Supplementary Information for:

Determining the spatial and seasonal variability in OM/OC ratios across the U.S. using multiple regression

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S1. Methodology

S1.1. Calculating the variance of regression coefficients

To find the estimated variance associated with the regression coefficients in equation (11), we need to make some additional calculations. This discussion, like that in Sec. 2.3, is based entirely on the work of Fuller (1987) (Sec 3.1.2), conforming to his original notation as much as is feasible. We begin by defining the matrix $\hat{M}_{z\pi z}$ as

$$\hat{M}_{z\pi z} = n^{-1}\sum_{t=1}^{n}[\tilde{\sigma}_{vvtt}^{-1}(Z_t' Z_t - \Sigma_{aatt})] \qquad \text{(S1)}$$

We are most interested in the lower right submatrix of $\hat{M}_{z\pi z}$; i.e., the submatrix which remains when the first row and first column of $\hat{M}_{z\pi z}$ are removed. We call this k x k submatrix $\hat{M}_{x\pi x}$, where k is the number of explanatory variables in the regression model.

The estimated covariance matrix associated with our estimated regression coefficients is given by

$$\hat{V}(\hat{\beta}) = n^{-2}\hat{M}_{x\pi x}^{-1}\{\sum_{t=1}^{n}[\tilde{\sigma}_{vvtt}^{-1}(X_t' X_t + \tilde{\sigma}_{vvtt}^{-1}\Sigma_{uutt}\tilde{\beta}\tilde{\beta}'\Sigma_{uutt})]\}\hat{M}_{x\pi x}^{-1} \qquad \text{(S2)}$$

As mentioned in Sec 2.3, the diagonal elements of the matrix given by $\hat{V}(\hat{\beta})$ are the estimated variances associated with each of the regression coefficients (each of the elements of $\hat{\beta}$). The square roots of these variances are referred to as the estimated standard errors for the regression coefficients.

S1.2. Sample R Code

The following R code can be used to calculate regression coefficients

```
# load functions necessary for these calculations
source("func_for_beta_est.r")

# calculate response variable
data$response <- data$PM25_Value - (data$EC_Value + 1.2*data$knon_Value +
1.8*data$Cl_Value)

# Set up a data frame with response variable and covariates.  Each entry in the data
# frame (measured sample) includes values and reported uncertainties for the PM
# components
regdata <- data.frame(y = data$response, sulfate = data$ammsulfate, nitrate <-
      data$ammnitrate_Value, OC = data$OC_Value, soil = data$soil_Value, y_Unc =
      data$response_Unc, sulfate_Unc = data$ammsulfate_Unc, nitrate_Unc =
      data$ammnitrate_Unc, OC_Unc = data$OC_Unc, soil_Unc = data$soil_Unc)

# Create a data frame.  Each row contains the name of the covariate value in the
# first column and the name of the column containing the uncertainty values for that
# variable in the second column.
names.covariates.columns.df <- data.frame(value=c("sulfate", "nitrate", "OC", "soil"),
sd=c("sulfate_Unc", "nitrate_Unc", "OC_Unc", "soil_Unc"), stringsAsFactors=F)
      num.covariates = nrow(names.covariates.columns.df)

# Create a data frame containing just one row.  The first column should hold the name of
# the column for the response variable value.  The second column should hold the name
# of the column for the error associated with the response.
names.response.columns.df <- data.frame(value="y", sd="y_Unc", stringsAsFactors=F)

# obtain preliminary estimate for betas
prelim.beta.est <- find.prelim.beta.est(regdata, names.response.columns.df,
      names.covariates.columns.df)

# Calculate var.qq given preliminary estimate
var.qq <- find.var.qq(regdata, names.response.columns.df, names.covariates.columns.df,
      prelim.beta.est)

# calculate new beta est, G, M.zpiz
beta.est.etc <- find.beta.est.etc(regdata, names.response.columns.df,
      names.covariates.columns.df, var.qq, prelim.beta.est)
beta.est <- beta.est.etc$beta.est
M.zpiz <- beta.est.etc$M.zpiz
var.beta.est <- find.beta.est.var(regdata, names.response.columns.df,
      names.covariates.columns.df, var.qq, M.zpiz)
stdev.beta.est <- sqrt(diag(var.beta.est))
```

```
var.beta.est <- find.beta.est.var(regdata, names.response.columns.df,
      names.covariates.columns.df, var.qq, M.zpiz)
stdev.beta.est <- sqrt(diag(var.beta.est))

sulfate_coeff <- beta.est[1]
nitrate_coeff <- beta.est[2]
oc_coeff <- beta.est[3]
soil_coeff <- beta.est[4]
sulfate_stdev <- stdev.beta.est[1]
nitrate_stdev <- stdev.beta.est[2]
oc_stdev <- stdev.beta.est[3]
soil_stdev <- stdev.beta.est[4]
```

Below is the text from a file that defines the functions needed to estimate the regression coefficients and standard deviations: func_for_beta_est.r.

```
##### find.prelim.beta.est function #####
find.prelim.beta.est <- function(data.df, names.response.columns.df,
      names.covariates.columns.df){

  # The number of observations is equal to the number of rows of data.df
  num.obs <- nrow(data.df)

  # The number of covariates is equal to the number of rows of
  # names.covariates.columns.df.
  num.covariates <- nrow(names.covariates.columns.df)


   # Initialize at 0.
   M.xx <- matrix(0.0, nrow=num.covariates, ncol=num.covariates)
   M.xy <- rep(0.0, num.covariates)

  for (j in 1:num.obs){

     # Calculate beta estimate.
     X.j <- as.vector(as.matrix(data.df[j, names.covariates.columns.df$value]))
     Y.j <- data.df[j, names.response.columns.df$value]

     M.xy <- M.xy + (X.j * Y.j)

     # Covariance matrix of measurement standard deviations among covariates.
     cov.uu <- diag(as.vector(as.matrix(data.df[j, names.covariates.columns.df$sd]^2)),
     ncol=num.covariates, nrow=num.covariates)
     M.xx <-  M.xx + ( X.j %*% t(X.j)  - cov.uu )
   }

```

```
  M.xy <- M.xy / num.obs
  M.xx <- M.xx / num.obs

  return(as.vector(solve(M.xx) %*% M.xy))
}

##### find.var.qq function #####
find.var.qq <- function(data.df, names.response.columns.df,
names.covariates.columns.df, prelim.beta.est){

  # The number of observations is equal to the number of rows of
  # data.df
  num.obs <- nrow(data.df)

  # The number of covariates is equal to the number of rows of
  # names.covariates.columns.df.
  num.covariates <- nrow(names.covariates.columns.df)

  # Initialize at 0.
  sig.qq <- 0.0
  A <- matrix(0, num.covariates+1, num.covariates+1)
  M <- matrix(0, num.covariates+1, num.covariates+1)

  # Loop through the observations, adding a contribution from each to sig.qq.
  for (j in 1:num.obs){

     # Identify response, covariates, and combined error matrix for
     # observation j.
     X.j <- as.vector(as.matrix(data.df[j, names.covariates.columns.df$value]))
     Y.j <- data.df[j, names.response.columns.df$value]
     cov.aa <- diag(as.vector(as.matrix(data.df[j, c(names.response.columns.df$sd,
          names.covariates.columns.df$sd)]^2)), ncol=num.covariates+1,
          nrow=num.covariates+1)

     ## Calculate var.qq estimate.
     first.part <- ( (Y.j - (t(X.j) %*% prelim.beta.est))^2 ) / (num.obs - num.covariates)
     one.and.neg.beta <- c(1.0, -prelim.beta.est)
     second.part <- ( t(one.and.neg.beta) %*% cov.aa %*% one.and.neg.beta ) / num.obs

     sig.qq <- sig.qq + (first.part - second.part)

     ## Calculate generalized eigenvalues.
     A <- A + ( c(Y.j, X.j) %*% t(c(Y.j, X.j)) )
     M <- M + cov.aa
   }

```

```
 1
 2      # Find the minimum of the generalized eigenvalues det(A - lamda M)
 3      # = 0.  Since our M is diagonal, we can simplify this to finding
 4      # the eigenvalues (in the standard fashion) of inv(M) %*% A.  We
 5      # know that these eigenvalues must be real, so any small imaginary
 6      # parts are numerical artifacts.
 7      lambda <- min ( Re( eigen(solve(M) %*% A)$values ) )
 8
 9
10      # If the lambda is smaller than one, then sig.qq should be 0,
11      # instead of the value we calculated in the loop.
12      if (lambda < 1)
13           return(0)
14      else
15           return(as.vector(sig.qq))
16      }
17
18    ##### find.var.vv.for.inidiv.obs function #####
19    # Assumes no correlation among covariate measurement errors and no
20    # correlation between covariate response measurement errors.
21    find.var.vv.for.indiv.obs <- function(var.qq, response.sd, covariates.sd, prelim.beta.est){
22
23      var.ww <- response.sd^2
24      cov.uu <- diag(covariates.sd^2, ncol=num.covariates, nrow=num.covariates)
25
26      return( as.vector(var.qq + var.ww + ( t(prelim.beta.est) %*% cov.uu %*%
27           prelim.beta.est ) ) )
28    }
29
30    ##### find.beta.est.etc function #####
31    find.beta.est.etc <- function(data.df, names.response.columns.df,
32           names.covariates.columns.df, var.qq, prelim.beta.est){
33
34      # The number of observations is equal to the number of rows of data.df
35      num.obs <- nrow(data.df)
36
37      # The number of covariates is equal to the number of rows of
38      # names.covariates.columns.df.
39      num.covariates <- nrow(names.covariates.columns.df)
40
41      # Initialize to 0.
42      G <- matrix(0.0, nrow=num.covariates, ncol=num.covariates)
43      mult1 <- matrix(0.0, nrow=num.covariates, ncol=num.covariates)
44      mult2 <- rep(0.0, num.covariates)
45      M.zpiz <- matrix(0.0, nrow=num.covariates+1, ncol=num.covariates+1)
46
```

```
 1
 2      for (j in 1:num.obs){
 3
 4        # Find var.vv for this observation.
 5        var.vv <- find.var.vv.for.indiv.obs(var.qq, response.sd=as.vector(data.df[j,
 6              names.response.columns.df$sd]), covariates.sd=as.vector(as.matrix(data.df[j,
 7              names.covariates.columns.df$sd])), prelim.beta.est)
 8
 9        cov.uu <- diag(as.vector(as.matrix(data.df[j, names.covariates.columns.df$sd]^2)),
10              ncol=num.covariates, nrow=num.covariates)
11        cov.uv <- -cov.uu %*% prelim.beta.est
12
13
14        # Now, we have enough info to get G.
15        X.j <- as.vector(as.matrix(data.df[j, names.covariates.columns.df$value]))
16        G <- G + ( ( (X.j %*% t(X.j) ) * var.vv) + (cov.uv %*% t(cov.uv)) )
17
18        # Find final beta estimate.
19
20        # Find Y.j
21        Y.j <- data.df[j, names.response.columns.df$value]
22
23        # Combine with var.vv, X.j, and cov.uu.
24        # First multiplier.
25        mult1 <- mult1 + ( ( ( X.j %*% t(X.j) ) - cov.uu ) / var.vv )
26        mult2 <- mult2 + ( (X.j * Y.j) / var.vv )
27
28        # Find M.zpiz.
29
30        Z.j <- c(Y.j, X.j)
31        cov.aa <- diag(as.vector(as.matrix(data.df[j, c(names.response.columns.df$sd,
32              names.covariates.columns.df$sd)]^2)), ncol=num.covariates+1,
33              nrow=num.covariates+1)
34        M.zpiz <- M.zpiz + ( ( ( Z.j %*% t(Z.j) ) - cov.aa ) / var.vv )
35
36      }
37
38      G <- G / num.obs
39      beta.est <- solve(mult1) %*% mult2
40      M.zpiz <- M.zpiz / num.obs
41
42      return(list(beta.est=as.vector(beta.est), G=G, M.zpiz=M.zpiz))
43    }
44
45
46
```

```
##### find.beta.est.var function #####
find.beta.est.var <- function(data.df, names.response.columns.df,
      names.covariates.columns.df, var.qq, M.zpiz){

 # The number of observations is equal to the number of rows of
 # data.df
 num.obs <- nrow(data.df)

 # The number of covariates is equal to the number of rows of
 # names.covariates.columns.df.
 num.covariates <- nrow(names.covariates.columns.df)

 # Initialize to 0.
 mid.part <- matrix(0.0, nrow=num.covariates, ncol=num.covariates)

 for (j in 1:num.obs){

  cov.uu <- diag(as.vector(as.matrix(data.df[j, names.covariates.columns.df$sd]^2)),
       ncol=num.covariates, nrow=num.covariates)
  cov.uv <- -cov.uu %*% prelim.beta.est

  X.j <- as.vector(as.matrix(data.df[j, names.covariates.columns.df$value]))

  var.vv <- find.var.vv.for.indiv.obs(var.qq, response.sd=as.vector(data.df[j,
       names.response.columns.df$sd]), covariates.sd=as.vector(as.matrix(data.df[j,
       names.covariates.columns.df$sd])), prelim.beta.est)

  mid.part <- mid.part + ( ( (X.j %*% t(X.j)) + ((cov.uv %*% t(cov.uv))/var.vv) ) /
       var.vv )
 }

 M.xpix <- M.zpiz[-1, -1]

 return( (1.0/(num.obs^2)) * (solve(M.xpix) %*% mid.part %*% solve(M.xpix)) )
}
```

S2. Sulfate coefficient analysis

Table S1 was created to show how β_{sulf} should change with RH and degree of sulfate neutralization (DSN) (NH_4HSO_4 represents a DSN of 1 and $(NH_4)_2SO_4$ represents a DSN of 2.) Table S1 was created using the AIM model (2002) to estimate total water mass associated with sulfate aerosols for both the dry hysteresis branch and for supersaturated aerosols. The RH at which sulfate switched from wet to dry was based on efflorescence relative humidities reported by (Colberg et al., 2003). Dry aerosols are represented in red and wet aerosols in blue. Figure S1 shows seasonal variation in the measurement laboratory RH based on several years of data. For this same time period, 90% of the samples were weighed between 5 and 29 days after sampling, so samples are generally weighed during the same time of year as they are sampled. To determine if estimated seasonal variation in β_{sulf} values is reasonable, we examined measurements from the CSN network which measures ammonium in addition to sulfate and nitrate concentrations (downloaded September 24, 2009 from http://www.epa.gov/cgi-bin/htmSQL/mxplorer/query_spe.hsql). DSN for CSN sites between 1999 and 2007 was calculated assuming that all nitrate is in the form of ammonium nitrate and that any ammonium not bound to nitrate is bound to sulfate (Equation S3). A degree of DSN of 2 would mean that there were two moles of ammonium available to bond with every mole of sulfate, indicating fully neutralized ammonium sulfate.

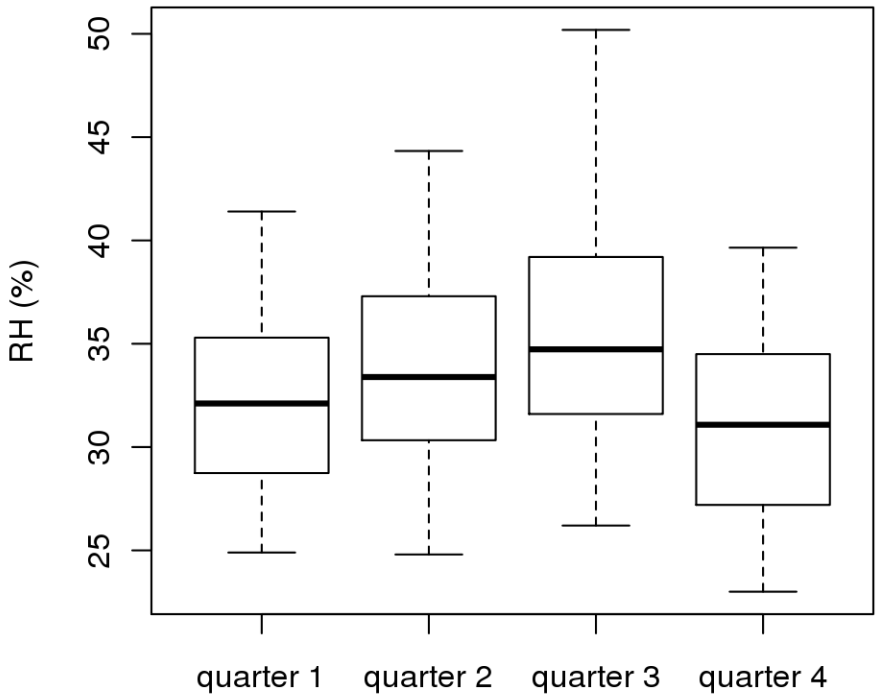
$$DSN = \frac{NH_4(moles) - NO_3(moles)}{SO_4(moles)} \qquad \text{(S3)}$$

These calculations showed that DSN does indeed vary seasonally in the central region, the great lakes region, and the northeast region, with lesser degrees of seasonal variation in the central region and the western region. These seasonal variations in DSN are consistent with measurements reported from the Pittsburgh supersite which showed that sulfate was fully neutralized in the winter but not in the summer (Khlystov et al., 2005). The calculated neutralization states were used to predict β_{sulf} values for CSN sites using Table S1 as a look-up table and assuming RH to be 35% in q1, 37% in q2, 39% in q3, and 35% in q4 (Figure S2b) . Estimated β_{sulf} values from the regression analysis are

shown in Figure S2a for comparison. These calculated CSN β_{sulf} values show a seasonal pattern similar to that estimated by our regression analysis with both having higher values in the summer and lower values in the winter. This analysis suggests that the trends predicted by this regression analysis are reasonably explained by known physical phenomena.

