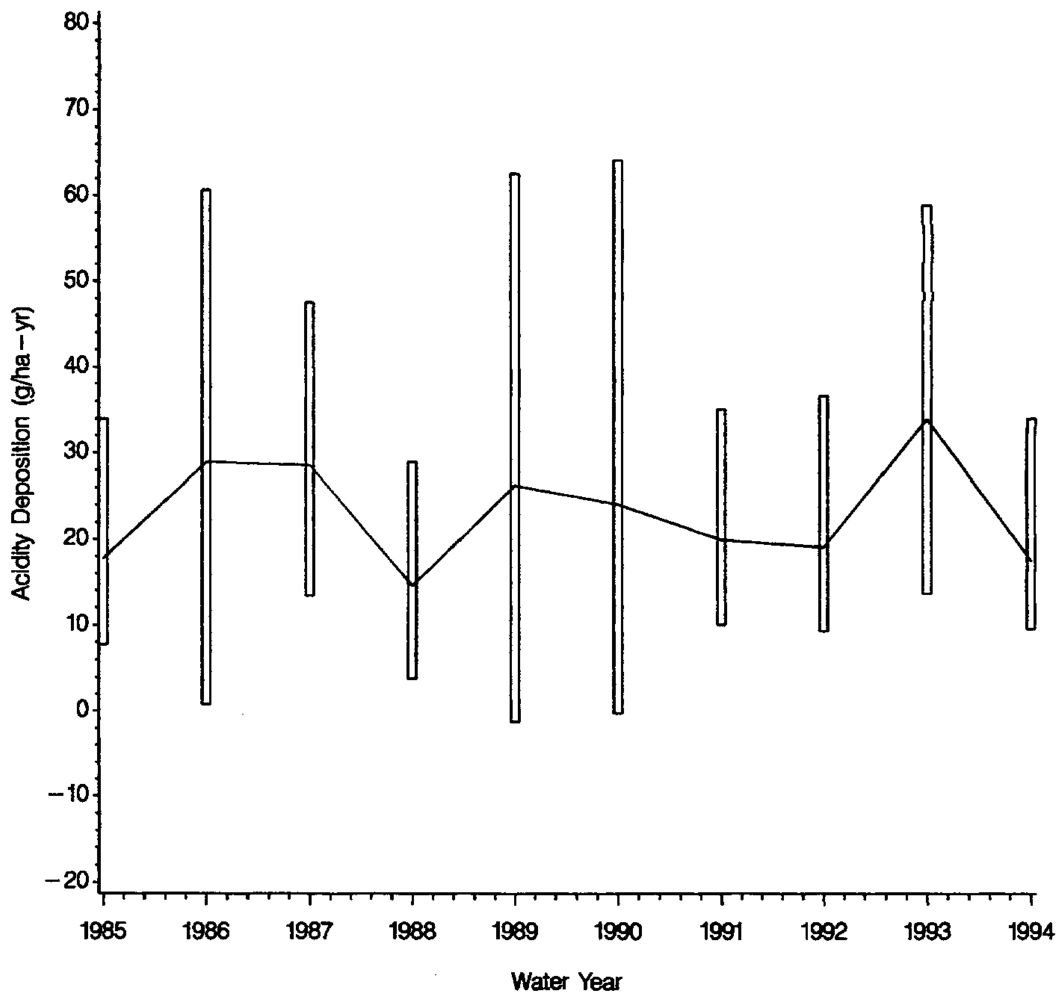

AIRBASIN=Great Basin Valleys
80
70
60
50
40
30
20
10
0
−10
−20
Acidity Deposition (g/ha−yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

