Supporting Information

Reyes and Cooke 10.1073/pnas.1013270108

SI Methods

Radiocarbon dates from $JY10_{all}$ (1) were rejected if they met any of the following conditions.

1 Lack of Supporting Stratigraphic Context. We rejected 29 ^{14}C dates from sources that did not provide a description, however brief, of a given sample's stratigraphic context. This approach may result in exclusion of legitimate basal peat dates, particularly in the case of new ^{14}C dates presented in JY10, but this is impossible to evaluate without the appropriate stratigraphic details.

2 Poor Suitability of the Dated Material. We rejected 10 ^{14}C dates on bulk silt because this material commonly yields erroneous ages (2) through hard-water effects (3) and incorporation of comminuted fossil coals and carbonate rock. Contamination by comminuted fossil coals is particularly problematic in the Kenai Peninsula (4) where many of the basal ^{14}C dates in JY10 were collected.

3 Unreliable Stratigraphy. We rejected 37 ^{14}C dates on material that was identified in the original source as cryoturbated, detrital, or reworked; these dates may be much younger than the true age of peatland initiation. We also rejected dates that, based on descriptions in the original sources, were not on basal peat samples.

4 Alternative Stratigraphic Interpretation. We rejected 36 ^{14}C dates on peat samples that better reflect the timing of geomorphic or landscape processes, rather than peatland initiation. For example, we reject ages on peaty interbeds in eolian or fluvial sediments; basal peats in pond or lake sediments; and, peats overlain by marine/lagoonal sediments, which record changes in Holocene relative sea level.

5 Multiple Basal Peat Samples from the Same Peatland. We rejected 3 ^{14}C dates where there were multiple dates on basal peat from different cores in the same peatland complex because they provide multiple initiation dates for one peatland. In these cases, we rejected all but the oldest basal ^{14}C date. We acknowledge, however, that multiple ^{14}C dates from the same peatland complex provide important detail on temporal patterns of peatland expansion (5).

1. Jones MC, Yu Z (2010) Rapid deglacial and early Holocene expansion of peatlands in Alaska. *Proc Natl Acad Sci USA* 107:7347–7352.
2. Grimm EC, Maher Jr LJ, Nelson DM (2009) The magnitude of error in conventional bulk-sediment radiocarbon dates from central North America. *Quaternary Res* 72:301–308.
3. MacDonald G, Beukens RP, Kieser WE (1991) Radiocarbon dating of limnic sediments: A comparative analysis and discussion. *Ecology* 72:1150–1155.
4. Reger RD, Sturmann AG, Berg EE, Burns PAC (2007) A guide to the late Quaternary history of the northern and western Kenai Peninsula, Alaska. *State of Alaska, Division of Geological and Geophysical Surveys, Guidebook 8*, p 110.
5. Korhola A, et al. (2010) The importance of northern peatland expansion to the late-Holocene rise of atmospheric methane. *Quaternary Sci Rev* 29:611–617.

