

A Moosy Proposal

Estimating Average Direction of Moose Travel from Weak Information

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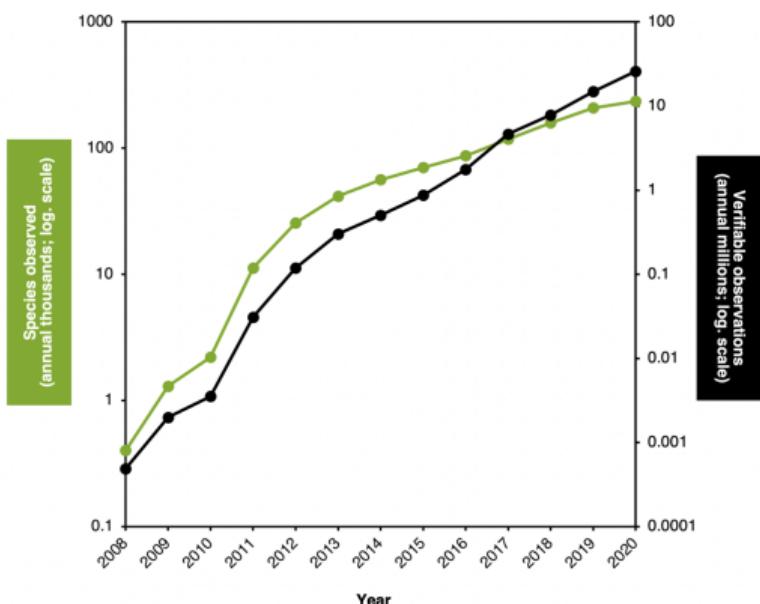
January 27, 2023

Purpose

Citizen Science



Fair Use



Observation

There are people willing to collect field data.



Can citizen scientists be persuaded to collect slightly different data if they provided with a working example?

I Love Moose

Forum Questions

- Do moose usually browse woody foliage approximately perpendicular to the long axis of the branch?
- Is there a published calibration between footprint measurements to body length in moose?
- How much does dry moose scat weigh and vary in dry weight?
- How can I adjust cumulative entropy of moose observations?
- Bounds of integration for marginalizing moose poop density



The moose must flow, but how?

Asked 8 months ago Modified 8 months ago Viewed 4k times

10 answers

Fair Use



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Rank	User	Observations
1	galenseilis	803
2	muir	149
3	desrochersa	136

Fair Use

From Collar to Compass



© Brian Peterson

Fair Use



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Indicators

Overview

- Tracks
- Large snapped plants
- Chewed bark
- Chewed buds
- Scat
- Wildlife cameras

Definition

An observation is a **weak indicator** of orientation if it is compatible with multiple orientations.

Definition

An observation is a **local indicator** of orientation if it describes orientation at a small and particular place.



Partial pooling may allow non-local estimates of orientation.

Tracks



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Large Snapped Plants



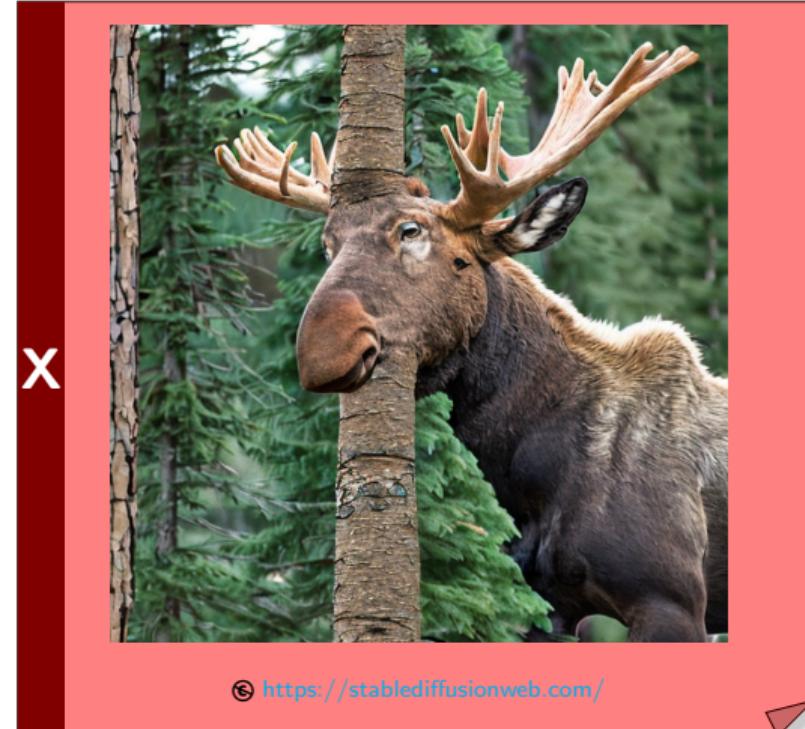
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Chewed Bark



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Chewed Buds



This type of observation can be especially weak.



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Scat

Pellet



Plopette



Plop



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Wildlife Cameras



CAMERA 1

02-06-2020 17:57:59 tasco

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CAMERA 1

04-30-2022 15:13:27 tasco

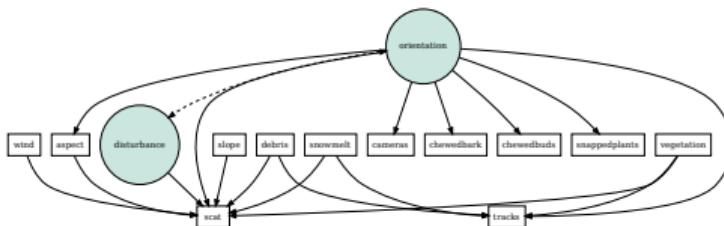
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Covariates & Confounds

Overview

- Wind
- Slope
- Aspect
- Debris
- Vegetation
- Sampling Intensity
- Animal disturbance
- Snow melt

? Would building a structural model accounting for some or all of these variables improve model performance?



! Collecting more data requires additional effort.

Purpose
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Indicators
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Covariates & Confounds
oo

Modelling Approaches
●oo

Collaboration
oo

Modelling Approaches

Bayesian Inference



- Include prior information
- Can study model-implied covariances
- Incorporates epistemic and aleatory uncertainty
- Degrees of freedom are not a problem
- Parameters are random variables

Reporting: Kruschke 2021, *Bayesian Analysis Reporting Guidelines*.
Course: Richard McElreath, *Statistical Rethinking* 2022.

Circular Distributions

- 
- von Mises ($\mu \in \mathbb{R}$, $\kappa \in (0, \infty)$)
 - Uniform ($-\pi \leq a < b \leq \pi$)
 - Truncated normal ($\mu \in \mathbb{R}$, $\sigma > 0$, $-\pi \leq a < b \leq \pi$)
 - Mixtures (any)
 - Bounded distributions can be used to limit possibility.

Mixed Effects / Multilevel / Hierarchical Models



- Account for types of measurements
- Account for spatial proximity of observations
- Allows estimate of both local and global effects



With model $f(\vec{x}; \vec{\theta})$ we may take any θ_j and replace it with

$$\theta_j := \gamma + \sum_{i=1}^k \beta_i \mathbb{I}_i$$

Purpose
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Indicators
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Covariates & Confounds
○○

Modelling Approaches
○○○

Collaboration
●○

Collaboration

Collaboration



I don't have the time to do data collection, or much literature review / writing about moose.



I'm willing to take on the statistical analysis.

- EDA
- Modelling
- Figures



I don't need to be the first author if someone wants to take this project on.



Bayesian inference is mainstream, but not understood or accepted everywhere.