Table S1–Acoustic survey results. a) recordings identified through an automated identification program (Kaleidoscope Pro; Wildlife Acoustics, Maynard, Massachusetts, USA) on each study island (LI = Suffolk County, Long Island, New York; MV = Martha's Vineyard, Massachusetts; N = Nantucket, Massachusetts). The number of files recorded are pooled across the study season from each survey night (LI surveyed from 25 May – 8 October 2017; MV and N surveyed between 22 May – 19 August 2018). Numbers indicate how many files were identified for a given species, and the total bat files column indicates the number of recordings that were identified for all species on each island (not including no ID/noise files). Note that these data include nights of partial recording that were excluded from further analysis. Species designations are as follows: MYSE = *Myotis septentrionalis*; MYLU = *Myotis lucifugus*; LABO = *Lasiurus borealis*; LACI = *Lasiurus cinereus*; LANO = *Lasionycteris noctivagans*; EPFU = *Eptesicus fuscus*); PESU = *Perimyotis subflavus*. b) Manual vetting designations for recordings designated as MYSE and MYLU. We indicate the percentage of recordings that were changed from MYLU to MYSE (6.65%), MYSE to no ID or another species (11.22%), and no ID/noise to MYSE (1.80%).

a)

Kaleidoscope automatic ID results

Island	No. of files	MYSE	MYLU	LABO	LACI	LANO	EPFU	PESU	No ID/noise	Total bat files
LI	185201	1523	3284	8590	5903	6487	20198	1355	137861	47340
MV	14167	826	580	738	771	891	7477	78	2813	11301
N	22207	5749	329	495	83	69	67	21	15374	6813
TOTAL	221575	8098	4193	9823	6757	7447	27742	1454	156048	65454

b)

Manual vetting results

Island	Final MYSE ID	Final MYLU ID	MYLU --> MYSE	MYSE --> other	No ID/noise --> MYSE
LI	1506	9	67	650	525
MV	812	19	51	217	131
N	8271	11	161	42	2156
TOTALS	10589	39	279	909	2812
		% changed	6.65	11.22	1.80

Table S2–Model selection tables. Model lists are separated by covariate effects on detection (p), local-scale occupancy (Theta, θ), and landscape-scale occupancy (Psi, ψ) of northern myotis *Myotis septentrionalis* on Suffolk County, Long Island, New York, and Martha's Vineyard and Nantucket, Massachusetts. The model-selection metrics are Akaike's Information Criterion adjusted for sample size (AIC_c), difference between model and minimum AIC_c value (ΔAIC_c), AIC_c weight (w_i), deviance, and parameter number (K). Models with $\Delta AIC_c < 2$ are shown in bold.

Long Island

Parameter	Model name	AIC_c	ΔAIC_c	w_i	Deviance	K
p	**p(.) + Theta(.) + Psi(.)**	399.14	0.00	0.25	392.62	3
	p(wind) + Theta(.) + Psi(.)	400.79	1.66	0.11	391.91	4
	p(date) + Theta(.) + Psi(.)	401.03	1.89	0.10	392.14	4
	p(date^2) + Theta(.) + Psi(.)	401.16	2.03	0.09	392.28	4
	p(tmin) + Theta(.) + Psi(.)	401.23	2.09	0.09	392.34	4
	p(dettype) + Theta(.) + Psi(.)	401.48	2.34	0.08	392.59	4
	p(date + wind) + Theta(.) + Psi(.)	402.93	3.79	0.04	391.57	5
	p(date^2 + wind) + Theta(.) + Psi(.)	402.98	3.84	0.04	391.62	5
	p(tmin + wind) + Theta(.) + Psi(.)	403.25	4.11	0.03	391.89	5
	p(dettype + wind) + Theta(.) + Psi(.)	403.25	4.11	0.03	391.89	5
	p(tmin + date) + Theta(.) + Psi(.)	403.39	4.26	0.03	392.03	5
	p(dettype + date) + Theta(.) + Psi(.)	403.48	4.34	0.03	392.11	5
	p(date^2 + tmin) + Theta(.) + Psi(.)	403.50	4.37	0.03	392.14	5
	p(date^2 + dettype) + Theta(.) + Psi(.)	403.64	4.50	0.03	392.27	5
	p(tmin + dettype) + Theta(.) + Psi(.)	403.66	4.52	0.03	392.29	5
Theta						
	p(.) + Theta(dev) + Psi(.)	379.57	0.00	0.54	370.68	4
	p(date) + Theta(dev) + Psi(.)	381.06	1.50	0.25	369.69	5
	p(wind) + Theta(dev) + Psi(.)	381.47	1.91	0.21	370.11	5
	p(.) + Theta(devo) + Psi(.)	394.09	14.53	0.00	385.20	4
	p(date) + Theta(devo) + Psi(.)	395.74	16.17	0.00	384.37	5
	p(wind) + Theta(devo) + Psi(.)	395.96	16.40	0.00	384.60	5
	p(.) + Theta(forest) + Psi(.)	396.37	16.81	0.00	387.49	4
	p(date) + Theta(forest) + Psi(.)	398.07	18.50	0.00	386.70	5
	p(wind) + Theta(forest) + Psi(.)	398.21	18.65	0.00	386.85	5
	p(.) + Theta(.) + Psi(.)	399.14	19.57	0.00	392.62	3
	p(.) + Theta(dedge) + Psi(.)	399.35	19.78	0.00	390.46	4
	p(.) + Theta(dwet) + Psi(.)	400.11	20.55	0.00	391.22	4
	p(.) + Theta(psm) + Psi(.)	400.28	20.71	0.00	391.39	4
	p(wind) + Theta(.) + Psi(.)	400.79	21.23	0.00	391.91	4
	p(date) + Theta(.) + Psi(.)	401.26	21.46	0.00	392.14	4