Table S1. Estimated β_{sulf} values based on RH and degree of sulfate neutralization

RH	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
30%	1.03	1.00	0.99	1.01	1.04	0.94	0.94	0.96	0.97	0.99	1.00
31%	1.04	1.01	1.00	1.01	1.05	0.94	0.94	0.96	0.97	0.99	1.00
32%	1.05	1.02	1.01	1.02	1.05	0.94	0.94	0.96	0.97	0.99	1.00
33%	1.06	1.03	1.02	1.03	1.06	0.94	0.94	0.96	0.97	0.99	1.00
34%	1.07	1.04	1.03	1.04	1.07	1.12	0.94	0.96	0.97	0.99	1.00
35%	1.08	1.05	1.04	1.05	1.08	1.13	0.94	0.96	0.97	0.99	1.00
36%	1.09	1.06	1.05	1.06	1.09	1.13	1.18	0.96	0.97	0.99	1.00
37%	1.11	1.07	1.06	1.06	1.10	1.14	1.19	0.96	0.97	0.99	1.00
38%	1.12	1.08	1.07	1.07	1.11	1.15	1.20	0.96	0.97	0.99	1.00
39%	1.13	1.09	1.08	1.08	1.12	1.16	1.21	0.96	0.97	0.99	1.00
40%	1.14	1.11	1.09	1.10	1.13	1.18	1.22	1.26	0.97	0.99	1.00
41%	1.15	1.12	1.10	1.11	1.14	1.19	1.23	1.27	1.30	0.99	1.00
42%	1.17	1.13	1.11	1.12	1.15	1.20	1.24	1.28	1.31	1.34	1.00



1

2

3 Figure S1. Seasonal variation in RH in the IMPROVE measurement laboratory

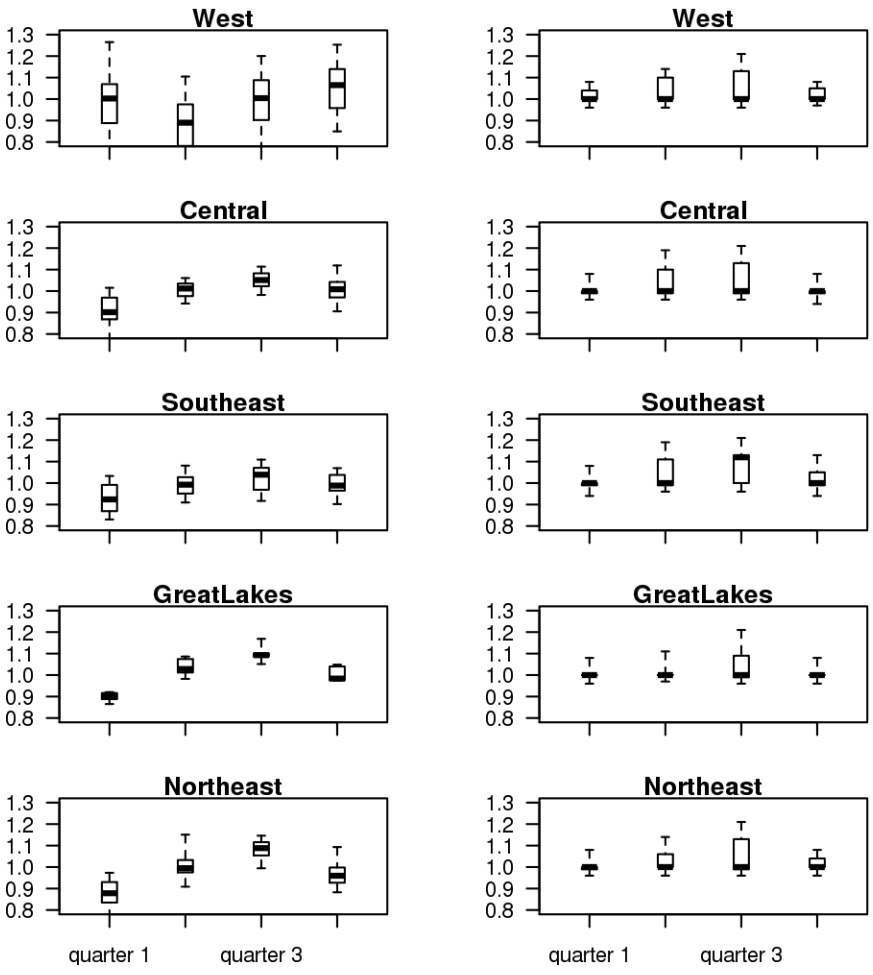


Figure S2. Seasonal and temporal trends in β_{sulf} from regression of IMPROVE data (left). Calculated β_{sulf} values based on CSN measurements of NH_4^+, SO_4^{2+}, NO_3^-, and laboratory RH (right).

S3. Sensitivity of β_{OC} to the inclusion of β_{EC} and assumptions about OC artifacts

Due to the large impact of including EC as a covariate, we perform further analysis to investigate the effect of assuming β_{EC} equals 1. It is possible that $PM_{2.5}$ reported as EC may not be purely graphitic and therefore may have some non-carbon mass associated with it. In that case, the EC coefficient could be greater than one. Also, there is some uncertainty in the method used to split total measured carbon (TC) into EC and OC which could lead to either a positive or negative EC artifact. Average EC/TC values have been reported to shift by around 15% due to changes in measurement equipment (White, 2007).

To determine the sensitivity of β_{OC} to β_{EC}, we perform 10 sets of new EiV regressions in which we fix the coefficient for EC at various values (0. 0.25, 0.5, 0.75, 1.25, 1.5, 1.75, 2, 2.5, and 3). This analysis shows that when the EC coefficient is set between 0.25 and 1.75, β_{OC} values generally change from baseline values by less than 0.2 (Figure S3). However, more extreme EC coefficients cause substantial changes in β_{OC}. Figure S3 shows that when EC is set to 0 or 2, a larger portion of the β_{OC} estimates change from baseline values by more than 0.2. In a sensitivity run that used both EC and OC as covariates, 25% of EC coefficients fall below -0.3 and 50% fell below 0.3. Such low β_{EC} values are unrealistic and they would cause β_{OC} to be substantially overestimated. The results reported by Hand and Malm (2006) show the opposite effect with most EC coefficients estimated above one. In that work, about one quarter of the reported EC coefficients were greater than 3 and one EC coefficient was as high as 11. These EC coefficients appear to be unrealistically high and are likely an artifact of co-linear coefficients in the multiple regression. Again, Figure S3 demonstrates that high EC coefficients like those from Hand and Malm (2006) would cause OC coefficients to be drastically underestimated.

We conduct a second analysis to estimate the range of actual β_{EC} values. To accomplish this, we perform a set of regressions in which we use TC instead of OC as our covariate (Figure S4). The actual coefficient for TC must be an intermediate value between the actual OC and EC coefficients. In these regressions the TC coefficient is generally very close to the estimated OC coefficient from our original regressions. We find that only 3% of the TC coefficients differ from the previously estimated OC

coefficient by more than 0.2. It may seem counter-intuitive that results using TC would be so similar to the original regression results, when including EC as a separate covariate has a much larger effect. However, on average the TC coefficient is slightly less than the OC coefficient. Assuming a maximum measurement artifact of 15%, we can set a lower bound for β_{EC} around 0.85. From this we can infer that $0.85 < \beta_{EC} < \beta_{TC} < \beta_{OC}$. Over eighty percent of the estimated TC coefficients fall in the range of 1.2 to 1.9. Therefore, we believe that most β_{EC} values should fall between 0.85 and 1.9. Consequently, EC coefficients in this analysis are much closer to 1 than the EC coefficients estimated by allowing EC to be an independent covariate. Based on this analysis, we find that our assumption of an EC coefficient equal to unity does not greatly bias OC coefficient results.

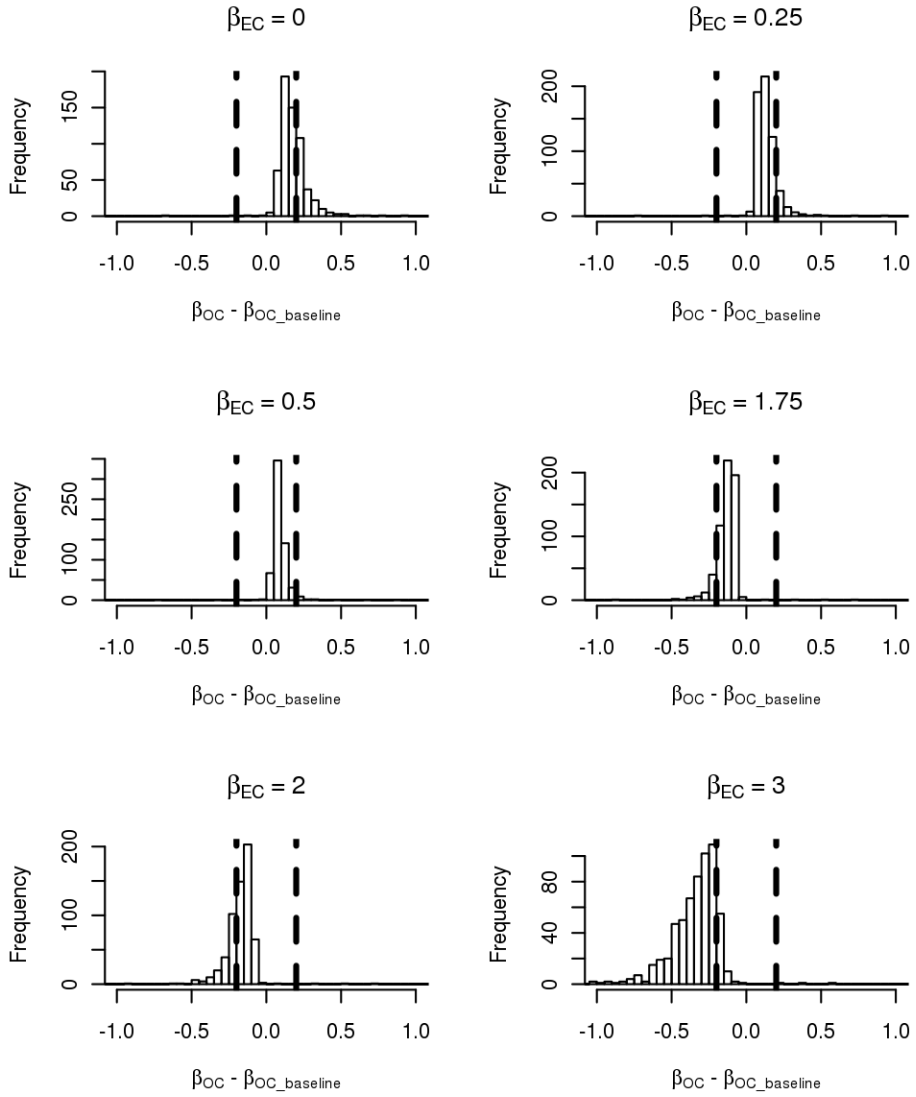


Figure S3. Comparison of β_{OC} estimates when β_{EC} is fixed at values between 0 and 3 to baseline β_{OC} estimates (β_{EC} fixed at 1). Dashed lines delimitate +/- 0.2 from baseline β_{OC} estimates.

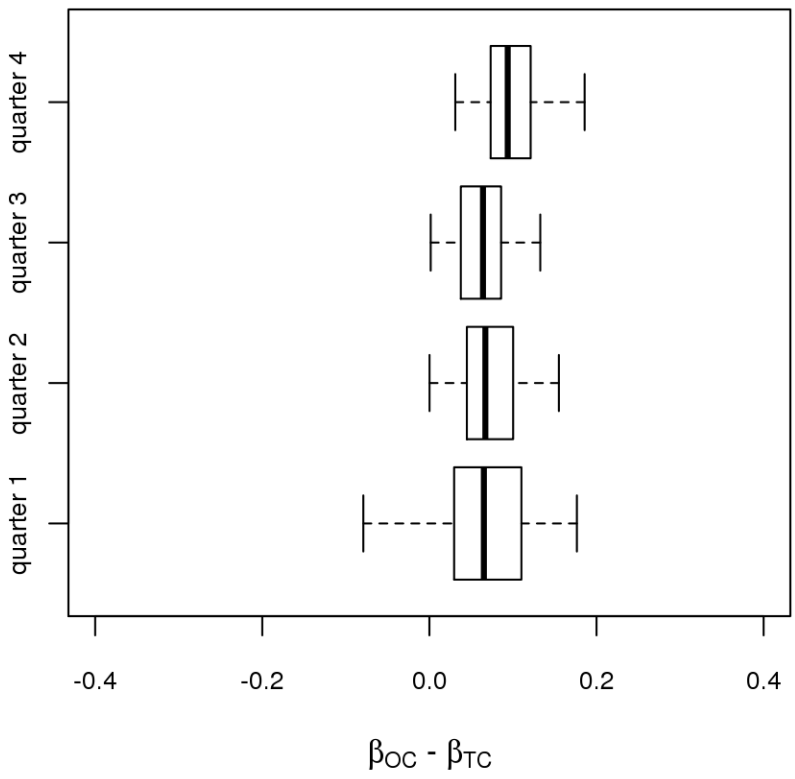


Figure S4: Comparison of estimated OC coefficients from the main regression to TC coefficients from regressions that used TC instead of OC as a covariate

As mentioned previously, OC artifacts on the quartz filter used to measure OC and on the Teflon filter used to measure $PM_{2.5}$ (and subsequently OM) are included in the β_{OC} estimates. Both positive and negative artifacts are possible. Quartz filters are more prone to positive artifact than Teflon. The literature is inconclusive regarding negative artifacts on quartz versus Teflon.

Data reported from the IMPROVE monitoring network include a correction for positive OC artifact on the quartz filter but no correction to the Teflon filter. Quartz-behind-quartz backup filters are collected at six IMPROVE sites (Chiricahua, Grand Canyon, Mount Rainier, Okefenokee, Shenandoah, and Yosemite). Each month, the median of all quartz-behind-quartz backup filters from these six sites is used as a

network-wide average value for positive OC artifact. The reported OC concentrations are calculated by subtracting the median artifact value for that month (μg/filter) from each OC sample at all sites (μg/filter) before converting filter concentrations to ambient concentrations of $\mu g/m^3$ (McDade, 2008). Here we evaluate the effect of using a single median artifact at all IMPROVE sites.

Since backup filters are only collected at 6 monitoring sites, it is not possible to determine how much site-to-site variability occurs network-wide. However, we perform a sensitivity study in which we look at site-to-site variability in back-up filter concentrations within the six sites used to create the median OC artifact value. For this analysis, all OC values for these six sites are recalculated using sample-specific backup filter values instead of the network-wide monthly median. We repeat the EiV regression analysis using these new sample-specific-corrected OC values and evaluate changes in β_{OC} values. These results are shown in Figure S5. There are two site- and quarter-specific datasets that have unreasonable coefficients with both the default and sample-specific artifact correction. In all regressions, changes in β_{OC} values are modest, with the average change being 0.05 (3%) and the maximum change being 0.14 (9%). Although it is not known how representative these six sites are of the network as a whole, this analysis suggests that using a single artifact correction network-wide does not substantially affect our estimations of β_{OC}.

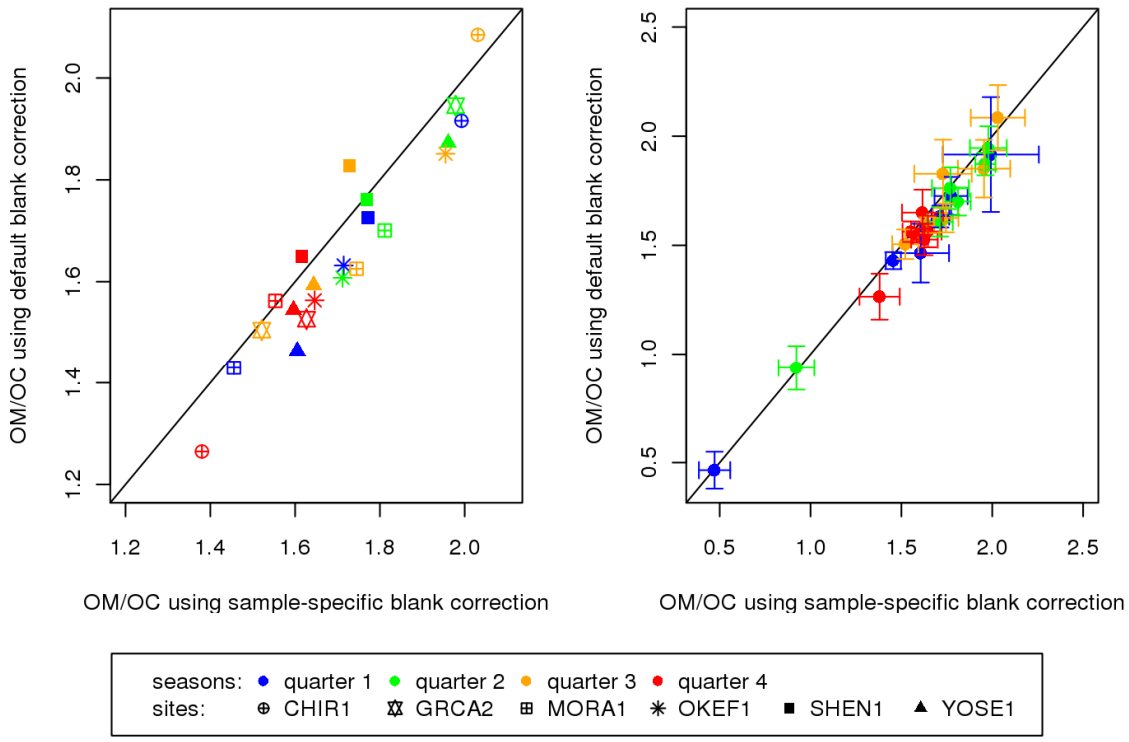
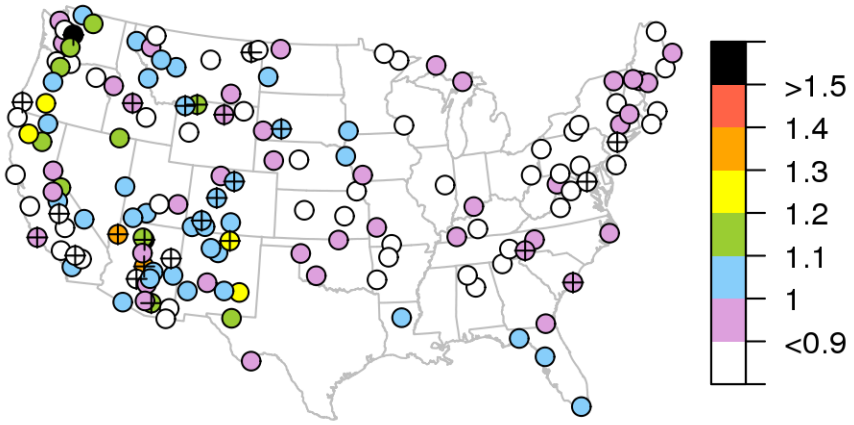
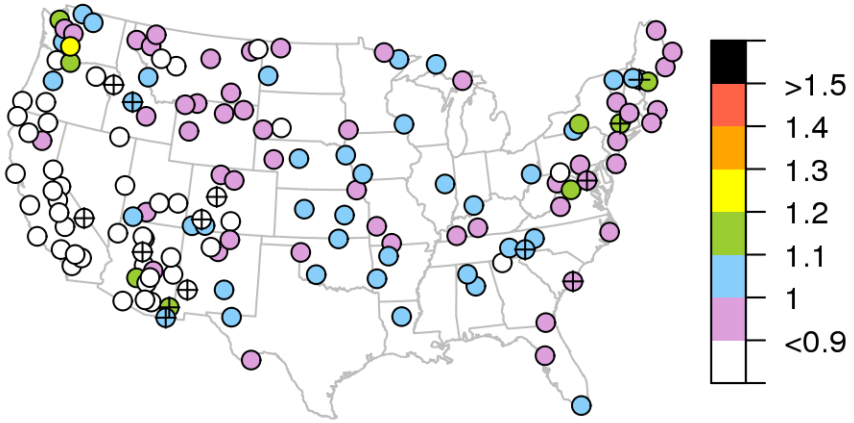


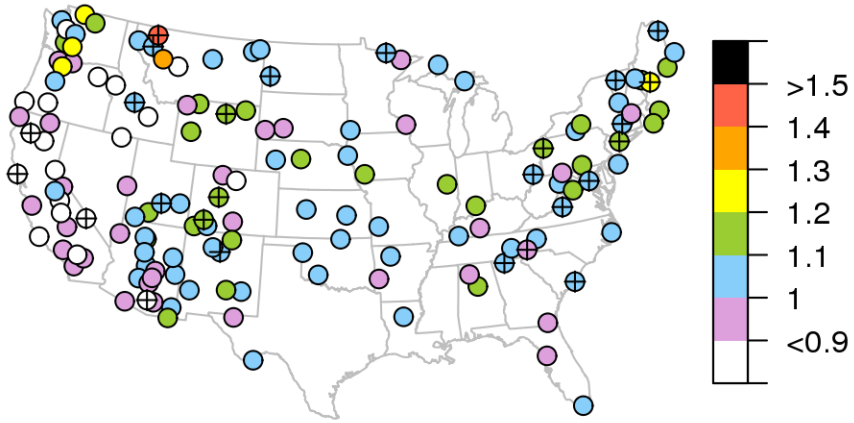
Figure S5. Comparison of β_{OC} values when using default artifact correction versus sample-specific artifact correction for only good regressions (left) and for all quarter-specific regressions (right). Uncertainty bars in the right-hand plot are standard error values for β_{OC} at each site and quarter.

