Supplementary Information

Study site and characteristics of plant species. Samples were collected from a sedge-dominated fen (10.2 ha) located in an 817 ha sub-watershed of the Lake Superior basin near White River Ontario, Canada (48°21' N, 85°21' W). The weather data (air temperature and precipitation) was provided by the Ontario Ministry of Natural Resources and Forestry, who installed a weather station and monitored the environmental conditions in this study site. The mean annual air temperature and precipitation from 2012 to 2018 were 1.7 °C and 721 mm, respectively. For the sample collecting year (2018), the mean annual air temperature and precipitation were 1.2 °C and 730 mm, respectively. The sedge-dominated fen is surrounded by a mixed-wood deciduous and coniferous forest with two small streams running along the northern and southwestern edges. The growing season is from June to September.

The sedge-dominated fen is mostly open and the vegetation community is dominated by three sedge species: few-seeded sedge [*Carex oligosperma* Michx.], wire sedge [*Carex lasiocarpa* Ehrh], tussock sedge [*Carex stricta* Lamb.] (Lyons and Lindo, 2019). Sweet gale [*Myrica gale* L.] is the dominant shrub at this site (Lyons and Lindo, 2019; Palozzi and Lindo, 2017). The characteristics of these plants are described in Newmaster *et al*. (1997). In brief, the few-seeded sedge is 40−100 cm tall; their leaves are 1−3 mm wide, stiff, smooth, edges rolled in toward midrib and rounded in cross-section, and red-tinged at the base. The wire sedge is 30−100 cm tall; leaves are arching, narrow, 1−2 mm wide, wire-like, folded along the midrib, and angular. Tussock sedge is 40−140 cm tall; leaves are 3−6 mm wide, lowest leaves reduced to bladeless sheaths. Sweet gale is a deciduous shrub, up to 1.5 m tall; leaves are alternate, 3−6 cm long, toothed at the tip; sweet gale is a nitrogen-fixer and its root nodules contain symbiotic nitrogen-fixing bacteria. In this study, few-seeded sedges and wire sedges were mixed during plant sample collection as they are indistinguishable in size and form from one another when not in flower/seed.

Foliar total mercury, C content, and N content. In the laboratory, leaf samples for chemical analyses were rinsed three times with deionized water (18.2 MΩ cm) and then freeze-dried for 48 h. Freeze-dried leaf samples were subsequently ground and homogenized with a stainless-steel blade grinder. All

powdered samples were stored in polyethylene bags for further chemical analysis. Precautions were performed to avoid any cross-contamination during the process. Disposable nitrile gloves were worn during sample handling. The blade grinder was thoroughly rinsed with deionized water (18.2 MΩ cm) after each sample grinding and completely dried with Kimwipes® (Kimtech Science™). THg in leaves was analyzed by thermal decomposition, amalgamation, and atomic absorption spectrometry using a Milestone™ DMA-80 (EPA method 7473) with the National Research Council Canada, DORM-4 as the Certified Reference Material (CRM) to validate instrument recovery and stability. Each analytical run for THg included 10 % method blanks (empty sample boat), 10 % duplicates, and 20 % matrix spikes. The detection limit for THg was 0.05 ng g^{-1}. All method blanks were below the detection limits. The relative standard deviation (RSD) was 4.42 ± 3.60 % for all duplicate samples. Recoveries of THg for matrix spikes and CRM (DORM-4) were 101.08 ± 3.08 %. All recoveries of matrix spikes and CRM were comparable well with the certified values: 25 ng and 0.41 ± 0.04 mg kg^{-1}, respectively.

Leaf C content (%C; w/w) and N content (%N; w/w) before and after the foliar Hg leaching experiment was analyzed using a CNSH analyzer (Vario Isotope Cube; Elementar). The ratio of leaf C content and N content (C:N) were calculated. Birch leaf Organic Analytical Standard (*Betula papyrifera* Marsh.) was the CRM. Each analytical run for C and N included 10 % method blanks and 10 % duplicates (no matrix spikes for C and N). The detection limits for C and N were 0.26 mg g^{-1} and 0.02 mg g^{-1}, respectively. All method blanks were below the detection limits. The RSDs of C and N were 0.28 ± 0.14 % and 4.73 ± 3.05 % for duplicate samples, respectively. Recoveries of CRM for C and N were 99.16 ± 0.30 %, and 101.62 ± 0.88 % of the certified values, respectively.