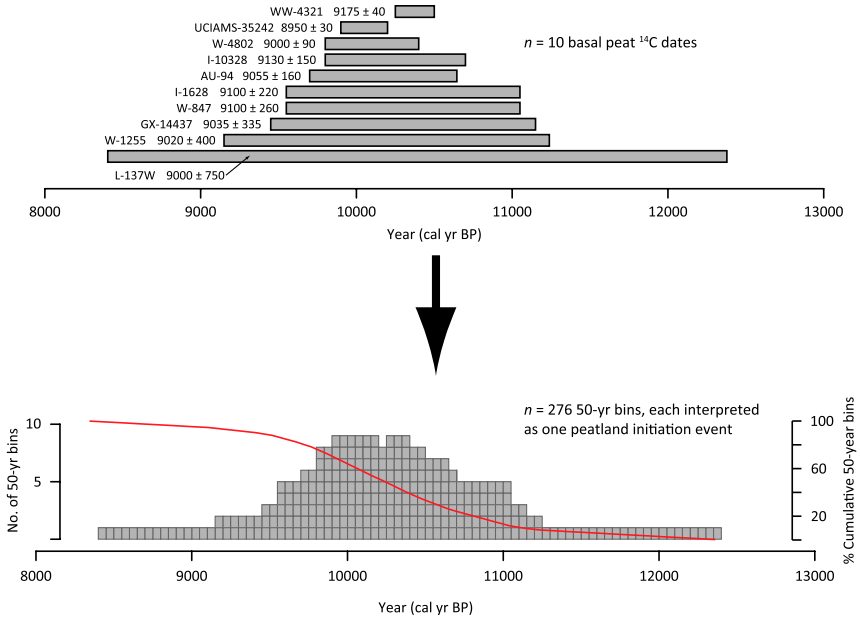

Fig. S1. Schematic figure of the histogram method (HIST) for assembling peatland initiation chronologies using frequency histograms of binned calibrated age ranges. Ten ^{14}C ages from $JY10_{all}$ are used as an example. (*Upper*) Calibrated 2σ age ranges are rounded to the nearest 50 yr and divided into 50 yr bins. (*Lower*) The number of bins in each 50 yr interval is summed to generate the frequency histogram, which in turn is used to generate a cumulative curve of peatland initiation. Note that each individual ^{14}C date generates multiple peatland initiation events.

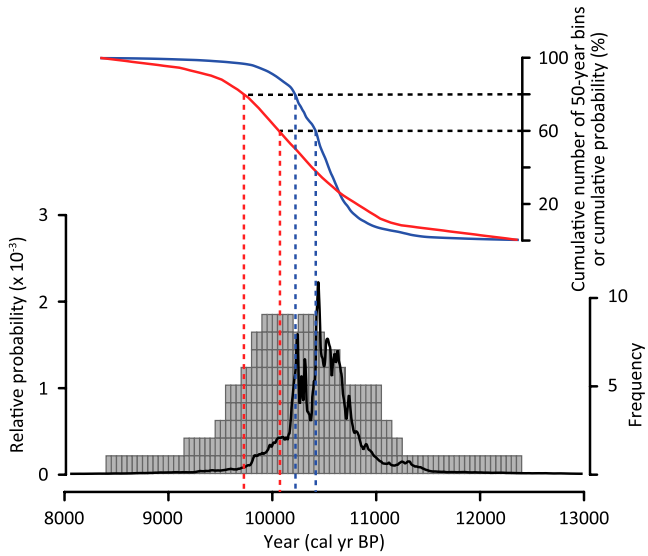

Fig. S2. Schematic comparison of nonnormalized peatland initiation chronologies, based on the ten ^{14}C ages from Fig. S1, using the HIST and probability methods (PROB). In this example, the mode of peatland initiation in this HIST record is several hundred years younger than the PROB record; the tails of the HIST initiation chronology are overemphasized because they are weighted as equally as the modes of each calibrated probability distribution. Dashed lines indicate differences in timing for equivalent levels of cumulative peatland initiation.