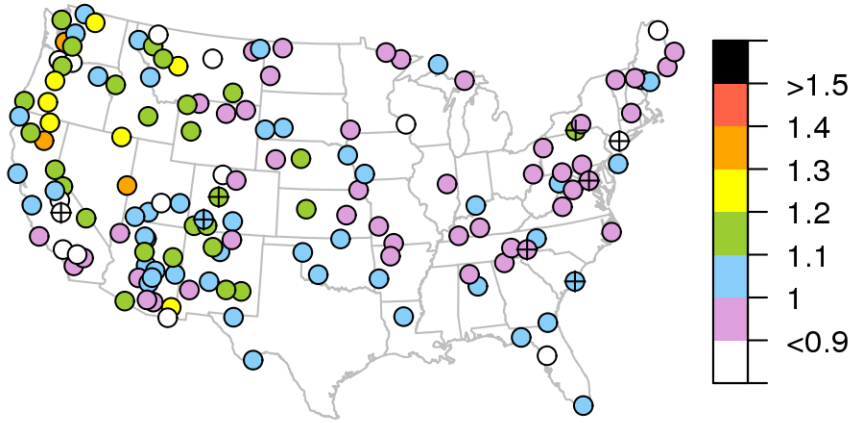
In addition to site-to-site variability, there may be other complications from IMPROVE's current OC artifact correction. If OC artifact is not properly corrected on both the Teflon and quartz filters, then the β_{OC} value will be influenced. This could occur if 1) the back-up filter method does not completely capture all positive artifact on quartz filters, 2) Teflon filters have non-negligible positive artifact, or 3) the magnitude of negative artifact differs on the quartz and Teflon filters. An in-depth exploration of OC artifact is beyond the scope of this paper, but the uncertainties associated with these issues should be kept in mind when interpreting the regression results presented here.

S4. Maps of regression coefficients

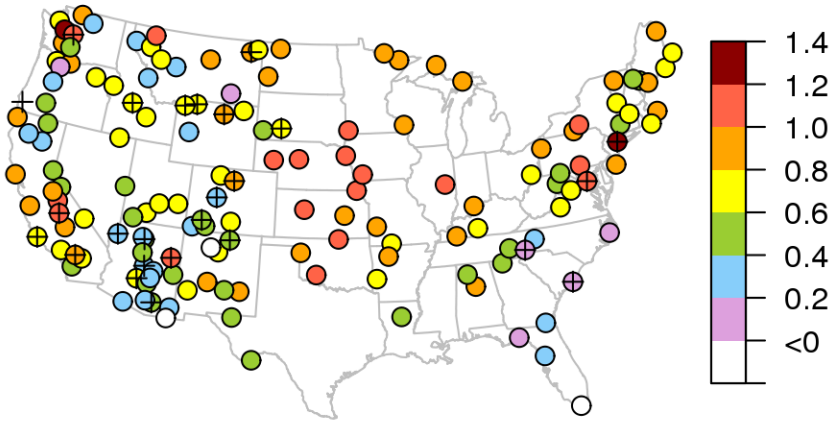


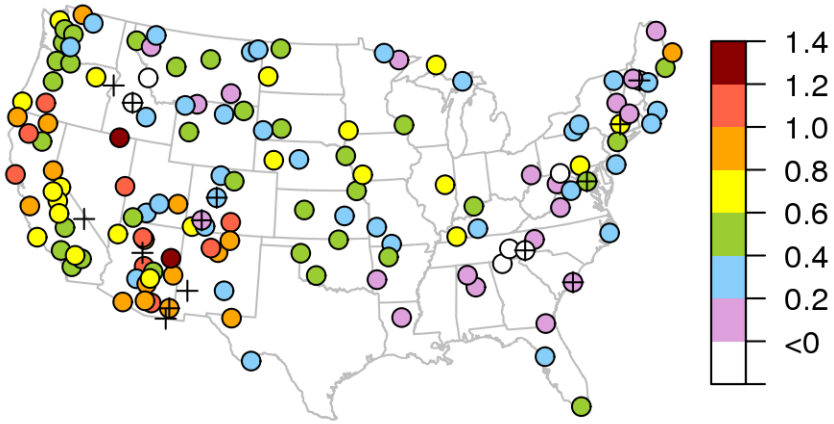


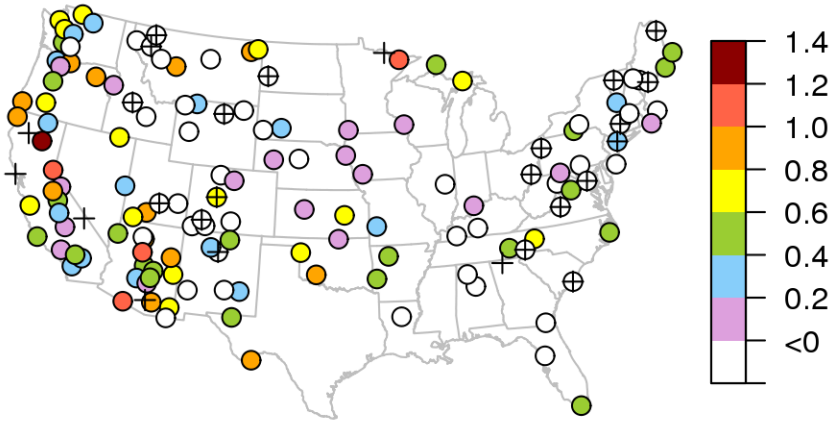


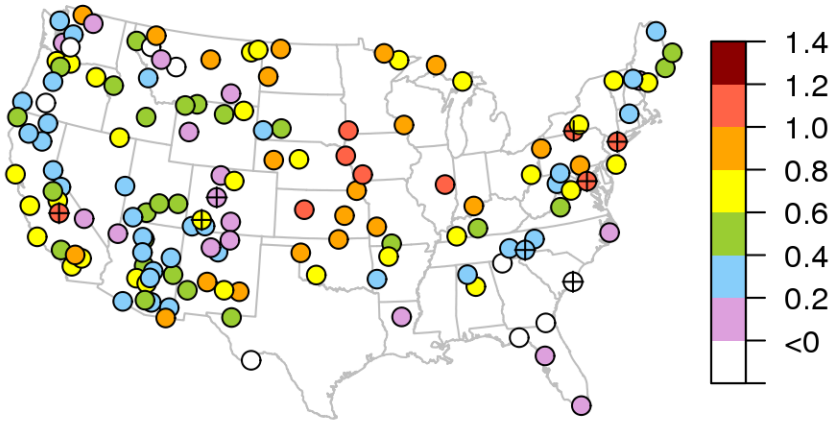


Figures S6-S9: Maps of sulfate coefficients in quarters 1-4. High confidence results are plotted with colored dots. Regressions that were flagged for problematic coefficients or temporal trends in the residual errors are marked with crosses.

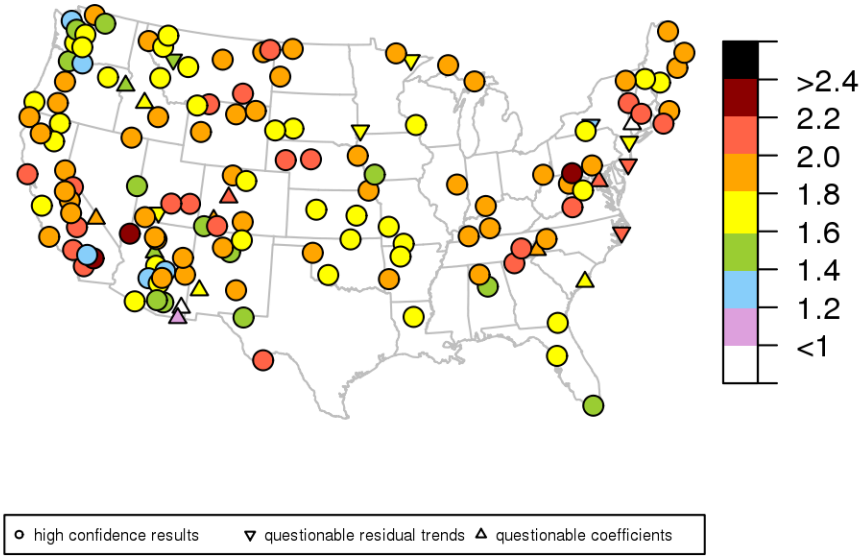

1.4
1.2
1.0
0.8
0.6
0.4
0.2
<0


1.4
1.2
1.0
0.8
0.6
0.4
0.2
<0

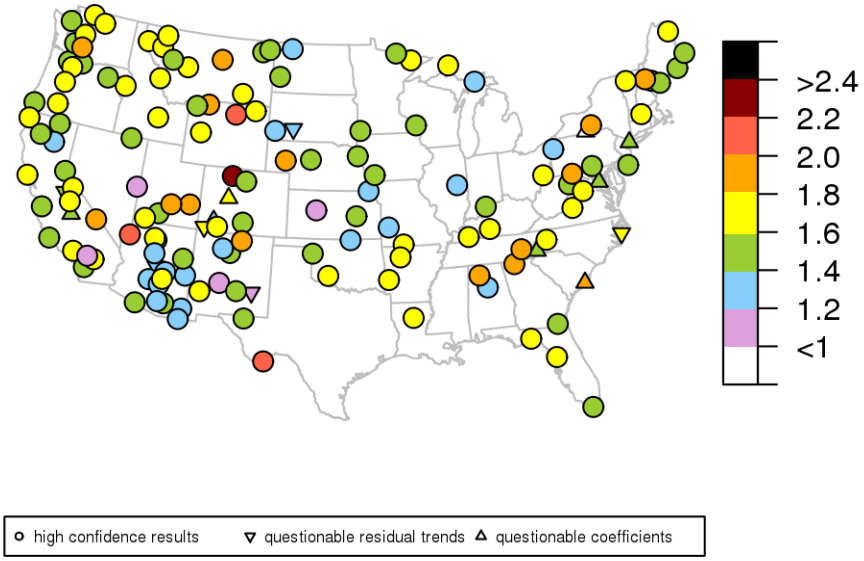

1.4
1.2
1.0
0.8
0.6
0.4
0.2
<0



Figures S10-S13: Maps of nitrate coefficients in quarters 1-4. High confidence results are plotted with colored dots. Regressions that were flagged for problematic coefficients or temporal trends in the residuals are marked with crosses.



1



2

3 Figures S14-S15: Maps of OC coefficients in quarters 2 and 4.

S5. Tabulated regression results

Table S2. Multiyear regression results. Physically unreasonable coefficients are shown in bold.

site	β_{OC}	β_{sulf}	β_{nit}	β_{soil}
Acadia NP	1.82 +/- 0.04	1.05 +/- 0.01	0.13 +/- 0.06	0.95 +/- 0.11
Addison Pinnacle	1.44 +/- 0.07	1.10 +/- 0.02	0.58 +/- 0.04	1.24 +/- 0.18
Agua Tibia	1.74 +/- 0.05	0.97 +/- 0.02	0.52 +/- 0.02	0.98 +/- 0.04
Arendtsville	1.63 +/- 0.06	1.06 +/- 0.02	0.77 +/- 0.02	0.49 +/- 0.13
Badlands NP	1.60 +/- 0.04	0.97 +/- 0.03	0.30 +/- 0.05	0.98 +/- 0.05
Mount Baldy	1.44 +/- 0.03	1.05 +/- 0.02	0.55 +/- 0.06	1.09 +/- 0.02
Bandelier NM	1.48 +/- 0.04	1.05 +/- 0.03	0.47 +/- 0.04	1.11 +/- 0.02
Big Bend NP	1.92 +/- 0.07	1.00 +/- 0.01	0.32 +/- 0.08	1.07 +/- 0.02
Birmingham	1.39 +/- 0.04	1.08 +/- 0.02	0.64 +/- 0.06	1.02 +/- 0.04
Bliss SP (TRPA)	1.76 +/- 0.02	0.95 +/- 0.03	0.38 +/- 0.05	1.01 +/- 0.03
Blue Mounds	1.70 +/- 0.05	0.93 +/- 0.02	1.05 +/- 0.01	0.79 +/- 0.05
Bosque del Apache	1.28 +/- 0.05	0.96 +/- 0.02	0.79 +/- 0.04	1.06 +/- 0.02
Bondville	1.65 +/- 0.07	1.10 +/- 0.02	0.85 +/- 0.02	0.82 +/- 0.09
Boundary Waters Canoe Area	1.80 +/- 0.04	0.95 +/- 0.02	0.77 +/- 0.02	0.82 +/- 0.10
Bryce Canyon NP	1.52 +/- 0.04	1.04 +/- 0.04	0.50 +/- 0.05	1.08 +/- 0.03
Bridger Wilderness	1.85 +/- 0.03	0.97 +/- 0.03	0.23 +/- 0.09	1.01 +/- 0.03
Brigantine NWR	1.79 +/- 0.06	1.03 +/- 0.02	0.52 +/- 0.04	0.79 +/- 0.14
Bridgton	1.76 +/- 0.04	1.07 +/- 0.02	-0.05 +/- 0.07	1.09 +/- 0.13
Casco Bay	1.56 +/- 0.03	1.17 +/- 0.02	0.18 +/- 0.07	1.03 +/- 0.10
Cabinet Mountains	1.76 +/- 0.02	1.02 +/- 0.03	0.17 +/- 0.07	1.11 +/- 0.03
Cape Cod	1.78 +/- 0.05	1.03 +/- 0.02	0.18 +/- 0.06	0.99 +/- 0.13
Caney Creek	1.75 +/- 0.04	0.99 +/- 0.01	0.44 +/- 0.03	0.98 +/- 0.02
Cadiz	1.68 +/- 0.05	1.04 +/- 0.01	0.71 +/- 0.02	0.96 +/- 0.05
Canyonlands NP	2.03 +/- 0.05	0.91 +/- 0.03	0.40 +/- 0.04	1.18 +/- 0.02
Capitol Reef NP	2.03 +/- 0.05	0.83 +/- 0.04	0.40 +/- 0.04	1.14 +/- 0.02
Cedar Bluff	1.43 +/- 0.09	1.05 +/- 0.04	0.88 +/- 0.02	1.02 +/- 0.06
Chassahowitzka NWR	1.60 +/- 0.04	1.00 +/- 0.02	0.17 +/- 0.10	1.01 +/- 0.03
Cherokee Nation	1.49 +/- 0.04	1.06 +/- 0.02	0.87 +/- 0.02	0.97 +/- 0.02
Chiricahua NM	1.45 +/- 0.07	1.15 +/- 0.02	0.25 +/- 0.10	1.11 +/- 0.02
Cloud Peak	1.94 +/- 0.03	0.97 +/- 0.03	0.31 +/- 0.08	1.05 +/- 0.03
Columbia Gorge #1	1.57 +/- 0.03	0.85 +/- 0.03	0.57 +/- 0.03	1.13 +/- 0.06
Connecticut Hill	1.53 +/- 0.08	1.07 +/- 0.02	0.61 +/- 0.04	0.69 +/- 0.15
Cohutta	1.88 +/- 0.06	0.96 +/- 0.01	0.12 +/- 0.05	0.82 +/- 0.05
Columbia River Gorge	1.47 +/- 0.03	0.96 +/- 0.04	0.62 +/- 0.02	1.05 +/- 0.02
Crescent Lake	1.97 +/- 0.05	0.92 +/- 0.03	0.92 +/- 0.02	0.86 +/- 0.05
Crater Lake NP	1.71 +/- 0.02	1.08 +/- 0.03	0.15 +/- 0.10	0.95 +/- 0.03

Craters of the Moon NM	1.85 +/- 0.03	0.88 +/- 0.04	0.50 +/- 0.02	1.04 +/- 0.02
Death Valley NP	1.83 +/- 0.05	0.87 +/- 0.03	0.70 +/- 0.09	1.16 +/- 0.02
Dome Lands Wilderness	1.79 +/- 0.06	0.77 +/- 0.05	0.70 +/- 0.02	1.12 +/- 0.05
Dolly Sods Wilderness	1.51 +/- 0.05	1.06 +/- 0.01	0.28 +/- 0.05	1.03 +/- 0.08
Douglas	1.31 +/- 0.08	1.04 +/- 0.04	0.60 +/- 0.15	1.02 +/- 0.01
El Dorado Springs	1.44 +/- 0.04	1.04 +/- 0.01	0.77 +/- 0.02	1.07 +/- 0.03
Ellis	1.59 +/- 0.05	1.06 +/- 0.02	0.86 +/- 0.02	0.93 +/- 0.03
Everglades NP	1.58 +/- 0.04	1.05 +/- 0.02	0.31 +/- 0.10	1.02 +/- 0.02
Flathead	1.74 +/- 0.02	0.97 +/- 0.03	0.17 +/- 0.06	1.01 +/- 0.04
Fort Peck	1.86 +/- 0.04	0.88 +/- 0.02	0.68 +/- 0.02	0.96 +/- 0.04
Frostberg Reservoir (Big Piney Run)	1.95 +/- 0.06	0.94 +/- 0.01	0.24 +/- 0.04	0.96 +/- 0.08
Gates of the Mountains	1.73 +/- 0.02	1.02 +/- 0.03	0.15 +/- 0.07	1.02 +/- 0.04
Gila Wilderness	1.49 +/- 0.03	0.96 +/- 0.03	0.77 +/- 0.18	1.10 +/- 0.02
Glacier NP	1.72 +/- 0.02	0.88 +/- 0.03	0.79 +/- 0.06	0.91 +/- 0.03
Great Basin NP	1.66 +/- 0.04	1.01 +/- 0.04	0.13 +/- 0.10	1.11 +/- 0.02
Hance Camp at Grand Canyon NP	1.54 +/- 0.04	1.15 +/- 0.03	0.57 +/- 0.06	1.11 +/- 0.02
Great Gulf Wilderness	1.83 +/- 0.04	1.02 +/- 0.02	0.06 +/- 0.07	0.82 +/- 0.12
Great River Bluffs	1.67 +/- 0.06	0.94 +/- 0.02	0.86 +/- 0.01	0.87 +/- 0.13
Great Sand Dunes NM	1.83 +/- 0.05	0.96 +/- 0.04	0.18 +/- 0.08	1.02 +/- 0.01
Great Smoky Mountains NP	1.86 +/- 0.05	1.05 +/- 0.01	0.18 +/- 0.05	1.06 +/- 0.08
Guadalupe Mountains NP	1.60 +/- 0.09	1.02 +/- 0.03	0.53 +/- 0.05	1.04 +/- 0.01
Hells Canyon	1.67 +/- 0.02	0.89 +/- 0.04	0.64 +/- 0.02	1.01 +/- 0.04
Hercules-Glades	1.64 +/- 0.04	0.99 +/- 0.01	0.58 +/- 0.02	1.00 +/- 0.03
Hoover	1.80 +/- 0.03	0.94 +/- 0.04	0.37 +/- 0.08	1.20 +/- 0.03
Ikes Backbone	1.30 +/- 0.05	1.03 +/- 0.04	0.40 +/- 0.05	1.19 +/- 0.02
Indian Gardens	1.71 +/- 0.05	0.99 +/- 0.03	0.36 +/- 0.08	1.11 +/- 0.02
Isle Royale NP	1.95 +/- 0.04	1.03 +/- 0.02	0.81 +/- 0.02	0.61 +/- 0.13
Jarbidge Wilderness	1.84 +/- 0.04	0.94 +/- 0.03	0.72 +/- 0.05	0.99 +/- 0.02
James River Face Wilderness	1.72 +/- 0.04	1.04 +/- 0.01	0.29 +/- 0.05	0.92 +/- 0.08
Joshua Tree NP	1.92 +/- 0.07	0.87 +/- 0.03	0.62 +/- 0.02	0.93 +/- 0.03
Kaiser	1.83 +/- 0.03	0.76 +/- 0.04	0.72 +/- 0.03	0.99 +/- 0.03
Kalmiopsis	1.53 +/- 0.02	0.93 +/- 0.04	0.93 +/- 0.15	1.06 +/- 0.08
Lava Beds NM	1.68 +/- 0.03	1.04 +/- 0.07	0.25 +/- 0.11	1.04 +/- 0.07
Lassen Volcanic NP	1.67 +/- 0.03	1.06 +/- 0.04	0.31 +/- 0.06	1.06 +/- 0.04
Linville Gorge	1.78 +/- 0.04	1.10 +/- 0.01	-0.07 +/- 0.07	0.83 +/- 0.08
Livonia	1.66 +/- 0.07	1.08 +/- 0.02	0.71 +/- 0.02	1.06 +/- 0.07
Lostwood	1.81 +/- 0.04	0.91 +/- 0.02	0.80 +/- 0.02	0.99 +/- 0.05
Lye Brook Wilderness	1.94 +/- 0.06	1.00 +/- 0.02	0.31 +/- 0.04	0.79 +/- 0.12
Mammoth Cave NP	1.88 +/- 0.05	0.93 +/- 0.01	0.42 +/- 0.02	0.91 +/- 0.05
Marthas Vineyard	1.87 +/- 0.06	1.04 +/- 0.01	0.18 +/- 0.06	0.93 +/- 0.12
Meadview	1.84 +/- 0.07	0.99 +/- 0.03	0.32 +/- 0.06	1.10 +/- 0.02
Medicine Lake	1.84 +/- 0.04	0.91 +/- 0.02	0.69 +/- 0.02	0.99 +/- 0.04
Mesa Verde NP	1.79 +/- 0.06	1.08 +/- 0.05	0.18 +/- 0.09	1.19 +/- 0.02