Dissolved total Hg concentrations analyses and QA/QC. The dissolved total Hg (THg_{aq}) concentrations in the rinse water and leachate were analyzed using Environmental Protection Agency (EPA) method 1631. Samples were oxidized for 12 h with BrCl oxidation, neutralized using hydroxylamine, reduced to Hg^0 by $SnCl_2$ reduction, purged onto gold traps, thermally desorbed in argon, and finally analyzed by cold vapor atomic fluorescence spectroscopy (CVAFS, Tekran 2600, Tekran Inc., Canada) (Bloom and Fitzgerald, 1988). The detection limit for THg_{aq} was 0.072 ng L^{-1}. The instrument, Tekran 2600, was calibrated daily. Each analytical run included 10 % method blanks

(deionized water), 10 % sample duplicates, and 20 % matrix spikes. Check standards (made from 1000 ppm stock standard) were included in every ten samples. All method blanks were below the detection limit. The RSD was 3.45 ± 2.48 % for all duplicate samples. Recoveries of matrix spikes and check standards were 101.09 ± 14.03 % and 104.60 ± 6.37 %, respectively.

Dissolved organic matter concentration analyses and QA/QC. Dissolved organic matter is quantified analytically as dissolved organic carbon (DOC). DOC concentrations in rinse water and leachate were measured using an iTOC Aurora 1030 (OI Analytical, College Station, TX, USA) using the persulfate wet oxidation method. Dissolved organic carbon in the liquid was oxidized to CO_2 gas by the persulfate wet oxidation and the amount of CO_2 was subsequently determined by measuring the infrared absorbance of CO_2 gas. DOC concentrations in blanks were less than 1 mg L^{-1}. Each run included 10 % deionized water blanks, 10 % sample duplicates, 10 % matrix spikes, and check standards. Deionized water blanks were generally less than 1 mg L^{-1}. The RSD was 1.58 ± 1.83 % for sample duplicates. Recoveries of matrix spikes and check standards were 101.04 ± 1.33 % and 104.60 ± 5.36 %, respectively. Concentrations of THg_{aq} and DOM in both rinse waters and leachate are presented as the mass of solute per mass of dry material.

Characteristics of DOM and QA/QC data. DOM in leachate was characterized as specific ultraviolet absorbance at a wavelength of 254 nm ($SUVA_{254}$), an indicator of the molecular weight (or size) and aromaticity (the content of aromatic molecules) of DOM (Weishaar *et al*., 2003). Higher $SUVA_{254}$ values suggest that DOM contains more high-molecular-weight and aromatic molecules (Weishaar *et al*., 2003). Sample absorbance was measured at λ = 254 nm using a Horiba Aqualog® fluorescence spectrofluorometer with a xenon lamp. $SUVA_{254}$ values were determined by dividing the absorbance at 254 nm by the DOM concentration of the same sample and multiplied by 100 and are reported in the unit of L mg C^{-1} m^{-1} (Weishaar *et al*., 2003). There were no reference materials to assess method performance, but 10 % of samples were run in duplicates. The RSDs of $SUVA_{254}$ were 0.62 ± 0.29 % for sample duplicates.

Fluorescence excitation-emission matrices (EEMs) were also collected for calculating informative optical indices that reflect differences in DOM characteristics in leachate using a Horiba Aqualog®

fluorescence spectrofluorometer with a xenon lamp. The ultrapure closed water blank was used to correct the inner-effects of the Horiba Aqualog® fluorescence spectrofluorometer. Aqualog® directly reported the fluorescence intensity as arbitrary units (A.U.). The reported EEMs were then converted to optical indices using R Software (R Core Team 2012). Three common indices were chosen in this study: the fluorescence index (FI), the humification index (HIX_{EM}), and the biological index or 'freshness' index (BIX). FI reflects DOM sources and characteristics with lower FI values (< 1.2) indicating that DOM is terrestrially derived (resulting from decomposition and leaching of plant and soil organic matter) and has higher aromaticity, while higher FI values (> 1.8) indicting that DOM is microbially derived (originating from processes as extracellular release and leachate of algae and bacteria) and has lower aromaticity (Fellman *et al*., 2010; McKnight *et al*., 2001). HIX_{EM} is an indicator of humic substance content or the extent of humification that converts lower-molecular weight organic matter derived from animal and plant products to more condensed and higher-molecular-weight organic matters by microbes. High HIX_{EM} (> 1.0) values reflect the high humification of DOM and DOM is composed of more highly condensed and higher molecular weight molecules (Fellman *et al*., 2010; Hansen *et al*., 2016; Huguet *et al*., 2009; Ohno, 2002). BIX reflects the contribution of autochthonous (or microbially derived) DOM with higher BIX values (> 1.0) reflecting that more low-molecular-weight DOM was recently produced by microbes (Fellman *et al*., 2010; Huguet *et al*., 2009). For FI, HIX_{EM}, and BIX, there were also no reference materials to assess method performance, but 10 % of samples were run in duplicates. The RSDs of FI, HIX_{EM}, and BIX were 7.27 ± 3.43 %, 2.05 ± 2.77 %, and 3.48 ± 3.50 % for sample duplicates respectively.

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