ENVIRONMENTAL STUDIES

Anthropogenic alteration of nutrient supply increases the global freshwater carbon sink

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Lakes have a disproportionate effect on the global carbon (C) cycle relative to their area, mediating C transfer from land to atmosphere, and burying organic-C in their sediments. The magnitude and temporal variability of C burial is, however, poorly constrained, and the degree to which humans have influenced lake C cycling through landscape alteration has not been systematically assessed. Here, we report global and biome specific trajectories of lake C sequestration based on 516 lakes and show that some lake C burial rates (i.e., those in tropical forest and grassland biomes) have quadrupled over the last 100 years. Global lake C-sequestration (~0.12 Pg year^{-1}) has increased by ~72 Tg year^{-1} since 1900, offsetting 20% of annual CO_2 freshwater emissions rising to ~30% if reservoirs are included and contributing to the residual continental C sink. Nutrient availability explains ~70% of the observed increase, while rising temperatures have a minimal effect.

INTRODUCTION

Filling gaps in the global C budget remains a critical aspect of understanding global biogeochemical change (*1*, *2*). Lakes act as integrators, sentinels, and regulators of climate change, and their sediments record disruption of key global biogeochemical cycles (principally, N and P but also S and Si) (*3*). Intimately linked to their catchments, lakes process large quantities of terrestrial C, much of which is degassed as CO_2 and CH_4 (*4*). The open-pipe model of lake C dynamics (*5*) has emphasized heterotrophic components of lake metabolism and systems in which net ecosystem respiration is greater than production. Although this is often true of boreal lakes (*6*), in other biomes, nutrient transfer associated with land-cover change (*7*) and agricultural intensification has increased lake production (autotrophy) and C burial rate (*8*–*10*). Estimates of CO_2 and CH_4 emissions have been revised extensively (*4*, *11*) and recently, reassessments of historic (*12*) global lake and reservoir C burial rates have been made (*13*). Yet, the global drivers of freshwater C sequestration and its temporal variability have not been systematically assessed.

Characterizing the temporal and spatial variability of lake C burial rates is critical for constraining the global C cycle, especially given widespread disruption of N and P cycles and their impact on lake primary production. In this study, we compare the trajectory of C burial rates across biomes over the last 100 to 150 years using a consistent methodology and accounting for spatial heterogeneity of sediment accumulation in individual lake basins. We applied a rigorous approach to site selection combined with a standardized correction for sediment focusing (see Materials and Methods). This resulted in the creation of a 516-lake database, representing the largest and most widely distributed coverage of organic-C burial rates. We coupled these data to a measure of global lake area (*14*) (fig. S1 and table S1) to yield a well-constrained global estimate of lake C sequestration over space and time. Although the distribution of the study lakes across the different biomes is uneven, in part because they were used initially to answer other research questions, the geographic sampling frequency adequately reflects the global distribution of lakes (see Materials and Methods and fig. S2). The uniformly treated data are presented as decadal global median burial rates and estimated individually for each of Earth's major biomes (*15*). We also supplement the calculations of lake burial rates with a first-order estimate of the temporal variability in carbon burial by reservoirs (as distinct from natural lakes) using global reservoir area over time from the GRanD database (*16*) and the most recent estimate of the global reservoir C burial rate (*13*).

RESULTS AND DISCUSSION

The total global C burial rate by lakes has increased from 0.05 [95% confidence interval (CI), 0.04 to 0.06] to 0.12 (95% CI, 0.09 to 0.16) Pg C year^{-1} over the last 100 years (Fig. 1A; see fig. S3 for biome-specific 95% CI through time), contributing an additional ~72 Tg annually to the global continental C sink. Across all biomes, burial rates have tripled, including ~4-fold increases in lakes in tropical grasslands and forests, reflecting high disturbance intensity during the 20th century in the tropics (*17*, *18*). Lake burial rates across biomes show nearly linear increases during the 20th century (Fig. 1B), with limited evidence of a more rapid increase associated with post–World War II industrialization (*19*).

Lakes in the boreal biome contribute the largest proportion to the global C burial rate (24%) due to their large areal coverage, but they are closely followed by lakes in tropical moist broadleaf (18%) and temperate broadleaf and mixed forests (16%) and lakes located in temperate grasslands and savannah (15%). These are all biomes that have been heavily affected by cultural landscape disturbance (*8*, *20*) (see below). Despite the large areal extent of tundra lakes, they contribute just 2% to the global total, because of their low C burial rate (3.1 g C m^{-2} year^{-1}). These rates may increase rapidly in the future as a result of the lateral transfer of organic-C from melting permafrost (*21*).

Although there have been localized hotspots of landscape change for millennia, the majority of the anthropogenic transformation of Earth's surface has occurred in the last 100 to 200 years (*22*), and rapid land-cover change since 1950 has resulted in increasing terrestrial C emissions (*23*). Consistent with recent definitions of the

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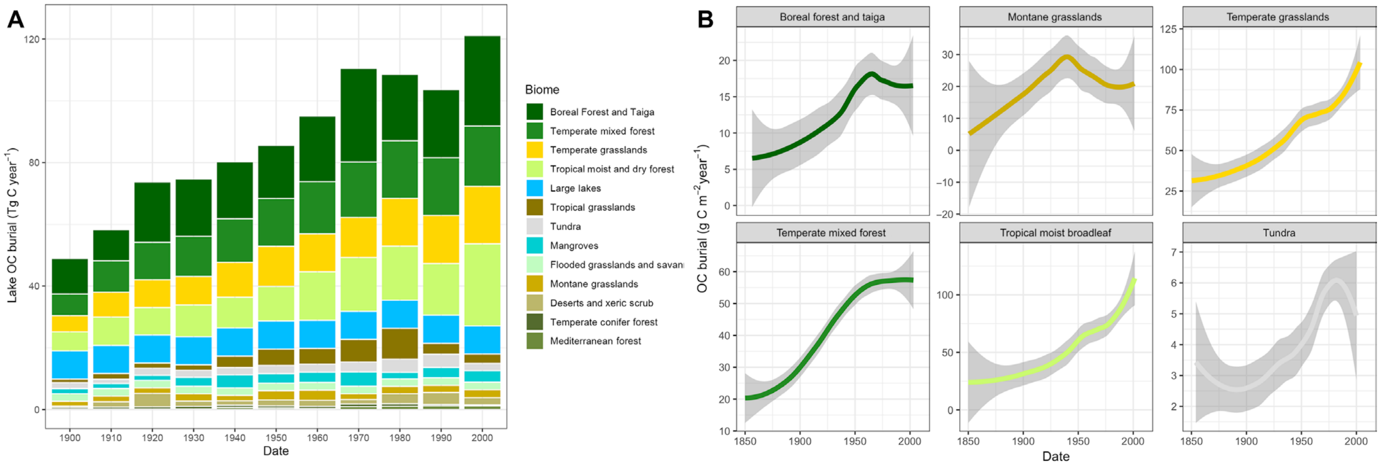

Fig. 1. Global distribution of annual lake organic-C burial rates. (**A**) Total organic-C burial rates by lakes over the last 100 years scaled by biome. (**B**) Comparative lake organic-C burial rates as LOWESS (locally weighted regression) curves with shaded 95% CI regions for selected biomes to show the variable trends in space and time. The number of lakes in each biome estimate is given in the table S2.

Anthropocene (*19*), most biomes show systematic increases in lake C burial from the late 19th century onward (Fig. 1B). Median lake C burial rates are high (46 to 88 g C m^{-2} $year^{-1}$) in those areas with intensive agriculture and substantial nutrient subsidies through fertilizer use (i.e., former temperate mixed forests and grasslands of Europe and North America), with a ~3-fold increase since the start of the 20th century. Not all individual lakes exhibit an increase in organic-C burial over the last 150 years, however, and some biomes show recent decreases. Montane grassland lakes, for example, show a steady increase from background rates of 6 g C m^{-2} $year^{-1}$ before 1900 but a decrease after 1940 (Fig. 1B), which may reflect marginalization of high-altitude agriculture in temperate biomes.

Global lake C sequestration is strongly correlated ($r = 0.9$) with disruption of the P cycle (Fig. 2B) during the 20th century, whereas the relationship with the global flux of reactive N plateaus at high rates of N loading (Fig. 2B). This suggests that the exponential increase in reactive N (*24*) is enhancing P limitation in lakes and is therefore not matched by a proportional increase in C burial, despite saturation of soils with P and increased P input to freshwaters (*25*). This divergence may be amplified with declining P availability globally, although continued disruption of the N cycle may offset this effect to some extent. Moreover, regional differences are likely, as many tropical lakes are N limited (*26*).

Using a multiple linear regression model based on contemporary temperature [mean annual temperature (MAT)] and fertilizer (N and P) use (see Materials and Methods), we predicted an increase in carbon burial by lakes of 52 Tg C $year^{-1}$ since 1900, which represents 72% of the observed change in the global lake dataset (Fig. 3B). The majority (70%) of this increase is explained solely by rising N and P fertilizer use (Fig. 2A) (*24*, *27*). Increasing atmospheric CO_2 concentration is unlikely to have affected aquatic production (and hence C sequestration), because lakes generally are supersaturated with respect to CO_2 during the ice-free season (*6*). The reduced fit of our predictive model to the data in the mid-20th century (Fig. 3B) can likely be attributed to the transfer of terrestrial C to lakes in association with land-cover changes (Fig. 2).

Contemporary organic-C burial rates increase latitudinally with increasing MAT to ~8°C before reaching a plateau (Fig. 3A), which suggests an initial temperature control on burial rates via increased aquatic production that is counteracted at higher temperatures by temperature-dependent respiratory losses. While there is a temperature effect on global aquatic primary production (*26*), the increase in burial rates from pre-1900 to post-1970 (Figs. 1A and 3B) is substantially greater than that attributable to regional temperature increases (*9*, *28*). This observation is supported by the inclusion of global temperature increase in the multiple regression modeling (Fig. 3B), which explained only ~4% of the rise in lake C burial since 1900. The pre-1900 burial rates for lakes located in the boreal zone and subtropical biomes (MAT range, 2° to 25°C) (Fig. 3A) are similar to one another (~10 to 15 g C m^{-2} $year^{-1}$), with the Arctic and Tropics representing the extremes (minimum and maximum are 3 to 30 g C m^{-2} $year^{-1}$, respectively). However, even these 19th century burial rates are likely elevated over a pre-Anthropocene background, which for boreal and temperate mixed-forest lakes is probably closer to long-term Holocene rates of ~5 g C m^{-2} $year^{-1}$ (*29*). Two notable exceptions from this trend include lakes from the Deserts and Xeric Scrub and Tundra biomes, which have been less influenced by fertilization due to the absence of arable land. MAT explained the greatest amount of variation (29 and 21%, respectively) of organic-C burial in these biomes (See table S3 for full biome-specific regression results).

Air temperature effects are difficult to disentangle from other global change processes that covary with latitude, including lateral transfer (erosion) of terrestrial C, increased autotrophic production from fertilizer use and associated nutrient runoff (*8*) (see above; Fig. 2), and elevated erosion rates, which reduce postdepositional mineralization through physical protection of sedimented organic matter. The latter effect is reflected in the high C burial rates of reservoirs (Fig. 3C), which were considered separately from natural lakes in more detail below.

These historic increases in lake C burial—driven, in part, by disruption of the major nutrient biogeochemical cycles—have been accompanied by alterations to surface hydrology, increased runoff (and erosion), and most notably, damming and reservoir construction. These changes all increase lateral C transfer and sequestration at the landscape scale. Although reservoir building has a long history

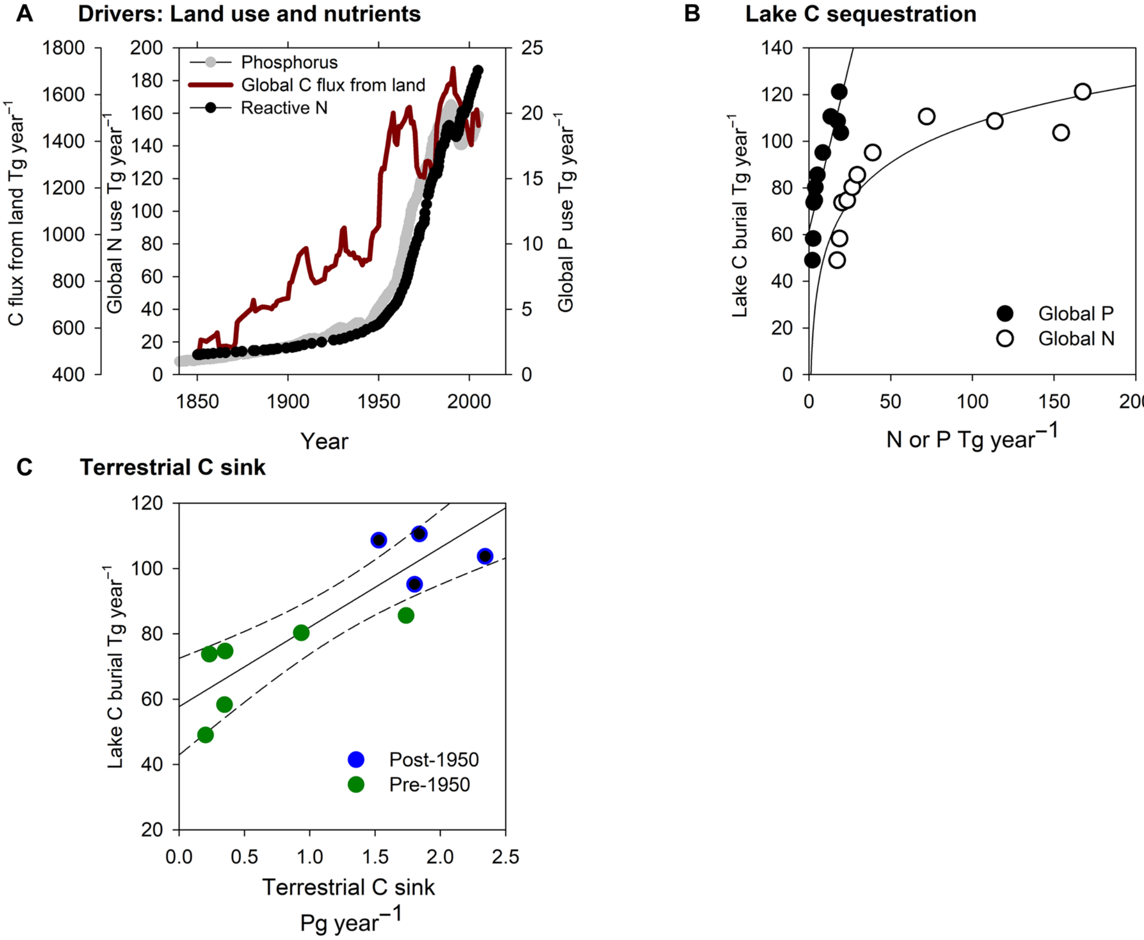

Fig. 2. Global drivers of organic-C burial and relevance to the terrestrial C sink. (**A**) Drivers of global environmental change that can affect lake C sequestration either through the promotion of primary production (key plant nutrients, such as reactive N and P) or via lateral transfer of terrestrial C due to land-cover change. Reactive N refers to that of which is biologically available. (**B**) Decadal lake C sequestration plotted against decadal mean global N and P use [from (A)], highlighting the strong linear relationship between phosphorus and lake C sequestration and the saturating relationship between nitrogen and C sequestration. (**C**) Decadal lake C sequestration plotted against the decadal total terrestrial C sink (note the contrasting units for each axis) derived from the Global C Project (www.globalcarbonproject.org), indicating that C sequestration by lakes contributes to the global terrestrial C sink [sensu Houghton (*23*)]. Pre- and post-1950 time periods are indicated. Sources for the biogeochemical drivers: (*23*, *24*, *27*).

dating back millennia, it increased markedly on a global scale after 1950 (*30*). Carbon burial rates generally are high in reservoirs as a result of catchment instability and high erosion rates. These high inputs [mean 239 g C m^{-2} $year^{-1}$ (*13*) or ~61 Tg $year^{-1}$ globally] due to catchment disturbance processes, coupled with their rapid areal expansion after 1950, nearly double the median total freshwater C burial rate (to 0.18 Pg $year^{-1}$) when combined across biomes (Fig. 3C). This combined lake and reservoir global burial rate is approximately 30% of annual lake CO_2 emission on a comparable areal basis (*4*). However, it is important to recognize that reservoir burial rates are presently poorly constrained in comparison to lakes (for example, they are uncorrected for sediment focusing), although they undoubtedly contribute substantially to aquatic C sequestration (Fig. 3C), particularly since 1950 with the major expansion of dam construction (*30*).

Although lateral transfer of terrestrial C is a natural process, mainly as dissolved organic-C, soil erosion rates have increased markedly owing to land-cover change (*31*), as exemplified by the estimated reservoir burial rate (Fig. 3C). Soil C is in a dynamic equilibrium with the atmosphere (although turnover times vary), but when transferred laterally and buried in lakes, this terrestrial-derived C is effectively removed from the short-term C cycle. Our estimate of the annual global lake and reservoir sequestration rate (0.18 Pg $year^{-1}$) is equivalent to the residual global forest C sink for the 1990s (*17*), which demonstrates that freshwaters play an important role in the integrated continental C cycle.

Beyond the impact of reservoir building and nutrient enrichment in cultural landscapes, our analysis shows that increases in aquatic C burial are occurring even in areas where there is limited land-cover change (i.e., boreal and tundra biomes) (see Fig. 2A), emphasizing the extent to which global development has resulted in fertilization of the biosphere (*32*). While land-use disruption of N and P cycles at regional and local scales is well documented (*22*), the results of the present study highlight the pervasive and integrated nature of anthropogenic environmental change on terrestrial and aquatic ecosystems (Fig. 2) through global disruption of biogeochemical cycles (*32*). Such global impacts include transboundary pollution by reactive nitrogen (derived from emissions from intensive agriculture

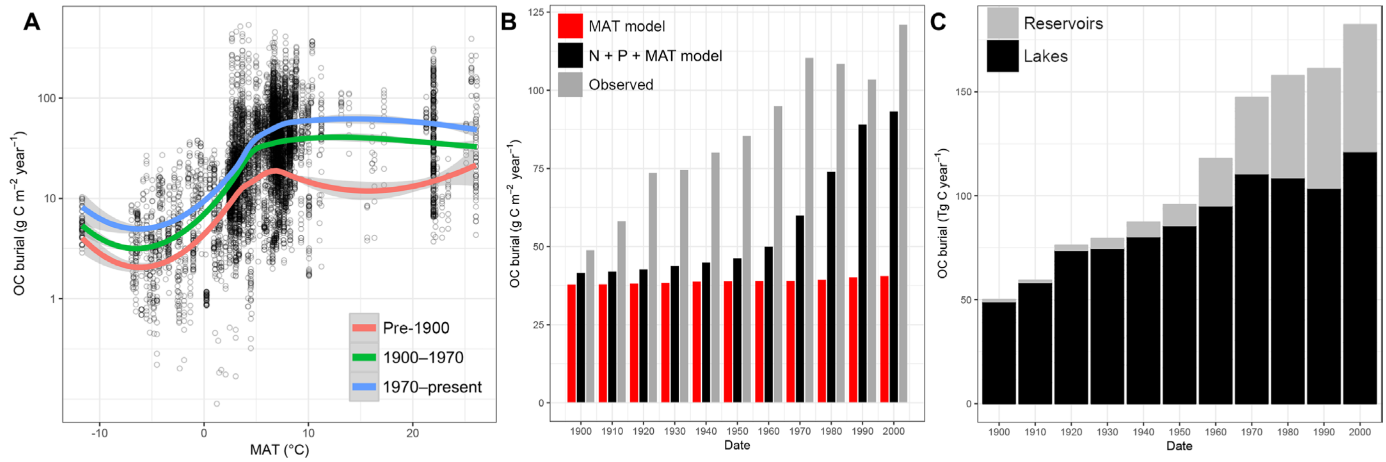

Fig. 3. Observed and predicted measurements of organic-C burial across space and time. (**A**) All C burial measurements for lakes included in this study versus the MAT of the site location. Lines represent LOWESS curves of this relationship with shaded 95% confidence regions, separated into three time intervals (pre-1900, pink; 1900–1970, green; and 1970 to present, blue). (**B**) Comparison of the global lake C burial rate and modeled C burial based on N and P availability and global temperature change during the period 1900 to 2000 (see the Supplementary Materials). The difference between modeled and measured lake C burial is attributable to terrestrial C from land-cover changes. (**C**) Global lake and reservoir C burial, by decade, from 1900 to present.

and industrial sources) (*24*). Although N-deposition rates are low (~1 kg N ha^{-1} year^{-1} or less) when the recipient areas are far removed from the source areas, long-term chronic inputs to remote nutrient-poor systems increase ecosystem productivity (*33*), and its historic effect as has been previously inferred (*9*). Land-cover change, land-use intensification, and the deflation of agricultural soils with resultant long-range atmospheric transfer of nutrient-rich dusts also contribute to nutrient loading to remote lakes (*34*). The temporal reconstructions provided here offer a long-term perspective on the aquatic C cycle and highlight its variability and dynamic nature, both geographically and temporally at 10^2-year time scales. These results also demonstrate the importance of C sequestration in offsetting CO_2 emissions from lakes and reservoirs.

