

SUPPLEMENTARY

Text S1. Hydraulic head measurement

Hydraulic heads at known depths were measured at fourteen well clusters during the 12 years (W1 - W14, Supplementary Table S1). Each well cluster contained at least three wells made from 1.91 cm or 2.54 cm nominal internal diameter PVC pipe fitted with 30 cm long machine slotted screens. The elevation of the top of each monitoring well was measured using an Ashtech dual frequency GPS. Standard errors calculated by postprocessing software were less than 1 cm. Elevation differences within each cluster were checked periodically using a carpenter's level over time, with little change observed. Water levels in monitoring wells were measured using an electrical water-level indicator, and converted to elevation above mean sea level using the resulting data. The head data were manually contoured using a 0.5 meter contour interval, and contour lines were constrained assuming zero flux boundary conditions at the interface between peat and low permeability sediment. Flow lines were assumed to deflect into the high permeability esker sediments.

Text S2. Methane, ammonium and phosphorus data

Porewater samples for dissolved CH₄ concentration (mg CH₄ L⁻¹) were collected from

20 Sites G1 and G2 on 2012 September 13, and from Sites G2 and G3 on 2012
21 November 26 (Bon et al., 2014). The head space of sample vials was capped and
22 sealed with Polytetrafluoroethylene (PTFE) coated red rubber septa and aluminum
23 crimp seals. A SRI 8610C Gas Chromatograph (GC) with flame ionization detector
24 (FID) and thermal conductivity detector (TCD) was used to obtain methane
25 concentrations. Methane was vaporized from the water samples with an oven and
26 directly injected into the GC (Bon et al., 2014). The dissolved CH₄ concentration at
27 each depth was determined by in-situ production, consumption and net CH₄ flux.

28

29 Porewater samples for ammonium (NH₄⁺) and soluble reactive phosphorus (P)
30 concentration were collected on 1999 Nov 16 and 2000 May 15 using a vacuum pump
31 to pull samples into an Erlenmeyer flask, from the same depths of the same wells
32 where hydraulic heads were measured. Water was placed into pre-cleaned plastic
33 sample containers, transported to the lab, filtered and then analyzed. The samples
34 were analyzed in the Maine Agricultural and Forest Experiment Station (MAFES)
35 Analytical Laboratory. All samples were taken to the laboratory, refrigerated at 4 °C
36 and analyzed within 21 days of collection. The samples were decanted into
37 high-density polyethylene (HDPE) bottles and filtered (0.045 micron) in the
38 laboratory. Ammonium was analyzed using a Wescom Ammonia Analyzer.
39 Phosphorus concentrations were analyzed by plasma spectrometry (Jarrel–Ash ICP).

40

41 **Text S3. Distances between eccentric bogs and major esker systems**

42 The distances between 231 eccentric bogs and nearest esker were measured (QGIS v.
43 3.10) and form a heavy-tailed frequency distribution. Outliers identified with a Q-Q
44 plot (R v. 3.4) are associated with eccentric bogs without nearby exposed eskers, such
45 as those north and west of Vanern Lake, Sweden (Figure, 4C), suggesting other
46 pool-clustering processes unrelated to eskers, or buried eskers not reaching the surface.
47 Discarding positive outliers exceeding 1.5 times the interquartile range results in a
48 skewed normal frequency (Mean = 9.06 km, Std. Dev. = 5.85 km, Skewness = 2.05).
49 Considering the map scale of Figure 4A-4C, the mean value, 9.06 km, is a small
50 distance comparable to the distance between the Central Unit of Caribou Bog and the
51 major surficial branches of the Katahdin esker system (Supplementary Figure S1).
52 Smaller surficial eskers extending from the major branches of the esker systems
53 shown in Fig. 4 were deposited before and thus below glacio-marine clay, leaving
54 some higher relief parts of the esker locally in contact with the upper peat soil across
55 the cay (Comas et al., 2005, 2011) and impacting downward flows within the
56 eccentric bogs.

57

58

59

60

61

62

63

64

65

66

67 **REFERENCES CITED**

68 Bon, C., Reeve, A., Slater, L., and Comas, X., 2014, Using hydrologic measurements
69 to investigate free-phase gas ebullition in a Maine peatland, USA: Hydrology and
70 Earth System Sciences, v. 18, p. 953–965, doi:10.5194/hess-18-953-2014.