M.K. Goddard	1.50 +/- 0.05	1.08 +/- 0.02	0.69 +/- 0.03	0.93 +/- 0.15
Mount Hood	1.79 +/- 0.03	1.17 +/- 0.03	0.21 +/- 0.06	1.00 +/- 0.06
Mohawk Mt.	1.53 +/- 0.07	1.02 +/- 0.02	0.28 +/- 0.06	1.11 +/- 0.19
Monture	1.67 +/- 0.02	1.01 +/- 0.03	0.22 +/- 0.13	1.08 +/- 0.03
Moosehorn NWR	1.70 +/- 0.04	1.02 +/- 0.02	0.23 +/- 0.07	0.70 +/- 0.14
Mount Rainier NP	1.59 +/- 0.03	1.20 +/- 0.04	0.38 +/- 0.13	1.16 +/- 0.09
Mount Zirkel Wilderness	2.02 +/- 0.04	0.82 +/- 0.03	0.33 +/- 0.06	1.04 +/- 0.03
Nebraska NF	1.91 +/- 0.07	0.98 +/- 0.03	0.77 +/- 0.02	0.84 +/- 0.07
New York City	1.62 +/- 0.09	1.01 +/- 0.03	0.91 +/- 0.04	**0.27 +/- 0.19**
North Absaroka	1.91 +/- 0.03	0.97 +/- 0.03	0.32 +/- 0.06	1.11 +/- 0.03
North Cascades	1.79 +/- 0.03	1.10 +/- 0.03	0.75 +/- 0.14	0.89 +/- 0.07
Northern Cheyenne	1.91 +/- 0.03	1.03 +/- 0.03	0.10 +/- 0.05	0.96 +/- 0.04
Okefenokee NWR	1.65 +/- 0.03	0.98 +/- 0.01	0.04 +/- 0.10	0.97 +/- 0.03
Olympic	1.53 +/- 0.03	1.11 +/- 0.03	0.47 +/- 0.06	0.99 +/- 0.10
Omaha	1.75 +/- 0.06	1.00 +/- 0.02	0.97 +/- 0.02	0.67 +/- 0.07
Organ Pipe	1.45 +/- 0.08	0.99 +/- 0.02	0.44 +/- 0.07	1.09 +/- 0.02
Pasayten	1.69 +/- 0.02	1.08 +/- 0.03	0.19 +/- 0.06	1.09 +/- 0.05
Petrified Forest NP	1.66 +/- 0.05	1.05 +/- 0.03	0.44 +/- 0.09	1.04 +/- 0.02
Phoenix	1.25 +/- 0.02	0.95 +/- 0.03	0.64 +/- 0.03	1.08 +/- 0.02
Pinnacles NM	1.69 +/- 0.06	0.93 +/- 0.05	0.65 +/- 0.05	1.05 +/- 0.13
Proctor Maple R. F.	1.86 +/- 0.04	1.01 +/- 0.01	0.46 +/- 0.04	0.69 +/- 0.13
Point Reyes National Seashore	1.58 +/- 0.07	0.95 +/- 0.03	0.78 +/- 0.03	1.03 +/- 0.17
Presque Isle	1.79 +/- 0.03	0.94 +/- 0.01	-0.01 +/- 0.05	0.94 +/- 0.03
Puget Sound	1.39 +/- 0.03	0.85 +/- 0.03	1.00 +/- 0.04	0.73 +/- 0.09
Quaker City	1.64 +/- 0.06	1.07 +/- 0.01	0.55 +/- 0.03	0.86 +/- 0.09
Quabbin Summit	1.76 +/- 0.04	0.96 +/- 0.01	0.30 +/- 0.04	0.85 +/- 0.11
Queen Valley	1.51 +/- 0.07	1.01 +/- 0.03	0.57 +/- 0.02	1.08 +/- 0.02
San Rafael	1.70 +/- 0.05	0.95 +/- 0.03	0.53 +/- 0.03	1.06 +/- 0.05
Redwood NP	1.73 +/- 0.03	0.95 +/- 0.03	0.80 +/- 0.09	0.88 +/- 0.09
Cape Romain NWR	1.69 +/- 0.04	1.02 +/- 0.01	**-0.27 +/- 0.10**	1.00 +/- 0.05
Rocky Mountain NP	1.84 +/- 0.05	0.81 +/- 0.05	0.56 +/- 0.04	1.05 +/- 0.03
Salt Creek	1.42 +/- 0.10	1.02 +/- 0.03	0.94 +/- 0.04	1.10 +/- 0.02
Sac and Fox	1.56 +/- 0.05	0.98 +/- 0.02	0.90 +/- 0.01	0.93 +/- 0.05
San Gabriel	1.86 +/- 0.05	0.81 +/- 0.03	0.50 +/- 0.02	1.02 +/- 0.04
San Gorgonio Wilderness	1.46 +/- 0.06	0.83 +/- 0.04	0.77 +/- 0.01	0.96 +/- 0.04
Saguaro NM	1.35 +/- 0.06	1.00 +/- 0.03	0.38 +/- 0.04	1.14 +/- 0.01
St. Marks	1.65 +/- 0.04	1.04 +/- 0.01	0.15 +/- 0.12	1.02 +/- 0.03
San Pedro Parks	1.62 +/- 0.05	1.02 +/- 0.03	0.18 +/- 0.11	1.16 +/- 0.02
Saguaro West	1.35 +/- 0.11	0.99 +/- 0.04	0.37 +/- 0.05	1.12 +/- 0.02
Sawtooth NF	1.65 +/- 0.03	1.01 +/- 0.07	**-1.79 +/- 0.50**	1.21 +/- 0.05
Seney	1.66 +/- 0.04	0.97 +/- 0.02	0.70 +/- 0.02	0.78 +/- 0.14
Sequoia NP	1.68 +/- 0.04	0.79 +/- 0.05	0.90 +/- 0.01	1.09 +/- 0.06
Shenandoah NP	1.73 +/- 0.06	1.10 +/- 0.01	0.36 +/- 0.04	1.02 +/- 0.08
Shamrock Mine	1.92 +/- 0.04	1.05 +/- 0.03	0.11 +/- 0.06	0.93 +/- 0.01
Shining Rock Wilderness	1.80 +/- 0.08	1.02 +/- 0.02	**-0.27 +/- 0.12**	0.95 +/- 0.07

Sierra Ancha	1.30 +/- 0.04	1.04 +/- 0.03	0.29 +/- 0.06	1.13 +/- 0.02
Sikes	1.71 +/- 0.03	1.06 +/- 0.01	0.14 +/- 0.05	1.03 +/- 0.02
Sipsy Wilderness	1.85 +/- 0.04	0.98 +/- 0.01	0.23 +/- 0.03	0.97 +/- 0.04
Snoqualmie Pass	1.64 +/- 0.05	1.09 +/- 0.05	0.43 +/- 0.06	0.98 +/- 0.15
Starkey	1.63 +/- 0.02	0.90 +/- 0.04	0.70 +/- 0.02	1.15 +/- 0.03
Sula Peak	1.73 +/- 0.02	0.99 +/- 0.04	-0.07 +/- 0.09	0.99 +/- 0.03
Swanquarter	1.80 +/- 0.05	1.01 +/- 0.01	0.01 +/- 0.06	1.06 +/- 0.05
Sycamore Canyon	1.29 +/- 0.04	1.13 +/- 0.04	0.47 +/- 0.06	1.04 +/- 0.01
Tallgrass	1.44 +/- 0.04	1.04 +/- 0.02	0.80 +/- 0.02	1.00 +/- 0.04
Thunder Basin	1.86 +/- 0.03	0.94 +/- 0.02	0.54 +/- 0.03	0.92 +/- 0.02
Theodore Roosevelt	1.83 +/- 0.04	0.96 +/- 0.03	0.80 +/- 0.03	0.91 +/- 0.03
Three Sisters Wilderness	1.75 +/- 0.02	1.07 +/- 0.03	0.35 +/- 0.10	0.99 +/- 0.04
Tonto NM	1.71 +/- 0.05	1.00 +/- 0.03	0.27 +/- 0.04	1.08 +/- 0.01
Trinity	1.63 +/- 0.03	1.08 +/- 0.05	0.40 +/- 0.06	0.94 +/- 0.06
UL Bend	1.91 +/- 0.03	0.86 +/- 0.02	0.81 +/- 0.03	1.04 +/- 0.03
Upper Buffalo Wilderness	1.63 +/- 0.04	1.04 +/- 0.01	0.68 +/- 0.02	1.01 +/- 0.03
Viking Lake	1.54 +/- 0.05	1.05 +/- 0.02	0.99 +/- 0.01	0.91 +/- 0.06
Voyageurs NP #2	1.70 +/- 0.04	0.94 +/- 0.02	0.87 +/- 0.02	0.97 +/- 0.13
Washington D.C.	1.67 +/- 0.06	1.07 +/- 0.02	0.78 +/- 0.03	**0.21 +/- 0.14**
Weminuche Wilderness	1.78 +/- 0.04	1.00 +/- 0.04	**-0.19 +/- 0.13**	1.09 +/- 0.02
White Mountain	1.63 +/- 0.06	1.08 +/- 0.03	0.55 +/- 0.04	1.13 +/- 0.02
White Pass	1.82 +/- 0.04	1.18 +/- 0.04	0.14 +/- 0.09	0.87 +/- 0.06
Wheeler Peak	1.68 +/- 0.06	1.08 +/- 0.04	0.17 +/- 0.13	1.24 +/- 0.03
White River NF	1.96 +/- 0.05	1.08 +/- 0.04	**-0.18 +/- 0.11**	1.17 +/- 0.02
Wind Cave	1.72 +/- 0.03	0.93 +/- 0.03	0.41 +/- 0.03	1.10 +/- 0.03
Wichita Mountains	1.53 +/- 0.05	1.10 +/- 0.02	0.81 +/- 0.02	0.95 +/- 0.03
Yellowstone NP 2	1.75 +/- 0.02	0.87 +/- 0.03	0.52 +/- 0.04	1.08 +/- 0.03
Yosemite NP	1.64 +/- 0.02	1.01 +/- 0.03	0.77 +/- 0.03	1.09 +/- 0.05
Zion Canyon	1.76 +/- 0.05	1.11 +/- 0.03	0.28 +/- 0.05	1.15 +/- 0.02

Table S3. Quarterly regressions eliminated because of colinearity between covariates or high correlation between residual error (ε_i) and a $PM_{2.5}$ component.

site	quarter	maximum r_P between covariates	correlated covariates	max r_S between $PM_{2.5}$ constituents and ε_i	$PM_{2.5}$ constituents correlated to ε_i
Bosque del Apache	2	<0.85		0.45	chloride
M.K. Goddard	2	<0.85		0.41	chloride
Mount Hood	2	<0.85		0.46	OC ; EC
Salt Creek	2	<0.85		0.49	chloride
St. Marks	2	<0.85		0.53	chloride
Bosque del	3	<0.85		0.48	chloride

Apache					
Hercules-Glades	3	<0.85		0.41	chloride
Lostwood	3	<0.85		0.45	chloride
Northern Cheyenne	3	0.86	sulfate:nitrate	<0.40	
Sac and Fox	3	<0.85		0.44	chloride
St. Marks	3	<0.85		0.50	chloride
Sula Peak	3	0.87	oc:nitrate	<0.40	
Cape Cod	4	0.90	sulfate:soil	<0.40	
Dome Lands Wilderness	4	<0.85		0.44	soil
Lye Brook Wilderness	4	0.86	oc:sulfate ; soil:sulfate	<0.40	
Marthas Vineyard	4	0.85	soil:sulfate	<0.40	
Mohawk Mt.	4	0.88	soil:nitrate	<0.40	
Puget Sound	4	0.86	sulfate:nitrate	<0.40	
Sawtooth NF	4	<0.85		0.42	KNON

Table S4. High-confidence quarter-specific regression results. This table includes 10 regressions originally flagged for a ε_i outlier year, but for which excluding that year did not change coefficients

Site	quarter	βoc	βsulf	βnit	NME (%)	NMB (%)
Acadia NP	1	1.66 +/- 0.14	0.89 +/- 0.04	0.62 +/- 0.11	7.38	-0.21
Addison Pinnacle	1	1.46 +/- 0.11	0.82 +/- 0.03	0.98 +/- 0.05	5.93	-0.12
Agua Tibia	1	1.38 +/- 0.12	1.08 +/- 0.08	0.56 +/- 0.04	9.52	0.07
Arendtsville	1	1.21 +/- 0.09	0.88 +/- 0.03	1.18 +/- 0.04	6.15	-0.38
Bandelier NM	1	1.15 +/- 0.08	1.05 +/- 0.06	0.71 +/- 0.06	10.48	-0.30
Big Bend NP	1	1.83 +/- 0.12	0.97 +/- 0.03	0.40 +/- 0.08	6.88	0.04
Birmingham	1	1.50 +/- 0.05	0.87 +/- 0.04	0.82 +/- 0.07	5.88	-0.14
Bliss SP (TRPA)	1	1.65 +/- 0.09	0.97 +/- 0.08	0.40 +/- 0.08	14.37	-1.83
Blue Mounds	1	1.53 +/- 0.14	1.00 +/- 0.04	1.08 +/- 0.02	5.24	0.12
Bondville	1	1.44 +/- 0.14	0.89 +/- 0.04	1.03 +/- 0.03	6.41	-0.19
Bosque del Apache	1	1.05 +/- 0.09	0.99 +/- 0.06	0.91 +/- 0.06	9.64	-0.08

Boundary Waters Canoe Area	1	1.62 +/- 0.25	0.87 +/- 0.06	0.88 +/- 0.04	9.16	0.59
Bridger Wilderness	1	1.81 +/- 0.19	0.89 +/- 0.06	0.36 +/- 0.12	13.66	-0.46
Bridgton	1	1.48 +/- 0.09	0.98 +/- 0.03	0.59 +/- 0.11	7.59	-0.04
Brigantine NWR	1	1.44 +/- 0.10	0.88 +/- 0.03	0.94 +/- 0.06	5.90	-0.10
Bryce Canyon NP	1	1.11 +/- 0.17	1.05 +/- 0.09	0.65 +/- 0.06	16.44	-1.81
Cabinet Mountains	1	1.48 +/- 0.08	1.03 +/- 0.05	0.38 +/- 0.12	14.49	1.49
Cadiz	1	1.47 +/- 0.09	0.91 +/- 0.03	0.93 +/- 0.03	7.14	-0.33
Caney Creek	1	1.64 +/- 0.07	0.89 +/- 0.03	0.62 +/- 0.04	7.95	-0.80
Canyonlands NP	1	1.31 +/- 0.25	0.95 +/- 0.07	0.65 +/- 0.08	11.49	-0.13
Cape Cod	1	1.62 +/- 0.14	0.85 +/- 0.03	0.80 +/- 0.10	6.38	-0.08
Cape Romain NWR	1	1.60 +/- 0.05	0.99 +/- 0.03	0.04 +/- 0.14	6.68	-0.30
Capitol Reef NP	1	1.37 +/- 0.28	0.82 +/- 0.12	0.62 +/- 0.10	15.98	-1.60
Casco Bay	1	1.38 +/- 0.06	0.95 +/- 0.04	0.95 +/- 0.12	7.48	-0.63
Cedar Bluff	1	1.18 +/- 0.13	0.87 +/- 0.07	1.01 +/- 0.03	9.92	-1.06
Chassahowitzka NWR	1	1.46 +/- 0.06	1.07 +/- 0.03	0.25 +/- 0.18	6.49	0.12
Cherokee Nation	1	1.32 +/- 0.08	0.94 +/- 0.05	1.00 +/- 0.03	7.72	-0.45
Chiricahua NM	1	1.99 +/- 0.25	0.88 +/- 0.09	0.29 +/- 0.16	10.11	-0.49
Cohutta	1	1.84 +/- 0.06	0.86 +/- 0.02	0.41 +/- 0.05	6.50	-0.10
Columbia Gorge #1	1	1.41 +/- 0.06	0.79 +/- 0.06	0.62 +/- 0.04	9.11	-0.89
Columbia River Gorge	1	1.00 +/- 0.08	0.79 +/- 0.09	0.82 +/- 0.04	12.37	0.66
Connecticut Hill	1	1.59 +/- 0.18	0.75 +/- 0.04	1.04 +/- 0.05	6.13	-0.25
Crater Lake NP	1	1.18 +/- 0.11	1.23 +/- 0.08	0.45 +/- 0.17	17.40	-2.30
Craters of the Moon NM	1	1.24 +/- 0.24	0.82 +/- 0.10	0.67 +/- 0.04	17.40	-0.57
Crescent Lake	1	1.31 +/- 0.20	0.95 +/- 0.07	1.04 +/- 0.03	9.64	-0.61
Death Valley NP	1	1.42 +/- 0.23	1.02 +/- 0.11	0.76 +/- 0.14	11.50	1.20
Dolly Sods Wilderness	1	1.38 +/- 0.07	0.99 +/- 0.03	0.57 +/- 0.06	7.56	-0.05
Dome Lands Wilderness	1	1.21 +/- 0.12	0.69 +/- 0.10	0.86 +/- 0.03	10.14	-0.11
Douglas	1	1.86 +/- 0.14	0.62 +/- 0.14	-0.06 +/- 0.25	6.33	0.27
El Dorado Springs	1	1.30 +/- 0.06	0.90 +/- 0.04	0.91 +/- 0.03	7.32	-0.20

