

Methods

Speciated data samples retrieved from AQS for NC monitors, time covering Jan 2002 through Nov 2004. Converted into an S-Plus object. We construct another object that is multivariate with data points for each site(identified by county name), each sample date, each pollutant species of interest.

We were advised to look for high levels of elemental carbon (EC) and nonsoil potassium as potential indicators of wood smoke. EC is directly obtained from the database. Nonsoil potassium must be estimated. It was suggested that *soil* potassium be estimated by multiplying the sample *iron* concentration by the constant 0.6. Then nonsoil potassium = total potassium – 0.6*iron.

The problem with this? Many data samples occur for which $0.6 \cdot \text{iron} > \text{total potassium}$, leading to inadmissible estimates of soil and nonsoil potassium. This proposed estimator for nonsoil potassium may be approximately unbiased, but if it is negative in $\frac{3}{4}$ of the samples, we have a credibility problem with the estimator. Lacking a better solution to the dilemma for the time being, I simply *truncated* all of the negative estimates at zero (and right-truncated the soil potassium estimates at equal to the total potassium). In the remainder of this report, I label “adj” (adjusted) the estimates that use this truncation rule. Table 1 through Table 13b show both untruncated and adjusted estimates of means. Figure 1 through Figure 12 use the adjusted estimates only.

Results

Without statistical rigor, EC and nonsoil K (adj) appear in general to be slightly higher than the overall averages during the colder 6 months of the year, and correspondingly lower than the averages during the warmer 6 months.

Overall, the highest EC averages are at Catawba, Mecklenburg and Davidson (in that order), and the highest nonsoil K (adj) averages are at Davidson, Caswell and Catawba. However, the Caswell comparison is problematic, because only the two months of Dec and Jan provide valid averages; and Mecklenburg is not among the high nonsoil K (adj) averages – except during *July*. In most of the winter months, the two highest EC averages are at Catawba and Mecklenburg, and the highest nonsoil K (adj) averages are at Davidson. Catawba has the highest nonsoil K (adj) averages in summer months (but Davidson is never second highest at those times). During the warm months, there is no readily apparent pattern for the highest EC average.

Table 1. Mean concentrations (ng/m³) (sorted from highest to lowest elemental carbon)

county	soil.K	nonsoil.K	soil.K(adj)	nonsoil.K(adj)	E.Carbon
Catawba	33	74	33	74	717
Mecklenburg	37	34	35	37	597
Davidson	38	85	38	85	596
Forsyth	27	43	27	44	546

county	soil.K	nonsoil.K	soil.K(adj)	nonsoil.K(adj)	E.Carbon
Wake	39	22	37	23	539
Guilford	37	31	36	32	527
Cumberland	29	31	27	33	499
Buncombe	31	27	31	27	482
Caswell	6	84	6	84	437
Lenoir	19	29	19	30	338

Table 2a. Mean concentrations (ng/m³) January

county	soil.K	nonsoil.K	EC
Catawba	27	75	845
Mecklenburg	35	69	780
Davidson	35	227	723
Forsyth	22	62	747
Wake	37	42	679
Guilford	16	51	484
Cumberland	25	53	686
Buncombe	11	37	383
Caswell	4	90	390
Lenoir	12	38	456

Table 2b. Mean concentrations (ng/m³) January

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	27	75	845
Mecklenburg	34	70	780
Davidson	35	227	723
Forsyth	22	62	747
Wake	35	43	679
Guilford	16	52	484
Cumberland	25	53	686
Buncombe	11	37	383
Caswell	4	90	390
Lenoir	12	38	456

Table 3a. Mean concentrations (ng/m³) February

county	soil.K	nonsoil.K	EC
Catawba	33	84	968
Mecklenburg	31	31	770
Davidson	22	121	681
Forsyth	22	48	675
Wake	36	30	740
Guilford	30	45	564
Cumberland	30	39	755
Buncombe	28	43	581
Caswell	NA	NA	NA
Lenoir	15	28	418