MATERIALS AND METHODS

Here, we summarize the approach taken to site selection and dataset compilation. The three critical criteria used in this process were availability of ^{210}Pb concentration, carbon or organic matter content in sediment cores, and lake geographic location. Because lake sediment studies are biased toward the temperate and boreal regions, major emphasis was given toward inclusion of the few extant studies that included the above criteria in underrepresented areas (see the "Geographical analyses" section).

Site selection

To ensure consistent dating and organic-C flux calculations across all sediment cores in this study, only records that had both ^{210}Pb and organic-C concentrations at approximately decadal resolutions for the last 100 years were selected. The initial dataset compilation was based on previous regional syntheses by Heathcote *et al.* (*9*, *20*) and Anderson *et al.* (*8*, *28*); however, these data represented less than half of Earth's major biomes. To address this, we conducted a literature review of other published ^{210}Pb-dated lake sediment records where sediment C content was measured.

The availability of ^{210}Pb concentrations (as opposed to only ^{210}Pb dates) was critical in terms of filtering the data because it was required to calculate a consistent sediment focusing correction across all sites. After this initial screening of data availability, we targeted other regional (i.e., multiple lakes) studies where ^{210}Pb concentrations were not published, but likely existed, with an emphasis on underrepresented geographic areas (i.e., the tropics and montane grasslands). We requested the raw data for these studies and included those who shared data as Globocarb data contributors for this study (see full authorship list at the end of the Acknowledgments). As a result of this dataset expansion, we compiled temporal trends in global organic-C burial rates from 438 previously published records from lake sediment studies combined with unpublished results from 78 additional lakes (see table S1 for a list of sources). Although it is not inclusive of all lake sediment core studies undertaken to date, primarily due the unavailability of raw data (notably ^{210}Pb concentrations), our total dataset of 516 lakes represents the largest synthesis of carbon burial fluxes in lakes to date.

Estimation of organic-C burial rates

Selected sediment records had a consistent methodology for calculating the age and organic-C content down the core (see above). In most cases, analyses were performed on the cores in 0.5- to 1-cm intervals. Organic-C content was estimated by loss on ignition (*35*). The age of sediment intervals was determined using ^{210}Pb, a naturally occurring radioisotope with a half-life of 22.3 years, following the constant rate of supply model (*36*). Because most burial rates are estimated on the basis of a single centrally located sediment core, we independently focus-corrected each core based on the ratio of the unsupported ^{210}Pb flux at the core site to the estimated regional average atmospheric ^{210}Pb flux (*37*). This method more accurately reflects the whole-basin sediment accumulation rate and takes into account uneven depositional patterns within a lake basin (*8*, *9*, *38*).

Literature values for organic-C burial lakes from the world's largest lakes (>1000 km^2) were used when available (see table S2). To minimize the influence of incomplete mineralization on our estimates, all sediment sections younger than 10 years (based on ^{210}Pb age) were excluded from the analysis (*9*, *39*). Median organic-C burial rates and nonparametric 95% CIs were calculated using a Mann-Whitney test.

Geographical analyses

The locations of all lakes were confirmed from either published coordinates or topographical maps using readily available satellite or aerial photography from Google Earth (Google Inc.). Climate data (MAT and annual precipitation) were derived from 30–arc sec interpolated averages spanning the period of 1950 to2000 available from the WORLDCLIM database (*40*) and extracted for each lake. Lakes were assigned to global biomes based on their location within The Nature Conservancy's Terrestrial Ecoregion polygons derived primarily from Olson *et al.* (*15*). The proportional areal distribution of lakes across global biomes was estimated from the Global Lakes and Wetlands Database, which only includes lakes with a surface area >0.1 km^2 (*41*). This proportion was then multiplied by the estimated global lake area (*14*) minus the known area of the world's 22 largest lakes and the global reservoir area (see table S2 for a list of biome-specific lake areas) (*16*). All geographical analyses were performed using the open-source software QuantumGIS, v.2.6.1 (*42*).

Since this study represents a synthesis of a large number of published and unpublished data (n = 516; see table 1), the selection of lakes was necessarily biased by data availability in the most studied biomes (e.g., boreal forest and mixed temperate forest). Furthermore, sampling sites were heterogeneously located across biomes due to the logistical reality of sampling lakes in sometimes remote areas. Some biomes are underrepresented in the sediment core dataset relative to their global distribution, for example, tropical lakes (see figs. S1 and S2). Southern South America, New Zealand, and the Antarctic are absent due to methodological constraints that make ^{210}Pb dating unreliable in this region due to low atmospheric fluxes of ^{210}Pb at high latitudes in the southern hemisphere (*43*). Despite this, the biomes with at least two or more sediment cores in this study represent 89% of global lake surface area (*41*), which includes independent literature-derived organic-C burial rates for the world's largest lakes (11% of global lake surface; see table S2). Given the disproportionately large areal extent of lakes in the boreal and temperate regions (58% of the global lake area, excluding the "Great Lakes"), it is important that these estimates be well constrained (i.e., the errors are lowest in the regions that contribute the most to the total global lake area) (see table S2).

Fertilizer use data were derived from 0.5–decimal degree interpolated averages of N and P fertilizer application spanning from 1994 to 2001; available online from NASA's Socioeconomic Data and Applications Center (SEDAC) (*44*–*46*).

Statistical analyses

For purposes of statistical comparison, organic-C burial rates were separated into two time periods (pre-1900 and 1970 to present) to represent the recently designated stratigraphic boundary between the Holocene and Anthropocene epochs (*19*). Differences in lake-specific averages for each time period were assessed via one-sided paired t tests for difference greater than zero. The direction of change over time was estimated as the slope of a linear regression over all observations for each lake. All data were log_{10}-transformed for statistical analysis to conform to the assumption of normality. We used a space-for-time substitution to build our linear regression model for the effect of temperature and N + P fertilizer application on organic-C burial rates using our global C-burial dataset and the global interpolated geographical data listed above (see the Supplementary Materials). All statistical analyses were performed using the statistical software R (*47*).

Organic-C burial modeling: Temperature and nutrient predictors

We used a space-for-time substitution to develop linear regression models to predict organic-C burial over a gradient of MAT and fertilizer use (based on modeled nitrogen and phosphorus application rates). All explanatory variables for the regression models were based on globally interpolated datasets. For temperature, we used the 30–arc sec interpolated WORLDCLIM database (www.worldclim.org), which provides an average elevation-adjusted MAT from 1950 to 2000 (*40*). Nitrogen and phosphorus fertilizer application rates (kilogram per hectare) were based on the 0.5–decimal degree interpolated averages compiled by Potter *et al.* (*44*–*46*) based on a synthesis of national fertilizer use and cropping pattern statistics. These data are publicly available as part of NASA's SEDAC at http://sedac.ciesin.columbia.edu/data/collection/ferman-v1.

The above explanatory variables were compared to log_{10}-transformed observations of organic-C burial from our global lakes dataset. MAT was compared to pre-1900 organic-C burial rates for the lakes to best isolate this signal from the rise of fertilizer use, which primarily occurred over the 20th century (*27*, *48*). Nitrogen and fertilizer application rates were compared to contemporary organic-C burial rates (1970 to present) for the same set of lakes; however, the y intercept from the pre-1900 temperature regression was used for the final predictive model to better represent true baseline conditions. Global predictions of organic-C burial rates were based on these regressions using global averages for fertilizer use (shown in Fig. 3A) and global average temperature data binned by decade (*27*, *48*).

Model selection

All three explanatory variables explained a significant amount of variation in organic-C burial rates. Although only a specific time period was used for the finalized model (pre-1900 for temperature and 1970 to present for N + P fertilizer use), this relationship was significant regardless of the time period chosen, and the slopes did not significantly differ. MAT explained 14% of the variance in organic-C burial ($F_{1,1671}$ = 257.4, P < 0.001) and was modeled as

$$\text{Log}_{10}\,\text{organic-C burial} = \text{MAT} \times 0.03 + 0.905$$

P fertilizer use explained 25% of the variance in organic-C burial ($F_{1,1911}$ = 637.1, P < 0.001) and was modeled as

$$\text{Log}_{10}\,\text{organic-C burial} = \text{P application} \times 0.04 + 0.905$$

N fertilizer use explained 28% of the variance in organic-C burial ($F_{1,1911}$ = 742.9, P < 0.001) and was modeled as

$$\text{Log}_{10}\,\text{organic-C burial} = \text{N application} \times 0.009 + 0.905$$

When combined into a multiple regression model, these three explanatory variables collectively explained 44% of the variance in organic-C burial rates ($F_{3,1909}$ = 499.6, P < 0.001)

$$\text{Log}_{10}\,\text{OCburial} = \text{MAT} \times 0.03 + \text{Papplication} \times 0.017 + \text{N application} \times 0.005 + 0.905$$

In addition to all predictors being significant individual predictors of organic-C burial, the full model had the lowest AIC (Akaike information criterion) score using both forward and backward selection of each parameter, indicating that it was the best performing and most parsimonious model.

SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at http://advances.sciencemag.org/cgi/content/full/6/16/eaaw2145/DC1

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Supplementary Materials for

Anthropogenic alteration of nutrient supply increases the global freshwater carbon sink

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Supplementary Materials

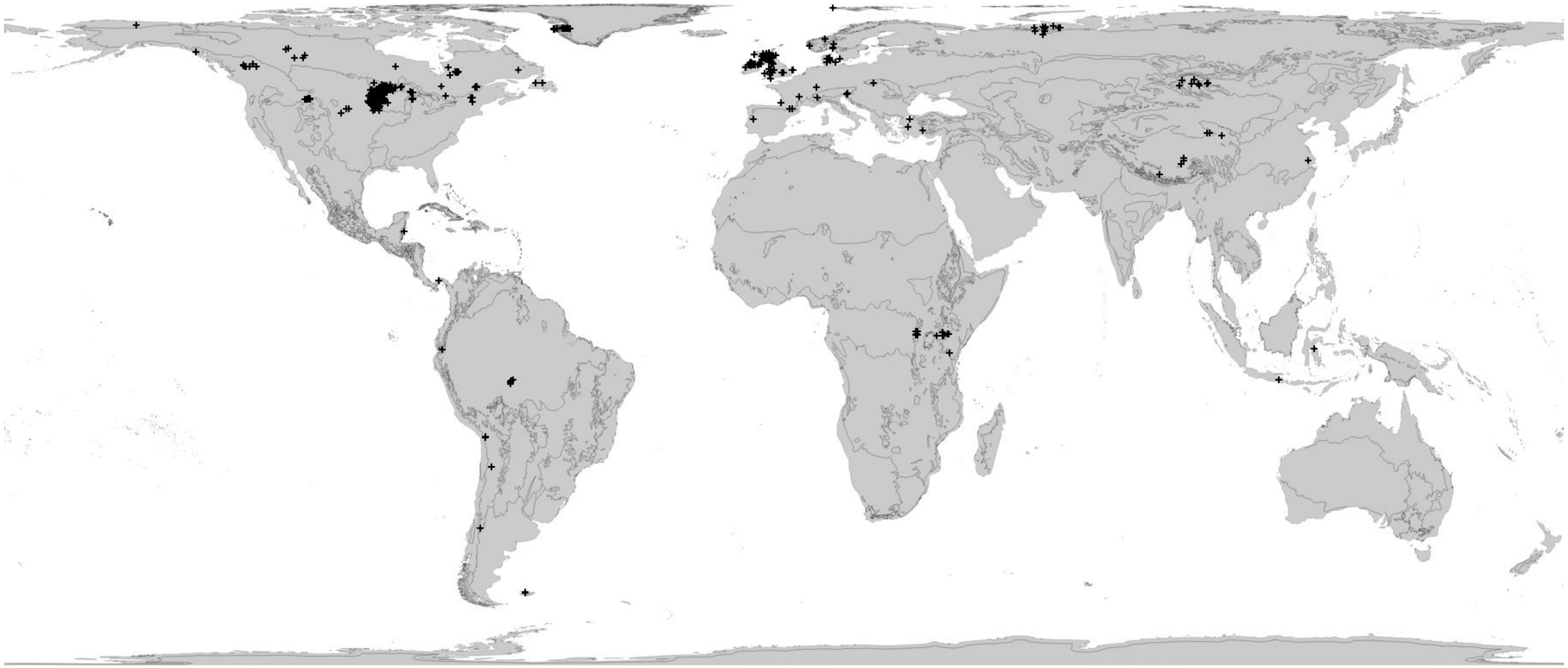

Fig. S1. Map showing the location of all sediment cores includes in this study (black crosses). For a full list of lake names and locations see Supplementary Table 2.

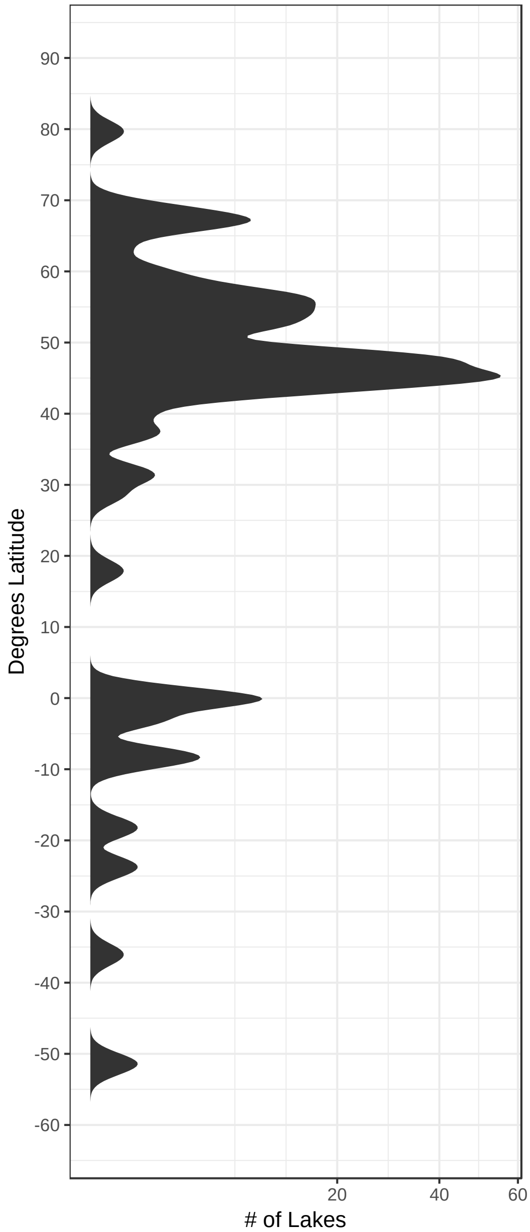

Fig. S2. Latitudinal distribution of lakes in this study. Density plot of the number of lakes by degree latitude included in this study.

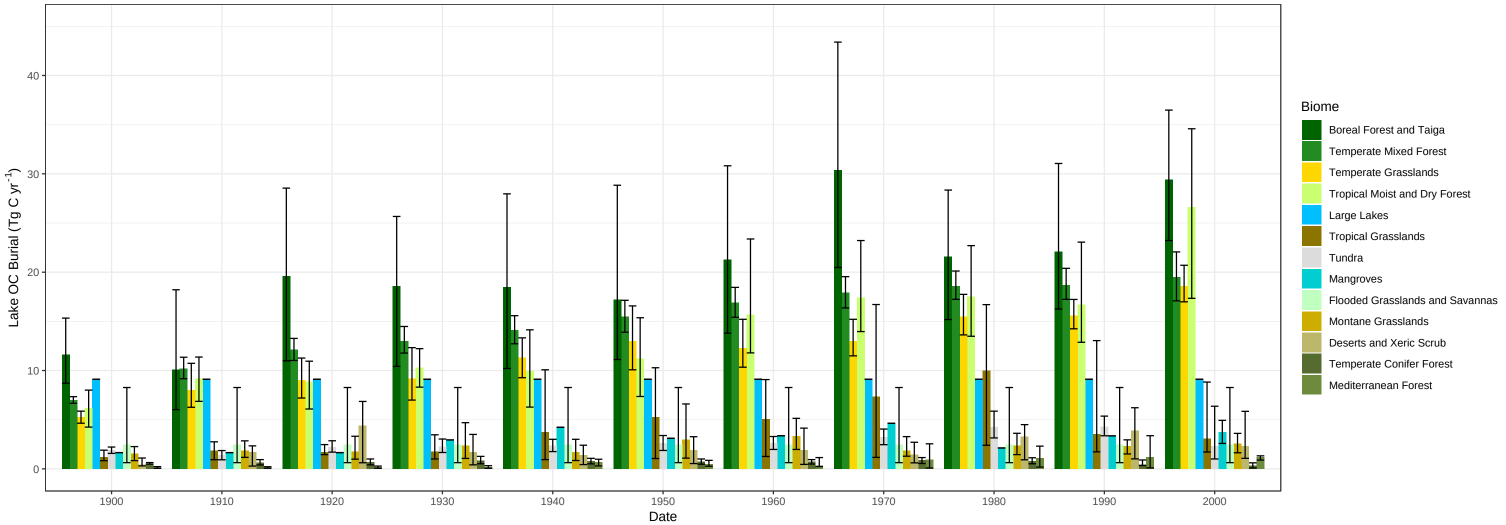

Fig. S3. Biome specific organic-C burial rates by decade from 1900 to present. Bars are colored by biome (see legend) and represent median organic-C burial rates for each decade. Black error-bars represent non-parametric 95% confidence intervals around the median.