Psi						
	p(.) + Theta(dev) + Psi(MPS)	379.41	0.00	0.23	368.05	5
	p(.) + Theta(dev) + Psi(.)	379.57	0.16	0.21	370.68	4
	p(.) + Theta(dev) + Psi(CC)	380.89	1.48	0.11	369.53	5
	p(date) + Theta(dev) + Psi(.)	381.06	1.65	0.10	369.70	5
	p(date) + Theta(dev) + Psi(MPS)	381.12	1.71	0.10	367.17	6
	p(wind) + Theta(dev) + Psi(MPS)	381.43	2.02	0.08	367.48	6
	p(wind) + Theta(dev) + Psi(.)	381.47	2.06	0.08	370.11	5
	p(date) + Theta(dev) + Psi(CC)	382.54	3.13	0.05	368.58	6
	p(wind) + Theta(dev) + Psi(CC)	382.90	3.49	0.04	368.95	6

Martha's Vineyard

Parameter	Model name	AIC_c	ΔAIC_c	w_i	Deviance	K
p	**p(.) + Theta(.) + Psi(.)**	282.70	0.00	0.26	275.55	3
	p(date) + Theta(.) + Psi(.)	283.45	0.75	0.18	273.45	4
	p($date^2$) + Theta(.) + Psi(.)	283.58	0.89	0.17	273.58	4
	p(tmin) + Theta(.) + Psi(.)	284.35	1.65	0.11	274.35	4
	p(wind) + Theta(.) + Psi(.)	285.40	2.70	0.07	275.40	4
	p(date + tmin) + Theta(.) + Psi(.)	285.70	3.00	0.06	272.54	5
	p($date^2$ + tmin) + Theta(.) + Psi(.)	285.87	3.17	0.05	272.72	5
	p(date + wind) + Theta(.) + Psi(.)	286.42	3.73	0.04	273.27	5
	p($date^2$ + wind) + Theta(.) + Psi(.)	286.51	3.82	0.04	273.36	5
	p(tmin + wind) + Theta(.) + Psi(.)	287.46	4.77	0.02	274.30	5
Theta						
	p(.) + Theta(forest) + Psi(.)	277.58	0.00	0.24	267.58	4
	p(date) + Theta(forest) + Psi(.)	279.05	1.47	0.11	265.89	5
	p(tmin) + Theta(forest) + Psi(.)	279.21	1.63	0.10	266.05	5
	p($date^2$) + Theta(forest) + Psi(.)	279.21	1.63	0.10	266.05	5
	p(.) + Theta(wet) + Psi(.)	280.76	3.17	0.05	270.76	4
	p(.) + Theta(dfresh) + Psi(.)	281.25	3.67	0.04	271.25	4
	p(date) + Theta(dfresh) + Psi(.)	281.70	4.12	0.03	268.55	5
	p(.) + Theta(grass) + Psi(.)	281.84	4.26	0.03	271.84	4
	p($date^2$) + Theta(dfresh) + Psi(.)	281.94	4.35	0.03	268.78	5
	p(date) + Theta(wet) + Psi(.)	281.94	4.36	0.03	268.78	5
	p($date^2$) + Theta(wet) + Psi(.)	282.05	4.47	0.03	268.89	5
	p(tmin) + Theta(wet) + Psi(.)	282.68	5.09	0.02	269.52	5
	p(.) + Theta(.) + Psi(.)	282.70	5.11	0.02	275.55	3
	p(.) + Theta(devo) + Psi(.)	282.98	5.39	0.02	272.98	4
	p(tmin) + Theta(dfresh) + Psi(.)	283.08	5.50	0.02	269.92	5
Psi						
	p(.) + Theta(forest) + Psi (.)	277.58	0.00	0.24	267.58	4
	p(date) + Theta(forest) + Psi (.)	279.05	1.47	0.12	265.89	5
	p(tmin) + Theta(forest) + Psi (.)	279.21	1.63	0.10	266.05	5