Ellis	1	1.24 +/- 0.09	0.97 +/- 0.05	0.99 +/- 0.03	8.14	-1.08
Everglades NP	1	1.97 +/- 0.13	1.02 +/- 0.03	-0.10 +/- 0.20	7.86	0.23
Flathead	1	1.48 +/- 0.09	0.91 +/- 0.05	0.62 +/- 0.10	11.99	0.36
Frostberg Reservoir (Big Piney Run)	1	2.03 +/- 0.12	0.83 +/- 0.03	0.46 +/- 0.06	5.77	-0.12
Gates of the Mountains	1	1.26 +/- 0.11	1.08 +/- 0.05	0.32 +/- 0.10	15.05	0.20
Gila Wilderness	1	1.18 +/- 0.09	1.06 +/- 0.06	0.75 +/- 0.21	9.18	-0.02
Glacier NP	1	1.52 +/- 0.03	0.79 +/- 0.04	1.05 +/- 0.06	7.46	-0.68
Great Basin NP	1	1.05 +/- 0.10	1.06 +/- 0.13	0.49 +/- 0.15	13.34	-1.00
Great Gulf Wilderness	1	1.62 +/- 0.18	0.97 +/- 0.04	0.46 +/- 0.12	8.38	-0.31
Great River Bluffs	1	1.42 +/- 0.20	0.86 +/- 0.07	1.00 +/- 0.03	8.40	-0.28
Great Sand Dunes NM	1	1.15 +/- 0.12	1.01 +/- 0.07	0.74 +/- 0.09	10.27	-0.41
Great Smoky Mountains NP	1	1.85 +/- 0.06	0.87 +/- 0.02	0.54 +/- 0.05	6.33	0.02
Guadalupe Mountains NP	1	1.29 +/- 0.28	1.14 +/- 0.13	0.53 +/- 0.10	11.30	1.00
Hells Canyon	1	1.33 +/- 0.10	0.97 +/- 0.09	0.72 +/- 0.03	13.60	-0.64
Hercules-Glades	1	1.61 +/- 0.07	0.87 +/- 0.04	0.74 +/- 0.04	8.07	-0.23
Hoover	1	1.42 +/- 0.17	1.17 +/- 0.08	0.43 +/- 0.09	15.29	0.01
Indian Gardens	1	1.20 +/- 0.16	1.15 +/- 0.10	0.32 +/- 0.08	10.96	1.37
Isle Royale NP	1	2.02 +/- 0.28	0.92 +/- 0.06	0.87 +/- 0.03	9.10	0.79
James River Face Wilderness	1	1.64 +/- 0.06	0.90 +/- 0.02	0.69 +/- 0.05	6.06	-0.10
Jarbidge Wilderness	1	1.12 +/- 0.18	1.17 +/- 0.09	0.69 +/- 0.08	16.68	0.89
Joshua Tree NP	1	1.26 +/- 0.16	0.79 +/- 0.10	0.78 +/- 0.03	10.58	0.46
Kaiser	1	1.06 +/- 0.13	1.02 +/- 0.09	1.00 +/- 0.05	12.89	-1.33
Lassen Volcanic NP	1	1.39 +/- 0.09	1.16 +/- 0.07	0.35 +/- 0.08	13.82	-1.05
Lava Beds NM	1	1.43 +/- 0.06	1.07 +/- 0.07	0.41 +/- 0.15	14.09	-1.13
Linville Gorge	1	1.80 +/- 0.05	0.92 +/- 0.02	0.33 +/- 0.08	6.82	-0.23
Livonia	1	1.58 +/- 0.09	0.92 +/- 0.03	0.92 +/- 0.02	6.01	-0.17
Lostwood	1	1.11 +/- 0.16	0.95 +/- 0.04	0.96 +/- 0.04	9.27	-0.92

Lye Brook Wilderness	1	1.60 +/- 0.23	0.87 +/- 0.05	0.77 +/- 0.07	9.20	-0.33
M.K. Goddard	1	1.57 +/- 0.09	0.79 +/- 0.03	0.98 +/- 0.04	6.55	-0.26
Mammoth Cave NP	1	1.79 +/- 0.07	0.77 +/- 0.02	0.67 +/- 0.03	6.77	-0.22
Marthas Vineyard	1	1.77 +/- 0.16	0.84 +/- 0.04	0.73 +/- 0.12	5.80	-0.29
Medicine Lake	1	1.59 +/- 0.19	0.89 +/- 0.04	0.76 +/- 0.04	10.64	-0.44
Mesa Verde NP	1	1.39 +/- 0.17	1.10 +/- 0.09	0.26 +/- 0.14	12.42	0.85
Mohawk Mt.	1	1.47 +/- 0.15	0.94 +/- 0.04	0.58 +/- 0.09	7.32	0.10
Monture	1	1.29 +/- 0.06	1.05 +/- 0.05	0.73 +/- 0.18	14.05	0.68
Moosehorn NWR	1	1.29 +/- 0.10	0.97 +/- 0.03	0.76 +/- 0.11	7.11	-0.07
Mount Baldy	1	1.31 +/- 0.05	1.02 +/- 0.04	0.60 +/- 0.07	9.14	0.06
Mount Hood	1	1.80 +/- 0.14	1.17 +/- 0.06	0.02 +/- 0.13	16.56	0.39
Mount Rainier NP	1	1.46 +/- 0.04	0.97 +/- 0.06	0.90 +/- 0.17	9.86	0.44
Mount Zirkel Wilderness	1	1.17 +/- 0.26	0.91 +/- 0.09	0.68 +/- 0.09	13.37	0.06
Nebraska NF	1	1.45 +/- 0.22	0.70 +/- 0.08	1.11 +/- 0.05	10.90	-0.15
North Cascades	1	1.62 +/- 0.12	1.04 +/- 0.07	0.93 +/- 0.27	15.51	0.36
Northern Cheyenne	1	1.86 +/- 0.11	0.95 +/- 0.04	0.19 +/- 0.06	10.85	-0.11
Okefenokee NWR	1	1.64 +/- 0.05	0.94 +/- 0.02	0.25 +/- 0.14	6.33	-0.25
Olympic	1	1.36 +/- 0.06	1.00 +/- 0.07	0.67 +/- 0.09	8.86	0.02
Omaha	1	1.23 +/- 0.12	1.02 +/- 0.03	1.09 +/- 0.03	4.82	0.01
Organ Pipe	1	1.40 +/- 0.13	1.01 +/- 0.06	0.35 +/- 0.10	8.48	0.83
Pasayten	1	1.47 +/- 0.11	1.11 +/- 0.06	0.27 +/- 0.08	16.62	0.64
Pinnacles NM	1	1.39 +/- 0.23	0.82 +/- 0.24	0.84 +/- 0.13	13.03	1.07
Point Reyes National Seashore	1	1.02 +/- 0.13	0.88 +/- 0.05	0.99 +/- 0.04	7.92	-0.93
Presque Isle	1	1.36 +/- 0.07	0.87 +/- 0.03	0.91 +/- 0.11	5.49	0.00
Proctor Maple R. F.	1	1.32 +/- 0.09	0.91 +/- 0.02	0.96 +/- 0.05	6.22	-0.04
Puget Sound	1	1.25 +/- 0.05	0.66 +/- 0.09	1.23 +/- 0.08	6.18	-0.05
Quabbin Summit	1	1.47 +/- 0.11	0.93 +/- 0.03	0.65 +/- 0.07	6.14	-0.07
Quaker City	1	1.81 +/- 0.10	0.86 +/- 0.02	0.79 +/- 0.03	6.66	-0.09
Queen Valley	1	1.31 +/- 0.16	0.94 +/- 0.09	0.54 +/- 0.03	7.88	0.34

Redwood NP	1	1.65 +/- 0.07	0.76 +/- 0.05	0.97 +/- 0.13	7.65	-0.85
Sac and Fox	1	1.27 +/- 0.08	0.84 +/- 0.05	1.07 +/- 0.03	7.23	-0.34
Saguaro West	1	1.33 +/- 0.20	0.96 +/- 0.13	0.28 +/- 0.08	8.45	0.73
San Gabriel	1	1.10 +/- 0.18	0.74 +/- 0.10	0.76 +/- 0.04	10.47	-0.40
San Pedro Parks	1	1.70 +/- 0.28	1.04 +/- 0.09	-0.11 +/- 0.18	12.96	0.03
Sawtooth NF	1	1.10 +/- 0.04	0.94 +/- 0.12	0.68 +/- 0.47	14.36	-1.80
Seney	1	1.42 +/- 0.16	0.91 +/- 0.03	0.86 +/- 0.03	7.24	0.87
Shenandoah NP	1	1.72 +/- 0.08	0.85 +/- 0.02	0.78 +/- 0.04	7.21	-0.43
Shining Rock Wilderness	1	1.58 +/- 0.08	0.97 +/- 0.03	0.13 +/- 0.11	8.78	-0.33
Sierra Ancha	1	1.15 +/- 0.09	1.07 +/- 0.09	0.29 +/- 0.10	11.57	-0.45
Sikes	1	1.52 +/- 0.05	1.01 +/- 0.02	0.44 +/- 0.05	5.92	-0.07
Sipsy Wilderness	1	1.81 +/- 0.05	0.84 +/- 0.02	0.44 +/- 0.04	6.30	-0.04
Starkey	1	1.40 +/- 0.05	0.77 +/- 0.05	0.78 +/- 0.03	10.02	-0.53
Sula Peak	1	1.30 +/- 0.10	1.05 +/- 0.07	0.36 +/- 0.16	15.56	-2.26
Swanquarter	1	1.71 +/- 0.09	0.99 +/- 0.02	0.19 +/- 0.09	6.60	0.02
Sycamore Canyon	1	1.21 +/- 0.05	0.95 +/- 0.06	0.52 +/- 0.05	8.21	0.25
Tallgrass	1	1.44 +/- 0.08	0.77 +/- 0.05	0.97 +/- 0.03	8.75	-0.50
Theodore Roosevelt	1	1.01 +/- 0.14	1.06 +/- 0.04	0.90 +/- 0.04	7.70	-0.31
Three Sisters Wilderness	1	1.65 +/- 0.09	1.05 +/- 0.06	0.33 +/- 0.20	14.39	-1.15
Thunder Basin	1	1.48 +/- 0.10	0.88 +/- 0.05	0.74 +/- 0.05	7.62	0.08
Tonto NM	1	1.52 +/- 0.14	1.05 +/- 0.08	0.33 +/- 0.06	8.99	0.16
Trinity	1	1.42 +/- 0.07	1.26 +/- 0.08	0.37 +/- 0.11	13.19	-0.85
UL Bend	1	1.65 +/- 0.12	0.81 +/- 0.04	0.90 +/- 0.04	9.92	0.05
Upper Buffalo Wilderness	1	1.46 +/- 0.06	0.87 +/- 0.03	0.89 +/- 0.03	7.83	-0.55
Viking Lake	1	1.27 +/- 0.09	0.92 +/- 0.04	1.12 +/- 0.02	5.27	0.01
Voyageurs NP #2	1	1.12 +/- 0.12	0.89 +/- 0.04	0.98 +/- 0.02	7.15	0.14
Weminuche Wilderness	1	1.14 +/- 0.10	1.01 +/- 0.07	0.45 +/- 0.14	10.27	-1.08
White Mountain	1	1.51 +/- 0.17	1.05 +/- 0.07	0.60 +/- 0.06	9.25	-0.14
White Pass	1	1.30 +/- 0.20	1.15 +/- 0.08	0.59 +/- 0.16	22.56	-1.95

White River NF	1	1.29 +/- 0.27	1.02 +/- 0.11	0.20 +/- 0.15	14.38	-0.04
Wichita Mountains	1	1.27 +/- 0.07	0.92 +/- 0.04	1.01 +/- 0.03	8.22	-0.84
Wind Cave	1	1.35 +/- 0.08	0.95 +/- 0.04	0.55 +/- 0.04	9.80	0.15
Yosemite NP	1	1.47 +/- 0.13	1.00 +/- 0.10	0.88 +/- 0.04	13.25	-2.28
Zion Canyon	1	1.17 +/- 0.12	1.07 +/- 0.08	0.55 +/- 0.07	11.12	-0.95
Acadia NP	2	1.93 +/- 0.06	0.97 +/- 0.02	0.45 +/- 0.11	6.54	0.38
Addison Pinnacle	2	1.63 +/- 0.13	1.08 +/- 0.03	0.35 +/- 0.10	7.37	-1.00
Agua Tibia	2	2.10 +/- 0.09	0.79 +/- 0.05	0.58 +/- 0.05	6.55	0.04
Arendtsville	2	1.84 +/- 0.12	0.99 +/- 0.03	0.69 +/- 0.05	7.31	-0.45
Badlands NP	2	1.69 +/- 0.09	0.89 +/- 0.06	0.45 +/- 0.14	11.19	0.13
Bandelier NM	2	1.43 +/- 0.09	0.98 +/- 0.07	0.82 +/- 0.27	7.86	0.07
Big Bend NP	2	2.16 +/- 0.12	0.96 +/- 0.03	0.24 +/- 0.28	6.72	0.19
Birmingham	2	1.41 +/- 0.08	1.07 +/- 0.04	0.18 +/- 0.34	5.54	0.21
Bliss SP (TRPA)	2	1.94 +/- 0.05	0.67 +/- 0.05	0.91 +/- 0.13	7.31	-0.48
Bondville	2	1.95 +/- 0.12	1.03 +/- 0.04	0.63 +/- 0.05	8.55	-0.67
Bridger Wilderness	2	1.83 +/- 0.07	0.93 +/- 0.05	0.45 +/- 0.18	7.90	-0.13
Cabinet Mountains	2	1.82 +/- 0.05	0.98 +/- 0.05	0.45 +/- 0.18	6.96	0.09
Cadiz	2	1.90 +/- 0.07	0.96 +/- 0.02	0.67 +/- 0.06	6.17	-0.07
Caney Creek	2	1.87 +/- 0.10	1.03 +/- 0.03	0.01 +/- 0.16	6.51	-0.15
Canyonlands NP	2	2.14 +/- 0.12	0.76 +/- 0.06	0.89 +/- 0.24	7.51	0.21
Cape Cod	2	1.98 +/- 0.12	0.98 +/- 0.03	0.35 +/- 0.14	7.03	-0.99
Cape Romain NWR	2	1.76 +/- 0.08	0.98 +/- 0.02	0.04 +/- 0.21	6.76	-0.01
Capitol Reef NP	2	2.20 +/- 0.12	0.75 +/- 0.08	0.33 +/- 0.24	7.39	-0.29
Casco Bay	2	1.72 +/- 0.07	1.10 +/- 0.03	0.25 +/- 0.14	7.36	-0.67
Cedar Bluff	2	1.69 +/- 0.10	1.03 +/- 0.04	0.40 +/- 0.05	6.96	-0.06
Chassahowitzka NWR	2	1.79 +/- 0.10	0.96 +/- 0.03	0.24 +/- 0.21	6.90	-0.02
Cherokee Nation	2	1.72 +/- 0.05	1.00 +/- 0.02	0.45 +/- 0.05	5.38	-0.07
Cloud Peak	2	1.92 +/- 0.07	0.99 +/- 0.06	0.30 +/- 0.16	7.81	-0.07
Cohutta	2	2.15 +/- 0.10	0.90 +/- 0.03	-0.26 +/- 0.19	5.76	-0.18
Columbia Gorge #1	2	1.57 +/- 0.06	0.85 +/- 0.06	0.52 +/- 0.09	7.03	-0.08

Columbia River Gorge	2	1.34 +/- 0.08	1.14 +/- 0.08	0.40 +/- 0.18	8.28	-0.61
Crater Lake NP	2	1.81 +/- 0.06	0.90 +/- 0.05	1.08 +/- 0.26	7.85	-0.14
Craters of the Moon NM	2	1.97 +/- 0.06	0.95 +/- 0.05	0.24 +/- 0.12	8.30	-0.26
Crescent Lake	2	2.02 +/- 0.13	0.94 +/- 0.06	0.73 +/- 0.06	9.17	0.14
Dolly Sods Wilderness	2	1.94 +/- 0.14	0.99 +/- 0.03	0.07 +/- 0.14	6.90	-0.26
Dome Lands Wilderness	2	2.05 +/- 0.14	0.64 +/- 0.11	0.56 +/- 0.06	7.08	-0.23
El Dorado Springs	2	1.78 +/- 0.07	0.98 +/- 0.03	0.27 +/- 0.06	6.24	-0.24
Ellis	2	1.88 +/- 0.08	0.98 +/- 0.03	0.51 +/- 0.06	6.52	-0.39
Everglades NP	2	1.53 +/- 0.04	1.04 +/- 0.03	0.44 +/- 0.21	7.28	0.10
Flathead	2	1.76 +/- 0.05	0.97 +/- 0.06	0.02 +/- 0.22	8.40	-0.52
Fort Peck	2	1.95 +/- 0.08	0.90 +/- 0.04	0.28 +/- 0.06	7.60	0.41
Frostberg Reservoir (Big Piney Run)	2	2.25 +/- 0.14	0.89 +/- 0.03	-0.07 +/- 0.10	5.34	0.34
Gates of the Mountains	2	1.74 +/- 0.08	0.89 +/- 0.08	0.45 +/- 0.20	9.98	0.30
Glacier NP	2	1.73 +/- 0.05	0.98 +/- 0.08	0.27 +/- 0.55	7.39	-0.73
Great Basin NP	2	1.56 +/- 0.14	0.88 +/- 0.10	1.10 +/- 0.37	9.56	0.10
Great Gulf Wilderness	2	1.70 +/- 0.07	1.06 +/- 0.03	0.04 +/- 0.33	7.36	-0.15
Great River Bluffs	2	1.69 +/- 0.07	1.01 +/- 0.03	0.41 +/- 0.05	8.14	0.01
Great Sand Dunes NM	2	1.89 +/- 0.11	0.75 +/- 0.09	1.07 +/- 0.27	7.76	-0.20
Great Smoky Mountains NP	2	2.15 +/- 0.10	1.01 +/- 0.03	-0.15 +/- 0.18	6.27	-0.39
Guadalupe Mountains NP	2	1.52 +/- 0.15	1.01 +/- 0.05	0.81 +/- 0.24	6.62	0.27
Hance Camp at Grand Canyon NP	2	1.89 +/- 0.10	0.93 +/- 0.06	0.81 +/- 0.15	7.05	-0.22
Hercules-Glades	2	1.72 +/- 0.07	0.98 +/- 0.03	0.39 +/- 0.10	6.94	-0.27
Hoover	2	2.04 +/- 0.07	0.70 +/- 0.06	0.71 +/- 0.20	8.25	0.38
Ikes Backbone	2	1.71 +/- 0.14	0.63 +/- 0.09	1.05 +/- 0.24	8.69	0.28
Indian Gardens	2	1.90 +/- 0.11	0.74 +/- 0.07	1.01 +/- 0.22	7.07	0.17
Isle Royale NP	2	1.94 +/- 0.07	1.09 +/- 0.03	0.62 +/- 0.08	8.44	-0.01
James River Face	2	2.19 +/- 0.09	0.91 +/- 0.03	0.02 +/- 0.12	6.36	-0.17

Wilderness						
Jarbidge Wilderness	2	1.83 +/- 0.08	0.86 +/- 0.07	1.21 +/- 0.36	8.64	-0.56
Joshua Tree NP	2	2.39 +/- 0.14	0.62 +/- 0.08	0.56 +/- 0.04	7.39	-0.18
Kaiser	2	1.87 +/- 0.08	0.78 +/- 0.07	0.61 +/- 0.08	7.88	0.22
Kalmiopsis	2	1.70 +/- 0.07	0.87 +/- 0.06	0.76 +/- 0.22	8.14	-0.33
Lassen Volcanic NP	2	1.72 +/- 0.05	0.96 +/- 0.05	0.47 +/- 0.09	8.70	1.16
Lava Beds NM	2	1.73 +/- 0.06	0.88 +/- 0.06	0.85 +/- 0.19	9.34	0.22
Linville Gorge	2	1.99 +/- 0.08	1.02 +/- 0.02	0.01 +/- 0.16	5.82	0.08
Livonia	2	1.97 +/- 0.13	1.01 +/- 0.03	0.44 +/- 0.05	7.43	-0.38
Lostwood	2	1.96 +/- 0.07	0.92 +/- 0.04	0.41 +/- 0.04	8.26	-0.07
Lye Brook Wilderness	2	2.00 +/- 0.10	0.99 +/- 0.03	0.10 +/- 0.15	6.81	-0.20
Mammoth Cave NP	2	1.99 +/- 0.08	0.93 +/- 0.02	0.27 +/- 0.08	6.04	-0.10
Marthas Vineyard	2	2.04 +/- 0.12	1.00 +/- 0.03	0.27 +/- 0.13	6.57	-0.18
Meadview	2	2.23 +/- 0.17	0.74 +/- 0.07	0.76 +/- 0.22	7.15	-0.03
Medicine Lake	2	2.17 +/- 0.07	0.83 +/- 0.04	0.39 +/- 0.07	8.83	-0.10
Mesa Verde NP	2	1.42 +/- 0.15	1.09 +/- 0.12	0.66 +/- 0.37	10.12	0.89
Moosehorn NWR	2	1.87 +/- 0.07	0.91 +/- 0.03	0.89 +/- 0.15	8.04	-0.44
Mount Baldy	2	1.83 +/- 0.10	0.79 +/- 0.07	0.94 +/- 0.17	6.55	-0.05
Mount Rainier NP	2	1.70 +/- 0.06	1.07 +/- 0.07	0.45 +/- 0.21	8.46	0.34
Mount Zirkel Wilderness	2	1.89 +/- 0.12	0.94 +/- 0.08	0.30 +/- 0.18	9.21	-0.46
Nebraska NF	2	2.10 +/- 0.19	1.03 +/- 0.08	0.37 +/- 0.07	10.49	0.01
North Absaroka	2	2.05 +/- 0.08	0.94 +/- 0.07	0.18 +/- 0.14	8.55	-0.14
North Cascades	2	1.90 +/- 0.07	1.02 +/- 0.06	0.81 +/- 0.24	8.42	0.06
Northern Cheyenne	2	2.06 +/- 0.07	0.96 +/- 0.04	0.13 +/- 0.09	7.45	-0.09
Okefenokee NWR	2	1.61 +/- 0.07	1.00 +/- 0.03	0.13 +/- 0.22	6.98	0.01
Olympic	2	1.39 +/- 0.08	1.13 +/- 0.07	0.74 +/- 0.17	7.30	-0.24
Omaha	2	1.91 +/- 0.09	1.03 +/- 0.04	0.53 +/- 0.05	8.00	-0.12
Organ Pipe	2	1.74 +/- 0.16	0.77 +/- 0.07	0.86 +/- 0.23	6.20	0.01
Pasayten	2	1.58 +/- 0.07	1.09 +/- 0.07	0.38 +/- 0.24	10.47	-0.24
Petrified Forest NP	2	1.94 +/- 0.11	0.72 +/- 0.07	1.24 +/- 0.18	6.54	0.20