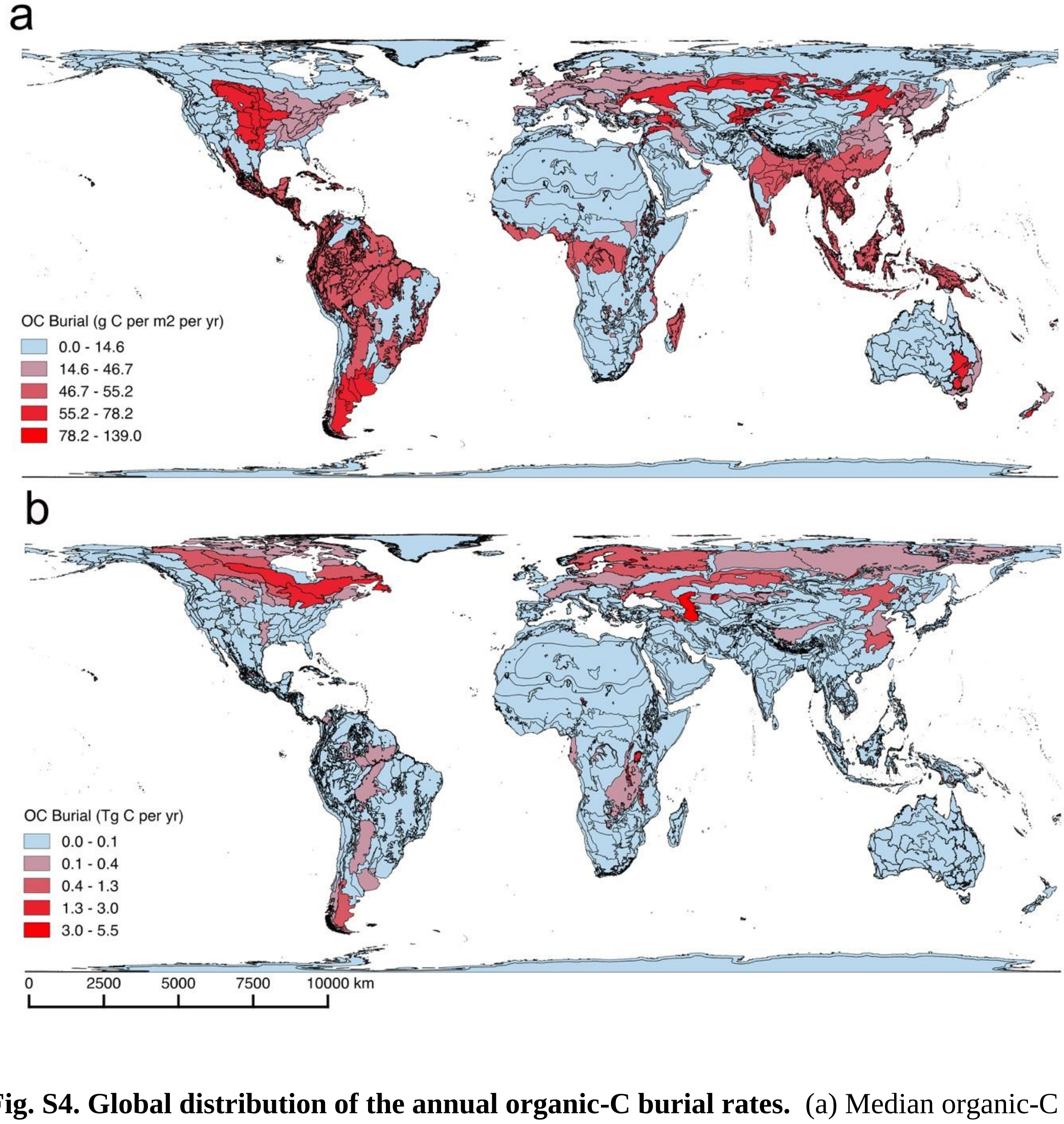

Fig. S4. Global distribution of the annual organic-C burial rates. (a) Median organic-C burial rates by biome (b) total organic-C burial rates as a product of the biome-specific burial rate multiplied by the total lake area in each polygon.

Table S1. List of lake sediment cores used in this study.

Lake	Region	Lat.	Long.	Source
Allen	Temperate Mixed Forest	54.05	-8.05	*(8)*
Ballywillin	Temperate Mixed Forest	54.4	-5.72	*(8)*
Brantry	Temperate Mixed Forest	54.254	-6.505	*(8)*
Broad Lough	Temperate Mixed Forest	54.3	-7.5	*(8)*
Bryrup	Temperate Mixed Forest	56.017	9.533	*(8)*
Corbet	Temperate Mixed Forest	54.337	-6.187	*(8)*
Creeve	Temperate Mixed Forest	54.241	-6.516	*(8)*
Esrum	Temperate Mixed Forest	55.992	12.373	*(8)*
Frederiksborg	Temperate Mixed Forest	55.933	12.3	*(8)*
Heron	Temperate Mixed Forest	54.254	-7.081	*(8)*
Knudsø	Temperate Mixed Forest	56.102	9.77	*(8)*
Lading Sø	Temperate Mixed Forest	56.217	9.964	*(8)*
Langesø	Temperate Mixed Forest	55.435	10.195	*(8)*
MacNean Upper	Temperate Mixed Forest	54.306	-7.957	*(8)*
Manor House	Temperate Mixed Forest	54.3	-7.5	*(8)*
Melvin	Temperate Mixed Forest	54.417	-8.133	*(8)*
Ravnsø	Temperate Mixed Forest	56.106	9.845	*(8)*
Skanderborg Sø	Temperate Mixed Forest	56.017	9.917	*(8)*
Søgård Sø	Temperate Mixed Forest	54.936	9.439	*(8)*
Tongree	Temperate Mixed Forest	54.14	-7.32	*(8)*
Torup Sø	Temperate Mixed Forest	56.016	9.431	*(8)*
Vesterborg	Temperate Mixed Forest	54.866	11.273	*(8)*
White	Temperate Mixed Forest	54.246	-6.546	*(8)*
Afunnagh	Temperate Mixed Forest	54.567	-7.883	*(8)*
Anarry	Temperate Mixed Forest	54.257	-8.277	*(8)*
Carrow	Temperate Mixed Forest	54.158	-8.677	*(8)*
Crockaleven	Temperate Mixed Forest	54.344	-7.258	*(8)*
Fadd	Temperate Mixed Forest	54.567	-7.881	*(8)*
Lettererafroe	Temperate Mixed Forest	53.379	-9.418	*(8)*
Namanfin	Temperate Mixed Forest	54.702	-8.314	*(8)*
ARKA1	Temperate Conifer Forest	56.97	-5.154	*(8)*
AURE1	Temperate Mixed Forest	44.22	-1.21	*(8)*
AWE2	Temperate Mixed Forest	56.308	-5.226	*(8)*

AYDA1	Temperate Mixed Forest	45.66	2.98	*(8)*
BALA1	Temperate Mixed Forest	52.888	-3.623	*(8)*
BART1	Temperate Mixed Forest	52.739	1.495	*(8)*
BASS1	Temperate Mixed Forest	54.653	-3.216	*(8)*
BLED3	Temperate Mixed Forest	46.36	14.1	*(8)*
BOSHC1	Temperate Mixed Forest	51.617	-4.923	*(8)*
BUTT3	Temperate Mixed Forest	56.587	-3.534	*(8)*
CARL12	Temperate Mixed Forest	54.931	-3.932	*(8)*
CASL1	Temperate Mixed Forest	56.271	-3.227	*(8)*
DAVA2	Temperate Conifer Forest	57.094	-2.923	*(8)*
EARN1	Temperate Mixed Forest	56.387	-4.203	*(8)*
ECK4	Temperate Mixed Forest	56.102	-4.991	*(8)*
ESTH1	Temperate Mixed Forest	54.359	-2.986	*(8)*
EYE1	Temperate Conifer Forest	57.792	-3.967	*(8)*
FLEM1	Temperate Mixed Forest	57.543	-3.99	*(8)*
GER3	Temperate Mixed Forest	48.06	6.99	*(8)*
GJER1	Boreal Forest and Taiga	59.78	10.78	*(8)*
KALA1	Temperate Conifer Forest	60.27	5.42	*(8)*
KENF2	Temperate Mixed Forest	51.52	-3.736	*(8)*
KILB1	Temperate Mixed Forest	55.755	-4.661	*(8)*
KINO2	Temperate Mixed Forest	56.675	-3.043	*(8)*
LEVE11	Temperate Mixed Forest	56.198	-3.376	*(8)*
LIND1	Temperate Mixed Forest	56.334	-3.187	*(8)*
LLAN3	Temperate Mixed Forest	51.93	-3.263	*(8)*
LOMO3	Temperate Mixed Forest	56.115	-4.622	*(8)*
LOMO4	Temperate Mixed Forest	56.115	-4.622	*(8)*
LOWE2	Temperate Mixed Forest	56.577	-3.549	*(8)*
LOWS1	Temperate Mixed Forest	54.59	-3.35	*(8)*
LUBN1	Temperate Mixed Forest	56.288	-4.288	*(8)*
MARE1	Temperate Conifer Forest	57.652	-5.379	*(8)*
MARS91	Temperate Mixed Forest	51.814	-0.667	*(8)*
MENT2	Temperate Mixed Forest	56.174	-4.292	*(8)*
MILL1	Temperate Mixed Forest	55.135	-3.449	*(8)*
MjosaB	Boreal Forest and Taiga	60.765	11.032	*(8)*
MONK1	Temperate Mixed Forest	56.57	-3.288	*(8)*
MONZ1	Temperate Mixed Forest	56.388	-3.88	*(8)*
NGAD1	Temperate Mixed Forest	55.757	-5.534	*(8)*
PLAN3	Temperate Mixed Forest	46.311	13.832	*(8)*
ROLL1	Temperate Mixed Forest	52.677	1.64	*(8)*
SCM27B	Temperate Mixed Forest	52.666	-2.725	*(8)*
SEMP1	Temperate Mixed Forest	55.798	-4.609	*(8)*

SHIE5	Temperate Mixed Forest	56.785	-5.608	*(8)*
SKEN1	Temperate Conifer Forest	57.157	-2.358	*(8)*
SLT4	Temperate Mixed Forest	50.277	-3.652	*(8)*
STOW91	Temperate Mixed Forest	52.026	-1.019	*(8)*
UPTO1	Temperate Mixed Forest	52.666	1.533	*(8)*
USSI1	Temperate Conifer Forest	57.579	-4.502	*(8)*
VAN2B	Temperate Mixed Forest	59.444	10.755	*(8)*
WHIE1	Temperate Mixed Forest	56.57	-3.353	*(8)*
WROX1	Temperate Mixed Forest	52.699	1.418	*(8)*
Bousquet	Boreal Forest and Taiga	48.029	-71.471	*(9)*
Cantin	Boreal Forest and Taiga	47.976	-71.157	*(9)*
Clarence-Gagnon	Boreal Forest and Taiga	48.091	-71.529	*(9)*
Faniant	Boreal Forest and Taiga	48.127	-71.264	*(9)*
Florence	Temperate Mixed Forest	45.011	-86.12	*(9)*
Fraser	Temperate Mixed Forest	45.388	-72.178	*(9)*
Grand Lac Montagnais	Boreal Forest and Taiga	47.919	-71.206	*(9)*
Lac Richelieu	Boreal Forest and Taiga	48.156	-71.351	*(9)*
Simoncouche	Boreal Forest and Taiga	48.24	-71.253	*(9)*
Stukely	Temperate Mixed Forest	45.364	-72.253	*(9)*
Tourangeau	Boreal Forest and Taiga	47.93	-71.243	*(9)*
CNT	Temperate Grasslands	43.412	-95.135	*(20)*
ELO	Temperate Grasslands	43.38	-95.119	*(20)*
LGR	Temperate Grasslands	43.354	-95.122	*(20)*
MIN	Temperate Grasslands	43.36	-95.124	*(20)*
SLD	Temperate Grasslands	43.445	-95.337	*(20)*
UGR	Temperate Grasslands	43.369	-95.121	*(20)*
WLO	Temperate Grasslands	43.374	-95.152	*(20)*
1st Crow Wing Lake	Temperate Mixed Forest	46.839	-94.841	*(28, 49)*
Agnes	Temperate Mixed Forest	47.528	-92.812	*(28, 49)*
Alton	Temperate Mixed Forest	47.863	-90.908	*(28, 49)*
Battle Creek Lake	Temperate Mixed Forest	44.944	-92.973	*(28, 49)*
Bean Lake	Temperate Grasslands	44.072	-95.374	*(28, 49)*
Big Carnelian Lake	Temperate Mixed Forest	45.132	-92.81	*(28, 49)*
Big Marine Lake	Temperate Mixed Forest	45.213	-92.868	*(28, 49)*
Brule	Temperate Mixed Forest	47.932	-90.672	*(28, 49)*
Dark Lake	Temperate Mixed Forest	48.212	-91.965	*(28, 49)*
Deepwater Lake	Temperate Mixed Forest	47.621	-92.825	*(28, 49)*
East Boot Lake	Temperate Mixed Forest	45.164	-92.831	*(28, 49)*
Edwards Lake	Temperate Mixed Forest	45.508	-95.469	*(28, 49)*
Greenleaf Lake	Temperate Mixed Forest	44.399	-93.626	*(28, 49)*
Hjermstad Lake	Temperate Grasslands	44.175	-96.004	*(28, 49)*
Lady Slipper Lake	Temperate Grasslands	44.573	-95.632	*(28, 49)*

Lake Mille Lacs	Temperate Mixed Forest	46.219	-93.664	*(28, 49)*
Lake Winnibigoshish	Temperate Mixed Forest	47.424	-94.244	*(28, 49)*
Little Lower Elk Lake	Temperate Grasslands	45.858	-95.791	*(28, 49)*
Little Turtle Lake	Temperate Grasslands	45.886	-95.836	*(28, 49)*
Lone Tree Lake	Temperate Grasslands	44.689	-95.445	*(28, 49)*
Margaret Lake	Temperate Mixed Forest	46.487	-94.364	*(28, 49)*
Middle Twin Lake	Temperate Mixed Forest	45.043	-93.34	*(28, 49)*
Nelson Lake	Temperate Mixed Forest	45.524	-95.446	*(28, 49)*
Oak Lake	Temperate Grasslands	44.537	-96.243	*(28, 49)*
Ohlsrud Lake	Temperate Grasslands	45.799	-96.049	*(28, 49)*
Peltier Lake	Temperate Mixed Forest	45.18	-93.056	*(28, 49)*
Portage Lake	Temperate Mixed Forest	46.965	-95.116	*(28, 49)*
Round Lake 2	Temperate Mixed Forest	45.56	-95.278	*(28, 49)*
Round Lake 4	Temperate Mixed Forest	47.214	-93.358	*(28, 49)*
Ryan	Temperate Mixed Forest	48.519	-92.707	*(28, 49)*
Sawbill	Temperate Mixed Forest	47.528	-90.88	*(28, 49)*
Shingobee Lake	Temperate Mixed Forest	47.003	-94.689	*(28, 49)*
Side Lake	Temperate Mixed Forest	47.671	-93.018	*(28, 49)*
Sissibakwet Lake	Temperate Mixed Forest	47.159	-93.671	*(28, 49)*
Solem Lake	Temperate Mixed Forest	45.809	-95.64	*(28, 49)*
Spectacle Lake	Temperate Mixed Forest	45.576	-93.406	*(28, 49)*
Spring Lake	Temperate Mixed Forest	44.702	-93.466	*(28, 49)*
Turtle Lake 2	Temperate Grasslands	45.885	-95.836	*(28, 49)*
Wakefield Lake	Temperate Mixed Forest	44.995	-93.035	*(28, 49)*
West Twin Lake	Temperate Mixed Forest	46.8	-92.592	*(28, 49)*
Willeys Lake	Temperate Mixed Forest	47.535	-93.459	*(28, 49)*
Williams Lake	Temperate Mixed Forest	46.954	-94.669	*(28, 49)*
Wolf Lake 2	Temperate Grasslands	43.858	-95.09	*(28, 49)*
Lake Shagawa	Temperate Mixed Forest	47.909	-91.895	*(50)*
Lake St. Croix	Temperate Mixed Forest	44.937	-92.757	*(50)*
Lake Winona	Temperate Mixed Forest	44.038	-91.637	*(50)*
SS32 (Nunatak)	Tundra	66.97	-49.8	*(51)*
SS4	Tundra	66.99	-51.05	*(51)*
SS53	Tundra	66.49	-53.53	*(51)*
SS6	Tundra	67	-51.11	*(51)*
SS70	Tundra	66.95	-51.58	*(51)*
Araca	Tropical Moist Broadleaf	-8.47	-63.506	*(52)*
Brasileira	Tropical Moist Broadleaf	-8.495	-63.487	*(52)*
Conceicao	Tropical Moist Broadleaf	-8.25	-63.19	*(52)*
Demarcacao	Tropical Moist Broadleaf	-8.097	-62.848	*(52)*
Nazare	Tropical Moist Broadleaf	-8.15	-63.335	*(52)*
Paca	Tropical Moist Broadleaf	-8.623	-63.512	*(52)*
Samuel	Tropical Moist Broadleaf	-8.748	-63.404	*(52)*

Sant Catarina	Tropical Moist Broadleaf	-8.263	-63.183	*(52)*
Tucunare	Tropical Moist Broadleaf	-8.401	-63.402	*(52)*
Island Lake Reservoir	Temperate Mixed Forest	47.008	-92.202	*(53)*
del Maule	Temperate Mixed Forest	-36.053	-70.5	*(54)*
ALB04b	Boreal Forest and Taiga	56.222	-111.17	*(55)*
ALB12b	Boreal Forest and Taiga	56.246	-113.141	*(55)*
ALB15b	Boreal Forest and Taiga	59.119	-115.128	*(55)*
ALB16b	Boreal Forest and Taiga	59.238	-114.524	*(55)*
ALB21b	Boreal Forest and Taiga	57.147	-110.865	*(55)*
Bogoria	Tropical Grasslands	0.258	36.095	*(56)*
Elementaita	Tropical Grasslands	-0.444	36.249	*(56)*
Nakuru	Tropical Grasslands	-0.348	36.087	*(56)*
Elk Lake	Temperate Grasslands	45.869	-95.808	*(57)*
Big Sandy Lake	Temperate Mixed Forest	46.768	-93.279	*(58)*
Dixon Lake	Temperate Mixed Forest	47.596	-94.287	*(58)*
South Twin Lake	Temperate Mixed Forest	47.229	-95.647	*(59)*
Ten Mile Lake	Temperate Mixed Forest	46.964	-94.577	*(59)*
Trout Lake	Temperate Mixed Forest	47.871	-90.169	*(59)*
White Iron Lake	Temperate Mixed Forest	47.892	-91.776	*(59)*
Lake Carlos	Temperate Mixed Forest	45.962	-95.364	*(59)*
Ahmik	Temperate Mixed Forest	48.148	-88.542	*(60, 61)*
Bass1	Temperate Mixed Forest	44.922	-85.883	*(60, 61)*
Beaver	Temperate Mixed Forest	46.565	-86.344	*(60, 61)*
Cruiser	Temperate Mixed Forest	48.499	-92.806	*(60, 61)*
Ek	Temperate Mixed Forest	47.529	-92.835	*(60, 61)*
Grand Sable	Temperate Mixed Forest	46.648	-86.034	*(60, 61)*
Harvey	Temperate Mixed Forest	48.051	-88.796	*(60, 61)*
Manitou	Temperate Mixed Forest	45.127	-86.024	*(60, 61)*
Outer	Temperate Mixed Forest	47.008	-90.46	*(60, 61)*
Peary	Temperate Mixed Forest	48.526	-92.771	*(60, 61)*
Richie	Temperate Mixed Forest	48.041	-88.702	*(60, 61)*
Shell	Temperate Mixed Forest	44.947	-85.899	*(60, 61)*
Namakan	Temperate Mixed Forest	48.435	-92.584	*(61, 101)*
Kabetogama	Temperate Mixed Forest	48.458	-93.042	*(61, 62)*
Rainy	Temperate Mixed Forest	48.624	-93.012	*(61, 62)*
Mukooda	Temperate Mixed Forest	48.334	-92.49	*(61, 71)*
Moskey Inlet (Superior)	Temperate Mixed Forest	48.069	-88.636	*(61)*
Spec Trout	Temperate Mixed Forest	47.95	-89.846	*(61)*
Swamp	Temperate Mixed Forest	47.951	-89.858	*(61)*
Bass Lake Morrison	Temperate Mixed Forest	46.226	-94.446	*(63)*
Coon Stump Lake	Temperate Mixed Forest	46.228	-94.428	*(63)*
Fosdick Lake	Temperate Mixed Forest	46.233	-94.436	*(63)*
Lake Ferrell	Temperate Mixed Forest	46.115	-94.418	*(63)*

