

Calibration of LEAP for Wisconsin Lakes

prepared for

Wisconsin Department of Natural Resources
Madison, Wisconsin

by

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December 1995

Purchase Order NMF 97283

To facilitate calibration, the provided spreadsheet (WISCLEAPD.WK1) has been translated to Lotus 123 Release >=4.0 format. Results are contained in the WISLEAP.WK4 file on the enclosed diskette. Model parameters are stored in Column B of the 'Cases' table. Click on the 'Update' button to calculate model error statistics. The spreadsheet has been checked for correct cell references. Table 1 lists model calibration results. Observed and estimated phosphorus, chlorophyll-a, and Secchi values are plotted in Figure 1.

Following the MINLEAP development, the lake data set is assumed to represent "minimally impacted" lakes within each ecoregion. The following procedure has been used in calibrating the models:

1. Secchi/Chlorophyll-a Model. Regress Log(Observed Secchi) against Log (Observed Chl-a) and regional dummy variables. Results are stored in the 'SecchiModel' table. Calibrated equation:

$$S = K_r 6.219 C^{-.412}$$

Ecoregion	NCHF	NLF	SE TILL	DRIFT
K _r	1.000	1.193	0.915	0.967

2. Chlorophyll-a/Phosphorus Model. Regress Log(Observed Chla) against Log (Observed Total P) and regional dummy variables. Results are stored in the 'ChlaModel' table. Calibrated equation:

$$C = K_r 0.169 P^{1.234}$$

Ecoregion	NCHF	NLF	SE TILL	DRIFT
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K_r	1.000	1.646	1.567	0.845
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The alternative equation ($C = 1.021 P^{.727}$) has similar error statistics, but is not recommended because residuals are not independent of phosphorus variations within ecoregions.

3. Phosphorus Model. For each phosphorus retention model (Walker, Reckhow, & Canfield/Bachmann), adjust stream phosphorus concentrations to give unbiased predictions in each ecoregion. Residual errors were lowest for the Walker & C/B models, which could be used interchangeably. Results for C/B model:

Ecoregion	NCHF	NLF	SE TILL	DRIFT
Stream P (ppb)	60	36	30	160

Additional data sets and analyses would be required to determine the extent to which these values are consistent with measured stream concentrations in each ecoregion. An alternative approach to calibrating the phosphorus model would be to fix the stream concentrations at measured values (if reliable ones are available) and calibrate the phosphorus sedimentation rate in each ecoregion.

**Wisconsin LEAP Calibration
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December 1995**

Phosphorus Models

Case	Used *	Orig	Model1	Model2	Model3
Model Number	3	3	1	2	3
Description	C/B	C/B	Walker	Reckhow	C/B
Stream P (ppb)					
NCHF	60	150	61	107	60
NLF	36	5	25	122	36
SE TILL	30	35	27	71	30
DRIFT	160	140	205	250	160
Mean Sq Errors					
ALL	0.064	0.128	0.060	0.117	0.064
NCHF	0.067	0.142	0.081	0.038	0.067
NLF	0.068	0.206	0.047	0.192	0.068
SE TILL	0.047	0.048	0.057	0.073	0.047
DRIFT	0.085	0.086	0.055	0.200	0.085

Chlorophyll-a Models

$$\text{Chla} = \text{Calib} \times \text{Intercept} \times \text{Total P}^{\text{Slope}}$$

Case	Used *	Orig	Other	Calib
Chla Intercept	0.169	0.066	1.021	0.169
Chla Slope	1.234	1.460	0.727	1.234
Calib Coefs				
NCHF	1.000	1.000	1.000	1.000
NLF	1.646	1.000	1.000	1.646
SE TILL	1.567	1.000	1.000	1.567
DRIFT	0.845	1.000	1.000	0.845
Mean Sq Errors				
ALL	0.137	0.210	0.144	0.137
NCHF	0.175	0.180	0.184	0.175
NLF	0.153	0.280	0.153	0.153
SE TILL	0.070	0.160	0.082	0.070
DRIFT	0.379	0.401	0.378	0.379

Secchi Models

$$\text{Secchi} = \text{Calib} \times \text{Intercept} \times \text{Chla}^{\text{Slope}}$$

Case	Used *	Orig	Calib
Secchi Intercept	6.219	7.760	6.219
Secchi Slope	-0.412	-0.590	-0.412
Calib Coefs			
NCHF	1.000	1.000	1.000
NLF	1.193	1.000	1.193
SE TILL	0.915	1.000	0.915
DRIFT	0.967	1.000	0.967
Mean Sq Errors			
ALL	0.051	0.064	0.051
NCHF	0.083	0.089	0.083
NLF	0.054	0.075	0.054
SE TILL	0.038	0.038	0.038
DRIFT	0.070	0.102	0.070

* Recommended Model Calibration