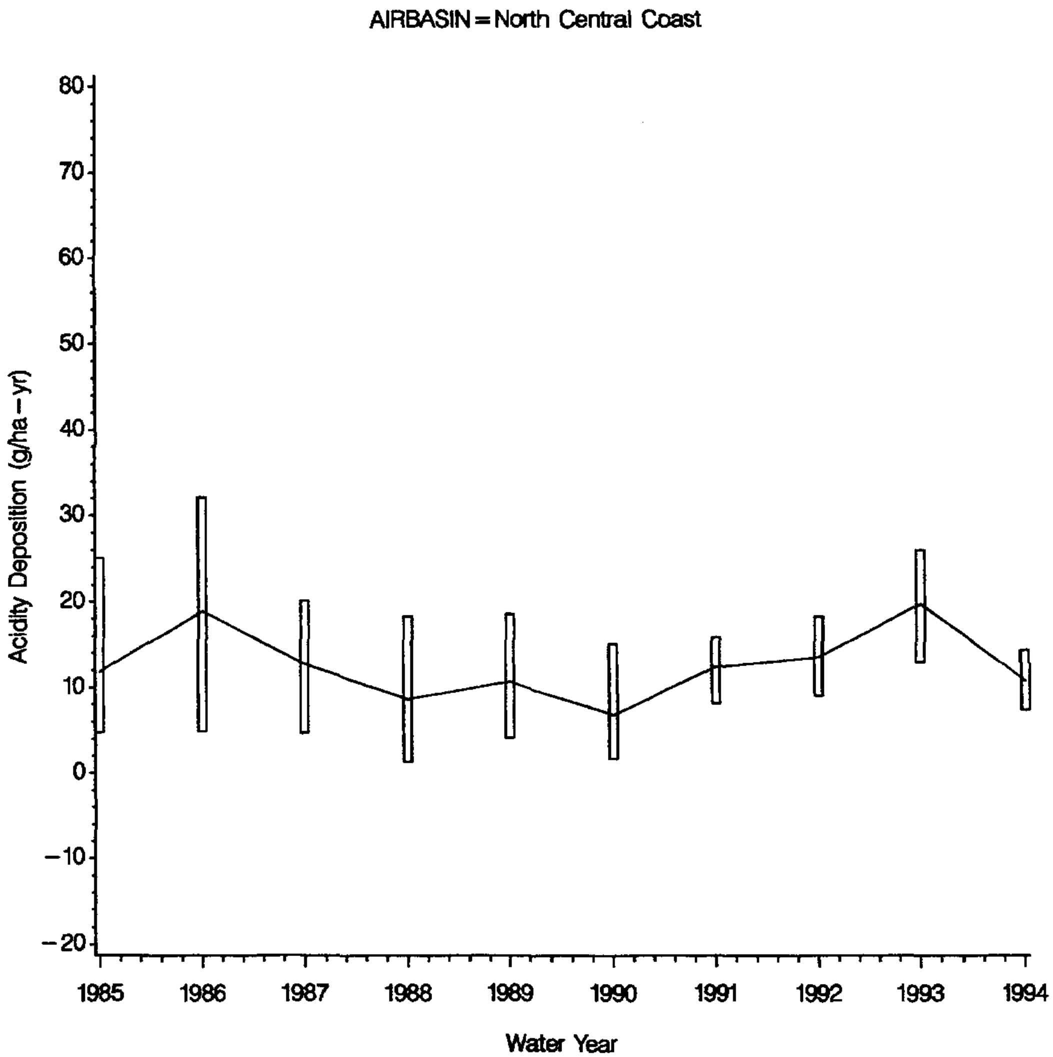
AIRBASIN=Lake County



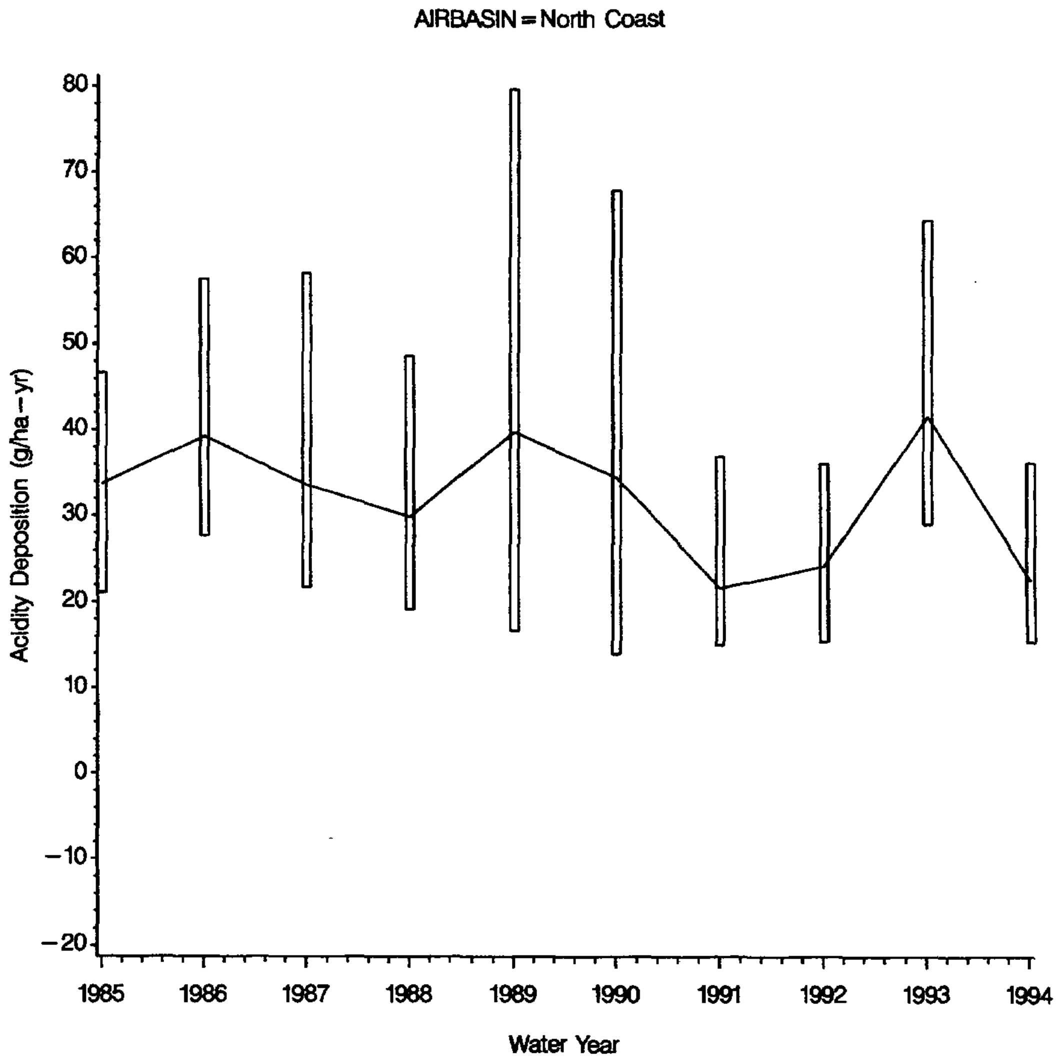

AIRBASIN = Lake Tahoe
80
70
60
50
40
30
20
10
0
−10
−20
Acidity Deposition (g/ha−yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=Mountain Counties