71 Comas, X., Slater, L., and Reeve, A., 2011, Pool patterning in a northern peatland:
72 Geophysical evidence for the role of postglacial landforms: Journal of hydrology,
73 v. 399, p. 173–184, doi:10.1016/j.jhydrol.2010.12.031.

74 Comas, X., Slater, L., and Reeve, A., 2005, Stratigraphic controls on pool formation
75 in a domed bog inferred from ground penetrating radar (GPR): Journal of
76 Hydrology, v. 315, p. 40–51, doi:10.1016/j.jhydrol.2005.04.020.

77

78

79

80

81

82

83

84 **FIGURES**

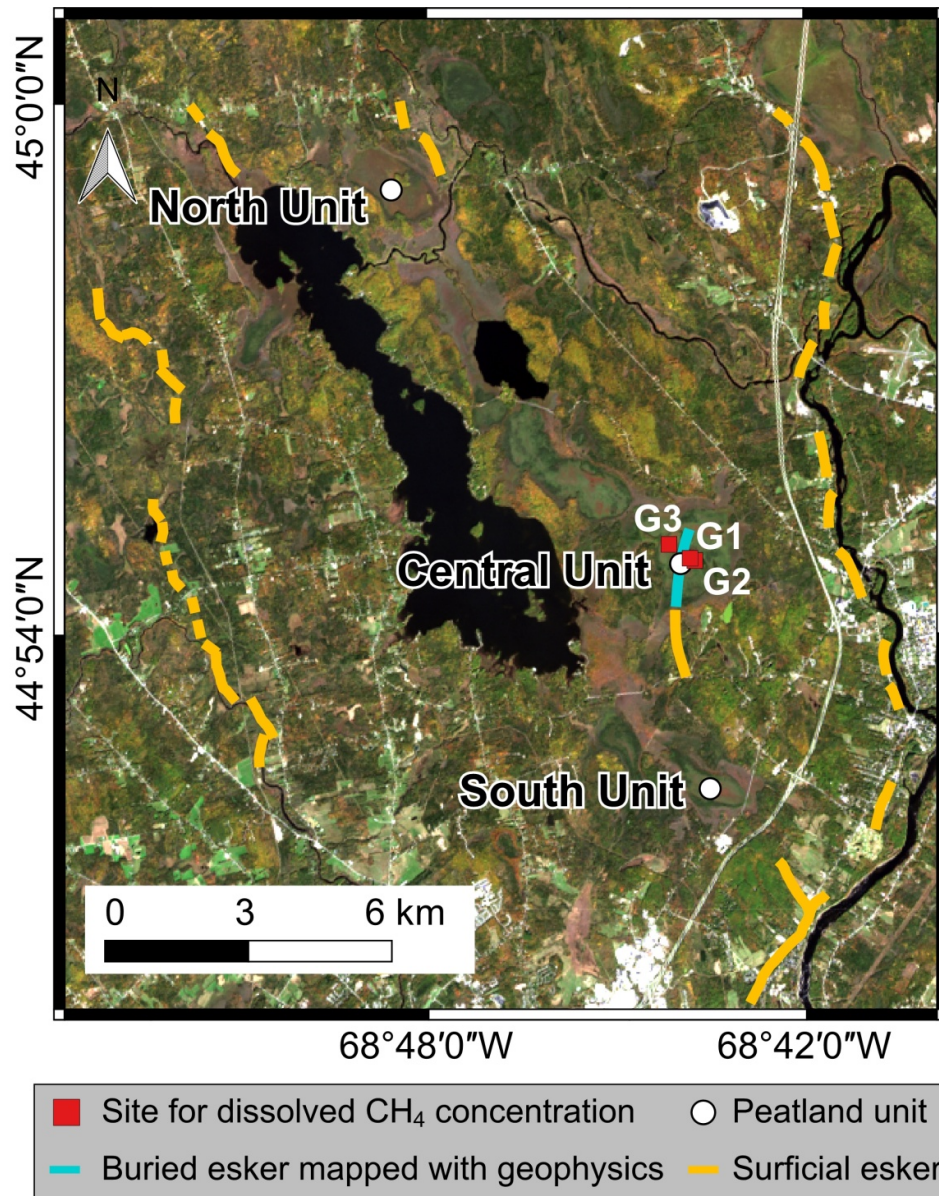


Figure S1. Porewater samples for dissolved CH₄ concentration were collected from three sites G1, G2 and G3 in the Central Unit of Caribou bog, about three km away from the major surficial branches of the Katahdin esker system. Geophysical datasets show that the surficial eskers on the southern edge of the Central Unit (not shown in Fig. 4) descend below glacio-marine clay and are locally in contact with the upper peat soil in the Central Unit (Comas et al., 2005, 2011).