Phoenix	2	1.23 +/- 0.08	1.11 +/- 0.08	0.21 +/- 0.20	5.95	-0.12
Pinnacles NM	2	1.65 +/- 0.07	0.78 +/- 0.04	1.00 +/- 0.07	6.64	0.36
Point Reyes National Seashore	2	2.06 +/- 0.24	0.69 +/- 0.08	1.12 +/- 0.25	8.31	0.01
Presque Isle	2	1.86 +/- 0.05	0.91 +/- 0.03	0.03 +/- 0.20	5.69	0.03
Proctor Maple R. F.	2	1.95 +/- 0.09	1.01 +/- 0.03	0.25 +/- 0.13	6.81	-0.46
Puget Sound	2	1.48 +/- 0.07	0.98 +/- 0.06	0.44 +/- 0.09	6.25	-0.18
Quabbin Summit	2	2.02 +/- 0.10	0.91 +/- 0.03	0.01 +/- 0.14	6.58	-0.29
Quaker City	2	1.83 +/- 0.14	1.07 +/- 0.03	0.17 +/- 0.11	7.39	-0.37
Queen Valley	2	1.73 +/- 0.16	0.85 +/- 0.07	0.88 +/- 0.18	6.73	-0.33
Redwood NP	2	1.81 +/- 0.12	0.88 +/- 0.06	0.95 +/- 0.23	7.81	-0.70
Rocky Mountain NP	2	1.67 +/- 0.10	0.94 +/- 0.08	0.47 +/- 0.07	8.43	-0.43
Sac and Fox	2	1.86 +/- 0.07	0.92 +/- 0.03	0.50 +/- 0.04	6.65	-0.43
Saguaro NM	2	1.44 +/- 0.13	0.80 +/- 0.09	1.02 +/- 0.30	7.39	-0.20
Saguaro West	2	1.59 +/- 0.19	0.76 +/- 0.11	0.85 +/- 0.29	6.93	-0.15
San Gabriel	2	2.10 +/- 0.10	0.71 +/- 0.05	0.47 +/- 0.03	7.47	0.05
San Gorgonio Wilderness	2	1.40 +/- 0.12	0.81 +/- 0.09	0.79 +/- 0.03	8.35	0.54
San Pedro Parks	2	1.85 +/- 0.09	0.66 +/- 0.08	1.12 +/- 0.24	8.41	0.03
San Rafael	2	1.81 +/- 0.12	0.81 +/- 0.07	0.71 +/- 0.09	8.42	0.13
Seney	2	1.83 +/- 0.07	0.97 +/- 0.02	0.31 +/- 0.07	6.86	-0.25
Sequoia NP	2	1.84 +/- 0.08	0.75 +/- 0.07	0.69 +/- 0.06	6.59	0.04
Shamrock Mine	2	2.01 +/- 0.11	1.01 +/- 0.07	0.27 +/- 0.23	5.14	-0.22
Shenandoah NP	2	1.76 +/- 0.10	1.13 +/- 0.03	0.21 +/- 0.09	6.69	-0.30
Sierra Ancha	2	1.36 +/- 0.07	0.98 +/- 0.06	0.59 +/- 0.16	6.43	-0.42
Sikes	2	1.79 +/- 0.06	1.06 +/- 0.03	0.02 +/- 0.20	5.60	-0.11
Sipsy Wilderness	2	1.87 +/- 0.07	1.01 +/- 0.02	0.02 +/- 0.11	5.39	0.05
Snoqualmie Pass	2	1.73 +/- 0.09	0.95 +/- 0.09	0.44 +/- 0.17	10.95	-0.88
Starkey	2	1.74 +/- 0.07	0.88 +/- 0.07	0.62 +/- 0.23	9.55	0.22
Sula Peak	2	1.71 +/- 0.07	1.04 +/- 0.11	-0.06 +/- 0.53	10.45	-0.26
Tallgrass	2	1.63 +/- 0.05	1.06 +/- 0.02	0.22 +/- 0.05	5.98	-0.69

Theodore Roosevelt	2	1.83 +/- 0.10	1.03 +/- 0.06	0.60 +/- 0.08	8.73	0.44
Three Sisters Wilderness	2	1.81 +/- 0.06	1.01 +/- 0.06	0.46 +/- 0.20	8.79	-0.06
Thunder Basin	2	1.86 +/- 0.08	0.96 +/- 0.05	0.59 +/- 0.10	6.27	-0.15
Tonto NM	2	1.94 +/- 0.12	0.75 +/- 0.07	0.78 +/- 0.16	5.73	-0.28
Trinity	2	1.80 +/- 0.07	0.81 +/- 0.06	1.08 +/- 0.21	8.68	-0.19
UL Bend	2	1.88 +/- 0.06	0.94 +/- 0.04	0.59 +/- 0.15	7.37	0.03
Upper Buffalo Wilderness	2	1.80 +/- 0.08	1.01 +/- 0.03	0.54 +/- 0.08	6.49	-0.22
Viking Lake	2	1.59 +/- 0.07	1.05 +/- 0.03	0.77 +/- 0.04	7.92	-0.63
Voyageurs NP #2	2	1.84 +/- 0.05	0.97 +/- 0.03	0.33 +/- 0.09	7.54	-0.34
Weminuche Wilderness	2	1.94 +/- 0.10	0.88 +/- 0.08	0.06 +/- 0.25	7.88	-0.21
Wheeler Peak	2	1.67 +/- 0.13	0.93 +/- 0.11	0.86 +/- 0.34	9.25	0.21
White Mountain	2	1.85 +/- 0.13	1.07 +/- 0.07	0.23 +/- 0.28	7.22	-0.02
White Pass	2	1.78 +/- 0.08	1.21 +/- 0.06	0.33 +/- 0.20	9.65	0.38
White River NF	2	2.14 +/- 0.10	0.87 +/- 0.07	0.28 +/- 0.19	8.32	0.12
Wichita Mountains	2	1.74 +/- 0.10	1.09 +/- 0.04	0.47 +/- 0.09	6.69	-0.54
Wind Cave	2	1.72 +/- 0.06	0.97 +/- 0.03	0.27 +/- 0.05	6.39	-1.02
Yellowstone NP 2	2	1.78 +/- 0.06	0.94 +/- 0.05	0.32 +/- 0.11	7.11	-0.70
Yosemite NP	2	1.87 +/- 0.05	0.86 +/- 0.04	0.72 +/- 0.07	5.53	-0.18
Zion Canyon	2	1.83 +/- 0.11	1.10 +/- 0.07	0.40 +/- 0.31	6.67	-0.31
Acadia NP	3	1.80 +/- 0.06	1.12 +/- 0.02	0.59 +/- 0.31	6.50	-0.15
Addison Pinnacle	3	1.82 +/- 0.11	1.08 +/- 0.02	0.49 +/- 0.46	6.85	-0.30
Agua Tibia	3	1.96 +/- 0.08	0.96 +/- 0.03	0.38 +/- 0.06	5.41	-0.30
Arendtsville	3	1.89 +/- 0.11	1.12 +/- 0.02	-0.06 +/- 0.11	6.22	-0.16
Badlands NP	3	1.80 +/- 0.05	0.94 +/- 0.05	0.22 +/- 0.17	9.80	-0.52
Big Bend NP	3	1.57 +/- 0.17	1.06 +/- 0.03	0.80 +/- 0.25	6.67	0.16
Birmingham	3	1.59 +/- 0.13	1.11 +/- 0.04	-0.48 +/- 0.55	6.10	-0.13
Bliss SP (TRPA)	3	1.79 +/- 0.04	0.88 +/- 0.06	1.18 +/- 0.26	6.44	-0.37
Blue Mounds	3	2.07 +/- 0.05	1.06 +/- 0.03	0.05 +/- 0.09	5.83	-0.42
Bondville	3	1.95 +/- 0.14	1.19 +/- 0.03	-0.05 +/- 0.17	8.03	-0.10

Boundary Waters Canoe Area	3	1.81 +/- 0.04	0.99 +/- 0.04	1.08 +/- 0.61	7.84	-0.64
Bridger Wilderness	3	1.83 +/- 0.05	1.10 +/- 0.09	-0.15 +/- 0.53	9.07	-0.86
Brigantine NWR	3	1.92 +/- 0.12	1.06 +/- 0.03	-0.06 +/- 0.29	8.06	-0.25
Bryce Canyon NP	3	1.44 +/- 0.07	1.13 +/- 0.08	0.88 +/- 0.53	10.89	-0.42
Cabinet Mountains	3	1.84 +/- 0.04	1.02 +/- 0.10	-0.27 +/- 0.41	6.38	-0.45
Cadiz	3	1.91 +/- 0.17	1.07 +/- 0.03	-0.05 +/- 0.55	7.81	-0.50
Canyonlands NP	3	2.04 +/- 0.08	1.02 +/- 0.07	-0.28 +/- 0.61	8.07	-0.16
Cape Cod	3	1.76 +/- 0.09	1.11 +/- 0.03	-0.09 +/- 0.33	8.50	-0.45
Cape Romain NWR	3	1.74 +/- 0.15	1.03 +/- 0.03	-0.33 +/- 0.40	8.17	-0.16
Cedar Bluff	3	1.78 +/- 0.08	1.05 +/- 0.03	0.14 +/- 0.14	6.06	-0.12
Cherokee Nation	3	1.82 +/- 0.10	1.05 +/- 0.03	0.07 +/- 0.24	5.13	-0.01
Chiricahua NM	3	1.93 +/- 0.13	1.02 +/- 0.04	0.78 +/- 0.43	7.69	-0.09
Columbia Gorge #1	3	1.61 +/- 0.05	0.98 +/- 0.07	0.35 +/- 0.15	7.36	-0.07
Columbia River Gorge	3	1.63 +/- 0.06	0.92 +/- 0.11	0.86 +/- 0.29	7.57	-0.09
Connecticut Hill	3	1.75 +/- 0.11	1.11 +/- 0.02	-0.33 +/- 0.36	6.04	-0.07
Crater Lake NP	3	1.78 +/- 0.04	0.90 +/- 0.11	0.61 +/- 0.77	8.54	-2.03
Craters of the Moon NM	3	1.93 +/- 0.05	0.79 +/- 0.09	-0.13 +/- 0.24	7.42	-0.60
Crescent Lake	3	2.02 +/- 0.05	1.09 +/- 0.04	0.09 +/- 0.08	6.17	-0.87
Dolly Sods Wilderness	3	1.77 +/- 0.12	1.05 +/- 0.02	-0.14 +/- 0.46	6.77	-0.25
Dome Lands Wilderness	3	1.92 +/- 0.07	0.93 +/- 0.07	0.13 +/- 0.10	5.97	-0.46
Douglas	3	1.45 +/- 0.12	1.10 +/- 0.05	-0.42 +/- 0.39	6.26	0.16
El Dorado Springs	3	1.48 +/- 0.09	1.10 +/- 0.03	0.34 +/- 0.23	5.99	-0.03
Ellis	3	1.85 +/- 0.11	1.04 +/- 0.04	0.71 +/- 0.24	6.34	-0.49
Everglades NP	3	1.52 +/- 0.10	1.05 +/- 0.03	0.58 +/- 0.25	7.12	0.05
Fort Peck	3	1.82 +/- 0.04	1.01 +/- 0.05	0.98 +/- 0.34	7.19	-0.13
Frostberg Reservoir (Big Piney Run)	3	1.90 +/- 0.12	0.98 +/- 0.02	0.02 +/- 0.56	4.83	0.10
Gates of the Mountains	3	1.80 +/- 0.04	0.75 +/- 0.10	0.95 +/- 0.34	7.23	-0.68
Gila Wilderness	3	1.50 +/- 0.06	1.06 +/- 0.05	-0.22 +/- 0.84	9.11	-0.28

Great Basin NP	3	1.88 +/- 0.05	0.90 +/- 0.05	0.32 +/- 0.36	7.17	-0.36
Great Gulf Wilderness	3	1.91 +/- 0.08	1.09 +/- 0.02	-1.69 +/- 1.66	6.85	-0.12
Great River Bluffs	3	1.96 +/- 0.05	0.98 +/- 0.02	0.09 +/- 0.09	5.56	-0.50
Great Sand Dunes NM	3	2.12 +/- 0.13	0.90 +/- 0.11	-0.35 +/- 1.30	8.90	-0.40
Great Smoky Mountains NP	3	1.84 +/- 0.15	1.07 +/- 0.03	0.43 +/- 0.82	6.94	-0.32
Hance Camp at Grand Canyon NP	3	1.52 +/- 0.06	1.13 +/- 0.06	0.93 +/- 0.40	8.28	-0.47
Hells Canyon	3	1.74 +/- 0.03	0.84 +/- 0.11	0.10 +/- 0.53	6.94	-0.25
Hoover	3	1.83 +/- 0.06	0.97 +/- 0.07	0.02 +/- 0.39	8.10	-0.42
Indian Gardens	3	1.65 +/- 0.10	1.09 +/- 0.08	-0.35 +/- 0.51	8.41	-0.49
Isle Royale NP	3	1.93 +/- 0.06	1.09 +/- 0.03	0.55 +/- 0.85	7.46	-0.63
Jarbidge Wilderness	3	1.93 +/- 0.06	0.81 +/- 0.09	0.77 +/- 0.69	6.22	-0.59
Joshua Tree NP	3	2.19 +/- 0.13	0.93 +/- 0.06	0.30 +/- 0.13	7.37	-0.17
Kaiser	3	2.00 +/- 0.05	0.73 +/- 0.06	0.46 +/- 0.07	6.30	-0.56
Kalmiopsis	3	1.65 +/- 0.05	0.83 +/- 0.08	0.96 +/- 0.28	8.59	-0.42
Lassen Volcanic NP	3	1.76 +/- 0.04	0.85 +/- 0.07	1.32 +/- 0.25	7.76	0.88
Lava Beds NM	3	1.75 +/- 0.07	0.98 +/- 0.21	0.35 +/- 1.20	8.65	-0.62
Linville Gorge	3	2.01 +/- 0.15	1.09 +/- 0.03	0.80 +/- 1.24	6.27	-0.32
Livonia	3	2.02 +/- 0.19	1.10 +/- 0.03	0.16 +/- 0.22	8.11	-0.41
Lye Brook Wilderness	3	1.98 +/- 0.08	1.03 +/- 0.02	0.28 +/- 0.38	6.59	0.09
Mammoth Cave NP	3	2.24 +/- 0.15	0.91 +/- 0.03	-0.46 +/- 0.40	5.78	-0.18
Marthas Vineyard	3	1.78 +/- 0.08	1.10 +/- 0.02	0.17 +/- 0.22	6.35	-0.07
Meadview	3	1.80 +/- 0.10	0.98 +/- 0.05	0.57 +/- 0.26	7.45	-0.01
Medicine Lake	3	1.73 +/- 0.04	1.03 +/- 0.05	0.63 +/- 0.29	7.58	0.28
Monture	3	1.88 +/- 0.12	1.37 +/- 0.55	-6.81 +/- 8.29	7.53	-0.05
Moosehorn NWR	3	1.65 +/- 0.06	1.09 +/- 0.03	0.48 +/- 0.46	7.90	-0.44
Mount Baldy	3	1.51 +/- 0.05	1.05 +/- 0.04	0.79 +/- 0.37	6.89	-0.81
Mount Hood	3	1.76 +/- 0.04	1.29 +/- 0.08	0.08 +/- 0.16	8.69	0.63
Mount Rainier NP	3	1.65 +/- 0.06	1.19 +/- 0.08	0.52 +/- 0.30	8.52	0.37

Mount Zirkel Wilderness	3	2.02 +/- 0.07	0.97 +/- 0.07	-0.62 +/- 0.44	6.67	-1.14
Nebraska NF	3	2.03 +/- 0.06	1.11 +/- 0.04	-0.19 +/- 0.14	7.31	-0.51
North Absaroka	3	1.86 +/- 0.05	1.11 +/- 0.09	0.31 +/- 0.42	7.02	-0.96
North Cascades	3	1.73 +/- 0.05	1.20 +/- 0.07	0.67 +/- 0.31	7.16	-0.16
Okefenokee NWR	3	1.90 +/- 0.12	0.92 +/- 0.03	-0.28 +/- 0.29	7.30	0.00
Olympic	3	1.68 +/- 0.06	1.00 +/- 0.05	0.71 +/- 0.14	7.76	-0.51
Omaha	3	2.12 +/- 0.08	1.04 +/- 0.03	0.09 +/- 0.14	6.09	-0.46
Organ Pipe	3	1.14 +/- 0.17	0.93 +/- 0.05	1.13 +/- 0.23	7.51	0.25
Pasayten	3	1.66 +/- 0.03	1.17 +/- 0.08	0.20 +/- 0.55	7.68	0.45
Petrified Forest NP	3	1.79 +/- 0.07	1.01 +/- 0.04	0.87 +/- 0.29	7.28	-0.66
Pinnacles NM	3	1.84 +/- 0.04	0.90 +/- 0.03	0.68 +/- 0.08	6.86	0.19
Puget Sound	3	1.53 +/- 0.05	0.87 +/- 0.04	0.71 +/- 0.10	6.04	-0.15
Quabbin Summit	3	1.78 +/- 0.05	1.00 +/- 0.02	-0.15 +/- 0.17	5.62	0.41
Queen Valley	3	1.90 +/- 0.13	0.98 +/- 0.05	0.09 +/- 0.16	7.39	-0.23
Redwood NP	3	1.83 +/- 0.05	0.94 +/- 0.05	0.95 +/- 0.18	7.94	-0.54
Rocky Mountain NP	3	1.97 +/- 0.08	0.84 +/- 0.11	0.18 +/- 0.18	8.26	-0.51
Saguaro NM	3	1.32 +/- 0.12	0.97 +/- 0.06	0.97 +/- 0.28	8.01	0.07
Salt Creek	3	1.78 +/- 0.14	1.00 +/- 0.05	0.35 +/- 0.24	8.47	0.30
San Gabriel	3	2.06 +/- 0.08	0.90 +/- 0.04	0.10 +/- 0.07	7.00	-0.32
San Gorgonio Wilderness	3	1.84 +/- 0.08	0.85 +/- 0.06	0.44 +/- 0.04	6.76	-0.20
San Pedro Parks	3	1.54 +/- 0.08	1.10 +/- 0.06	0.23 +/- 0.49	8.28	-0.08
San Rafael	3	2.00 +/- 0.06	0.85 +/- 0.04	0.57 +/- 0.09	7.33	-0.43
Sawtooth NF	3	1.88 +/- 0.07	1.02 +/- 0.24	-4.18 +/- 2.96	7.19	-0.15
Seney	3	1.61 +/- 0.06	1.04 +/- 0.03	0.77 +/- 0.45	7.71	-0.67
Sequoia NP	3	1.87 +/- 0.06	0.87 +/- 0.07	0.28 +/- 0.12	5.92	0.11
Shamrock Mine	3	2.02 +/- 0.07	1.06 +/- 0.07	-0.25 +/- 0.56	6.01	-0.59
Shenandoah NP	3	1.76 +/- 0.13	1.11 +/- 0.02	0.53 +/- 0.40	7.50	-0.17
Shining Rock Wilderness	3	2.08 +/- 0.20	0.98 +/- 0.03	-0.82 +/- 0.80	6.68	-0.30
Sierra Ancha	3	1.32 +/- 0.07	0.99 +/- 0.06	0.41 +/- 0.38	8.03	-0.21
Sikes	3	1.88 +/- 0.09	1.03 +/- 0.03	-0.37 +/- 0.36	5.79	-0.14