Mud Lake	Temperate Mixed Forest	46.201	-94.445	*(63)*
Muskrat Lake	Temperate Mixed Forest	46.193	-94.457	*(63)*
Vadnais Lake	Temperate Mixed Forest	45.047	-93.087	*(64)*
Loon Lake 2	Temperate Mixed Forest	45.114	-92.837	*(65)*
Lake L'Homme Dieu	Temperate Mixed Forest	45.932	-95.351	*(66)*
Lake Wirth	Temperate Mixed Forest	44.982	-93.323	*(66)*
Arrowhead Lake	Temperate Mixed Forest	44.886	-93.394	*(67)*
Crystal Lake	Temperate Mixed Forest	45.026	-93.328	*(67)*
Farquhar Lake	Temperate Mixed Forest	44.758	-93.165	*(67)*
Gleason Lake	Temperate Mixed Forest	44.978	-93.493	*(67)*
Holyname Lake	Temperate Mixed Forest	45.016	-93.531	*(67)*
Indianhead Lake	Temperate Mixed Forest	44.88	-93.387	*(67)*
Lake Hadley	Temperate Mixed Forest	44.986	-93.514	*(67)*
Lake Josephine	Temperate Mixed Forest	45.036	-93.155	*(67)*
Lake Suzanne	Temperate Mixed Forest	44.852	-93.539	*(67)*
Woldsfeld Lake	Temperate Mixed Forest	45.005	-93.571	*(67)*
Buck_YS	Temperate Conifer Forest	44.904	-110.125	*(68)*
Buffalo_YS	Temperate Conifer Forest	44.935	-110.384	*(68)*
Floating Island_YS	Temperate Conifer Forest	44.958	-110.437	*(68)*
Foster_YS	Temperate Conifer Forest	44.873	-110.168	*(68)*
Rainbow_YS	Temperate Conifer Forest	45.022	-110.74	*(68)*
Slide	Temperate Conifer Forest	45.004	-110.699	*(68)*
Slough_YS	Temperate Conifer Forest	44.926	-110.352	*(68)*
Trumpeter_YS	Temperate Conifer Forest	44.916	-110.369	*(68)*
August	Temperate Mixed Forest	47.761	-91.606	*(69)*
Bass Lake Faribault	Temperate Grasslands	43.818	-94.079	*(69)*
Bean 2	Temperate Mixed Forest	47.309	-91.301	*(69)*
Bear	Temperate Mixed Forest	47.285	-91.344	*(69)*
Beaver Lake	Temperate Mixed Forest	43.89	-93.347	*(69)*
Carver Lake	Temperate Mixed Forest	44.905	-92.981	*(69)*
Christmas Lake	Temperate Mixed Forest	44.896	-93.545	*(69)*
Diamond Lake	Temperate Mixed Forest	45.183	-94.854	*(69)*
Dickman Lake	Temperate Mixed Forest	44.862	-93.08	*(69)*
Duck Lake	Temperate Mixed Forest	44.218	-93.817	*(69)*
Dyers	Temperate Mixed Forest	47.529	-90.981	*(69)*
Fish Lake	Temperate Mixed Forest	44.823	-93.166	*(69)*
Forsythe Lake	Temperate Mixed Forest	47.267	-93.602	*(69)*
George Lake Blue Earth	Temperate Mixed Forest	44.234	-93.872	*(69)*
George Lake Kandiyohi	Temperate Mixed Forest	45.245	-94.986	*(69)*
Gervais Lake	Temperate Mixed Forest	45.023	-93.069	*(69)*

Henderson Lake	Temperate Mixed Forest	45.23	-94.993	*(69)*
Hook Lake	Temperate Grasslands	44.956	-94.339	*(69)*
Kreighle Lake	Temperate Mixed Forest	45.581	-94.478	*(69)*
Lake Calhoun	Temperate Mixed Forest	44.94	-93.312	*(69)*
Lake Elmo	Temperate Mixed Forest	44.981	-92.886	*(69)*
Lake Harriet	Temperate Mixed Forest	44.921	-93.303	*(69)*
Lake Johanna	Temperate Mixed Forest	45.044	-93.17	*(69)*
Lake Owasso	Temperate Mixed Forest	45.038	-93.117	*(69)*
Lake Sagatagan	Temperate Mixed Forest	45.574	-94.39	*(69)*
Little Bass Lake	Temperate Mixed Forest	47.286	-93.599	*(69)*
Little Carnelian Lake	Temperate Mixed Forest	45.118	-92.795	*(69)*
Little Long Lake	Temperate Mixed Forest	44.988	-93.563	*(69)*
Little Trout	Temperate Mixed Forest	48.397	-92.523	*(69)*
Little Trout Lake	Temperate Mixed Forest	48.397	-92.523	*(69)*
Locator	Temperate Mixed Forest	48.541	-93.006	*(69)*
Loiten	Temperate Mixed Forest	48.526	-92.923	*(69)*
Long Lake Itasca	Temperate Mixed Forest	47.225	-93.653	*(69)*
Long Lake Kandiyohi	Temperate Mixed Forest	45.327	-94.866	*(69)*
Loon Lake	Temperate Mixed Forest	47.232	-93.64	*(69)*
Marcott Lake	Temperate Mixed Forest	44.821	-93.074	*(69)*
McCarrons Lake	Temperate Mixed Forest	44.998	-93.114	*(69)*
Ninemile	Temperate Mixed Forest	47.579	-91.083	*(69)*
Nipisiquit	Temperate Mixed Forest	47.356	-91.247	*(69)*
Schultz Lake	Temperate Mixed Forest	44.785	-93.129	*(69)*
Shoepack	Temperate Mixed Forest	48.503	-92.88	*(69)*
Snells Lake	Temperate Mixed Forest	47.24	-93.678	*(69)*
Square Lake	Temperate Mixed Forest	45.155	-92.801	*(69)*
Stahls Lake	Temperate Grasslands	44.953	-94.423	*(69)*
Tanners Lake	Temperate Mixed Forest	44.951	-92.983	*(69)*
Tettegouche	Temperate Mixed Forest	47.346	-91.268	*(69)*
Tooth	Temperate Mixed Forest	48.398	-92.643	*(69)*
Turtle Lake	Temperate Mixed Forest	45.099	-93.139	*(69)*
Twin Lake	Temperate Mixed Forest	44.991	-93.337	*(69)*
Wilson	Temperate Mixed Forest	47.675	-91.084	*(69)*
Windy	Temperate Mixed Forest	47.729	-91.077	*(69)*
Wolf (Johnson)	Temperate Mixed Forest	47.376	-91.189	*(69)*
Lake Pepin	Temperate Mixed Forest	44.466	-92.253	*(70)*
Astrid	Temperate Mixed Forest	48.111	-92.329	*(71)*
Dunnigan	Temperate Mixed Forest	47.707	-91.632	*(71)*
Grassy	Temperate Mixed Forest	47.804	-92.043	*(71)*
Greenstone	Temperate Mixed Forest	47.932	-91.606	*(71)*
Kjostad	Temperate Mixed Forest	48.11	-92.611	*(71)*
Little	Temperate Mixed Forest	48.333	-93.096	*(71)*

Little Wilson	Temperate Mixed Forest	47.658	-91.067	*(71)*
Maude	Temperate Mixed Forest	48.109	-92.353	*(71)*
Wilson Lake 3	Temperate Mixed Forest	47.212	-92.366	*(71)*
Clever	Boreal Forest and Taiga	49.17	-57.768	*(72)*
Cliff	Temperate Conifer Forest	58.24	-135.842	*(72)*
Frank	Boreal Forest and Taiga	49.178	-57.648	*(72)*
Goldeneye	Temperate Conifer Forest	58.247	-135.833	*(72)*
Rectangle	Temperate Conifer Forest	58.237	-135.877	*(72)*
Sapsucker	Temperate Conifer Forest	58.233	-135.823	*(72)*
Tomtit	Boreal Forest and Taiga	49.172	-57.79	*(72)*
Topsail	Boreal Forest and Taiga	49.133	-56.013	*(72)*
Brendan	Boreal Forest and Taiga	52.065	-75.503	*(73)*
Clarkie	Boreal Forest and Taiga	52.228	-75.489	*(73)*
EM320	Boreal Forest and Taiga	52.166	-76.121	*(73)*
Labyrinthe	Boreal Forest and Taiga	52.226	-75.714	*(73)*
Lac 11	Boreal Forest and Taiga	52.153	-75.76	*(73)*
Lac 2	Boreal Forest and Taiga	52.132	-75.819	*(73)*
Lac 34	Boreal Forest and Taiga	51.985	-75.767	*(73)*
Lac 40	Boreal Forest and Taiga	52.029	-75.524	*(73)*
Lac 60	Boreal Forest and Taiga	52.232	-75.762	*(73)*
Lac 66	Boreal Forest and Taiga	51.96	-76.01	*(73)*
Lac 8	Boreal Forest and Taiga	52.132	-75.724	*(73)*
Mistumis	Boreal Forest and Taiga	52.162	-76.181	*(73)*
Natel	Boreal Forest and Taiga	52.185	-75.712	*(73)*
Lake10_Toolik	Tundra	68.637	-149.601	*(74)*
Lake14_Toolik	Tundra	68.637	-149.601	*(74)*
Lake19_Toolik	Tundra	68.637	-149.601	*(74)*
Lake7_Toolik	Tundra	68.637	-149.601	*(74)*
Lake9_Toolik	Tundra	68.637	-149.601	*(74)*
BHL	Temperate Grasslands	42.3	-95.02	*(75,76)*
BRT	Temperate Grasslands	43.502	-94.385	*(75,76)*
CRY	Temperate Grasslands	43.23	-93.792	*(75,76)*
DMD	Temperate Grasslands	43.481	-95.192	*(75,76)*
FIL	Temperate Grasslands	43.155	-94.65	*(75,76)*
HIG	Temperate Grasslands	43.303	-94.706	*(75,76)*
ING	Temperate Grasslands	43.319	-94.697	*(75,76)*
IOW	Temperate Grasslands	43.498	-94.459	*(75,76)*
LCO	Temperate Grasslands	42.785	-93.689	*(75,76)*
LIL	Temperate Grasslands	43.17	-94.901	*(75,76)*
LSL	Temperate Grasslands	43.512	-95.126	*(75,76)*
LWL	Temperate Grasslands	42.269	-93.636	*(75,76)*

MRS	Temperate Grasslands	42.839	-93.693	*(75,76)*
NTL	Temperate Grasslands	42.485	-94.627	*(75,76)*
PIC	Temperate Grasslands	42.905	-94.922	*(75,76)*
RIC	Temperate Grasslands	43.391	-93.501	*(75,76)*
SLP	Temperate Grasslands	43.034	-94.89	*(75,76)*
TRU	Temperate Grasslands	43.199	-94.951	*(75,76)*
TUT	Temperate Grasslands	43.497	-94.594	*(75,76)*
VIR	Temperate Grasslands	43.101	-94.894	*(75,76)*
WSL	Temperate Grasslands	43.355	-94.683	*(75,76)*
WTL	Temperate Grasslands	42.936	-93.732	*(75,76)*
Long Lake 2	Temperate Mixed Forest	47.276	-95.297	*(77)*
Lake Christina (East Basin)	Temperate Mixed Forest	46.083	-95.692	*(78)*
Lake Christina (West Basin)	Temperate Mixed Forest	46.087	-95.747	*(78)*
Jessie Lake	Temperate Mixed Forest	47.585	-93.816	*(79)*
Boomerang	Temperate Conifer Forest	53.677	-124.516	*(80)*
Jakes	Temperate Conifer Forest	54.325	-122.712	*(80)*
Justine	Temperate Conifer Forest	54.212	-124.938	*(80)*
Laurie	Temperate Conifer Forest	53.878	-124.888	*(80)*
Pitoney	Temperate Conifer Forest	53.63	-122.033	*(80)*
Secord	Temperate Conifer Forest	53.628	-124.337	*(80)*
Tang	Temperate Conifer Forest	54.323	-122.785	*(80)*
Unnamed	Temperate Conifer Forest	53.847	-125.017	*(80)*
Upper Summit	Temperate Conifer Forest	54.294	-122.717	*(80)*
Woodcock	Temperate Conifer Forest	53.582	-123.596	*(80)*
Beysehir	Temperate Mixed Forest	37.75	31.514	*(81)*
Marmara	Mediterranean Forest	38.609	27.981	*(81)*
Uluabat	Mediterranean Forest	40.217	28.486	*(81)*
Lake B	Tundra	67.27	-51.58	*(81)*
SS16	Tundra	66.91	-50.46	*(82)*
Chorreras	Montane Grasslands	-2.771	-79.16	*(83, 84)*
Llaviacu	Tropical Moist Broadleaf	-2.843	-79.147	*(83, 84)*
Toreadora	Montane Grasslands	-2.781	-79.224	*(83, 84)*
Kako	Tropical Moist Broadleaf	-0.307	30.097	*(85)*
Kamunzuka	Tropical Moist Broadleaf	-0.263	30.156	*(85)*
Kigezi	Tropical Moist Broadleaf	-0.287	30.111	*(85)*
Nyungu	Tropical Moist Broadleaf	-0.257	30.094	*(85)*
Kyasanduku	Tropical Moist Broadleaf	-0.288	30.05	*(86)*
Nyamogusingiri Crater	Tropical Moist Broadleaf	-0.285	30.013	*(86)*
Big Trout	Boreal Forest and Taiga	53.721	-89.943	*(87)*

Eva	Temperate Mixed Forest	48.713	-91.186	*(87)*
Lac Dasserat	Boreal Forest and Taiga	48.249	-79.406	*(87)*
Lake Superior	Temperate Mixed Forest	46.898	-86.501	*(87)*
Levi Pond	Temperate Mixed Forest	44.267	-72.228	*(87)*
Minipi	Boreal Forest and Taiga	52.668	-61.724	*(87)*
Opeongo	Boreal Forest and Taiga	45.718	-78.361	*(87)*
Q27	Boreal Forest and Taiga	53.507	-77.699	*(87)*
Q6	Boreal Forest and Taiga	51.116	-77.326	*(87)*
Siskwit	Temperate Mixed Forest	47.999	-88.8	*(87)*
Lotus Lake	Temperate Mixed Forest	44.872	-93.528	*(88)*
Mitchell Lake	Temperate Mixed Forest	44.86	-93.497	*(88)*
Dean Lake	Temperate Mixed Forest	45.12	-93.835	*(89)*
Rice Marsh Lake	Temperate Mixed Forest	44.851	-93.517	*(90)*
Blakesly Lake	Temperate Mixed Forest	47.271	-95.442	*(91)*
Mavis Lake	Temperate Mixed Forest	46.262	-96.043	*(91)*
Lake of the Woods	Temperate Mixed Forest	49.053	-94.951	*(92)*
Lake Logung (Legung)	Tropical Moist Broadleaf	-8.042	113.307	*(93)*
Lake Lading	Tropical Moist Broadleaf	-8.009	113.313	*(94)*
Arresjoen ARSJ 93/4	Tundra	79.67	10.8	*(95)*
Adam Tarn, FILP1	Temperate Grasslands	-51.345	-60.043	*(96)*
Sulivan N Lake	Temperate Grasslands	-51.507	-60.119	*(96)*
Edward (EO3-1G)	Tropical Grasslands	-0.275	29.754	*(97)*
Batoda	Montane Grasslands	0.298	29.883	*(97)*
Lac Speke	Montane Grasslands	0.405	29.881	*(97)*
Upper Kitranda	Montane Grasslands	0.353	29.887	*(97)*
Kitagata	Tropical Moist Broadleaf	-0.066	29.975	*(98)*
Wandakara	Tropical Moist Broadleaf	0.417	30.271	*(99)*
Beauty_BT	Temperate Conifer Forest	45.106	-109.971	*(100)*
Emerald_BT	Temperate Conifer Forest	45.257	-109.695	*(100)*
Fossil_BT	Temperate Conifer Forest	45.091	-109.79	*(100)*
Heart_BT	Temperate Conifer Forest	45.024	-109.639	*(100)*
Lac La Croix	Temperate Mixed Forest	48.35	-92.134	*(101)*
Big Alkali	Temperate Grasslands	42.624	-100.617	*(102)*
Island	Temperate Grasslands	41.734	-102.4	*(102)*
Two Mile	Temperate Grasslands	42.672	-101.263	*(102)*
TDRV1.1-Podvaty	Tundra	67.45	63.083	*(103)*
TDRV4.2	Boreal Forest and Taiga	65.967	57.267	*(103)*
F6-4 (Malyi Patok Lake)	Tundra	64.317	59.083	*(104)*
F8-4 (Moreju Lake)	Tundra	67.883	59.667	*(104)*
Mitrofanovskoe	Tundra	67.29	57.181	*(104)*
Vankavad Lake	Tundra	65.986	59.456	*(104)*