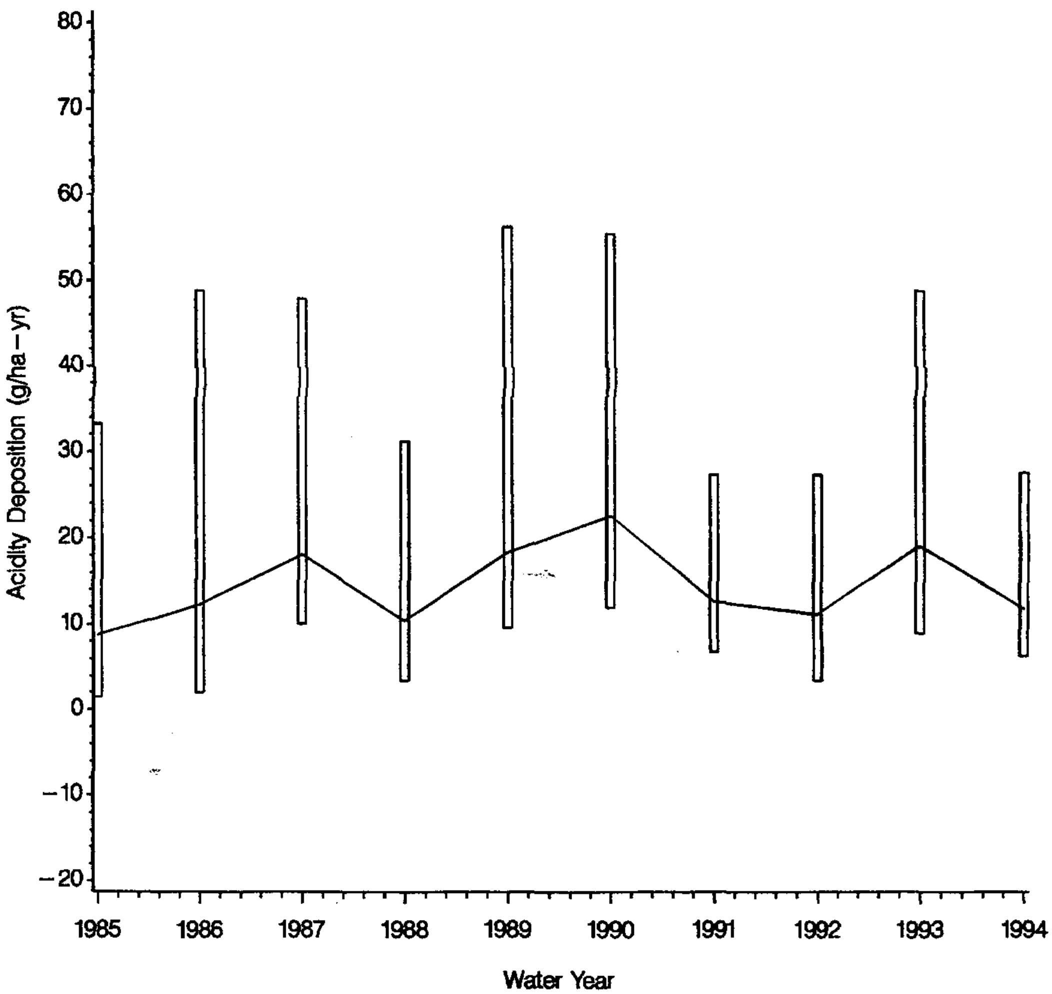


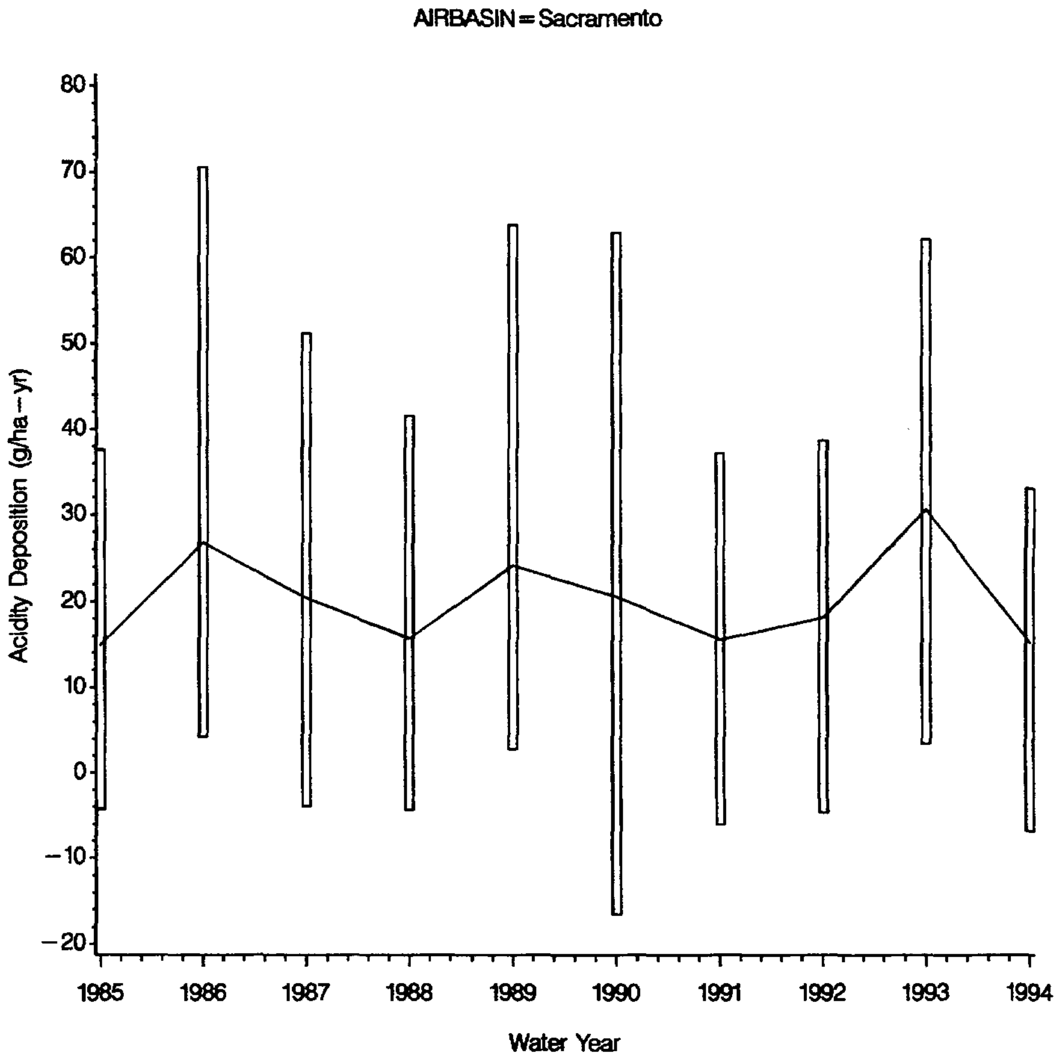


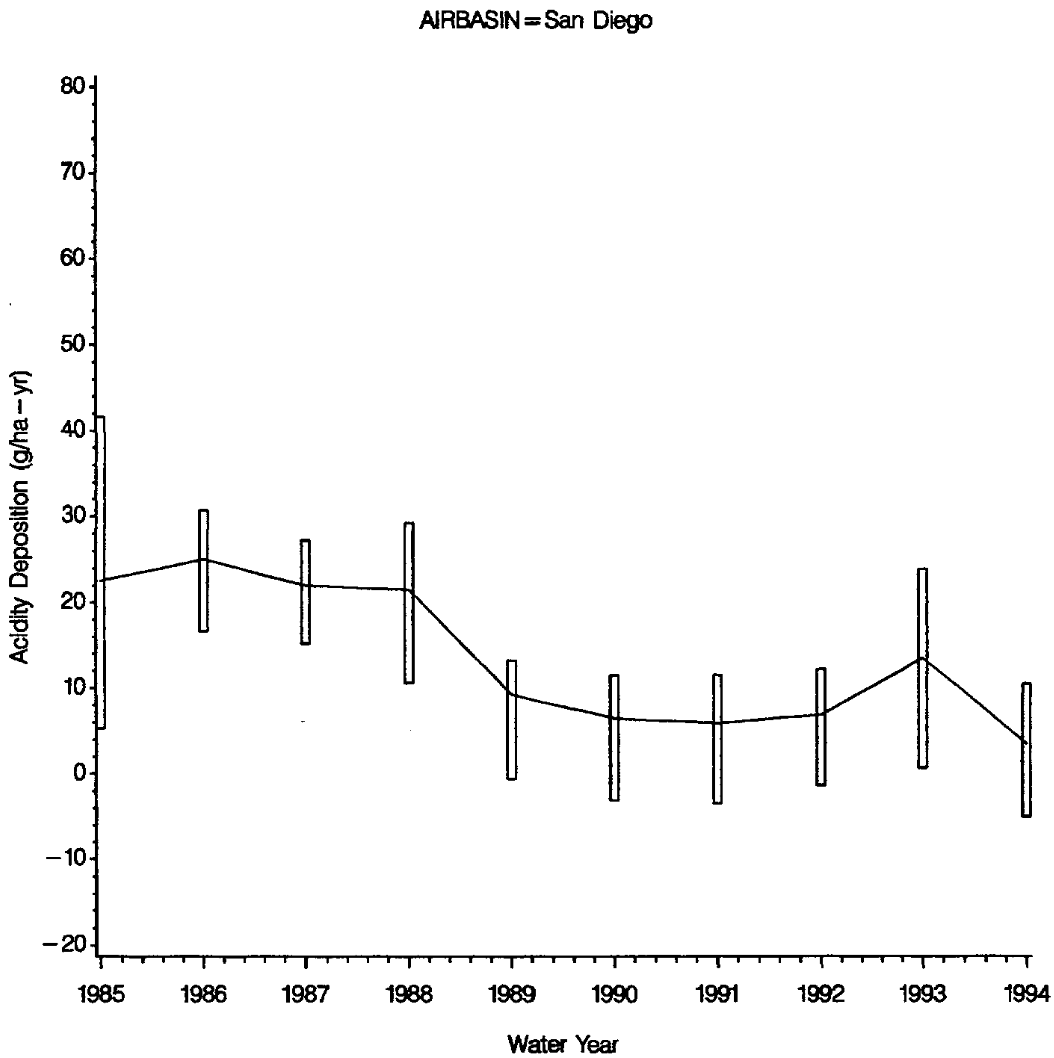
AIRBASIN=North Central Coast
Acidity Deposition (g/ha-yr)
80
70
60
50
40
30
20
10
0
-10
-20
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