	p(date^2) + Theta(forest) + Psi (.)	279.21	1.63	0.10	266.05	5
	p(.) + Theta(forest) + Psi (Forest)	279.37	1.79	0.10	266.22	5
	p(.) + Theta(forest) + Psi (NWIfresh)	280.24	2.66	0.06	267.08	5
	p(.) + Theta(forest) + Psi (Impervious)	280.71	3.13	0.05	267.56	5
	p(date) + Theta(forest) + Psi (Forest)	281.25	3.67	0.04	264.59	6
	p(tmin) + Theta(forest) + Psi (Forest)	281.36	3.78	0.04	264.70	6
	p(date^2) + Theta(forest) + Psi (Forest)	281.40	3.82	0.03	264.74	6
	p(date) + Theta(forest) + Psi (NWIfresh)	282.01	4.43	0.03	265.34	6
	p(tmin) + Theta(forest) + Psi (NWIfresh)	282.16	4.57	0.02	265.49	6
	p(date^2) + Theta(forest) + Psi (NWIfresh)	282.25	4.67	0.02	265.58	6
	p(date) + Theta(forest) + Psi (Impervious)	282.54	4.96	0.02	265.88	6
	p(tmin) + Theta(forest) + Psi (Impervious)	282.69	5.10	0.02	266.02	6

Nantucket

Parameter	Model name	AIC$_c$	ΔAIC$_c$	w_i	Deviance	K
p	**p(wind + date^2) + Theta(.) + Psi(.)**	288.59	0.00	0.83	275.43	5
	p(wind + date) + Theta(.) + Psi(.)	294.28	5.69	0.05	281.12	5
	p(tmin + wind) + Theta(.) + Psi(.)	294.70	6.11	0.04	281.54	5
	p(wind) + Theta(.) + Psi(.)	294.81	6.23	0.04	284.81	4
	p(date^2) + Theta(.) + Psi(.)	295.24	6.66	0.03	285.24	4
	p(date^2 + tmin) + Theta(.) + Psi(.)	298.32	9.73	0.01	285.16	5
	p(tmin) + Theta(.) + Psi(.)	299.72	11.13	0.003	289.72	4
	p(.) + Theta(.) + Psi(.)	300.58	11.99	0.002	293.43	3
	p(date) + Theta(.) + Psi(.)	300.69	12.11	0.002	290.69	4
	p(date + tmin) + Theta(.) + Psi(.)	302.36	13.78	0.001	289.20	5
Theta						
	p(date^2 + wind) + Theta(devo) + Psi(.)	286.96	0.00	0.49	270.3	6
	p(date^2 + wind) + Theta(.) + Psi(.)	288.59	1.62	0.22	275.43	5
	p(date^2 + wind) + Theta(dfresh) + Psi(.)	290.29	3.32	0.09	273.62	6
	p(date^2 + wind) + Theta(forest) + Psi(.)	291.73	4.77	0.04	275.06	6
	p(date^2 + wind) + Theta(grass) + Psi(.)	291.78	4.81	0.04	275.11	6
	p(date^2 + wind) + Theta(dev) + Psi(.)	291.97	5.01	0.04	275.30	6
	p(date^2 + wind) + Theta(wet) + Psi(.)	291.99	5.03	0.04	275.33	6
	p(date^2 + wind) + Theta(shrub) + Psi(.)	292.09	5.13	0.04	275.43	6
Psi						
	p(date^2 + wind) + Theta(devo) + Psi(.)	286.96	0.00	0.43	270.30	6
	p(date^2 + wind) + Theta(.) + Psi(.)	288.59	1.62	0.19	275.43	5
	p(date^2 + wind) + Theta(devo) + Psi(CC)	290.17	3.20	0.09	269.58	7
	p(date^2 + wind) + Theta(devo) + Psi(Herb)	290.20	3.24	0.09	269.61	7
	p(date^2 + wind) + Theta(devo) + Psi(Impervious)	290.69	3.73	0.07	270.10	7
	p(date^2 + wind) + Theta(.) + Psi(CC)	291.38	4.42	0.05	274.72	6
	p(date^2 + wind) + Theta(.) + Psi(Herb)	291.42	4.45	0.05	274.75	6
	p(date^2 + wind) + Theta(.) + Psi(Impervious)	291.90	4.94	0.04	275.23	6

