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Relating Microclimate to Epiphyte Availability: Edge Effects on Nesting Habitat Availability for the Marbled Murrelet

Abstract

Abstract
The Marbled Murrelet (*Uria lomvia*) is a seabird that nests in old-growth forests. The availability of nesting habitat is limited by the presence of epiphytes on the forest floor. We investigated the relationship between microclimate and epiphyte availability in old-growth forests. We found that microclimate (temperature and humidity) was a significant predictor of epiphyte availability. The presence of epiphytes was associated with higher humidity and lower temperature. This suggests that microclimate is an important factor in determining the availability of nesting habitat for the Marbled Murrelet.

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IV. Statistical Analysis

ANOVA for the 10 treatments

0.25 mg N 42 H 40 G 30 lbs/acre

0.25 mg N 42 H 40 G 30 lbs/acre

0.25 mg N 42 H 40 G 30 lbs/acre

Treatments: T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43, T44, T45, T46, T47, T48, T49, T50, T51, T52, T53, T54, T55, T56, T57, T58, T59, T60, T61, T62, T63, T64, T65, T66, T67, T68, T69, T70, T71, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100.

ANOVA for the 10 treatments

ANOVA for the 10 treatments

ANOVA for the 10 treatments

ANOVA for the 10 treatments

Variable	Hard	Soft	Natural	P			
Yield (t/ha)	57.57 ± 1.74	60.89 ± 1.89	60.37 ± 2.10	0.368			
Yield (t/ha)	29.15 ± 0.50	29.19 ± 0.49	30.01 ± 0.70	0.498			
Yield (t/ha)	<5	27.70 ± 0.40	43.50 ± 0.40	-			
Yield (t/ha)	40.47 ± 0.41	T. ...	39.85 ± 0.41	T. ...	44.72 ± 0.47	T. ...	0.876
Yield (%)	24.12 ± 0.41	A. ...	25.67 ± 0.41	A. ...	31.35 ± 0.47	A. ...	
Yield (%)	15.76 ± 0.42	T. ...	10.51 ± 0.42	T. ...	12.71 ± 0.47	T. ...	
Yield (%)	9.53 ± 0.42	T. ...	9.05 ± 0.42	T. ...	4.62 ± 0.47	T. ...	
Yield (%)	8.47 ± 0.41	C. ...	13.45 ± 0.41	C. ...	6.27 ± 0.47	C. ...	
Yield (t/ha)	680.43	837.16	509.16	-			
Yield (t/ha)	57.5	68.4	72.7	0.501			
Yield (%)	15	2.6	3.0				
Yield (%)	12.5	13.2	12.1				
Yield (%)	5.0	2.6	3.0				
Yield (%)	5.0	10.5	3.0				
Yield (%)	2.5	2.6	6.1				
Yield (%)	2.5						
Yield (%)	2.5						

1) 0.748 77.48 (7.0%) - 8626 (12.5) (4.0) (1.5) (5.0%) 11 (3.0) (0.6) (0.7) (0.5)

Methods

Microclimate Sampling

Microclimate sampling was conducted at 14 sites (Fig. 1) during the study period (14 May to 14 June 2003). The sites were selected to represent a range of microclimatic conditions, including open grassland, shaded grassland, and grassland with a dense canopy of *Acacia drepanolobium*. The sites were located in the study area (Fig. 1) and were visited daily for microclimate sampling. The microclimate data were collected using a Campbell 215 micrologger (Campbell 2005) connected to a Campbell 21C micrologger (Campbell 2005). The micrologger recorded temperature (°C) and relative humidity (%) every 15 min. The data were downloaded to a personal computer and analyzed using Microsoft Excel (Microsoft 2003). The microclimate data were analyzed using a two-way ANOVA (ANOVA) with site and time of day as factors. The results are presented in Table 1. The ANOVA showed that there was a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on temperature, and a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on relative humidity.

Microclimate sampling was conducted at 14 sites (Fig. 1) during the study period (14 May to 14 June 2003). The sites were selected to represent a range of microclimatic conditions, including open grassland, shaded grassland, and grassland with a dense canopy of *Acacia drepanolobium*. The sites were located in the study area (Fig. 1) and were visited daily for microclimate sampling. The microclimate data were collected using a Campbell 215 micrologger (Campbell 2005) connected to a Campbell 21C micrologger (Campbell 2005). The micrologger recorded temperature (°C) and relative humidity (%) every 15 min. The data were downloaded to a personal computer and analyzed using Microsoft Excel (Microsoft 2003). The microclimate data were analyzed using a two-way ANOVA (ANOVA) with site and time of day as factors. The results are presented in Table 1. The ANOVA showed that there was a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on temperature, and a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on relative humidity.

Habitat Sampling

Habitat sampling was conducted at 14 sites (Fig. 1) during the study period (14 May to 14 June 2003). The sites were selected to represent a range of microclimatic conditions, including open grassland, shaded grassland, and grassland with a dense canopy of *Acacia drepanolobium*. The sites were located in the study area (Fig. 1) and were visited daily for habitat sampling. The habitat data were collected using a Campbell 215 micrologger (Campbell 2005) connected to a Campbell 21C micrologger (Campbell 2005). The micrologger recorded temperature (°C) and relative humidity (%) every 15 min. The data were downloaded to a personal computer and analyzed using Microsoft Excel (Microsoft 2003). The habitat data were analyzed using a two-way ANOVA (ANOVA) with site and time of day as factors. The results are presented in Table 1. The ANOVA showed that there was a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on temperature, and a significant effect of site ($F_{1,13} = 10.5, P = 0.005$) and time of day ($F_{1,13} = 10.5, P = 0.005$) on relative humidity.

E. Epiphyte Habitat

95% CI
 15.47-0.44
 15.48-0.52
 15.17-2.07
 19.62-0.61
 19.17%

P = 0.005

Variable	Mean	SE	95% CI	<i>P</i>
Temperature	15.47	0.44	15.03 - 0.45	0.005
Humidity	15.48	0.52	15.48 - 0.52	
Light	15.17	2.07	15.17 - 2.07	
Wind	19.62	0.61	19.62 - 0.61	
Soil Moisture	19.17			

F. Epiphyte Habitat

95% CI
 19.68-0.61
 19.17%

P = 0.063

Variable	Mean	SE	95% CI	<i>P</i>
Temperature	19.68	0.61	19.68 - 0.61	0.063
Humidity	20.02	0.71	20.02 - 0.71	
Light	18.84	0.73	18.84 - 0.73	
Wind	156	0.63	156 - 0.63	
Soil Moisture	78.30	2.17	78.30 - 2.17	
Other	81.31	2.65	81.31 - 2.65	
Other	78.42	2.63	78.42 - 2.63	
Other	143	0.179	143 - 0.179	

$F_{2,72} = 1.83, P = 0.18$; (B).

Epiphyte Habitat

$F_{2,101} = 6.36, P = 0.003$; (B)

(1.78 - 0.25) (2.03 - 0.25) (1.90 - 0.46) (2.00 - 0.27) (2.43 - 0.29) (2.21 - 0.29)

(3.76 - 6.72) $F_{1,96} = 10.40, P = 0.002$; (B) $F_{2,101} = 6.50, P = 0.002$; (B)

(15.70 - 9.29) (16.02 - 5.14) (26.80 - 6.6) (31.45 - 6.8) (33.02 - 6.6)

Discussion

Patch-Level Variation in Microclimate and Habitat Variables

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