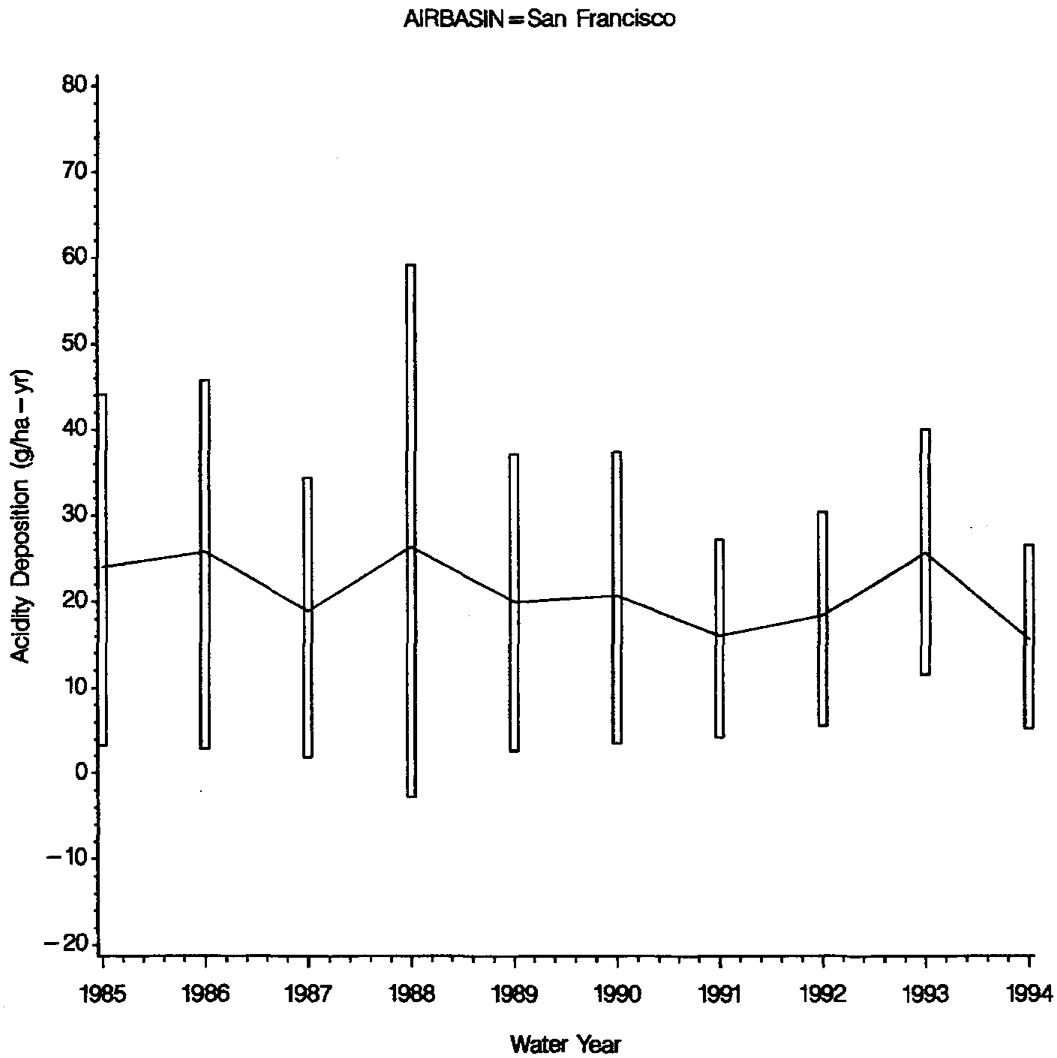

AIRBASIN=North Coast
Acidity Deposition (g/ha-yr)
80
70
60
50
40
30
20
10
0
-10
-20
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