Sipsy Wilderness	3	2.27 +/- 0.11	0.92 +/- 0.03	-0.53 +/- 0.41	5.54	-0.20
Snoqualmie Pass	3	1.79 +/- 0.06	1.04 +/- 0.08	0.39 +/- 0.20	8.20	-0.60
Starkey	3	1.75 +/- 0.04	0.75 +/- 0.11	0.97 +/- 0.43	8.04	0.15
Swanquarter	3	1.83 +/- 0.09	1.02 +/- 0.02	0.45 +/- 0.27	5.46	0.01
Sycamore Canyon	3	1.32 +/- 0.08	1.03 +/- 0.11	1.05 +/- 0.58	7.34	0.26
Tallgrass	3	1.51 +/- 0.09	1.06 +/- 0.03	0.69 +/- 0.34	6.37	-0.10
Three Sisters Wilderness	3	1.80 +/- 0.04	1.05 +/- 0.08	0.44 +/- 0.33	5.43	-0.64
Tonto NM	3	1.75 +/- 0.10	0.98 +/- 0.05	0.45 +/- 0.28	7.33	-0.54
UL Bend	3	1.89 +/- 0.05	1.09 +/- 0.07	-1.04 +/- 0.94	7.52	-0.58
Upper Buffalo Wilderness	3	1.88 +/- 0.08	1.01 +/- 0.02	0.45 +/- 0.27	6.04	-0.35
Viking Lake	3	1.81 +/- 0.07	1.12 +/- 0.03	0.13 +/- 0.12	5.95	-0.10
Weminuche Wilderness	3	1.80 +/- 0.08	1.15 +/- 0.09	-0.92 +/- 0.94	9.46	-0.82
Wheeler Peak	3	1.63 +/- 0.11	1.15 +/- 0.08	0.49 +/- 0.45	9.63	0.18
White Mountain	3	1.71 +/- 0.11	1.10 +/- 0.04	-0.04 +/- 0.32	7.19	-0.47
White Pass	3	1.81 +/- 0.06	1.27 +/- 0.10	-0.22 +/- 0.35	10.27	0.11
White River NF	3	1.80 +/- 0.08	1.17 +/- 0.08	0.74 +/- 0.64	8.89	-0.42
Wichita Mountains	3	1.69 +/- 0.09	1.08 +/- 0.03	0.83 +/- 0.18	5.32	-0.06
Wind Cave	3	1.83 +/- 0.04	0.98 +/- 0.05	-0.48 +/- 0.42	6.44	-0.66
Yellowstone NP 2	3	1.80 +/- 0.04	0.98 +/- 0.11	-0.46 +/- 0.51	8.58	-0.81
Yosemite NP	3	1.67 +/- 0.04	1.01 +/- 0.07	0.96 +/- 0.28	7.49	0.11
Zion Canyon	3	1.83 +/- 0.07	1.08 +/- 0.04	0.73 +/- 0.34	6.28	-0.42
Acadia NP	4	1.56 +/- 0.09	0.99 +/- 0.04	0.55 +/- 0.11	8.50	-0.37
Agua Tibia	4	1.54 +/- 0.09	0.95 +/- 0.06	0.63 +/- 0.04	9.37	-0.70
Arendtsville	4	1.49 +/- 0.11	0.96 +/- 0.03	0.89 +/- 0.05	7.98	-0.74
Bandelier NM	4	1.43 +/- 0.05	1.06 +/- 0.04	0.39 +/- 0.08	9.10	-0.46
Big Bend NP	4	2.00 +/- 0.14	1.01 +/- 0.03	-0.22 +/- 0.21	8.13	-0.26
Birmingham	4	1.38 +/- 0.05	1.07 +/- 0.04	0.75 +/- 0.08	5.11	-0.10
Bliss SP (TRPA)	4	1.59 +/- 0.04	1.11 +/- 0.06	0.38 +/- 0.14	9.77	-0.70
Blue Mounds	4	1.57 +/- 0.09	0.96 +/- 0.05	1.11 +/- 0.03	6.56	0.13

Bondville	4	1.31 +/- 0.10	0.98 +/- 0.04	1.05 +/- 0.03	7.49	-0.29
Bosque del Apache	4	1.15 +/- 0.08	1.01 +/- 0.04	0.83 +/- 0.08	8.70	0.11
Boundary Waters Canoe Area	4	1.65 +/- 0.11	0.97 +/- 0.05	0.80 +/- 0.04	8.87	0.26
Bridger Wilderness	4	1.71 +/- 0.12	1.12 +/- 0.08	0.18 +/- 0.21	14.92	-0.88
Bridgton	4	1.60 +/- 0.08	1.06 +/- 0.04	0.19 +/- 0.14	8.38	-0.42
Brigantine NWR	4	1.50 +/- 0.10	1.01 +/- 0.03	0.71 +/- 0.06	6.71	-0.33
Bryce Canyon NP	4	1.49 +/- 0.10	1.07 +/- 0.07	0.51 +/- 0.08	13.47	-2.55
Cabinet Mountains	4	1.66 +/- 0.04	1.01 +/- 0.09	0.41 +/- 0.18	9.42	-0.31
Cadiz	4	1.75 +/- 0.06	0.90 +/- 0.03	0.75 +/- 0.03	6.50	-0.04
Caney Creek	4	1.74 +/- 0.06	1.01 +/- 0.03	0.32 +/- 0.04	7.02	-0.22
Canyonlands NP	4	1.84 +/- 0.15	1.03 +/- 0.07	0.45 +/- 0.08	11.88	0.45
Capitol Reef NP	4	1.96 +/- 0.13	0.86 +/- 0.08	0.53 +/- 0.06	11.25	-0.63
Casco Bay	4	1.50 +/- 0.05	1.00 +/- 0.03	0.66 +/- 0.10	7.34	-0.59
Cedar Bluff	4	1.03 +/- 0.39	1.12 +/- 0.23	1.01 +/- 0.09	14.58	-0.05
Chassahowitzka NWR	4	1.67 +/- 0.05	0.89 +/- 0.02	0.12 +/- 0.10	4.79	0.01
Cherokee Nation	4	1.39 +/- 0.08	1.03 +/- 0.04	0.91 +/- 0.03	7.89	-0.59
Chiricahua NM	4	1.24 +/- 0.10	1.23 +/- 0.04	0.21 +/- 0.14	9.28	1.55
Cloud Peak	4	2.11 +/- 0.13	0.94 +/- 0.07	0.50 +/- 0.25	17.70	-0.45
Cohutta	4	1.83 +/- 0.08	1.00 +/- 0.03	-0.01 +/- 0.06	6.22	-0.44
Columbia Gorge #1	4	1.60 +/- 0.04	0.68 +/- 0.07	0.72 +/- 0.05	8.73	-0.94
Columbia River Gorge	4	1.46 +/- 0.05	0.84 +/- 0.07	0.73 +/- 0.04	9.09	-0.65
Connecticut Hill	4	1.83 +/- 0.18	0.91 +/- 0.04	0.70 +/- 0.06	7.38	-0.89
Crater Lake NP	4	1.68 +/- 0.06	1.22 +/- 0.08	-0.32 +/- 0.25	12.88	-1.87
Craters of the Moon NM	4	1.68 +/- 0.10	1.10 +/- 0.10	0.47 +/- 0.04	12.35	-0.68
Crescent Lake	4	1.90 +/- 0.19	0.98 +/- 0.11	0.95 +/- 0.04	10.63	0.76
Death Valley NP	4	1.84 +/- 0.15	1.12 +/- 0.07	0.09 +/- 0.11	9.79	-0.52
Dolly Sods Wilderness	4	1.43 +/- 0.07	1.02 +/- 0.02	0.39 +/- 0.08	7.23	-0.24
Douglas	4	1.29 +/- 0.14	0.87 +/- 0.13	0.87 +/- 0.28	6.03	-0.09
El Dorado Springs	4	1.37 +/- 0.08	0.97 +/- 0.04	0.85 +/- 0.03	7.91	-0.29

Ellis	4	1.53 +/- 0.10	1.04 +/- 0.05	0.86 +/- 0.03	8.74	-1.10
Everglades NP	4	1.52 +/- 0.11	1.09 +/- 0.03	0.17 +/- 0.19	7.48	-0.24
Flathead	4	1.66 +/- 0.04	1.12 +/- 0.06	-0.05 +/- 0.11	8.03	-0.57
Fort Peck	4	1.44 +/- 0.09	0.96 +/- 0.05	0.76 +/- 0.04	10.16	-0.36
Frostberg Reservoir (Big Piney Run)	4	1.85 +/- 0.09	0.93 +/- 0.02	0.33 +/- 0.06	5.15	-0.27
Gates of the Mountains	4	1.67 +/- 0.06	1.25 +/- 0.07	-0.18 +/- 0.16	11.47	0.06
Gila Wilderness	4	1.61 +/- 0.09	0.97 +/- 0.05	0.43 +/- 0.31	9.70	-0.16
Glacier NP	4	1.65 +/- 0.03	0.87 +/- 0.06	0.94 +/- 0.07	6.97	-0.47
Great Basin NP	4	1.01 +/- 0.09	1.33 +/- 0.07	0.24 +/- 0.13	14.95	-1.22
Great Gulf Wilderness	4	1.88 +/- 0.13	0.91 +/- 0.04	0.26 +/- 0.10	8.58	0.22
Great River Bluffs	4	1.45 +/- 0.15	0.86 +/- 0.07	0.91 +/- 0.03	10.20	-0.11
Great Sand Dunes NM	4	1.43 +/- 0.09	1.06 +/- 0.06	0.09 +/- 0.18	11.34	-1.24
Great Smoky Mountains NP	4	1.83 +/- 0.08	0.96 +/- 0.03	0.36 +/- 0.07	6.90	-0.32
Guadalupe Mountains NP	4	1.55 +/- 0.18	1.04 +/- 0.07	0.49 +/- 0.08	9.50	-0.70
Hance Camp at Grand Canyon NP	4	1.54 +/- 0.07	1.16 +/- 0.05	0.59 +/- 0.09	11.29	0.25
Hells Canyon	4	1.64 +/- 0.05	1.17 +/- 0.10	0.51 +/- 0.04	9.27	-0.97
Hercules-Glades	4	1.62 +/- 0.07	0.96 +/- 0.03	0.55 +/- 0.03	7.54	-0.70
Hoover	4	1.63 +/- 0.06	1.13 +/- 0.07	0.24 +/- 0.15	12.62	0.88
Indian Gardens	4	1.69 +/- 0.06	1.09 +/- 0.04	0.36 +/- 0.11	7.55	0.29
Isle Royale NP	4	1.62 +/- 0.11	1.05 +/- 0.04	0.88 +/- 0.03	8.24	0.70
James River Face Wilderness	4	1.61 +/- 0.05	0.99 +/- 0.02	0.42 +/- 0.07	6.20	-0.18
Jarbidge Wilderness	4	1.55 +/- 0.09	1.26 +/- 0.09	0.77 +/- 0.07	13.67	-0.40
Joshua Tree NP	4	1.64 +/- 0.12	0.95 +/- 0.07	0.64 +/- 0.03	10.63	-0.56
Kaiser	4	1.74 +/- 0.07	0.86 +/- 0.09	0.68 +/- 0.06	13.01	-1.63
Kalmiopsis	4	1.55 +/- 0.03	1.14 +/- 0.11	0.25 +/- 0.40	8.92	-0.61
Lassen Volcanic NP	4	1.39 +/- 0.05	1.31 +/- 0.08	0.28 +/- 0.09	11.99	-0.61

Lava Beds NM	4	1.53 +/- 0.04	1.25 +/- 0.08	0.25 +/- 0.08	9.43	-1.11
Linville Gorge	4	1.66 +/- 0.06	1.04 +/- 0.02	0.38 +/- 0.10	6.41	-0.01
Livonia	4	1.48 +/- 0.12	1.04 +/- 0.04	0.82 +/- 0.04	8.19	-0.69
Lostwood	4	1.25 +/- 0.08	0.96 +/- 0.05	0.99 +/- 0.04	9.37	-1.06
M.K. Goddard	4	1.34 +/- 0.07	1.00 +/- 0.03	0.84 +/- 0.03	6.18	-0.16
Mammoth Cave NP	4	1.69 +/- 0.10	0.95 +/- 0.04	0.45 +/- 0.04	7.97	-0.34
Meadview	4	2.14 +/- 0.17	0.91 +/- 0.07	0.17 +/- 0.11	8.99	0.14
Medicine Lake	4	1.55 +/- 0.11	1.05 +/- 0.05	0.72 +/- 0.05	11.09	0.03
Monture	4	1.59 +/- 0.04	1.19 +/- 0.08	0.11 +/- 0.22	9.89	-0.92
Moosehorn NWR	4	1.57 +/- 0.08	0.95 +/- 0.03	0.52 +/- 0.12	7.84	0.01
Mount Baldy	4	1.39 +/- 0.04	1.05 +/- 0.03	0.44 +/- 0.19	8.88	-0.29
Mount Hood	4	1.66 +/- 0.04	1.20 +/- 0.06	0.54 +/- 0.11	11.27	0.23
Mount Rainier NP	4	1.56 +/- 0.04	1.38 +/- 0.10	0.04 +/- 0.28	10.28	0.75
Mount Zirkel Wilderness	4	2.32 +/- 0.15	0.72 +/- 0.07	0.09 +/- 0.18	14.94	-2.20
Nebraska NF	4	1.51 +/- 0.11	1.12 +/- 0.07	0.72 +/- 0.04	10.13	-0.15
North Absaroka	4	1.83 +/- 0.12	0.99 +/- 0.09	0.41 +/- 0.16	14.77	-0.55
North Cascades	4	1.75 +/- 0.05	1.07 +/- 0.07	0.83 +/- 0.29	10.76	0.23
Northern Cheyenne	4	1.71 +/- 0.07	1.16 +/- 0.06	0.16 +/- 0.11	11.39	0.31
Okefenokee NWR	4	1.60 +/- 0.07	1.04 +/- 0.03	-0.23 +/- 0.19	7.07	-0.02
Olympic	4	1.60 +/- 0.06	1.14 +/- 0.09	0.40 +/- 0.12	9.79	-0.28
Omaha	4	1.47 +/- 0.11	1.02 +/- 0.05	1.06 +/- 0.03	7.15	0.07
Organ Pipe	4	1.46 +/- 0.12	1.15 +/- 0.04	0.29 +/- 0.08	6.92	0.22
Pasayten	4	1.70 +/- 0.05	1.23 +/- 0.06	0.11 +/- 0.12	11.26	0.60
Petrified Forest NP	4	1.57 +/- 0.08	1.12 +/- 0.05	0.37 +/- 0.14	8.12	-0.09
Phoenix	4	1.24 +/- 0.04	0.97 +/- 0.07	0.69 +/- 0.05	5.41	0.17
Pinnacles NM	4	1.55 +/- 0.06	1.02 +/- 0.07	0.60 +/- 0.04	9.07	-0.53
Point Reyes National Seashore	4	1.63 +/- 0.11	1.03 +/- 0.07	0.65 +/- 0.04	8.85	-0.70
Presque Isle	4	1.71 +/- 0.06	0.89 +/- 0.03	0.31 +/- 0.10	6.85	-0.06
Proctor Maple R. F.	4	1.65 +/- 0.09	0.99 +/- 0.03	0.60 +/- 0.06	8.08	-0.37

Quabbin Summit	4	1.65 +/- 0.12	0.96 +/- 0.04	0.38 +/- 0.09	8.01	-0.10
Quaker City	4	1.61 +/- 0.09	0.98 +/- 0.03	0.67 +/- 0.04	6.48	-0.20
Queen Valley	4	1.34 +/- 0.09	1.07 +/- 0.04	0.69 +/- 0.03	8.04	0.18
Redwood NP	4	1.70 +/- 0.05	1.09 +/- 0.10	0.45 +/- 0.24	7.57	-1.08
Rocky Mountain NP	4	1.44 +/- 0.11	0.96 +/- 0.07	0.64 +/- 0.07	14.04	-2.04
Sac and Fox	4	1.38 +/- 0.10	0.94 +/- 0.05	0.95 +/- 0.03	9.43	-0.47
Saguaro NM	4	1.42 +/- 0.09	0.91 +/- 0.04	0.37 +/- 0.04	7.24	0.13
Saguaro West	4	1.27 +/- 0.09	0.94 +/- 0.06	0.41 +/- 0.04	6.06	-0.21
San Gabriel	4	1.64 +/- 0.10	0.83 +/- 0.08	0.53 +/- 0.04	11.87	-0.40
San Gorgonio Wilderness	4	1.20 +/- 0.11	0.87 +/- 0.08	0.87 +/- 0.03	11.27	-1.21
San Pedro Parks	4	1.38 +/- 0.09	1.13 +/- 0.06	0.20 +/- 0.17	12.38	0.76
San Rafael	4	1.50 +/- 0.10	0.94 +/- 0.07	0.60 +/- 0.04	10.81	-1.19
Seney	4	1.31 +/- 0.11	0.97 +/- 0.04	0.73 +/- 0.03	8.60	0.61
Shamrock Mine	4	1.72 +/- 0.08	1.11 +/- 0.05	0.23 +/- 0.12	8.15	-0.74
Shenandoah NP	4	1.66 +/- 0.10	0.97 +/- 0.03	0.60 +/- 0.05	7.42	0.03
Shining Rock Wilderness	4	1.59 +/- 0.14	0.98 +/- 0.04	0.35 +/- 0.17	9.40	-0.92
Sierra Ancha	4	1.36 +/- 0.06	1.00 +/- 0.05	0.25 +/- 0.09	8.78	-0.43
Sikes	4	1.66 +/- 0.06	1.09 +/- 0.03	0.03 +/- 0.12	6.96	-0.35
Sipsy Wilderness	4	1.80 +/- 0.06	0.94 +/- 0.03	0.36 +/- 0.04	5.81	-0.15
Snoqualmie Pass	4	1.71 +/- 0.05	1.05 +/- 0.07	0.28 +/- 0.07	10.01	-0.72
St. Marks	4	1.69 +/- 0.08	1.05 +/- 0.03	-0.23 +/- 0.23	7.05	-0.12
Starkey	4	1.50 +/- 0.03	1.09 +/- 0.07	0.76 +/- 0.04	8.75	-0.05
Sula Peak	4	1.62 +/- 0.05	1.08 +/- 0.07	0.22 +/- 0.14	11.05	-1.08
Sycamore Canyon	4	1.26 +/- 0.05	1.12 +/- 0.06	0.31 +/- 0.12	7.35	-0.30
Tallgrass	4	1.47 +/- 0.09	0.98 +/- 0.04	0.81 +/- 0.03	8.73	-0.70
Theodore Roosevelt	4	1.54 +/- 0.08	0.93 +/- 0.05	0.99 +/- 0.04	8.36	0.15
Three Sisters Wilderness	4	1.64 +/- 0.04	1.24 +/- 0.08	0.38 +/- 0.15	9.69	-0.99
Thunder Basin	4	1.78 +/- 0.08	0.92 +/- 0.06	0.61 +/- 0.07	7.24	-0.27
Tonto NM	4	1.62 +/- 0.07	1.06 +/- 0.04	0.23 +/- 0.05	6.71	-0.32
Trinity	4	1.56 +/- 0.04	1.19 +/- 0.10	0.37 +/- 0.08	9.89	-0.92

UL Bend	4	1.85 +/- 0.07	0.89 +/- 0.05	0.91 +/- 0.05	9.37	-0.25
Upper Buffalo Wilderness	4	1.64 +/- 0.08	0.99 +/- 0.04	0.65 +/- 0.04	7.83	-0.49
Viking Lake	4	1.44 +/- 0.09	1.03 +/- 0.04	1.03 +/- 0.02	6.44	-0.11
Voyageurs NP #2	4	1.50 +/- 0.08	0.91 +/- 0.04	1.00 +/- 0.03	8.54	-0.51
Weminuche Wilderness	4	1.35 +/- 0.12	1.05 +/- 0.07	0.69 +/- 0.27	13.73	-0.55
Wheeler Peak	4	1.81 +/- 0.08	0.98 +/- 0.05	0.14 +/- 0.16	11.14	-1.58
White Mountain	4	1.40 +/- 0.10	1.12 +/- 0.05	0.64 +/- 0.07	9.57	-0.01
White Pass	4	1.90 +/- 0.08	1.20 +/- 0.07	-0.19 +/- 0.21	14.93	-1.02
White River NF	4	1.62 +/- 0.17	1.16 +/- 0.08	0.20 +/- 0.33	16.34	-0.39
Wichita Mountains	4	1.62 +/- 0.09	1.04 +/- 0.04	0.70 +/- 0.03	8.41	-1.04
Wind Cave	4	1.32 +/- 0.08	1.08 +/- 0.07	0.37 +/- 0.08	11.75	0.23
Yellowstone NP 2	4	1.51 +/- 0.08	1.11 +/- 0.08	0.52 +/- 0.07	12.26	-1.93
Zion Canyon	4	1.78 +/- 0.07	1.09 +/- 0.05	0.29 +/- 0.07	8.62	-0.58

Table S5. Quarter-specific regression results flagged for single outlier year (n = 28) or temporal trend (n = 7) in residual errors. Values in parentheses represent regression results when the outlier year was removed from the dataset. Regressions for which all coefficients changed by less than 0.1 when the outlier year was removed (high confidence results) are highlighted in gray and all coefficient changes greater than 0.1 are emphasized with bold text.