Vanuk-ty Lake	Tundra	67.978	61.571	*(104)*
Meander Lake	Temperate Mixed Forest	46.778	-92.912	*(105)*
Airag	Deserts and Xeric Scrub	48.909	93.371	*(106)*
Dune Baga	Deserts and Xeric Scrub	49.921	93.849	*(106)*
Dune Bayan	Deserts and Xeric Scrub	48.463	95.16	*(106)*
Khundt Nuur	Temperate Grasslands	49.05	97.161	*(106)*
Kohlboo	Deserts and Xeric Scrub	49.701	91.091	*(106)*
Takkilt Nuur	Temperate Grasslands	48.806	96.806	*(106)*
Tsegen	Deserts and Xeric Scrub	48.912	94.867	*(106)*
Zagas	Temperate Conifer Forest	48.506	90.61	*(106)*
Miscanti	Montane Grasslands	-23.726	-67.771	*(107)*
Chungara	Montane Grasslands	-18.242	-69.155	*(108)*
Nam Co	Montane Grasslands	30.77	90.929	*(109)*
Cuo E	Montane Grasslands	31.42	91.485	*(109)*
Cuo Na	Montane Grasslands	32.049	91.513	*(109)*
Ga Hai	Deserts and Xeric Scrub	37.143	97.554	*(109)*
Keluke Hu	Deserts and Xeric Scrub	37.286	96.882	*(109)*
Kemen Co	Montane Grasslands	28.688	85.949	*(109)*
Oughter	Temperate Mixed Forest	54.01	-8.25	*(109)*
TPNA1 (Qinghai Hu)	Montane Grasslands	36.717	100.253	*(109)*
Bujuku	Montane Grasslands	0.377	29.893	*(110)*
Kitandara	Montane Grasslands	0.349	29.886	*(110)*
Mahoma	Montane Grasslands	0.344	29.967	*(110)*
SS2	Tundra	67	-50.97	*(111)*
AT1	Tundra	66.58	-53.24	*(112)*
AT6	Tundra	66.97	-53.49	*(112)*
AT7	Tundra	66.97	-53.59	*(112)*
SS1341	Tundra	66.99	-51.14	*(112)*
SS901	Tundra	67.13	-50.23	*(112)*
SS904	Tundra	67.16	-50.28	*(112)*
SS49	Tundra	66.86	-52.66	*(113)*
SS86	Tundra	66.96	-49.81	*(113)*
Big Lake	Temperate Mixed Forest	46.706	-92.63	this study, data provided by A. Myrbo*
Dead Fish Lake	Temperate Mixed Forest	46.747	-92.689	this study, data provided by A. Myrbo*
Middle Portage	Temperate Mixed Forest	46.701	-92.682	this study, data provided by A. Myrbo*
Perch Lake	Temperate Mixed Forest	46.689	-92.669	this study, data provided by A. Myrbo*
Rice Portage Lake	Temperate Mixed Forest	46.699	-92.69	this study, data provided by A. Myrbo*
Third Lake	Temperate Mixed Forest	46.712	-92.503	this study, data provided by A. Myrbo*
Wild Rice Lake	Temperate Mixed Forest	46.674	-92.604	this study, data provided by A. Myrbo*

Argent	Temperate Mixed Forest	45.309	-72.316	this study, data provided by A.J. Heathcote*
Brompton	Temperate Mixed Forest	45.425	-72.145	this study, data provided by A.J. Heathcote*
Waterloo	Temperate Mixed Forest	45.335	-72.521	this study, data provided by A.J. Heathcote*
Cotacotani	Montane Grasslands	-18.191	-69.222	this study, data provided B. Valero-Garcés*
Miniques	Montane Grasslands	-23.767	-67.789	this study, data provided B. Valero-Garcés*
Lake Muijongo	Tropical Moist Broadleaf	-0.271	30.085	this study, data provided D. Ryves*
Mafura	Tropical Moist Broadleaf	-0.265	30.102	this study, data provided D. Ryves*
Challa	Tropical Grasslands	-3.315	37.691	this study, data provided D. Verschuren*
Ellis	Tropical Moist Broadleaf	-0.125	37.401	this study, data provided D. Verschuren*
Emerald	Montane Grasslands	-0.152	37.294	this study, data provided D. Verschuren*
Hausberg	Montane Grasslands	-0.144	37.3	this study, data provided D. Verschuren*
Katinda	Tropical Moist Broadleaf	-0.22	30.106	this study, data provided D. Verschuren*
Oblong	Montane Grasslands	-0.145	37.302	this study, data provided D. Verschuren*
Rutundu	Tropical Moist Broadleaf	-0.042	37.463	this study, data provided D. Verschuren*
Simbi	Tropical Grasslands	-0.368	34.629	this study, data provided D. Verschuren*
Baby Lake	Temperate Mixed Forest	45.53	-95.495	this study, data provided D.R. Engstrom*
Barrett Lake	Temperate Grasslands	45.916	-95.878	this study, data provided D.R. Engstrom*
Big Elk Lake	Temperate Mixed Forest	45.473	-93.946	this study, data provided D.R. Engstrom*
Buffalo Lake	Temperate Grasslands	44.076	-95.579	this study, data provided D.R. Engstrom*
Cedar	Temperate Mixed Forest	45.231	-92.571	this study, data provided D.R. Engstrom*
Dunns Lake	Temperate Mixed Forest	45.153	-94.428	this study, data provided D.R. Engstrom*
Fish	Temperate Grasslands	43.847	-95.042	this study, data provided D.R. Engstrom*
Fox Lake	Temperate Grasslands	44.137	-95.646	this study, data provided D.R. Engstrom*
Gilchrist Lake	Temperate Mixed Forest	45.473	-95.362	this study, data provided D.R. Engstrom*
Island Lake	Temperate Grasslands	44.379	-96.009	this study, data provided D.R. Engstrom*
Kansas	Temperate Grasslands	43.917	-94.697	this study, data provided D.R. Engstrom*
Lake Emily	Temperate Grasslands	44.958	-94.33	this study, data provided D.R. Engstrom*
Lake Emily (St. Peter)	Temperate Mixed Forest	44.285	-93.88	this study, data provided D.R. Engstrom*
Lake Louisa	Temperate Mixed Forest	45.309	-94.246	this study, data provided D.R. Engstrom*
Lake Nakomis	Temperate Mixed Forest	44.907	-93.243	this study, data provided D.R. Engstrom*

Lake Superior (Duluth Harbor)	Temperate Mixed Forest	46.766	-92.095	this study, data provided D.R. Engstrom*
Lura Lake	Temperate Grasslands	43.88	-94.018	this study, data provided D.R. Engstrom*
Madison Lake	Temperate Mixed Forest	44.188	-93.812	this study, data provided D.R. Engstrom*
Malachy Lake	Temperate Grasslands	45.368	-95.681	this study, data provided D.R. Engstrom*
Miller	Temperate Mixed Forest	44.785	-93.74	this study, data provided D.R. Engstrom*
Mountain Lake	Temperate Mixed Forest	45.541	-95.522	this study, data provided D.R. Engstrom*
Richardson	Temperate Mixed Forest	45.157	-94.44	this study, data provided D.R. Engstrom*
Round Lake	Temperate Mixed Forest	45.024	-93.1	this study, data provided D.R. Engstrom*
Round Lake 3	Temperate Mixed Forest	45.008	-94.025	this study, data provided D.R. Engstrom*
Slotsye Lake	Temperate Mixed Forest	46.064	-95.845	this study, data provided D.R. Engstrom*
South Heron	Temperate Grasslands	43.719	-95.229	this study, data provided D.R. Engstrom*
Steep Bank	Temperate Grasslands	44.538	-96.328	this study, data provided D.R. Engstrom*
Tyson Lake	Temperate Grasslands	44.614	-95.53	this study, data provided D.R. Engstrom*
Upper Prior Lake	Temperate Mixed Forest	44.713	-93.443	this study, data provided D.R. Engstrom*
Lake Towuti	Tropical Moist Broadleaf	-2.713	121.541	this study, data provided J. Russell*
Arrowhead_BT	Temperate Conifer Forest	45.032	-109.606	this study, data provided J. Saros*
Arctic Lake	Temperate Mixed Forest	44.72	-93.458	this study, data provided M.B. Edlund*
Cedar Lake	Temperate Mixed Forest	45.814	-94.633	this study, data provided M.B. Edlund*
Fish Lake 2	Temperate Mixed Forest	44.651	-93.46	this study, data provided M.B. Edlund*
Hill Lake	Temperate Mixed Forest	46.474	-93.765	this study, data provided M.B. Edlund*
Lower Prior Lake	Temperate Mixed Forest	44.735	-93.417	this study, data provided M.B. Edlund*
South Center Lake	Temperate Mixed Forest	45.376	-92.828	this study, data provided M.B. Edlund*
TDRD2.2-Tumbolovat	Tundra	67.117	59.567	this study, data provided N. Solovieva*
Dlugi Staw DLUG 93/1	Temperate Conifer Forest	49.227	20.011	this study, data provided N.L. Rose*
Estanh Redon REDO 93/2	Temperate Mixed Forest	42.641	0.778	this study, data provided N.L. Rose*
Lac Noir NOIR 93/1	Temperate Conifer Forest	45.41	7.11	this study, data provided N.L. Rose*
Lagoa Escura ESCU 93/2	Mediterranean Forest	40.355	-7.637	this study, data provided N.L. Rose*
Laguna Caldera CALD 93/1	Mediterranean Forest	40.355	-7.635	this study, data provided N.L. Rose*
Lake Aguilo AGUI 93/2	Temperate Mixed Forest	42.71	1.33	this study, data provided N.L. Rose*
Liyn Hir (Hir Hir1)	Temperate Mixed Forest	52.292	-3.777	this study, data provided N.L. Rose*

Llagi LAG3	Temperate Mixed Forest	53.015	-4.015	this study, data provided N.L. Rose*
Maam Maam3	Temperate Mixed Forest	54.98	-8.11	this study, data provided N.L. Rose*
Nizne Terienske Pleso TERI 93/2	Temperate Conifer Forest	49.167	20	this study, data provided N.L. Rose*
Øvre Neådalsvatnet	Tundra	62.775	9	this study, data provided N.L. Rose*
Scoat SKT1	Temperate Mixed Forest	54.482	-3.299	this study, data provided N.L. Rose*
Starolesnienske Pleso STAR 93/2	Temperate Conifer Forest	49.167	20.167	this study, data provided N.L. Rose*
Teanga TEAN5	Temperate Mixed Forest	57.323	-7.288	this study, data provided N.L. Rose*
KHAR	Tundra	67.363	62.751	this study, data provided S. Turner*
MG Big Pool	Mangroves	17.882	-88.014	this study, data provided S. Turner*
Tai Hu	Temperate Mixed Forest	31.382	120.132	this study, data provided S. Turner*
Vork5	Tundra	67.857	59.026	this study, data provided S. Turner*

*Data requests for the data collected for this study should be directed to the corresponding author.

Table S2. Median biome-specific and great lake areal organic-C burial rates and total annual organic-C burial with 95% confidence intervals in parentheses.

Biome	Lake Area (km^2)	Median OCAR (g C m^{-2} yr^{-1})	Total OCAR (Tg C yr^{-1})	% of Total Burial	Source
Tropical and Subtropical Moist Broadleaf Forests (n=26)	219703	98 (64 – 128)	21.6 (14.1 – 28.2)	17.92	This study
Tropical and Subtropical Dry Broadleaf Forests*	43179	98 (64 – 128)	21.6 (14.1 – 28.2)	3.52	This study
Tropical and Subtropical Coniferous Forests*	6865	98 (64 – 128)	21.6 (14.1 – 28.2)	0.56	This study
Temperate Broadleaf and Mixed Forests (n=280)	394236	50 (43 - 56)	19.5 (17.1 - 22.1)	16.14	This study
Temperate Conifer Forests (n=39)	86912	4 (1 - 7)	0.3 (0.1 – 0.6)	0.27	This study
Boreal and Taiga (n=39)	1644866	18 (14 - 22)	29.4 (23.2 - 36.5)	24.32	This study
Tropical and Subtropical Grasslands, Savannas and Shrublands (n=6)	139885	22 (12 - 63)	3.1 (1.7 – 8.8)	2.53	This study
Temperate Grasslands, Savannas and Shrublands (n=62)	211708	88 (80 - 98)	18.6 (17.0 – 20.7)	15.41	This study
Flooded Grasslands and Savannas	74046	31 (8 - 105)	2.3 (0.6 - 7.8)	1.90	(*114*)
Montane Grasslands and Shrublands (n=20)	131396	19 (12 - 26)	2.4 (1.5 - 3.4)	2.01	This study
Tundra (n=32)	744140	3 (1 - 9)	2.3 (1.1 - 5.8)	1.91	This study
Mediterranean Forests, Woodlands and Scrub (n=4)	31083	38 (29 - 43)	1.2 (0.9 – 1.3)	0.98	This study
Deserts and Xeric Shrublands (n=7)	236105	10 (5 - 25)	2.3 (1.1 - 5.8)	1.91	This study
Mangroves (n=1)	31774	118	3.8	3.11	This study
Rock and Ice†	4923	3 (1 - 9)	0.02 (0.01 - 0.04)	0.03	This study
Great Lakes					
Lake Titicaca	8372	4.4	0.037	0.04	(*115*)
Lake Ontario	18960	58.0	1.100	1.10	(*115*)
Lake Erie	25740	26.1	0.671	0.67	(*115*)
Lake Michigan	58000	2.6	0.151	0.15	(*115*)

Lake Onega	9894	10.0	0.099	0.10	(*116*)
Lake Ladoga	17700	5.0	0.089	0.09	(*115*)
Vanern	5650	38.1	0.215	0.21	(*115*)
Lake Baikal	32494	2.7	0.088	0.09	(*115*)
Caspian Sea	371000	10.5	3.896	3.89	(*115*)
Lake Balkhash‡	17000	13.1	0.223	0.22	This study
Aral Sea	3300	13.1	0.043	0.04	This study
Issyk Kul	6236	1.8	0.011	0.01	(*115*)
Lake Urmia‡	5200	13.1	0.068	0.07	This study
Lake Tchad	1350	19.0	0.026	0.03	(*115*)
Lake Turkana	6405	7.0	0.045	0.04	(*115*)
Lake Albert	5300	5.3	0.028	0.03	(*115*)
Lake Victoria	68800	16.1	1.108	1.11	(*115*)
Lake Tanganyika	32900	15.0	0.494	0.49	(*115*)
Lake Malawi	29600	12.5	0.369	0.37	(*115*)
Lago Nicaragua	8264	10.2	0.084	0.08	*(115*)
Lake Huron	59600	3.4	0.200	0.20	(*115*)
Lake Superior	82100	1.2	0.099	0.10	(*115*)

**Used Tropical and Subtropical Moist Broadleaf Forests burial rate due to lack of data in this biome*

†Used Tundra burial rate due to lake of data in this biome

‡Used mean burial rate for Great Lakes due to lack of data for this lake

Table S3. Adjusted Pearson correlation coefficients for organic-C burial versus mean annual temperature (MAT), phosphorus (P) fertilizer use, and nitrogen (N) fertilizer use for each biome and for all lakes combined.

Biome	$\mathbf{R^2_{MAT}}$	$\mathbf{R^2_{P}}$	$\mathbf{R^2_{N}}$
Boreal Forest and Taiga	-0.017	0.005	0.006
Deserts and Xeric Scrub	0.296*	0.225**	0.204**
Mediterranean Forest	-	0.630***	0.491**
Montane Grasslands	0.276***	0.236***	0.239***
Temperate Conifer Forest	0.054**	0.156***	0.181***
Temperate Grasslands	0.128***	0.571***	0.560***
Temperate Mixed Forest	0.069***	0.210***	0.208***
Tropical Grasslands	0.021	0.121*	0.074
Tropical Moist Broadleaf	0.050*	0.074***	0.074***
Tundra	0.209***	0	0
All Lakes	0.133***	0.250***	0.280***

**p-value < 0.1, **p-value < 0.01, p-value < 0.001*

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Supplementary Materials for

Anthropogenic alteration of nutrient supply increases the global freshwater carbon sink

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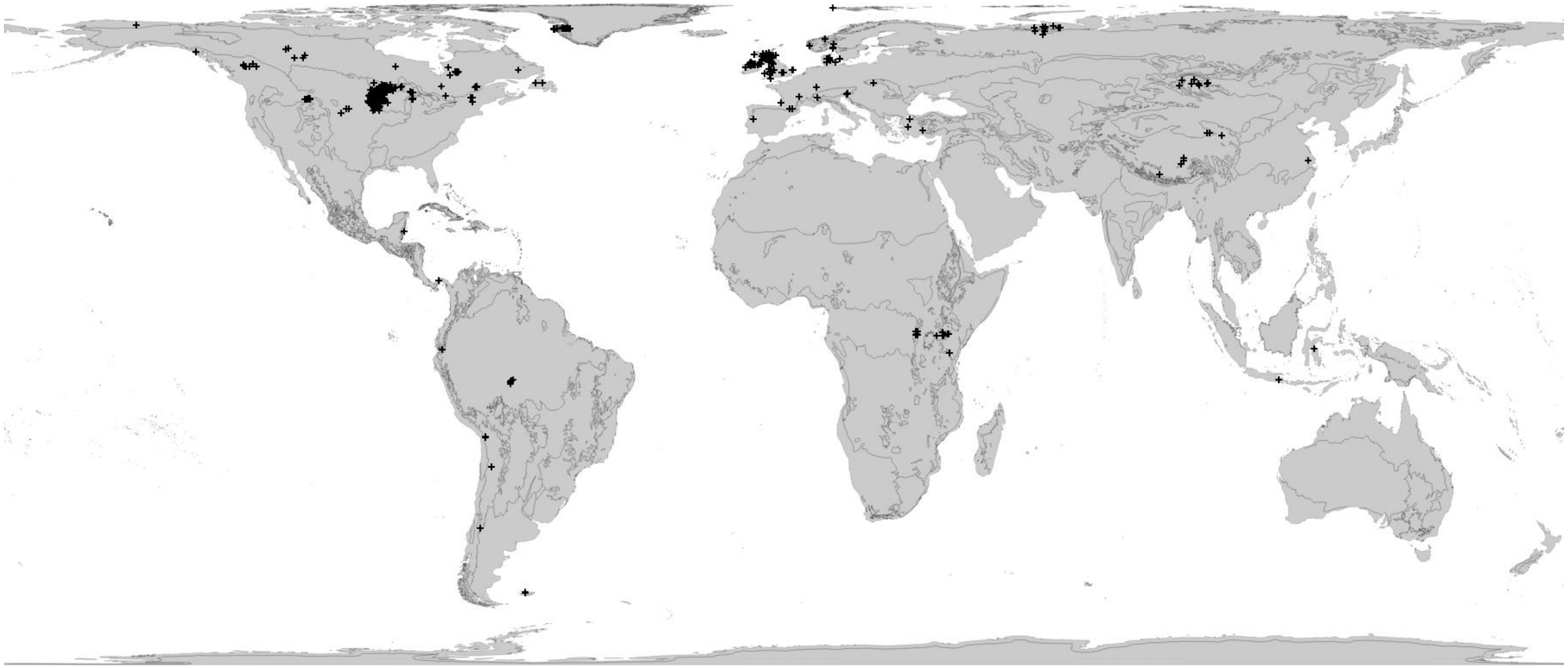

Fig. S1. Map showing the location of all sediment cores includes in this study (black crosses). For a full list of lake names and locations see Supplementary Table 2.