Table S3–The relationship between northern myotis *Myotis septentrionalis* local occupancy and forest patch size. Patch size (ha) of acoustically sampled study sites on Suffolk County, Long Island (LI), New York, Martha's Vineyard (MV), Massachusetts, and Nantucket (N), Massachusetts. The percentage of sites that were occupied (169 out of 280 total sites) out of the total number of sites within that size category is presented for patch sizes of ≥1,000 ha, ≤250 ha, ≤50 ha, ≤10 ha, ≤5 ha, ≤1 ha, and ≤0.05 ha.

Island	All	LI	MV	N
Sample size (n)	280	134	73	73
Patch size $\bar{x}$ ± SD (median)	528 ± 214 (12)	309 ± 585 (38)	247 ± 460 (65)	5 ± 17 (0.1)
% of occupied patches	60% (n=169)	44% (n=59)	60% (n=44)	90% (n=66)
Occupied patch size $\bar{x}$ ± SD (median)	176 ± 396 (16)	242 ± 413 (102)	342 ± 552 (108)	5 ± 18 (0.1)
% Occupied ≥1000	30% (n=19)	7% (n=1)	63% (n=8)	0% (n=0)
% Occupied ≤250	61% (n=228)	45% (n=100)	53% (n=55)	90% (n=73)
% Occupied ≤50	58% (n=176)	34% (n=73)	44% (n=34)	90% (n=69)
% Occupied ≤10	58% (n=139)	24% (n=50)	36% (n=22)	90% (n=67)
% Occupied ≤5	59% (n=120)	17% (n=40)	36% (n=14)	89% (n=66)
% Occupied ≤1	63% (n=60)	19% (n=26)	27% (n=11)	88% (n=59)
% Occupied ≤0.05	64% (n=53)	20% (n=20)	22% (n=9)	87% (n=54)

$\bar{x}$ = mean
SD = standard deviation

Table S4–Parameter estimates, standard errors (SE), and 95% confidence intervals (CI) for northern myotis *Myotis septentrionalis* detection ($\hat{p}$), local occupancy (θ), and landscape occupancy (ψ) on Suffolk County, Long Island, New York, Martha's Vineyard, Massachusetts, and Nantucket, Massachusetts. Covariates followed by $\hat{p}$, θ, and ψ intercepts are detection, local occupancy, and landscape occupancy parameters, respectively. Significant coefficient estimates (confidence intervals do not overlap zero) are denoted with an asterisk (*). Estimates were calculated by averaging across the set of models including all covariates. Detection covariate abbreviations are as follows: date = linear survey date, date^2 = quadratic survey date, wind = mean nightly wind speed (mph), tmin = minimum nightly temperature (°C). Local occupancy covariates are defined as the proportion of development, forest, and open development within a 200 m buffer. Landscape occupancy covariates are defined as the MPS = mean patch size, CC = canopy cover, and Forest = forest habitat within the 1 km^2 survey cells.

Parameter	Estimate	SE	95% Lower CI	95% Upper CI
		Long Island		
$\hat{p}$ intercept	0.38	0.38	-0.35	1.11
date	0.61	0.62	-0.60	1.83
wind	-0.40	0.53	-1.43	0.64
θ intercept	1.83	0.45	0.95	2.73
development*	-4.51	0.99	-6.47	-2.56
ψ intercept	1.90	0.72	0.48	3.31
MPS	-1.73	1.09	-3.87	0.42
CC	-2.06	2.20	-6.38	2.26
		Martha's Vineyard		
$\hat{p}$ intercept	0.67	0.31	0.06	1.27
date	-0.65	0.50	-1.64	0.33
tmin	-0.72	0.58	-1.86	0.42
date^2	-0.56	0.46	-1.46	0.33
θ intercept	-1.57	0.90	-3.34	0.21
forest*	3.40	1.18	1.08	5.72
ψ intercept	0.5	1.54	-2.53	3.52
Forest	3.99	3.14	-2.17	10.15
		Nantucket		
$\hat{p}$ intercept	2.38	0.38	1.64	3.13
date^2*	-1.28	0.47	-2.19	-0.37
wind*	-1.81	0.59	-2.97	-0.65
θ intercept	4.94	1.60	1.81	8.06
open development*	-4.45	2.08	-8.52	-0.37
ψ intercept	3.118	1.03	1.17	5.20