TABLE

Table S1. Water table elevation and hydraulic head (cm) data. 'NA' means null reading.

Well	Sensor position	Aug-5-1999 (cm)	Apr-26-2000 (cm)
1	Water table	39.42	39.92
1	Surface	39.19	39.84
1	Deep	39.73	39.91
2	Water table	39.62	39.90
2	Surface	39.62	39.86
2	Deep	39.63	39.89
3	Water table	40.58	40.80
3	Surface	40.86	40.60
3	Medium	40.58	40.67
3	Deep	40.36	40.63
4	Water table	41.06	41.12
4	Surface	41.05	41.32
4	Medium	41.23	41.19
4	Deep	38.60	40.27
5	Water table	41.14	41.28
5	Surface	41.16	41.26
5	Medium (upper)	41.14	41.32
5	Medium (lower)	41.09	41.22
5	Deep	38.88	40.85
6	Water table	40.85	41.05
6	Surface	NA	41.04
6	Medium	41.25	41.47
6	Deep	39.94	41.00
7	Water table	40.73	40.97
7	Surface	40.78	40.98
7	Medium	40.79	40.93
7	Deep	40.76	40.92
8	Water table	39.23	39.34
8	Surface	39.23	39.34
8	Deep	39.19	39.34
9	Water table	39.52	39.74
9	Surface	NA	NA
9	Deep	39.49	39.73
10	Water table	39.01	NA
10	Surface	39.02	NA

10	Deep	39.11	NA
----	------	-------	----

Well	Sensor position	May-2-2012 (cm)
5	1.5 m depth	40.79
5	3.0 m depth	40.76
5	Mineral deposit	40.08
6	1.5 m depth	40.99
6	3.0 m depth	40.95
6	Mineral deposit	40.83
7	1.5 m depth	41.00
7	3.0 m depth	40.97
7	Mineral deposit	40.96
8	1.5 m depth	39.77
8	3.0 m depth	39.73
8	Mineral deposit	39.69

Table S2. Chemistry data. 'NA' means null reading.

Well	Sampling position	NH₄⁺ (mg N L⁻¹)	P (mg P L⁻¹)
1	Surface	NA	NA
1	Deep	4.13	0.02
2	Surface	3.46	0.52
2	Deep	7.31	0.05
3	Surface	0.76	0.02
3	Medium	3.01	0.17
3	Deep	5.83	0.02
4	Surface	4.51	0.12
4	Medium	1.43	0.29
4	Deep	8.17	0.04
5	Surface	0.85	0.03
5	Medium (upper)	2.75	0.10
5	Medium (lower)	13.30	0.13
5	Deep	19.78	0.06
6	Surface	NA	NA
6	Medium	6.49	0.35
6	Deep	11.69	0.03
7	Surface	1.40	0.16
7	Medium	3.85	0.31
7	Deep	8.81	0.33
8	Deep	0.85	0.02
8	Surface	8.99	0.08
9	Surface	NA	NA
9	Deep	3.96	0.11
10	Surface	2.52	0.16
10	Deep	6.40	0.05

Well	Sampling position	NH₄⁺ (mg N L⁻¹)	P (mg P L⁻¹)
1	Surface	1.32	0.03
1	Deep	0.12	0.01
2	Surface	3.44	0.24
2	Deep	3.88	0.07
3	Surface	4.43	0.01
3	Medium	4.40	0.17
3	Deep	6.63	0.04
4	Surface	1.15	0.10
4	Medium	3.07	0.23
4	Deep	5.65	0.01
5	Surface	1.80	0.07
5	Medium (upper)	4.58	0.15
5	Medium (lower)	5.40	0.15
5	Deep	0.94	0.11
6	Surface	2.59	0.27
6	Medium	11.96	0.40
6	Deep	19.01	0.01
7	Surface	7.50	0.14
7	Medium	13.39	0.24
7	Deep	1.77	0.24
8	Surface	3.96	0.01
8	Deep	7.28	0.01
9	Surface	NA	NA
9	Deep	0.99	0.04
10	Surface	0.11	0.17
10	Deep	3.88	0.01