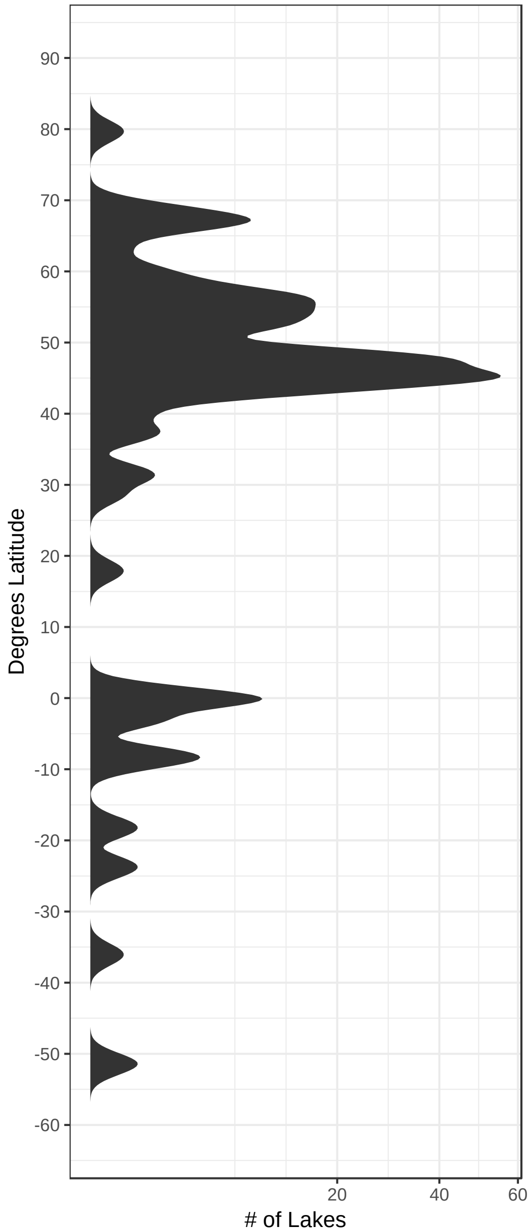

Fig. S2. Latitudinal distribution of lakes in this study. Density plot of the number of lakes by degree latitude included in this study.

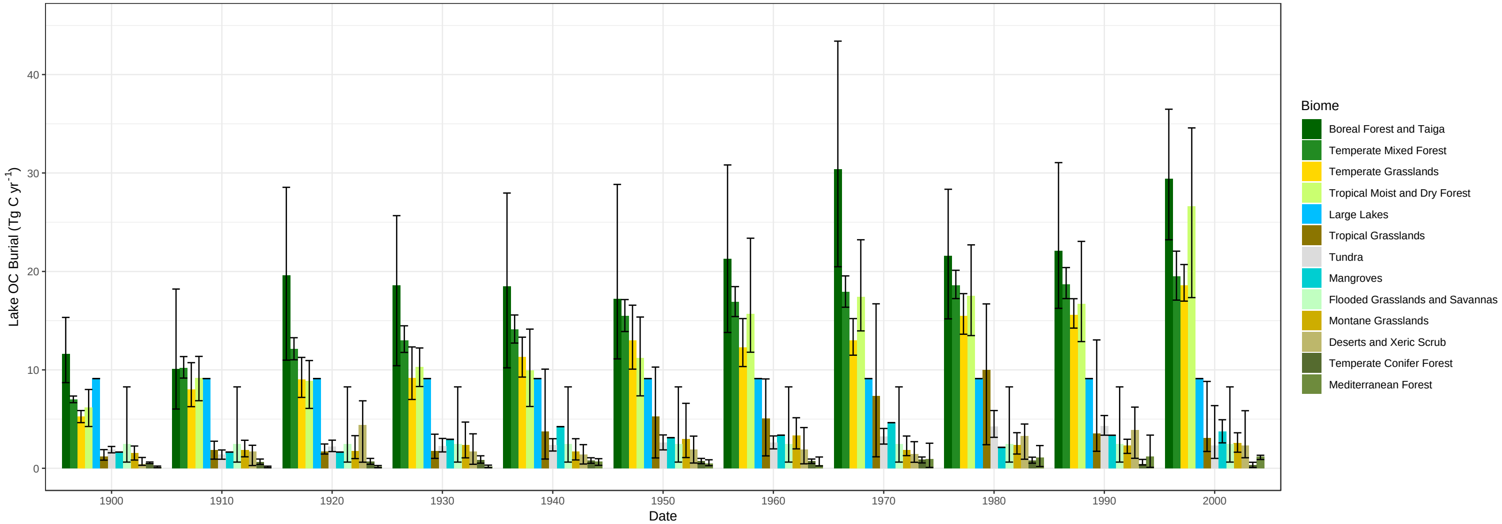

Fig. S3. Biome specific organic-C burial rates by decade from 1900 to present. Bars are colored by biome (see legend) and represent median organic-C burial rates for each decade. Black error-bars represent non-parametric 95% confidence intervals around the median.

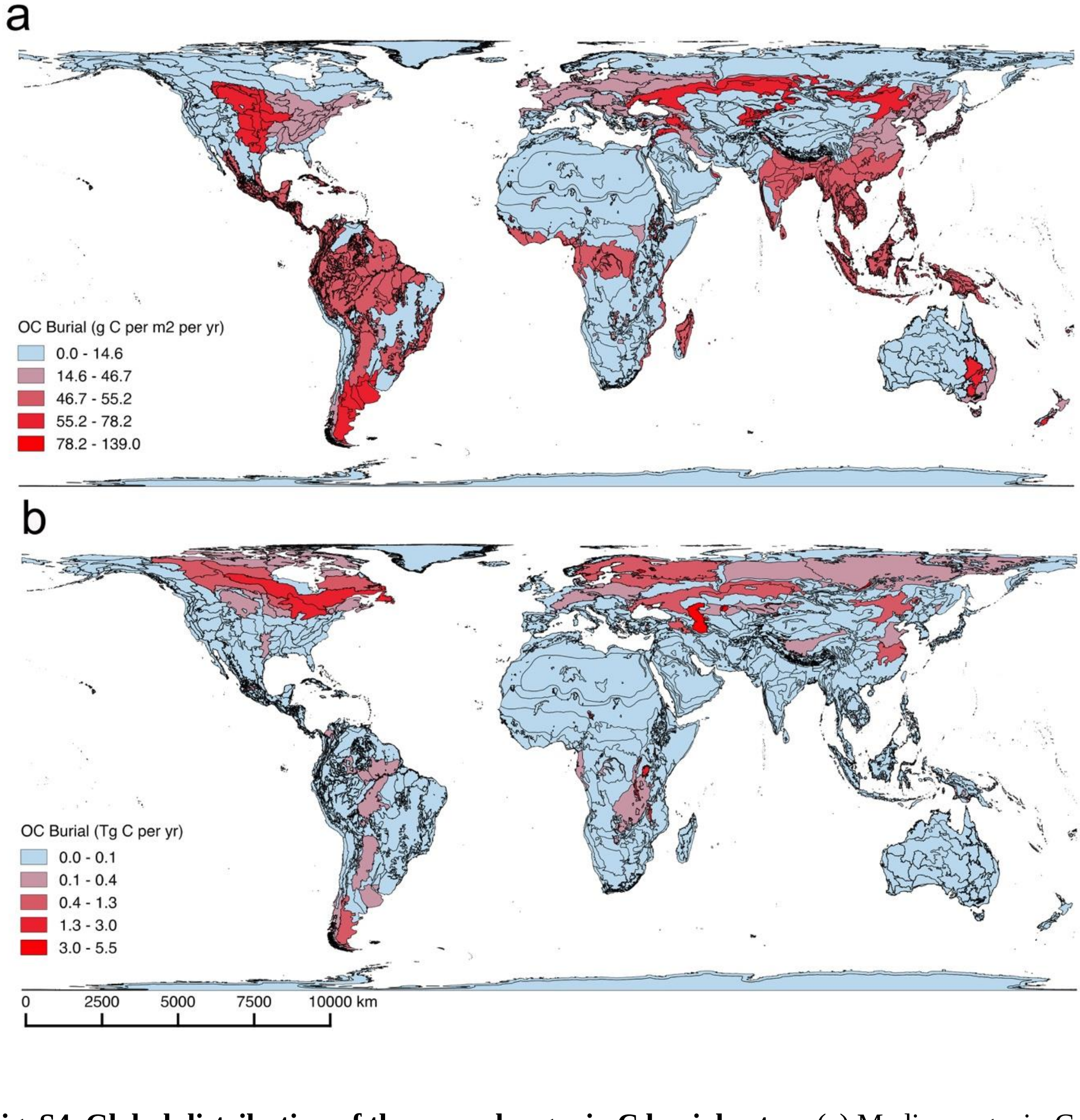

Fig. S4. Global distribution of the annual organic-C burial rates. (a) Median organic-C burial rates by biome (b) total organic-C burial rates as a product of the biome-specific burial rate multiplied by the total lake area in each polygon.

Table S1. List of lake sediment cores used in this study.

Lake	Region	Lat.	Long.	Source
Allen	Temperate Mixed Forest	54.05	-8.05	*(8)*
Ballywillin	Temperate Mixed Forest	54.4	-5.72	*(8)*
Brantry	Temperate Mixed Forest	54.254	-6.505	*(8)*
Broad Lough	Temperate Mixed Forest	54.3	-7.5	*(8)*
Bryrup	Temperate Mixed Forest	56.017	9.533	*(8)*
Corbet	Temperate Mixed Forest	54.337	-6.187	*(8)*
Creeve	Temperate Mixed Forest	54.241	-6.516	*(8)*
Esrum	Temperate Mixed Forest	55.992	12.373	*(8)*
Frederiksborg	Temperate Mixed Forest	55.933	12.3	*(8)*
Heron	Temperate Mixed Forest	54.254	-7.081	*(8)*
Knudsø	Temperate Mixed Forest	56.102	9.77	*(8)*
Lading Sø	Temperate Mixed Forest	56.217	9.964	*(8)*
Langesø	Temperate Mixed Forest	55.435	10.195	*(8)*
MacNean Upper	Temperate Mixed Forest	54.306	-7.957	*(8)*
Manor House	Temperate Mixed Forest	54.3	-7.5	*(8)*
Melvin	Temperate Mixed Forest	54.417	-8.133	*(8)*
Ravnsø	Temperate Mixed Forest	56.106	9.845	*(8)*
Skanderborg Sø	Temperate Mixed Forest	56.017	9.917	*(8)*
Søgård Sø	Temperate Mixed Forest	54.936	9.439	*(8)*
Tongree	Temperate Mixed Forest	54.14	-7.32	*(8)*
Torup Sø	Temperate Mixed Forest	56.016	9.431	*(8)*
Vesterborg	Temperate Mixed Forest	54.866	11.273	*(8)*
White	Temperate Mixed Forest	54.246	-6.546	*(8)*
Afunnagh	Temperate Mixed Forest	54.567	-7.883	*(8)*
Anarry	Temperate Mixed Forest	54.257	-8.277	*(8)*
Carrow	Temperate Mixed Forest	54.158	-8.677	*(8)*
Crockaleven	Temperate Mixed Forest	54.344	-7.258	*(8)*
Fadd	Temperate Mixed Forest	54.567	-7.881	*(8)*
Lettererafroe	Temperate Mixed Forest	53.379	-9.418	*(8)*
Namanfin	Temperate Mixed Forest	54.702	-8.314	*(8)*
ARKA1	Temperate Conifer Forest	56.97	-5.154	*(8)*
AURE1	Temperate Mixed Forest	44.22	-1.21	*(8)*
AWE2	Temperate Mixed Forest	56.308	-5.226	*(8)*

AYDA1	Temperate Mixed Forest	45.66	2.98	*(8)*
BALA1	Temperate Mixed Forest	52.888	-3.623	*(8)*
BART1	Temperate Mixed Forest	52.739	1.495	*(8)*
BASS1	Temperate Mixed Forest	54.653	-3.216	*(8)*
BLED3	Temperate Mixed Forest	46.36	14.1	*(8)*
BOSHC1	Temperate Mixed Forest	51.617	-4.923	*(8)*
BUTT3	Temperate Mixed Forest	56.587	-3.534	*(8)*
CARL12	Temperate Mixed Forest	54.931	-3.932	*(8)*
CASL1	Temperate Mixed Forest	56.271	-3.227	*(8)*
DAVA2	Temperate Conifer Forest	57.094	-2.923	*(8)*
EARN1	Temperate Mixed Forest	56.387	-4.203	*(8)*
ECK4	Temperate Mixed Forest	56.102	-4.991	*(8)*
ESTH1	Temperate Mixed Forest	54.359	-2.986	*(8)*
EYE1	Temperate Conifer Forest	57.792	-3.967	*(8)*
FLEM1	Temperate Mixed Forest	57.543	-3.99	*(8)*
GER3	Temperate Mixed Forest	48.06	6.99	*(8)*
GJER1	Boreal Forest and Taiga	59.78	10.78	*(8)*
KALA1	Temperate Conifer Forest	60.27	5.42	*(8)*
KENF2	Temperate Mixed Forest	51.52	-3.736	*(8)*
KILB1	Temperate Mixed Forest	55.755	-4.661	*(8)*
KINO2	Temperate Mixed Forest	56.675	-3.043	*(8)*
LEVE11	Temperate Mixed Forest	56.198	-3.376	*(8)*
LIND1	Temperate Mixed Forest	56.334	-3.187	*(8)*
LLAN3	Temperate Mixed Forest	51.93	-3.263	*(8)*
LOMO3	Temperate Mixed Forest	56.115	-4.622	*(8)*
LOMO4	Temperate Mixed Forest	56.115	-4.622	*(8)*
LOWE2	Temperate Mixed Forest	56.577	-3.549	*(8)*
LOWS1	Temperate Mixed Forest	54.59	-3.35	*(8)*
LUBN1	Temperate Mixed Forest	56.288	-4.288	*(8)*
MARE1	Temperate Conifer Forest	57.652	-5.379	*(8)*
MARS91	Temperate Mixed Forest	51.814	-0.667	*(8)*
MENT2	Temperate Mixed Forest	56.174	-4.292	*(8)*
MILL1	Temperate Mixed Forest	55.135	-3.449	*(8)*
MjosaB	Boreal Forest and Taiga	60.765	11.032	*(8)*
MONK1	Temperate Mixed Forest	56.57	-3.288	*(8)*
MONZ1	Temperate Mixed Forest	56.388	-3.88	*(8)*
NGAD1	Temperate Mixed Forest	55.757	-5.534	*(8)*
PLAN3	Temperate Mixed Forest	46.311	13.832	*(8)*
ROLL1	Temperate Mixed Forest	52.677	1.64	*(8)*
SCM27B	Temperate Mixed Forest	52.666	-2.725	*(8)*
SEMP1	Temperate Mixed Forest	55.798	-4.609	*(8)*

SHIE5	Temperate Mixed Forest	56.785	-5.608	*(8)*
SKEN1	Temperate Conifer Forest	57.157	-2.358	*(8)*
SLT4	Temperate Mixed Forest	50.277	-3.652	*(8)*
STOW91	Temperate Mixed Forest	52.026	-1.019	*(8)*
UPTO1	Temperate Mixed Forest	52.666	1.533	*(8)*
USSI1	Temperate Conifer Forest	57.579	-4.502	*(8)*
VAN2B	Temperate Mixed Forest	59.444	10.755	*(8)*
WHIE1	Temperate Mixed Forest	56.57	-3.353	*(8)*
WROX1	Temperate Mixed Forest	52.699	1.418	*(8)*
Bousquet	Boreal Forest and Taiga	48.029	-71.471	*(9)*
Cantin	Boreal Forest and Taiga	47.976	-71.157	*(9)*
Clarence-Gagnon	Boreal Forest and Taiga	48.091	-71.529	*(9)*
Faniant	Boreal Forest and Taiga	48.127	-71.264	*(9)*
Florence	Temperate Mixed Forest	45.011	-86.12	*(9)*
Fraser	Temperate Mixed Forest	45.388	-72.178	*(9)*
Grand Lac Montagnais	Boreal Forest and Taiga	47.919	-71.206	*(9)*
Lac Richelieu	Boreal Forest and Taiga	48.156	-71.351	*(9)*
Simoncouche	Boreal Forest and Taiga	48.24	-71.253	*(9)*
Stukely	Temperate Mixed Forest	45.364	-72.253	*(9)*
Tourangeau	Boreal Forest and Taiga	47.93	-71.243	*(9)*
CNT	Temperate Grasslands	43.412	-95.135	*(20)*
ELO	Temperate Grasslands	43.38	-95.119	*(20)*
LGR	Temperate Grasslands	43.354	-95.122	*(20)*
MIN	Temperate Grasslands	43.36	-95.124	*(20)*
SLD	Temperate Grasslands	43.445	-95.337	*(20)*
UGR	Temperate Grasslands	43.369	-95.121	*(20)*
WLO	Temperate Grasslands	43.374	-95.152	*(20)*
1st Crow Wing Lake	Temperate Mixed Forest	46.839	-94.841	*(28, 49)*
Agnes	Temperate Mixed Forest	47.528	-92.812	*(28, 49)*
Alton	Temperate Mixed Forest	47.863	-90.908	*(28, 49)*
Battle Creek Lake	Temperate Mixed Forest	44.944	-92.973	*(28, 49)*
Bean Lake	Temperate Grasslands	44.072	-95.374	*(28, 49)*
Big Carnelian Lake	Temperate Mixed Forest	45.132	-92.81	*(28, 49)*
Big Marine Lake	Temperate Mixed Forest	45.213	-92.868	*(28, 49)*
Brule	Temperate Mixed Forest	47.932	-90.672	*(28, 49)*
Dark Lake	Temperate Mixed Forest	48.212	-91.965	*(28, 49)*
Deepwater Lake	Temperate Mixed Forest	47.621	-92.825	*(28, 49)*
East Boot Lake	Temperate Mixed Forest	45.164	-92.831	*(28, 49)*
Edwards Lake	Temperate Mixed Forest	45.508	-95.469	*(28, 49)*
Greenleaf Lake	Temperate Mixed Forest	44.399	-93.626	*(28, 49)*
Hjermstad Lake	Temperate Grasslands	44.175	-96.004	*(28, 49)*
Lady Slipper Lake	Temperate Grasslands	44.573	-95.632	*(28, 49)*