Site	quarter	βoc	βsulf	βnit	NME (%)	NMB (%)	outlier year
Agua Tibia	1	1.38 +/- 0.12 (1.30 +/- 0.16)	1.08 +/- 0.08 (1.15 +/- 0.09)	0.56 +/- 0.04 (0.52 +/- 0.05)	9.52	0.07	2002
Salt Creek	1	0.74 +/- 0.29 (0.71 +/- 0.17)	**1.22 +/- 0.12 (1.03 +/- 0.07)**	**0.98 +/- 0.07 (1.08 +/- 0.05)**	10.70	-0.26	2004
Shamrock Mine	1	**1.52 +/- 0.16 (1.64 +/- 0.05)**	**1.06 +/- 0.07 (0.94 +/- 0.03)**	**0.43 +/- 0.11 (0.22 +/- 0.14)**	10.59	0.08	2002
St. Marks	1	1.63 +/- 0.06	1.02 +/- 0.03	0.06 +/- 0.19	7.53	-0.47	N/A
Big Bend NP	2	2.16 +/- 0.12 (2.18 +/- 0.13)	0.96 +/- 0.03 (0.93 +/- 0.03)	0.24 +/- 0.28 (0.34 +/- 0.26)	6.72	0.19	2002
Blue Mounds	2	1.67 +/- 0.09 (1.67 +/- 0.10)	0.95 +/- 0.04 (1.00 +/- 0.04)	**0.74 +/- 0.04 (0.63 +/- 0.05)**	9.62	-0.23	2003

Boundary Waters Canoe Area	2	**1.69 +/- 0.06 (1.98 +/- 0.06)**	**1.06 +/- 0.03 (0.94 +/- 0.03)**	0.20 +/- 0.10 (0.28 +/- 0.09)	8.25	-0.01	2003
Brigantine NWR	2	**2.07 +/- 0.11 (2.17 +/- 0.13)**	0.99 +/- 0.03 (0.97 +/- 0.03)	0.35 +/- 0.13 (0.31 +/- 0.13)	6.98	-0.26	2008
Bryce Canyon NP	2	1.62 +/- 0.06 (1.60 +/- 0.06)	**0.97 +/- 0.05 (1.08 +/- 0.05)**	0.27 +/- 0.15 (0.19 +/- 0.16)	7.56	-0.21	2005
Caney Creek	2	1.87 +/- 0.10 (1.87 +/- 0.09)	1.03 +/- 0.03 (1.00 +/- 0.03)	0.01 +/- 0.16 (-0.08 +/- 0.14)	6.51	-0.15	2002
Connecticut Hill	2	1.28 +/- 0.14	1.15 +/- 0.03	0.40 +/- 0.10	7.92	-0.64	N/A
El Dorado Springs	2	1.78 +/- 0.07 (1.78 +/- 0.06)	0.98 +/- 0.03 (0.96 +/- 0.02)	0.27 +/- 0.06 (0.29 +/- 0.05)	6.24	-0.24	2002
Fort Peck	2	1.95 +/- 0.08 (1.91 +/- 0.08)	0.90 +/- 0.04 (0.92 +/- 0.04)	0.28 +/- 0.06 (0.28 +/- 0.06)	7.60	0.41	2002
Great Gulf Wilderness	2	1.70 +/- 0.07 (1.63 +/- 0.07)	1.06 +/- 0.03 (1.06 +/- 0.03)	0.04 +/- 0.33 (0.10 +/- 0.34)	7.36	-0.15	2007
Monture	2	**1.52 +/- 0.05 (1.65 +/- 0.06)**	0.90 +/- 0.08 (0.96 +/- 0.08)	**2.23 +/- 0.79 (1.80 +/- 0.72)**	10.09	0.43	2004
New York City	2	1.75 +/- 0.14	0.99 +/- 0.05	0.58 +/- 0.08	6.91	-0.62	N/A
Northern Cheyenne	2	2.06 +/- 0.07 (2.07 +/- 0.07)	0.96 +/- 0.04 (0.93 +/- 0.03)	0.13 +/- 0.09 (0.14 +/- 0.07)	7.45	-0.09	2002
Okefenokee NWR	2	1.61 +/- 0.07 (1.65 +/- 0.06)	1.00 +/- 0.03 (1.02 +/- 0.03)	0.13 +/- 0.22 (0.12 +/- 0.19)	6.98	0.01	2005
Swanquarter	2	2.03 +/- 0.08	0.93 +/- 0.02	0.28 +/- 0.14	6.02	-0.61	N/A
Boundary Waters Canoe Area	3	1.81 +/- 0.04 (1.89 +/- 0.05)	0.99 +/- 0.04 (0.96 +/- 0.03)	1.08 +/- 0.61 (1.03 +/- 0.53)	7.84	-0.64	2003
Bridgton	3	1.84 +/- 0.06 (1.89 +/- 0.07)	1.14 +/- 0.02 (1.11 +/- 0.03)	**-0.48 +/- 0.45 (-0.73 +/- 0.45)**	6.90	-0.22	2002
Cadiz	3	1.91 +/- 0.17 (1.83 +/- 0.16)	1.07 +/- 0.03 (1.07 +/- 0.03)	-0.05 +/- 0.55 (0.02 +/- 0.59)	7.81	-0.50	2002
Caney Creek	3	1.81 +/- 0.08 (1.82 +/- 0.07)	0.97 +/- 0.03 (0.96 +/- 0.02)	**0.45 +/- 0.28 (0.31 +/- 0.24)**	6.07	-0.18	2002

Chassahowitzka NWR	3	2.11 +/- 0.17	0.93 +/- 0.04	-0.56 +/- 0.35	6.98	-0.21	N/A
Guadalupe Mountains NP	3	**1.76 +/- 0.13 (1.93 +/- 0.13)**	0.98 +/- 0.04 (0.97 +/- 0.04)	**0.57 +/- 0.29 (0.67 +/- 0.31)**	7.13	-0.19	2005
Ikes Backbone	3	**1.33 +/- 0.10 (1.61 +/- 0.12)**	1.01 +/- 0.08 (1.03 +/- 0.08)	**0.56 +/- 0.34 (0.28 +/- 0.33)**	10.26	-0.24	2005
Mesa Verde NP	3	1.90 +/- 0.09 (1.97 +/- 0.08)	1.11 +/- 0.08 (1.07 +/- 0.08)	**-0.29 +/- 0.52 (0.05 +/- 0.64)**	9.03	0.14	2002
Phoenix	3	**1.19 +/- 0.07 (1.45 +/- 0.07)**	1.08 +/- 0.06 (0.99 +/- 0.05)	0.29 +/- 0.18 (0.22 +/- 0.15)	6.20	0.03	2004
Thunder Basin	3	1.88 +/- 0.04	1.14 +/- 0.06	-0.74 +/- 0.50	5.87	-0.78	N/A
Badlands NP	4	**1.22 +/- 0.08 (1.35 +/- 0.08)**	1.02 +/- 0.06 (0.93 +/- 0.05)	**0.49 +/- 0.08 (0.60 +/- 0.07)**	11.60	-0.34	2007
Ikes Backbone	4	**1.28 +/- 0.06 (1.62 +/- 0.08)**	1.06 +/- 0.05 (1.04 +/- 0.05)	**0.44 +/- 0.05 (0.32 +/- 0.05)**	10.74	0.90	2005
Mesa Verde NP	4	**1.79 +/- 0.13 (1.65 +/- 0.11)**	1.14 +/- 0.08 (1.21 +/- 0.06)	0.32 +/- 0.12 (0.23 +/- 0.13)	11.63	0.32	2002
Salt Creek	4	1.17 +/- 0.20 (1.26 +/- 0.15)	**1.16 +/- 0.09 (0.99 +/- 0.07)**	0.93 +/- 0.08 (1.03 +/- 0.06)	10.45	-0.17	2003
Swanquarter	4	1.67 +/- 0.12 (1.62 +/- 0.12)	0.98 +/- 0.03 (0.99 +/- 0.03)	**0.02 +/- 0.15 (-0.08 +/- 0.15)**	6.28	-0.13	2008
Yosemite NP	4	1.56 +/- 0.03	1.05 +/- 0.06	0.59 +/- 0.05	8.93	-1.00	N/A

Table S6. Quarter-specific regression results flagged because of physically unrealistic coefficients. Sites with a * are already flagged due to an influential outlier year (see Table S5). Also note that New York City and Washington D.C. have multiyear β_{soil} values that are physically unrealistic.

Site	quarter	β_{oc}	β_{sulf}	β_{nit}	NME (%)	NMB (%)
Badlands NP	1	**0.54 +/- 0.07**	1.03 +/- 0.04	0.72 +/- 0.08	12.00	1.42
Cloud Peak	1	**0.93 +/- 0.30**	0.98 +/- 0.09	0.83 +/- 0.13	16.48	0.56
Fort Peck	1	**0.99 +/- 0.17**	0.87 +/- 0.05	0.90 +/- 0.04	11.01	-0.93
Hance Camp at Grand Canyon NP	1	**0.45 +/- 0.08**	1.51 +/- 0.05	0.59 +/- 0.06	11.21	1.56
Ikes Backbone	1	**0.76 +/- 0.08**	1.34 +/- 0.07	0.34 +/- 0.05	11.66	1.11

Kalmiopsis	1	1.37 +/- 0.03	0.75 +/- 0.08	**1.66 +/- 0.30**	9.25	-0.75
Meadview	1	**0.87 +/- 0.13**	1.33 +/- 0.07	0.39 +/- 0.07	10.61	1.72
New York City	1	1.59 +/- 0.14	0.76 +/- 0.05	1.34 +/- 0.06	4.82	-0.02
North Absaroka	1	**0.90 +/- 0.19**	1.17 +/- 0.07	0.61 +/- 0.09	14.93	-0.26
Petrified Forest NP	1	**0.96 +/- 0.18**	0.90 +/- 0.12	1.05 +/- 0.20	14.88	2.40
Phoenix	1	1.31 +/- 0.04	**0.57 +/- 0.10**	0.67 +/- 0.04	6.01	0.20
Rocky Mountain NP	1	**0.64 +/- 0.17**	1.00 +/- 0.09	0.89 +/- 0.06	13.72	-0.24
Saguaro NM	1	**0.93 +/- 0.13**	1.11 +/- 0.08	0.50 +/- 0.07	8.59	1.52
Salt Creek*	1	**0.74 +/- 0.29**	1.22 +/- 0.12	0.98 +/- 0.07	10.70	-0.26
San Gorgonio Wilderness	1	**0.81 +/- 0.15**	0.84 +/- 0.09	0.93 +/- 0.03	9.02	0.40
San Rafael	1	**0.92 +/- 0.08**	0.94 +/- 0.07	0.77 +/- 0.06	11.48	-0.40
Sequoia NP	1	**0.72 +/- 0.14**	0.84 +/- 0.13	1.10 +/- 0.03	9.20	-0.22
Snoqualmie Pass	1	**0.23 +/- 0.06**	**1.55 +/- 0.09**	1.02 +/- 0.07	19.60	0.86
Washington D.C.	1	1.55 +/- 0.06	0.88 +/- 0.03	1.08 +/- 0.04	5.59	-0.23
Wheeler Peak	1	**0.58 +/- 0.26**	1.27 +/- 0.17	0.54 +/- 0.23	15.48	0.02
Yellowstone NP 2	1	**0.92 +/- 0.11**	1.00 +/- 0.06	0.74 +/- 0.05	12.55	-1.07
Bridgton	2	1.85 +/- 0.08	1.01 +/- 0.03	**-0.43 +/- 0.23**	7.50	-0.23
Chiricahua NM	2	**1.00 +/- 0.10**	1.15 +/- 0.06	0.88 +/- 0.26	7.17	0.01
Death Valley NP	2	1.82 +/- 0.16	0.71 +/- 0.08	**1.41 +/- 0.28**	6.26	-0.26
Douglas	2	1.04 +/- 0.17	**1.10 +/- 0.14**	**1.49 +/- 0.56**	5.27	0.36
Gila Wilderness	2	1.64 +/- 0.06	0.52 +/- 0.07	**2.43 +/- 0.29**	7.25	-0.37
Hells Canyon	2	1.56 +/- 0.07	0.81 +/- 0.11	**1.87 +/- 0.65**	9.47	-0.96
Mohawk Mt.	2	**0.76 +/- 0.12**	1.18 +/- 0.04	0.72 +/- 0.30	11.47	0.95
Monture*	2	1.52 +/- 0.05	0.90 +/- 0.08	**2.23 +/- 0.79**	10.09	0.43
New York City*	2	1.75 +/- 0.14	0.99 +/- 0.05	0.58 +/- 0.08	6.91	-0.62
Sawtooth NF	2	1.65 +/- 0.07	1.03 +/- 0.13	**-2.00 +/- 1.03**	9.74	-1.19
Shining Rock Wilderness	2	1.88 +/- 0.17	1.05 +/- 0.04	**-0.64 +/- 0.33**	7.89	-0.68
Sycamore Canyon	2	1.59 +/- 0.10	0.73 +/- 0.09	**1.52 +/- 0.22**	6.20	-0.15
Washington D.C.	2	2.05 +/- 0.10	1.00 +/- 0.03	0.52 +/- 0.07	6.91	-0.52
Bandelier NM	3	1.83 +/- 0.08	1.04 +/- 0.05	**-0.96 +/- 0.56**	7.76	-0.58

Capitol Reef NP	3	2.04 +/- 0.07	1.04 +/- 0.05	**-0.81 +/- 0.46**	7.22	-0.86
Casco Bay	3	1.69 +/- 0.05	1.29 +/- 0.03	**-0.76 +/- 0.25**	7.21	-0.65
Chassahowitzka NWR*	3	2.11 +/- 0.17	0.93 +/- 0.04	**-0.56 +/- 0.35**	6.98	-0.21
Cloud Peak	3	1.96 +/- 0.04	1.14 +/- 0.07	**-0.89 +/- 0.30**	6.36	-0.78
Cohutta	3	1.30 +/- 0.17	1.04 +/- 0.04	**2.92 +/- 0.74**	6.43	-0.10
Death Valley NP	3	1.75 +/- 0.06	0.69 +/- 0.05	**1.88 +/- 0.30**	7.24	-0.02
Flathead	3	1.82 +/- 0.03	1.09 +/- 0.10	**-1.26 +/- 0.57**	7.27	-1.13
Glacier NP	3	1.90 +/- 0.06	1.48 +/- 0.19	**-4.94 +/- 1.74**	8.00	-0.14
James River Face Wilderness	3	2.09 +/- 0.11	1.04 +/- 0.02	**-0.41 +/- 0.25**	6.22	-0.24
M.K. Goddard	3	1.77 +/- 0.08	1.13 +/- 0.02	**-0.46 +/- 0.29**	6.84	-0.26
Mohawk Mt.	3	1.75 +/- 0.09	1.03 +/- 0.03	**-0.55 +/- 0.21**	8.31	0.14
New York City	3	1.75 +/- 0.14	1.13 +/- 0.04	0.38 +/- 0.17	7.61	-0.36
Point Reyes National Seashore	3	1.51 +/- 0.11	0.86 +/- 0.05	**1.49 +/- 0.16**	9.38	-0.44
Presque Isle	3	1.85 +/- 0.04	1.05 +/- 0.02	**-1.28 +/- 0.52**	6.12	-0.39
Proctor Maple R. F.	3	2.03 +/- 0.06	1.05 +/- 0.02	**-1.05 +/- 0.52**	6.09	0.24
Quaker City	3	1.90 +/- 0.13	1.09 +/- 0.02	**-0.70 +/- 0.40**	6.59	0.01
Saguaro West	3	1.68 +/- 0.35	0.70 +/- 0.14	**2.11 +/- 0.63**	10.17	-1.59
Theodore Roosevelt	3	1.95 +/- 0.05	1.07 +/- 0.05	**-0.46 +/- 0.18**	6.58	-0.90
Trinity	3	1.66 +/- 0.04	0.83 +/- 0.08	**1.75 +/- 0.36**	9.51	1.35
Voyageurs NP #2	3	1.54 +/- 0.06	1.08 +/- 0.06	**1.90 +/- 1.20**	10.12	-0.18
Washington D.C.	3	2.05 +/- 0.14	1.08 +/- 0.03	-0.09 +/- 0.27	7.36	-0.35
Addison Pinnacle	4	**0.26 +/- 0.07**	1.19 +/- 0.03	1.11 +/- 0.06	9.05	0.14
Cape Romain NWR	4	1.81 +/- 0.09	1.03 +/- 0.04	**-0.63 +/- 0.19**	7.98	-0.56
New York City	4	1.42 +/- 0.11	0.87 +/- 0.05	1.17 +/- 0.06	6.02	0.07
Sequoia NP	4	1.43 +/- 0.07	**0.45 +/- 0.13**	1.04 +/- 0.02	8.85	-0.19
Washington D.C.	4	1.48 +/- 0.07	0.95 +/- 0.04	1.06 +/- 0.06	6.95	-0.42

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S6. References

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