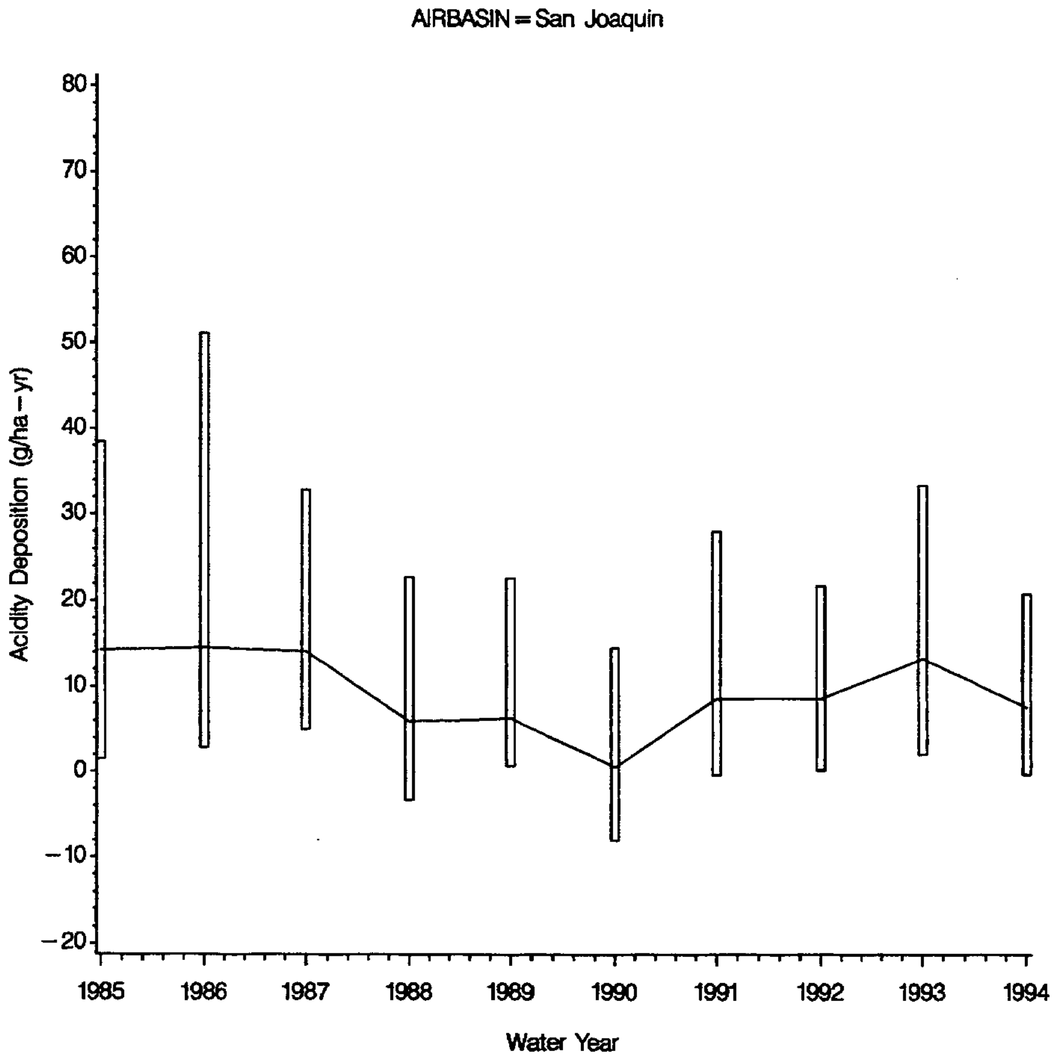
AIRBASIN=Northeast Plateau



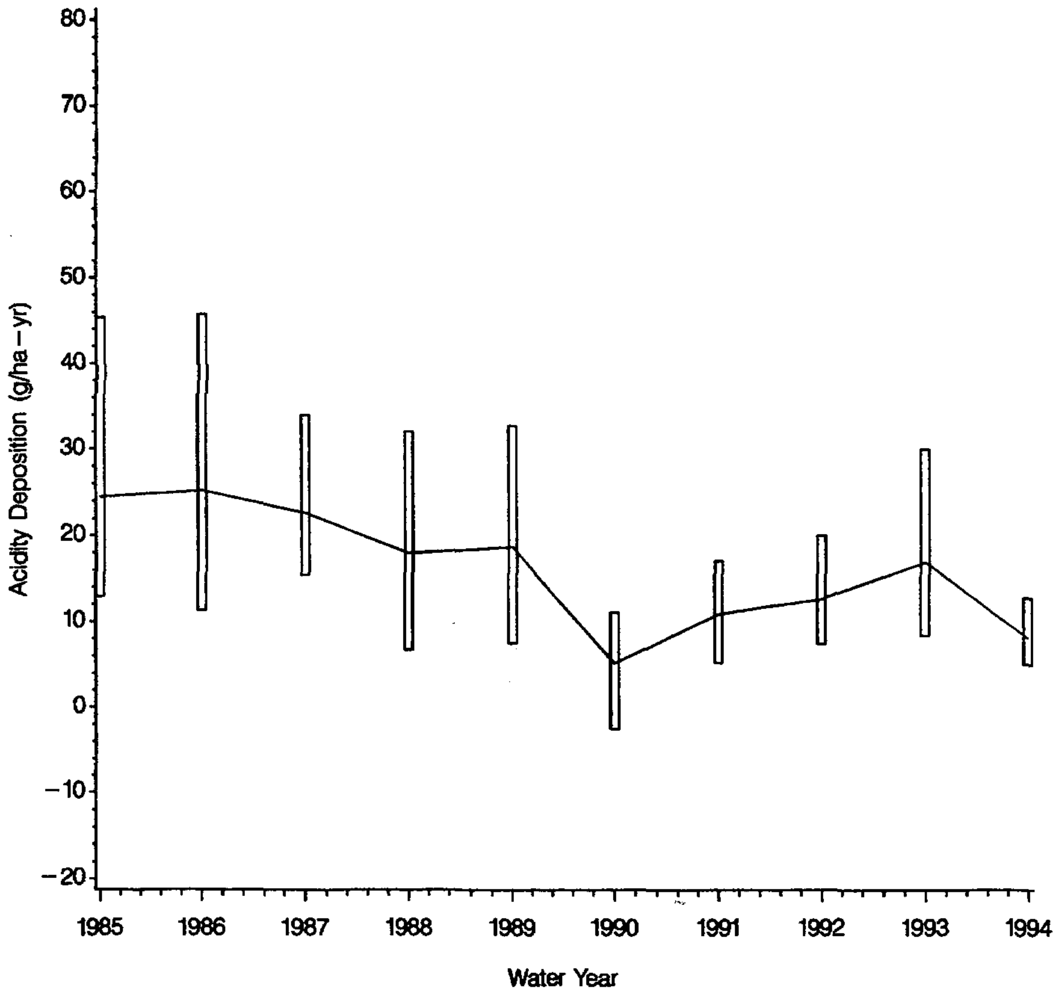

AIRBASIN=Sacramento
80
70
60
50
40
30
20
10
0
−10
−20
Acidity Deposition (g/ha−yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year


AIRBASIN=San Diego
Acidity Deposition (g/ha-yr)
80
70
60
50
40
30
20
10
0
-10
-20
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