Lake Mille Lacs	Temperate Mixed Forest	46.219	-93.664	*(28, 49)*
Lake Winnibigoshish	Temperate Mixed Forest	47.424	-94.244	*(28, 49)*
Little Lower Elk Lake	Temperate Grasslands	45.858	-95.791	*(28, 49)*
Little Turtle Lake	Temperate Grasslands	45.886	-95.836	*(28, 49)*
Lone Tree Lake	Temperate Grasslands	44.689	-95.445	*(28, 49)*
Margaret Lake	Temperate Mixed Forest	46.487	-94.364	*(28, 49)*
Middle Twin Lake	Temperate Mixed Forest	45.043	-93.34	*(28, 49)*
Nelson Lake	Temperate Mixed Forest	45.524	-95.446	*(28, 49)*
Oak Lake	Temperate Grasslands	44.537	-96.243	*(28, 49)*
Ohlsrud Lake	Temperate Grasslands	45.799	-96.049	*(28, 49)*
Peltier Lake	Temperate Mixed Forest	45.18	-93.056	*(28, 49)*
Portage Lake	Temperate Mixed Forest	46.965	-95.116	*(28, 49)*
Round Lake 2	Temperate Mixed Forest	45.56	-95.278	*(28, 49)*
Round Lake 4	Temperate Mixed Forest	47.214	-93.358	*(28, 49)*
Ryan	Temperate Mixed Forest	48.519	-92.707	*(28, 49)*
Sawbill	Temperate Mixed Forest	47.528	-90.88	*(28, 49)*
Shingobee Lake	Temperate Mixed Forest	47.003	-94.689	*(28, 49)*
Side Lake	Temperate Mixed Forest	47.671	-93.018	*(28, 49)*
Sissibakwet Lake	Temperate Mixed Forest	47.159	-93.671	*(28, 49)*
Solem Lake	Temperate Mixed Forest	45.809	-95.64	*(28, 49)*
Spectacle Lake	Temperate Mixed Forest	45.576	-93.406	*(28, 49)*
Spring Lake	Temperate Mixed Forest	44.702	-93.466	*(28, 49)*
Turtle Lake 2	Temperate Grasslands	45.885	-95.836	*(28, 49)*
Wakefield Lake	Temperate Mixed Forest	44.995	-93.035	*(28, 49)*
West Twin Lake	Temperate Mixed Forest	46.8	-92.592	*(28, 49)*
Willeys Lake	Temperate Mixed Forest	47.535	-93.459	*(28, 49)*
Williams Lake	Temperate Mixed Forest	46.954	-94.669	*(28, 49)*
Wolf Lake 2	Temperate Grasslands	43.858	-95.09	*(28, 49)*
Lake Shagawa	Temperate Mixed Forest	47.909	-91.895	*(50)*
Lake St. Croix	Temperate Mixed Forest	44.937	-92.757	*(50)*
Lake Winona	Temperate Mixed Forest	44.038	-91.637	*(50)*
SS32 (Nunatak)	Tundra	66.97	-49.8	*(51)*
SS4	Tundra	66.99	-51.05	*(51)*
SS53	Tundra	66.49	-53.53	*(51)*
SS6	Tundra	67	-51.11	*(51)*
SS70	Tundra	66.95	-51.58	*(51)*
Araca	Tropical Moist Broadleaf	-8.47	-63.506	*(52)*
Brasileira	Tropical Moist Broadleaf	-8.495	-63.487	*(52)*
Conceicao	Tropical Moist Broadleaf	-8.25	-63.19	*(52)*
Demarcacao	Tropical Moist Broadleaf	-8.097	-62.848	*(52)*
Nazare	Tropical Moist Broadleaf	-8.15	-63.335	*(52)*
Paca	Tropical Moist Broadleaf	-8.623	-63.512	*(52)*
Samuel	Tropical Moist Broadleaf	-8.748	-63.404	*(52)*

Sant Catarina	Tropical Moist Broadleaf	-8.263	-63.183	*(52)*
Tucunare	Tropical Moist Broadleaf	-8.401	-63.402	*(52)*
Island Lake Reservoir	Temperate Mixed Forest	47.008	-92.202	*(53)*
del Maule	Temperate Mixed Forest	-36.053	-70.5	*(54)*
ALB04b	Boreal Forest and Taiga	56.222	-111.17	*(55)*
ALB12b	Boreal Forest and Taiga	56.246	-113.141	*(55)*
ALB15b	Boreal Forest and Taiga	59.119	-115.128	*(55)*
ALB16b	Boreal Forest and Taiga	59.238	-114.524	*(55)*
ALB21b	Boreal Forest and Taiga	57.147	-110.865	*(55)*
Bogoria	Tropical Grasslands	0.258	36.095	*(56)*
Elementaita	Tropical Grasslands	-0.444	36.249	*(56)*
Nakuru	Tropical Grasslands	-0.348	36.087	*(56)*
Elk Lake	Temperate Grasslands	45.869	-95.808	*(57)*
Big Sandy Lake	Temperate Mixed Forest	46.768	-93.279	*(58)*
Dixon Lake	Temperate Mixed Forest	47.596	-94.287	*(58)*
South Twin Lake	Temperate Mixed Forest	47.229	-95.647	*(59)*
Ten Mile Lake	Temperate Mixed Forest	46.964	-94.577	*(59)*
Trout Lake	Temperate Mixed Forest	47.871	-90.169	*(59)*
White Iron Lake	Temperate Mixed Forest	47.892	-91.776	*(59)*
Lake Carlos	Temperate Mixed Forest	45.962	-95.364	*(59)*
Ahmik	Temperate Mixed Forest	48.148	-88.542	*(60, 61)*
Bass1	Temperate Mixed Forest	44.922	-85.883	*(60, 61)*
Beaver	Temperate Mixed Forest	46.565	-86.344	*(60, 61)*
Cruiser	Temperate Mixed Forest	48.499	-92.806	*(60, 61)*
Ek	Temperate Mixed Forest	47.529	-92.835	*(60, 61)*
Grand Sable	Temperate Mixed Forest	46.648	-86.034	*(60, 61)*
Harvey	Temperate Mixed Forest	48.051	-88.796	*(60, 61)*
Manitou	Temperate Mixed Forest	45.127	-86.024	*(60, 61)*
Outer	Temperate Mixed Forest	47.008	-90.46	*(60, 61)*
Peary	Temperate Mixed Forest	48.526	-92.771	*(60, 61)*
Richie	Temperate Mixed Forest	48.041	-88.702	*(60, 61)*
Shell	Temperate Mixed Forest	44.947	-85.899	*(60, 61)*
Namakan	Temperate Mixed Forest	48.435	-92.584	*(61, 101)*
Kabetogama	Temperate Mixed Forest	48.458	-93.042	*(61, 62)*
Rainy	Temperate Mixed Forest	48.624	-93.012	*(61, 62)*
Mukooda	Temperate Mixed Forest	48.334	-92.49	*(61, 71)*
Moskey Inlet (Superior)	Temperate Mixed Forest	48.069	-88.636	*(61)*
Spec Trout	Temperate Mixed Forest	47.95	-89.846	*(61)*
Swamp	Temperate Mixed Forest	47.951	-89.858	*(61)*
Bass Lake Morrison	Temperate Mixed Forest	46.226	-94.446	*(63)*
Coon Stump Lake	Temperate Mixed Forest	46.228	-94.428	*(63)*
Fosdick Lake	Temperate Mixed Forest	46.233	-94.436	*(63)*
Lake Ferrell	Temperate Mixed Forest	46.115	-94.418	*(63)*

Mud Lake	Temperate Mixed Forest	46.201	-94.445	*(63)*
Muskrat Lake	Temperate Mixed Forest	46.193	-94.457	*(63)*
Vadnais Lake	Temperate Mixed Forest	45.047	-93.087	*(64)*
Loon Lake 2	Temperate Mixed Forest	45.114	-92.837	*(65)*
Lake L'Homme Dieu	Temperate Mixed Forest	45.932	-95.351	*(66)*
Lake Wirth	Temperate Mixed Forest	44.982	-93.323	*(66)*
Arrowhead Lake	Temperate Mixed Forest	44.886	-93.394	*(67)*
Crystal Lake	Temperate Mixed Forest	45.026	-93.328	*(67)*
Farquhar Lake	Temperate Mixed Forest	44.758	-93.165	*(67)*
Gleason Lake	Temperate Mixed Forest	44.978	-93.493	*(67)*
Holyname Lake	Temperate Mixed Forest	45.016	-93.531	*(67)*
Indianhead Lake	Temperate Mixed Forest	44.88	-93.387	*(67)*
Lake Hadley	Temperate Mixed Forest	44.986	-93.514	*(67)*
Lake Josephine	Temperate Mixed Forest	45.036	-93.155	*(67)*
Lake Suzanne	Temperate Mixed Forest	44.852	-93.539	*(67)*
Woldsfeld Lake	Temperate Mixed Forest	45.005	-93.571	*(67)*
Buck_YS	Temperate Conifer Forest	44.904	-110.125	*(68)*
Buffalo_YS	Temperate Conifer Forest	44.935	-110.384	*(68)*
Floating Island_YS	Temperate Conifer Forest	44.958	-110.437	*(68)*
Foster_YS	Temperate Conifer Forest	44.873	-110.168	*(68)*
Rainbow_YS	Temperate Conifer Forest	45.022	-110.74	*(68)*
Slide	Temperate Conifer Forest	45.004	-110.699	*(68)*
Slough_YS	Temperate Conifer Forest	44.926	-110.352	*(68)*
Trumpeter_YS	Temperate Conifer Forest	44.916	-110.369	*(68)*
August	Temperate Mixed Forest	47.761	-91.606	*(69)*
Bass Lake Faribault	Temperate Grasslands	43.818	-94.079	*(69)*
Bean 2	Temperate Mixed Forest	47.309	-91.301	*(69)*
Bear	Temperate Mixed Forest	47.285	-91.344	*(69)*
Beaver Lake	Temperate Mixed Forest	43.89	-93.347	*(69)*
Carver Lake	Temperate Mixed Forest	44.905	-92.981	*(69)*
Christmas Lake	Temperate Mixed Forest	44.896	-93.545	*(69)*
Diamond Lake	Temperate Mixed Forest	45.183	-94.854	*(69)*
Dickman Lake	Temperate Mixed Forest	44.862	-93.08	*(69)*
Duck Lake	Temperate Mixed Forest	44.218	-93.817	*(69)*
Dyers	Temperate Mixed Forest	47.529	-90.981	*(69)*
Fish Lake	Temperate Mixed Forest	44.823	-93.166	*(69)*
Forsythe Lake	Temperate Mixed Forest	47.267	-93.602	*(69)*
George Lake Blue Earth	Temperate Mixed Forest	44.234	-93.872	*(69)*
George Lake Kandiyohi	Temperate Mixed Forest	45.245	-94.986	*(69)*
Gervais Lake	Temperate Mixed Forest	45.023	-93.069	*(69)*

Henderson Lake	Temperate Mixed Forest	45.23	-94.993	*(69)*
Hook Lake	Temperate Grasslands	44.956	-94.339	*(69)*
Kreighle Lake	Temperate Mixed Forest	45.581	-94.478	*(69)*
Lake Calhoun	Temperate Mixed Forest	44.94	-93.312	*(69)*
Lake Elmo	Temperate Mixed Forest	44.981	-92.886	*(69)*
Lake Harriet	Temperate Mixed Forest	44.921	-93.303	*(69)*
Lake Johanna	Temperate Mixed Forest	45.044	-93.17	*(69)*
Lake Owasso	Temperate Mixed Forest	45.038	-93.117	*(69)*
Lake Sagatagan	Temperate Mixed Forest	45.574	-94.39	*(69)*
Little Bass Lake	Temperate Mixed Forest	47.286	-93.599	*(69)*
Little Carnelian Lake	Temperate Mixed Forest	45.118	-92.795	*(69)*
Little Long Lake	Temperate Mixed Forest	44.988	-93.563	*(69)*
Little Trout	Temperate Mixed Forest	48.397	-92.523	*(69)*
Little Trout Lake	Temperate Mixed Forest	48.397	-92.523	*(69)*
Locator	Temperate Mixed Forest	48.541	-93.006	*(69)*
Loiten	Temperate Mixed Forest	48.526	-92.923	*(69)*
Long Lake Itasca	Temperate Mixed Forest	47.225	-93.653	*(69)*
Long Lake Kandiyohi	Temperate Mixed Forest	45.327	-94.866	*(69)*
Loon Lake	Temperate Mixed Forest	47.232	-93.64	*(69)*
Marcott Lake	Temperate Mixed Forest	44.821	-93.074	*(69)*
McCarrons Lake	Temperate Mixed Forest	44.998	-93.114	*(69)*
Ninemile	Temperate Mixed Forest	47.579	-91.083	*(69)*
Nipisiquit	Temperate Mixed Forest	47.356	-91.247	*(69)*
Schultz Lake	Temperate Mixed Forest	44.785	-93.129	*(69)*
Shoepack	Temperate Mixed Forest	48.503	-92.88	*(69)*
Snells Lake	Temperate Mixed Forest	47.24	-93.678	*(69)*
Square Lake	Temperate Mixed Forest	45.155	-92.801	*(69)*
Stahls Lake	Temperate Grasslands	44.953	-94.423	*(69)*
Tanners Lake	Temperate Mixed Forest	44.951	-92.983	*(69)*
Tettegouche	Temperate Mixed Forest	47.346	-91.268	*(69)*
Tooth	Temperate Mixed Forest	48.398	-92.643	*(69)*
Turtle Lake	Temperate Mixed Forest	45.099	-93.139	*(69)*
Twin Lake	Temperate Mixed Forest	44.991	-93.337	*(69)*
Wilson	Temperate Mixed Forest	47.675	-91.084	*(69)*
Windy	Temperate Mixed Forest	47.729	-91.077	*(69)*
Wolf (Johnson)	Temperate Mixed Forest	47.376	-91.189	*(69)*
Lake Pepin	Temperate Mixed Forest	44.466	-92.253	*(70)*
Astrid	Temperate Mixed Forest	48.111	-92.329	*(71)*
Dunnigan	Temperate Mixed Forest	47.707	-91.632	*(71)*
Grassy	Temperate Mixed Forest	47.804	-92.043	*(71)*
Greenstone	Temperate Mixed Forest	47.932	-91.606	*(71)*
Kjostad	Temperate Mixed Forest	48.11	-92.611	*(71)*
Little	Temperate Mixed Forest	48.333	-93.096	*(71)*

Little Wilson	Temperate Mixed Forest	47.658	-91.067	*(71)*
Maude	Temperate Mixed Forest	48.109	-92.353	*(71)*
Wilson Lake 3	Temperate Mixed Forest	47.212	-92.366	*(71)*
Clever	Boreal Forest and Taiga	49.17	-57.768	*(72)*
Cliff	Temperate Conifer Forest	58.24	-135.842	*(72)*
Frank	Boreal Forest and Taiga	49.178	-57.648	*(72)*
Goldeneye	Temperate Conifer Forest	58.247	-135.833	*(72)*
Rectangle	Temperate Conifer Forest	58.237	-135.877	*(72)*
Sapsucker	Temperate Conifer Forest	58.233	-135.823	*(72)*
Tomtit	Boreal Forest and Taiga	49.172	-57.79	*(72)*
Topsail	Boreal Forest and Taiga	49.133	-56.013	*(72)*
Brendan	Boreal Forest and Taiga	52.065	-75.503	*(73)*
Clarkie	Boreal Forest and Taiga	52.228	-75.489	*(73)*
EM320	Boreal Forest and Taiga	52.166	-76.121	*(73)*
Labyrinthe	Boreal Forest and Taiga	52.226	-75.714	*(73)*
Lac 11	Boreal Forest and Taiga	52.153	-75.76	*(73)*
Lac 2	Boreal Forest and Taiga	52.132	-75.819	*(73)*
Lac 34	Boreal Forest and Taiga	51.985	-75.767	*(73)*
Lac 40	Boreal Forest and Taiga	52.029	-75.524	*(73)*
Lac 60	Boreal Forest and Taiga	52.232	-75.762	*(73)*
Lac 66	Boreal Forest and Taiga	51.96	-76.01	*(73)*
Lac 8	Boreal Forest and Taiga	52.132	-75.724	*(73)*
Mistumis	Boreal Forest and Taiga	52.162	-76.181	*(73)*
Natel	Boreal Forest and Taiga	52.185	-75.712	*(73)*
Lake10_Toolik	Tundra	68.637	-149.601	*(74)*
Lake14_Toolik	Tundra	68.637	-149.601	*(74)*
Lake19_Toolik	Tundra	68.637	-149.601	*(74)*
Lake7_Toolik	Tundra	68.637	-149.601	*(74)*
Lake9_Toolik	Tundra	68.637	-149.601	*(74)*
BHL	Temperate Grasslands	42.3	-95.02	*(75,76)*
BRT	Temperate Grasslands	43.502	-94.385	*(75,76)*
CRY	Temperate Grasslands	43.23	-93.792	*(75,76)*
DMD	Temperate Grasslands	43.481	-95.192	*(75,76)*
FIL	Temperate Grasslands	43.155	-94.65	*(75,76)*
HIG	Temperate Grasslands	43.303	-94.706	*(75,76)*
ING	Temperate Grasslands	43.319	-94.697	*(75,76)*
IOW	Temperate Grasslands	43.498	-94.459	*(75,76)*
LCO	Temperate Grasslands	42.785	-93.689	*(75,76)*
LIL	Temperate Grasslands	43.17	-94.901	*(75,76)*
LSL	Temperate Grasslands	43.512	-95.126	*(75,76)*
LWL	Temperate Grasslands	42.269	-93.636	*(75,76)*

MRS	Temperate Grasslands	42.839	-93.693	*(75,76)*
NTL	Temperate Grasslands	42.485	-94.627	*(75,76)*
PIC	Temperate Grasslands	42.905	-94.922	*(75,76)*
RIC	Temperate Grasslands	43.391	-93.501	*(75,76)*
SLP	Temperate Grasslands	43.034	-94.89	*(75,76)*
TRU	Temperate Grasslands	43.199	-94.951	*(75,76)*
TUT	Temperate Grasslands	43.497	-94.594	*(75,76)*
VIR	Temperate Grasslands	43.101	-94.894	*(75,76)*
WSL	Temperate Grasslands	43.355	-94.683	*(75,76)*
WTL	Temperate Grasslands	42.936	-93.732	*(75,76)*
Long Lake 2	Temperate Mixed Forest	47.276	-95.297	*(77)*
Lake Christina (East Basin)	Temperate Mixed Forest	46.083	-95.692	*(78)*
Lake Christina (West Basin)	Temperate Mixed Forest	46.087	-95.747	*(78)*
Jessie Lake	Temperate Mixed Forest	47.585	-93.816	*(79)*
Boomerang	Temperate Conifer Forest	53.677	-124.516	*(80)*
Jakes	Temperate Conifer Forest	54.325	-122.712	*(80)*
Justine	Temperate Conifer Forest	54.212	-124.938	*(80)*
Laurie	Temperate Conifer Forest	53.878	-124.888	*(80)*
Pitoney	Temperate Conifer Forest	53.63	-122.033	*(80)*
Secord	Temperate Conifer Forest	53.628	-124.337	*(80)*
Tang	Temperate Conifer Forest	54.323	-122.785	*(80)*
Unnamed	Temperate Conifer Forest	53.847	-125.017	*(80)*
Upper Summit	Temperate Conifer Forest	54.294	-122.717	*(80)*
Woodcock	Temperate Conifer Forest	53.582	-123.596	*(80)*
Beysehir	Temperate Mixed Forest	37.75	31.514	*(81)*
Marmara	Mediterranean Forest	38.609	27.981	*(81)*
Uluabat	Mediterranean Forest	40.217	28.486	*(81)*
Lake B	Tundra	67.27	-51.58	*(81)*
SS16	Tundra	66.91	-50.46	*(82)*
Chorreras	Montane Grasslands	-2.771	-79.16	*(83, 84)*
Llaviacu	Tropical Moist Broadleaf	-2.843	-79.147	*(83, 84)*
Toreadora	Montane Grasslands	-2.781	-79.224	*(83, 84)*
Kako	Tropical Moist Broadleaf	-0.307	30.097	*(85)*
Kamunzuka	Tropical Moist Broadleaf	-0.263	30.156	*(85)*
Kigezi	Tropical Moist Broadleaf	-0.287	30.111	*(85)*
Nyungu	Tropical Moist Broadleaf	-0.257	30.094	*(85)*
Kyasanduku	Tropical Moist Broadleaf	-0.288	30.05	*(86)*
Nyamogusingiri Crater	Tropical Moist Broadleaf	-0.285	30.013	*(86)*
Big Trout	Boreal Forest and Taiga	53.721	-89.943	*(87)*