Table 3b. Mean concentrations (ng/m³) February

county	soil.K(adj)	nonsoil.K(adj)	EC
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county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	33	84	968
Mecklenburg	31	31	770
Davidson	22	121	681
Forsyth	22	48	675
Wake	36	30	740
Guilford	30	45	564
Cumberland	28	41	755
Buncombe	28	43	581
Caswell	NA	NA	NA
Lenoir	15	29	418

Table 4a. Mean concentrations (ng/m³) March

county	soil.K	nonsoil.K	EC
Catawba	25	76	696
Mecklenburg	29	26	607
Davidson	33	183	627
Forsyth	19	38	544
Wake	31	20	490
Guilford	23	64	648
Cumberland	19	29	505
Buncombe	19	28	493
Caswell	NA	NA	NA
Lenoir	14	23	330

Table 4b. Mean concentrations (ng/m³) March

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	25	76	696
Mecklenburg	28	27	607
Davidson	33	183	627
Forsyth	19	38	544
Wake	30	21	490
Guilford	23	64	648
Cumberland	19	29	505
Buncombe	19	28	493
Caswell	NA	NA	NA
Lenoir	14	23	330

Table 5a. Mean concentrations (ng/m³) April

county	soil.K	nonsoil.K	EC
Catawba	39	51	785
Mecklenburg	42	19	607
Davidson	41	95	535
Forsyth	34	29	542
Wake	41	15	559
Guilford	41	16	447
Cumberland	29	28	487
Buncombe	37	15	513
Caswell	NA	NA	NA
Lenoir	20	25	429

Table 5b. Mean concentrations (ng/m³) April

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	39	51	785
Mecklenburg	41	20	607
Davidson	41	95	535
Forsyth	34	29	542
Wake	39	17	559
Guilford	41	16	447
Cumberland	29	28	487
Buncombe	37	15	513
Caswell	NA	NA	NA
Lenoir	20	25	429

Table 6a. Mean concentrations (ng/m³) May

county	soil.K	nonsoil.K	EC
Catawba	33	75	536
Mecklenburg	37	37	583
Davidson	51	66	565
Forsyth	32	49	558
Wake	40	29	506
Guilford	30	28	496
Cumberland	28	48	347
Buncombe	42	42	620
Caswell	NA	NA	NA
Lenoir	25	42	328

Table 6b. Mean concentrations (ng/m³) May

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	33	75	536
Mecklenburg	35	39	583
Davidson	51	66	565
Forsyth	32	49	558
Wake	38	31	506
Guilford	30	28	496
Cumberland	27	48	347
Buncombe	42	42	620
Caswell	NA	NA	NA
Lenoir	25	42	328

Table 7a. Mean concentrations (ng/m³) June

county	soil.k	nonsoil.K	EC
Catawba	30	54	576
Mecklenburg	39	14	501
Davidson	46	72	500
Forsyth	26	41	413
Wake	44	24	440
Guilford	30	28	422
Cumberland	32	49	417
Buncombe	26	26	409
Caswell	NA	NA	NA
Lenoir	32	71	288

Table 7b. Mean concentrations (ng/m³) June

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	30	54	576
Mecklenburg	37	17	501
Davidson	46	72	500
Forsyth	26	41	413
Wake	43	25	440
Guilford	30	28	422
Cumberland	32	49	417
Buncombe	26	26	409
Caswell	NA	NA	NA
Lenoir	29	73	288

Table 8a. Mean concentrations (ng/m³) July

county	soil.k	nonsoil.K	EC
Catawba	50	79	495
Mecklenburg	53	115	444
Davidson	42	69	492
Forsyth	45	44	392
Wake	56	29	406
Guilford	82	7	543
Cumberland	41	19	274
Buncombe	42	32	393
Caswell	NA	NA	NA
Lenoir	35	20	199

Table 8b. Mean concentrations (ng/m³) July

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	50	80	495
Mecklenburg	47	120	444
Davidson	42	69	492
Forsyth	43	46	392
Wake	49	36	406
Guilford	75	14	543
Cumberland	37	23	274
Buncombe	40	34	393
Caswell	NA	NA	NA
Lenoir	31	24	199