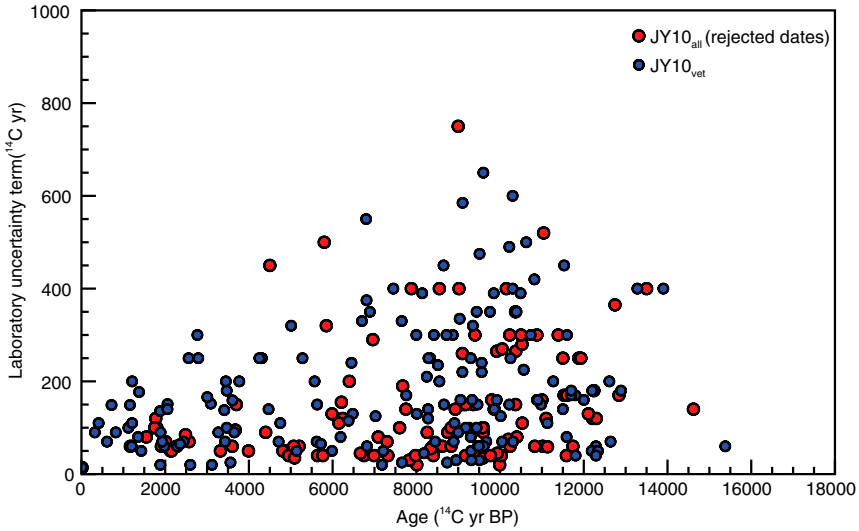

Fig. S3. Scatterplot of the 274 Alaska basal peat ^{14}C dates in JY10 against their associated laboratory uncertainty terms. The increase in laboratory uncertainty with older ^{14}C dates is important because large uncertainty terms yield large calibrated age ranges and a greater number of bins for each ^{14}C date. This bias tends to overemphasize apparent peatland initiation during the early Holocene and late Pleistocene, when the mean laboratory uncertainty terms are twice as large as the late Holocene uncertainties.

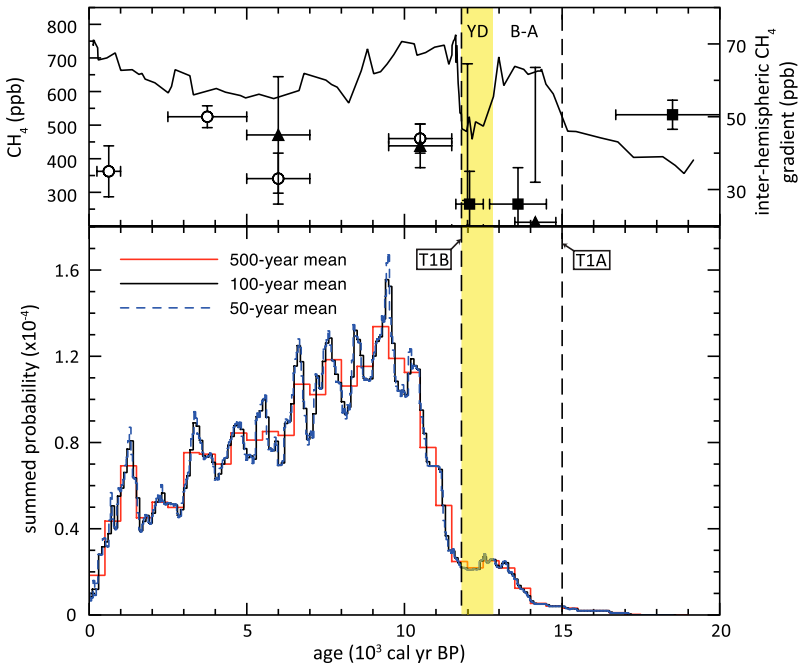

Fig. S4. Comparison of atmospheric CH_4 concentration (*Upper*) and summed probability distributions for the 1,516 ^{14}C dates in MacD06, compiled using 50-yr, 100-yr, and 500-yr means of summer probability (*Lower*). The lower panel shows that broad temporal trends, including the timing of abrupt deglacial increases in peatland initiation, are relatively insensitive to the length of time used to calculate mean summed probability.

Table S1. Summary of basal peat ^{14}C dates for $JY10_{vet}$ and $JY10_{all}$

	$JY10_{vet}$	$JY10_{all}$
^{14}C laboratory uncertainty		
>100 yrs	101	155
<100 yrs	58	119
Last glacial maxium (LGM)		
Within LGM limits	82	133
Outside LGM limits	77	141
Measurement technique		
Radiometric	110	171
Accelerator mass spectrometry	37	87
Unknown	12	16
Pretreatment method		
Acid-base-acid	28	42
NaOH	2	5
Unknown	129	227
% areal coverage of organic-rich soils at basal peat sampling sites		
<5%	83	146
5–25%	31	63
26–50%	45	65
>50%	0	0

Other Supporting Information Files

Dataset S1 (XLS)
Dataset S2 (XLS)