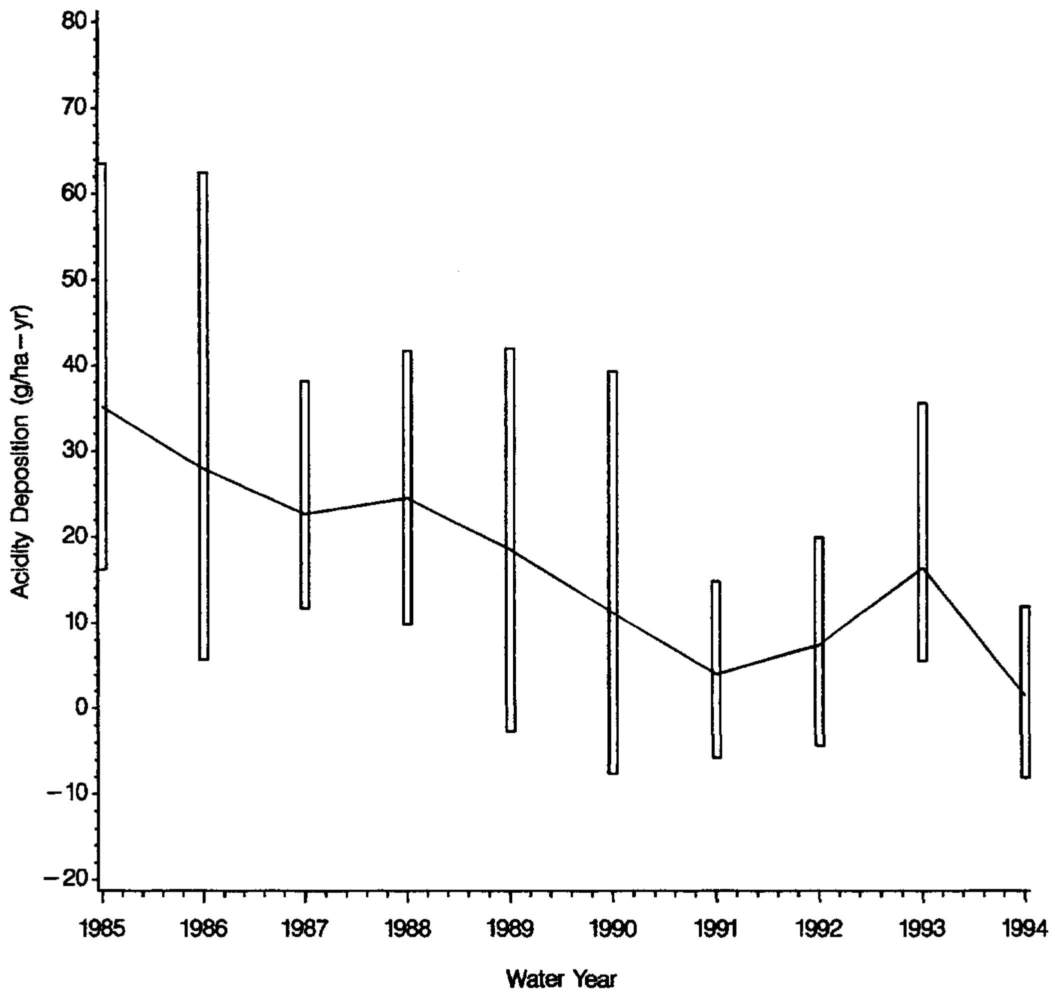

AIRBASIN=San Francisco
80
70
60
50
40
30
20
10
0
−10
−20
Acidity Deposition (g/ha−yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

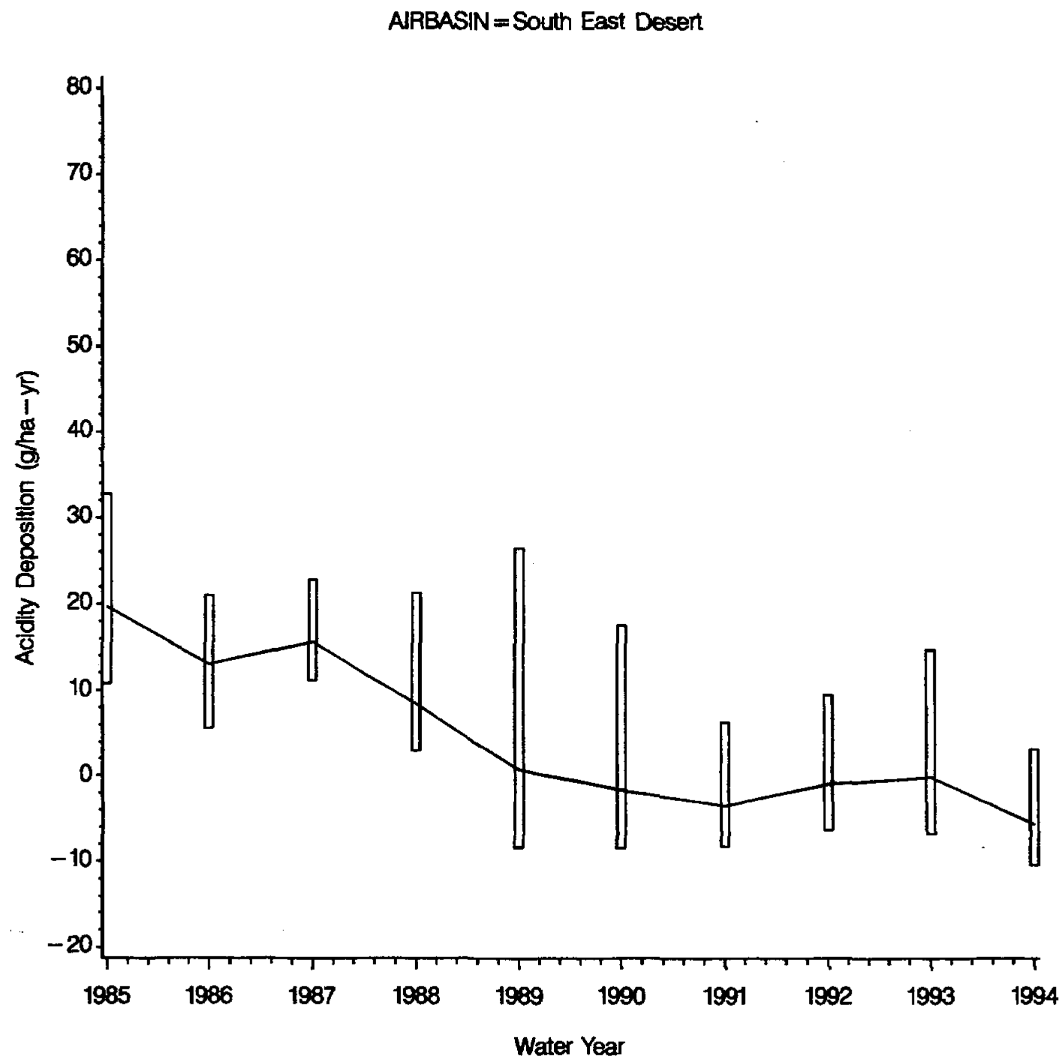

AIRBASIN=San Joaquin
Acidity Deposition (g/ha-yr)
80
70
60
50
40
30
20
10
0
-10
-20
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year

AIRBASIN=South Central Coast



AIRBASIN=South Coast





AIRBASIN=South East Desert
80
70
60
50
40
30
20
10
0
-10
-20
Acidity Deposition (g/ha-yr)
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
Water Year