Table 9a. Mean concentrations (ng/m³) August

county	soil.k	nonsoil.K	EC
Catawba	36	58	593
Mecklenburg	35	7	437
Davidson	33	35	542
Forsyth	26	34	405
Wake	36	9	487
Guilford	49	18	488
Cumberland	28	8	290
Buncombe	43	11	420
Caswell	NA	NA	NA
Lenoir	17	15	182

Table 9b. Mean concentrations (ng/m³) August

county	soil.K(adj)	nonsoil.K(adj)	EC	
Catawba	35	58		593
Mecklenburg	32	10		437
Davidson	33	35		542
Forsyth	26	35		405
Wake	35	10		487
Guilford	45	22		488
Cumberland	26	9		290
Buncombe	42	12		420
Caswell	NA	NA		NA
Lenoir	17	15		182

Table 10a. Mean concentrations (ng/m³) September

county	soil.k	nonsoil.K	EC	
Catawba	34	58		743
Mecklenburg	32	5		464
Davidson	39	19		563
Forsyth	23	28		395
Wake	28	12		366
Guilford	32	13		382
Cumberland	41	-3		391
Buncombe	37	20		471
Caswell	NA	NA		NA
Lenoir	15	17		260

Table 10b. Mean concentrations (ng/m³) September

county	soil.K(adj)	nonsoil.K(adj)	EC	
Catawba	34	58		743
Mecklenburg	27	9		464
Davidson	37	21		563
Forsyth	23	28		395
Wake	26	13		366
Guilford	32	13		382
Cumberland	30	8		391
Buncombe	37	20		471
Caswell	NA	NA		NA
Lenoir	15	17		260

Table 11a. Mean concentrations (ng/m³) October

county	soil.k	nonsoil.K	EC	
Catawba	32	93		819
Mecklenburg	35	17		575
Davidson	38	55		723
Forsyth	28	45		720
Wake	42	15		605
Guilford	28	35		595
Cumberland	27	30		662
Buncombe	32	23		606
Caswell	NA	NA		NA
Lenoir	15	26		546

Table 11b. Mean concentrations (ng/m³) October

county	soil.K(adj)	nonsoil.K(adj)	EC	
Catawba	32	93		819
Mecklenburg	34	19		575
Davidson	38	55		723
Forsyth	28	45		720
Wake	40	17		605
Guilford	28	35		595
Cumberland	27	30		662
Buncombe	32	23		606
Caswell	NA	NA		NA
Lenoir	15	26		546

Table 12a. Mean concentrations (ng/m³) November

county	soil.k	nonsoil.K	EC	
Catawba	25	101		805
Mecklenburg	43	24		788
Davidson	29	74		786
Forsyth	24	55		663
Wake	46	20		685
Guilford	32	41		954
Cumberland	25	39		607
Buncombe	17	21		424
Caswell	NA	NA		NA
Lenoir	13	26		321

Table 12b. Mean concentrations (ng/m³) November

county	soil.K(adj)	nonsoil.K(adj)	EC	
Catawba	25	101		805
Mecklenburg	40	27		788
Davidson	29	74		786
Forsyth	24	55		663
Wake	41	24		685
Guilford	32	41		954
Cumberland	25	39		607
Buncombe	17	21		424
Caswell	NA	NA		NA
Lenoir	13	26		321

Table 13a. Mean concentrations (ng/m³) December

county	soil.k	nonsoil.K	EC	
Catawba	24	97		731
Mecklenburg	34	52		823
Davidson	NA	NA		NA
Forsyth	21	59		601
Wake	27	19		589
Guilford	30	50		663
Cumberland	22	45		657
Buncombe	20	38		483

county	soil.k	nonsoil.K	EC	
Caswell		9	77	468
Lenoir		13	23	360

Table 13b. Mean concentrations (ng/m³) December

county	soil.K(adj)	nonsoil.K(adj)	EC
Catawba	24	97	731
Mecklenburg	34	52	823
Davidson	NA	NA	NA
Forsyth	21	59	601
Wake	27	20	589
Guilford	30	50	663
Cumberland	22	45	657
Buncombe	20	38	483
Caswell	9	77	468
Lenoir	13	23	360