Eva	Temperate Mixed Forest	48.713	-91.186	*(87)*
Lac Dasserat	Boreal Forest and Taiga	48.249	-79.406	*(87)*
Lake Superior	Temperate Mixed Forest	46.898	-86.501	*(87)*
Levi Pond	Temperate Mixed Forest	44.267	-72.228	*(87)*
Minipi	Boreal Forest and Taiga	52.668	-61.724	*(87)*
Opeongo	Boreal Forest and Taiga	45.718	-78.361	*(87)*
Q27	Boreal Forest and Taiga	53.507	-77.699	*(87)*
Q6	Boreal Forest and Taiga	51.116	-77.326	*(87)*
Siskwit	Temperate Mixed Forest	47.999	-88.8	*(87)*
Lotus Lake	Temperate Mixed Forest	44.872	-93.528	*(88)*
Mitchell Lake	Temperate Mixed Forest	44.86	-93.497	*(88)*
Dean Lake	Temperate Mixed Forest	45.12	-93.835	*(89)*
Rice Marsh Lake	Temperate Mixed Forest	44.851	-93.517	*(90)*
Blakesly Lake	Temperate Mixed Forest	47.271	-95.442	*(91)*
Mavis Lake	Temperate Mixed Forest	46.262	-96.043	*(91)*
Lake of the Woods	Temperate Mixed Forest	49.053	-94.951	*(92)*
Lake Logung (Legung)	Tropical Moist Broadleaf	-8.042	113.307	*(93)*
Lake Lading	Tropical Moist Broadleaf	-8.009	113.313	*(94)*
Arresjoen ARSJ 93/4	Tundra	79.67	10.8	*(95)*
Adam Tarn, FILP1	Temperate Grasslands	-51.345	-60.043	*(96)*
Sulivan N Lake	Temperate Grasslands	-51.507	-60.119	*(96)*
Edward (EO3-1G)	Tropical Grasslands	-0.275	29.754	*(97)*
Batoda	Montane Grasslands	0.298	29.883	*(97)*
Lac Speke	Montane Grasslands	0.405	29.881	*(97)*
Upper Kitranda	Montane Grasslands	0.353	29.887	*(97)*
Kitagata	Tropical Moist Broadleaf	-0.066	29.975	*(98)*
Wandakara	Tropical Moist Broadleaf	0.417	30.271	*(99)*
Beauty_BT	Temperate Conifer Forest	45.106	-109.971	*(100)*
Emerald_BT	Temperate Conifer Forest	45.257	-109.695	*(100)*
Fossil_BT	Temperate Conifer Forest	45.091	-109.79	*(100)*
Heart_BT	Temperate Conifer Forest	45.024	-109.639	*(100)*
Lac La Croix	Temperate Mixed Forest	48.35	-92.134	*(101)*
Big Alkali	Temperate Grasslands	42.624	-100.617	*(102)*
Island	Temperate Grasslands	41.734	-102.4	*(102)*
Two Mile	Temperate Grasslands	42.672	-101.263	*(102)*
TDRV1.1-Podvaty	Tundra	67.45	63.083	*(103)*
TDRV4.2	Boreal Forest and Taiga	65.967	57.267	*(103)*
F6-4 (Malyi Patok Lake)	Tundra	64.317	59.083	*(104)*
F8-4 (Moreju Lake)	Tundra	67.883	59.667	*(104)*
Mitrofanovskoe	Tundra	67.29	57.181	*(104)*
Vankavad Lake	Tundra	65.986	59.456	*(104)*

Vanuk-ty Lake	Tundra	67.978	61.571	*(104)*
Meander Lake	Temperate Mixed Forest	46.778	-92.912	*(105)*
Airag	Deserts and Xeric Scrub	48.909	93.371	*(106)*
Dune Baga	Deserts and Xeric Scrub	49.921	93.849	*(106)*
Dune Bayan	Deserts and Xeric Scrub	48.463	95.16	*(106)*
Khundt Nuur	Temperate Grasslands	49.05	97.161	*(106)*
Kohlboo	Deserts and Xeric Scrub	49.701	91.091	*(106)*
Takkilt Nuur	Temperate Grasslands	48.806	96.806	*(106)*
Tsegen	Deserts and Xeric Scrub	48.912	94.867	*(106)*
Zagas	Temperate Conifer Forest	48.506	90.61	*(106)*
Miscanti	Montane Grasslands	-23.726	-67.771	*(107)*
Chungara	Montane Grasslands	-18.242	-69.155	*(108)*
Nam Co	Montane Grasslands	30.77	90.929	*(109)*
Cuo E	Montane Grasslands	31.42	91.485	*(109)*
Cuo Na	Montane Grasslands	32.049	91.513	*(109)*
Ga Hai	Deserts and Xeric Scrub	37.143	97.554	*(109)*
Keluke Hu	Deserts and Xeric Scrub	37.286	96.882	*(109)*
Kemen Co	Montane Grasslands	28.688	85.949	*(109)*
Oughter	Temperate Mixed Forest	54.01	-8.25	*(109)*
TPNA1 (Qinghai Hu)	Montane Grasslands	36.717	100.253	*(109)*
Bujuku	Montane Grasslands	0.377	29.893	*(110)*
Kitandara	Montane Grasslands	0.349	29.886	*(110)*
Mahoma	Montane Grasslands	0.344	29.967	*(110)*
SS2	Tundra	67	-50.97	*(111)*
AT1	Tundra	66.58	-53.24	*(112)*
AT6	Tundra	66.97	-53.49	*(112)*
AT7	Tundra	66.97	-53.59	*(112)*
SS1341	Tundra	66.99	-51.14	*(112)*
SS901	Tundra	67.13	-50.23	*(112)*
SS904	Tundra	67.16	-50.28	*(112)*
SS49	Tundra	66.86	-52.66	*(113)*
SS86	Tundra	66.96	-49.81	*(113)*
Big Lake	Temperate Mixed Forest	46.706	-92.63	this study, data provided by A. Myrbo*
Dead Fish Lake	Temperate Mixed Forest	46.747	-92.689	this study, data provided by A. Myrbo*
Middle Portage	Temperate Mixed Forest	46.701	-92.682	this study, data provided by A. Myrbo*
Perch Lake	Temperate Mixed Forest	46.689	-92.669	this study, data provided by A. Myrbo*
Rice Portage Lake	Temperate Mixed Forest	46.699	-92.69	this study, data provided by A. Myrbo*
Third Lake	Temperate Mixed Forest	46.712	-92.503	this study, data provided by A. Myrbo*
Wild Rice Lake	Temperate Mixed Forest	46.674	-92.604	this study, data provided by A. Myrbo*

Argent	Temperate Mixed Forest	45.309	-72.316	this study, data provided by A.J. Heathcote*
Brompton	Temperate Mixed Forest	45.425	-72.145	this study, data provided by A.J. Heathcote*
Waterloo	Temperate Mixed Forest	45.335	-72.521	this study, data provided by A.J. Heathcote*
Cotacotani	Montane Grasslands	-18.191	-69.222	this study, data provided B. Valero-Garcés*
Miniques	Montane Grasslands	-23.767	-67.789	this study, data provided B. Valero-Garcés*
Lake Muijongo	Tropical Moist Broadleaf	-0.271	30.085	this study, data provided D. Ryves*
Mafura	Tropical Moist Broadleaf	-0.265	30.102	this study, data provided D. Ryves*
Challa	Tropical Grasslands	-3.315	37.691	this study, data provided D. Verschuren*
Ellis	Tropical Moist Broadleaf	-0.125	37.401	this study, data provided D. Verschuren*
Emerald	Montane Grasslands	-0.152	37.294	this study, data provided D. Verschuren*
Hausberg	Montane Grasslands	-0.144	37.3	this study, data provided D. Verschuren*
Katinda	Tropical Moist Broadleaf	-0.22	30.106	this study, data provided D. Verschuren*
Oblong	Montane Grasslands	-0.145	37.302	this study, data provided D. Verschuren*
Rutundu	Tropical Moist Broadleaf	-0.042	37.463	this study, data provided D. Verschuren*
Simbi	Tropical Grasslands	-0.368	34.629	this study, data provided D. Verschuren*
Baby Lake	Temperate Mixed Forest	45.53	-95.495	this study, data provided D.R. Engstrom*
Barrett Lake	Temperate Grasslands	45.916	-95.878	this study, data provided D.R. Engstrom*
Big Elk Lake	Temperate Mixed Forest	45.473	-93.946	this study, data provided D.R. Engstrom*
Buffalo Lake	Temperate Grasslands	44.076	-95.579	this study, data provided D.R. Engstrom*
Cedar	Temperate Mixed Forest	45.231	-92.571	this study, data provided D.R. Engstrom*
Dunns Lake	Temperate Mixed Forest	45.153	-94.428	this study, data provided D.R. Engstrom*
Fish	Temperate Grasslands	43.847	-95.042	this study, data provided D.R. Engstrom*
Fox Lake	Temperate Grasslands	44.137	-95.646	this study, data provided D.R. Engstrom*
Gilchrist Lake	Temperate Mixed Forest	45.473	-95.362	this study, data provided D.R. Engstrom*
Island Lake	Temperate Grasslands	44.379	-96.009	this study, data provided D.R. Engstrom*
Kansas	Temperate Grasslands	43.917	-94.697	this study, data provided D.R. Engstrom*
Lake Emily	Temperate Grasslands	44.958	-94.33	this study, data provided D.R. Engstrom*
Lake Emily (St. Peter)	Temperate Mixed Forest	44.285	-93.88	this study, data provided D.R. Engstrom*
Lake Louisa	Temperate Mixed Forest	45.309	-94.246	this study, data provided D.R. Engstrom*
Lake Nakomis	Temperate Mixed Forest	44.907	-93.243	this study, data provided D.R. Engstrom*

Lake Superior (Duluth Harbor)	Temperate Mixed Forest	46.766	-92.095	this study, data provided D.R. Engstrom*
Lura Lake	Temperate Grasslands	43.88	-94.018	this study, data provided D.R. Engstrom*
Madison Lake	Temperate Mixed Forest	44.188	-93.812	this study, data provided D.R. Engstrom*
Malachy Lake	Temperate Grasslands	45.368	-95.681	this study, data provided D.R. Engstrom*
Miller	Temperate Mixed Forest	44.785	-93.74	this study, data provided D.R. Engstrom*
Mountain Lake	Temperate Mixed Forest	45.541	-95.522	this study, data provided D.R. Engstrom*
Richardson	Temperate Mixed Forest	45.157	-94.44	this study, data provided D.R. Engstrom*
Round Lake	Temperate Mixed Forest	45.024	-93.1	this study, data provided D.R. Engstrom*
Round Lake 3	Temperate Mixed Forest	45.008	-94.025	this study, data provided D.R. Engstrom*
Slotsye Lake	Temperate Mixed Forest	46.064	-95.845	this study, data provided D.R. Engstrom*
South Heron	Temperate Grasslands	43.719	-95.229	this study, data provided D.R. Engstrom*
Steep Bank	Temperate Grasslands	44.538	-96.328	this study, data provided D.R. Engstrom*
Tyson Lake	Temperate Grasslands	44.614	-95.53	this study, data provided D.R. Engstrom*
Upper Prior Lake	Temperate Mixed Forest	44.713	-93.443	this study, data provided D.R. Engstrom*
Lake Towuti	Tropical Moist Broadleaf	-2.713	121.541	this study, data provided J. Russell*
Arrowhead_BT	Temperate Conifer Forest	45.032	-109.606	this study, data provided J. Saros*
Arctic Lake	Temperate Mixed Forest	44.72	-93.458	this study, data provided M.B. Edlund*
Cedar Lake	Temperate Mixed Forest	45.814	-94.633	this study, data provided M.B. Edlund*
Fish Lake 2	Temperate Mixed Forest	44.651	-93.46	this study, data provided M.B. Edlund*
Hill Lake	Temperate Mixed Forest	46.474	-93.765	this study, data provided M.B. Edlund*
Lower Prior Lake	Temperate Mixed Forest	44.735	-93.417	this study, data provided M.B. Edlund*
South Center Lake	Temperate Mixed Forest	45.376	-92.828	this study, data provided M.B. Edlund*
TDRD2.2-Tumbolovat	Tundra	67.117	59.567	this study, data provided N. Solovieva*
Dlugi Staw DLUG 93/1	Temperate Conifer Forest	49.227	20.011	this study, data provided N.L. Rose*
Estanh Redon REDO 93/2	Temperate Mixed Forest	42.641	0.778	this study, data provided N.L. Rose*
Lac Noir NOIR 93/1	Temperate Conifer Forest	45.41	7.11	this study, data provided N.L. Rose*
Lagoa Escura ESCU 93/2	Mediterranean Forest	40.355	-7.637	this study, data provided N.L. Rose*
Laguna Caldera CALD 93/1	Mediterranean Forest	40.355	-7.635	this study, data provided N.L. Rose*
Lake Aguilo AGUI 93/2	Temperate Mixed Forest	42.71	1.33	this study, data provided N.L. Rose*
Liyn Hir (Hir Hir1)	Temperate Mixed Forest	52.292	-3.777	this study, data provided N.L. Rose*

Llagi LAG3	Temperate Mixed Forest	53.015	-4.015	this study, data provided N.L. Rose*
Maam Maam3	Temperate Mixed Forest	54.98	-8.11	this study, data provided N.L. Rose*
Nizne Terienske Pleso TERI 93/2	Temperate Conifer Forest	49.167	20	this study, data provided N.L. Rose*
Øvre Neådalsvatnet	Tundra	62.775	9	this study, data provided N.L. Rose*
Scoat SKT1	Temperate Mixed Forest	54.482	-3.299	this study, data provided N.L. Rose*
Starolesnienske Pleso STAR 93/2	Temperate Conifer Forest	49.167	20.167	this study, data provided N.L. Rose*
Teanga TEAN5	Temperate Mixed Forest	57.323	-7.288	this study, data provided N.L. Rose*
KHAR	Tundra	67.363	62.751	this study, data provided S. Turner*
MG Big Pool	Mangroves	17.882	-88.014	this study, data provided S. Turner*
Tai Hu	Temperate Mixed Forest	31.382	120.132	this study, data provided S. Turner*
Vork5	Tundra	67.857	59.026	this study, data provided S. Turner*

*Data requests for the data collected for this study should be directed to the corresponding author.

Table S2. Median biome-specific and great lake areal organic-C burial rates and total annual organic-C burial with 95% confidence intervals in parentheses.

Biome	Lake Area (km^2)	Median OCAR (g C m^{-2} yr^{-1})	Total OCAR (Tg C yr^{-1})	% of Total Burial	Source
Tropical and Subtropical Moist Broadleaf Forests (n=26)	219703	98 (64 – 128)	21.6 (14.1 – 28.2)	17.92	This study
Tropical and Subtropical Dry Broadleaf Forests*	43179	98 (64 – 128)	21.6 (14.1 – 28.2)	3.52	This study
Tropical and Subtropical Coniferous Forests*	6865	98 (64 – 128)	21.6 (14.1 – 28.2)	0.56	This study
Temperate Broadleaf and Mixed Forests (n=280)	394236	50 (43 - 56)	19.5 (17.1 - 22.1)	16.14	This study
Temperate Conifer Forests (n=39)	86912	4 (1 - 7)	0.3 (0.1 – 0.6)	0.27	This study
Boreal and Taiga (n=39)	1644866	18 (14 - 22)	29.4 (23.2 - 36.5)	24.32	This study
Tropical and Subtropical Grasslands, Savannas and Shrublands (n=6)	139885	22 (12 - 63)	3.1 (1.7 – 8.8)	2.53	This study
Temperate Grasslands, Savannas and Shrublands (n=62)	211708	88 (80 - 98)	18.6 (17.0 – 20.7)	15.41	This study
Flooded Grasslands and Savannas	74046	31 (8 - 105)	2.3 (0.6 - 7.8)	1.90	(*114*)
Montane Grasslands and Shrublands (n=20)	131396	19 (12 - 26)	2.4 (1.5 - 3.4)	2.01	This study
Tundra (n=32)	744140	3 (1 - 9)	2.3 (1.1 - 5.8)	1.91	This study
Mediterranean Forests, Woodlands and Scrub (n=4)	31083	38 (29 - 43)	1.2 (0.9 – 1.3)	0.98	This study
Deserts and Xeric Shrublands (n=7)	236105	10 (5 - 25)	2.3 (1.1 - 5.8)	1.91	This study
Mangroves (n=1)	31774	118	3.8	3.11	This study
Rock and Ice†	4923	3 (1 - 9)	0.02 (0.01 - 0.04)	0.03	This study
Great Lakes					
Lake Titicaca	8372	4.4	0.037	0.04	(*115*)
Lake Ontario	18960	58.0	1.100	1.10	(*115*)
Lake Erie	25740	26.1	0.671	0.67	(*115*)
Lake Michigan	58000	2.6	0.151	0.15	(*115*)

Lake Onega	9894	10.0	0.099	0.10	(*116*)
Lake Ladoga	17700	5.0	0.089	0.09	(*115*)
Vanern	5650	38.1	0.215	0.21	(*115*)
Lake Baikal	32494	2.7	0.088	0.09	(*115*)
Caspian Sea	371000	10.5	3.896	3.89	(*115*)
Lake Balkhash‡	17000	13.1	0.223	0.22	This study
Aral Sea	3300	13.1	0.043	0.04	This study
Issyk Kul	6236	1.8	0.011	0.01	(*115*)
Lake Urmia‡	5200	13.1	0.068	0.07	This study
Lake Tchad	1350	19.0	0.026	0.03	(*115*)
Lake Turkana	6405	7.0	0.045	0.04	(*115*)
Lake Albert	5300	5.3	0.028	0.03	(*115*)
Lake Victoria	68800	16.1	1.108	1.11	(*115*)
Lake Tanganyika	32900	15.0	0.494	0.49	(*115*)
Lake Malawi	29600	12.5	0.369	0.37	(*115*)
Lago Nicaragua	8264	10.2	0.084	0.08	*(115*)
Lake Huron	59600	3.4	0.200	0.20	(*115*)
Lake Superior	82100	1.2	0.099	0.10	(*115*)

**Used Tropical and Subtropical Moist Broadleaf Forests burial rate due to lack of data in this biome*

†Used Tundra burial rate due to lake of data in this biome

‡Used mean burial rate for Great Lakes due to lack of data for this lake

Table S3. Adjusted Pearson correlation coefficients for organic-C burial versus mean annual temperature (MAT), phosphorus (P) fertilizer use, and nitrogen (N) fertilizer use for each biome and for all lakes combined.

Biome	$\mathbf{R^2_{MAT}}$	$\mathbf{R^2_{P}}$	$\mathbf{R^2_{N}}$
Boreal Forest and Taiga	-0.017	0.005	0.006
Deserts and Xeric Scrub	0.296*	0.225**	0.204**
Mediterranean Forest	-	0.630***	0.491**
Montane Grasslands	0.276***	0.236***	0.239***
Temperate Conifer Forest	0.054**	0.156***	0.181***
Temperate Grasslands	0.128***	0.571***	0.560***
Temperate Mixed Forest	0.069***	0.210***	0.208***
Tropical Grasslands	0.021	0.121*	0.074
Tropical Moist Broadleaf	0.050*	0.074***	0.074***
Tundra	0.209***	0	0
All Lakes	0.133***	0.250***	0.280***

**p-value < 0.1, **p-value < 0.01, p-value < 0.001*

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