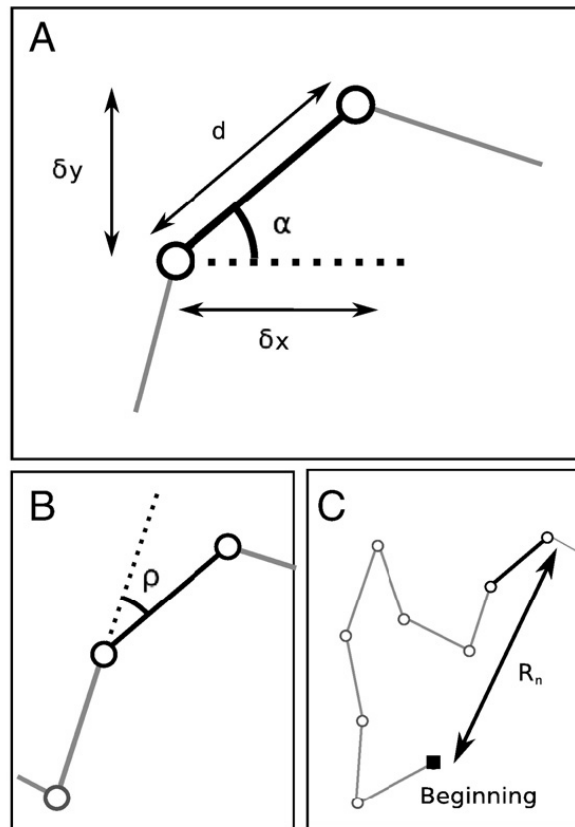


Movement paths analyses



Luca Börger (@lucaborger)
Movement Ecology Workshop
UNESP Rio Claro, 19 March 2018



Swansea University
Prifysgol Abertawe

College of Science
Coleg Gwyddoniaeth

Definition of movement

Movement

A change in the spatial location of the whole individual over time.

Scales of movement:

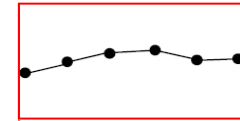
Movement step

A single displacement of the entire body of an organism.

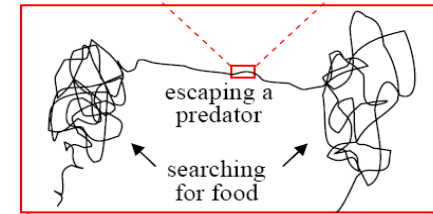
Increasing spatiotemporal scale



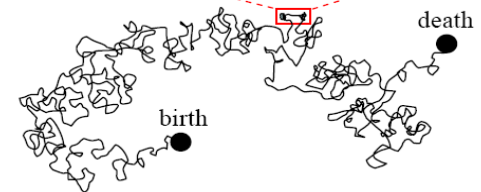
A
Movement steps



B
Movement phases



C
Lifetime track

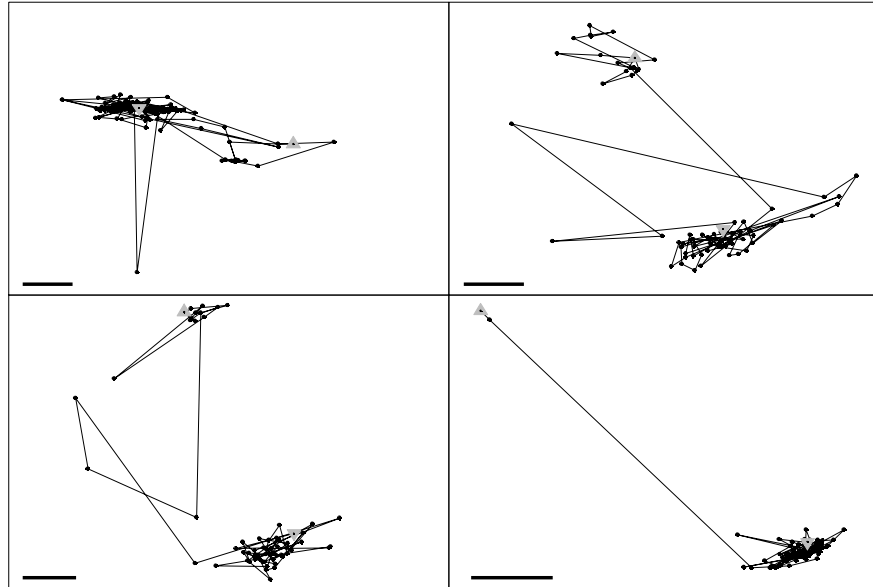


Lifetime track

The complete sequence of steps of an individual from birth to death.

The wider context

Animal movement modes & the movement path



Home range
Migration
Dispersal
Nomadism

CHAPTER 8

Migration quantified: constructing models and linking them with data

Luca Börger, Jason Matthiopoulos, Ricardo M. Holdo, Juan M. Morales, Iain Couzin, and Edward McCauley

In many cases, the daily movements of animals represent in miniature movements similar to migration, and require similar mechanisms of operation.

Woodbury (1941)

(...) we now probably see more clearly than ever before the intimate relation existing between the animals and the conditions which influence their migrations.

Adams (1918)

Multiscale

Behaviour

Oxford Univ. Press (2011)

Concepts: The movement path

ECOLOGICAL INFORMATICS 4 (2009) 34–41



available at www.sciencedirect.com



www.elsevier.com/locate/ecolinf

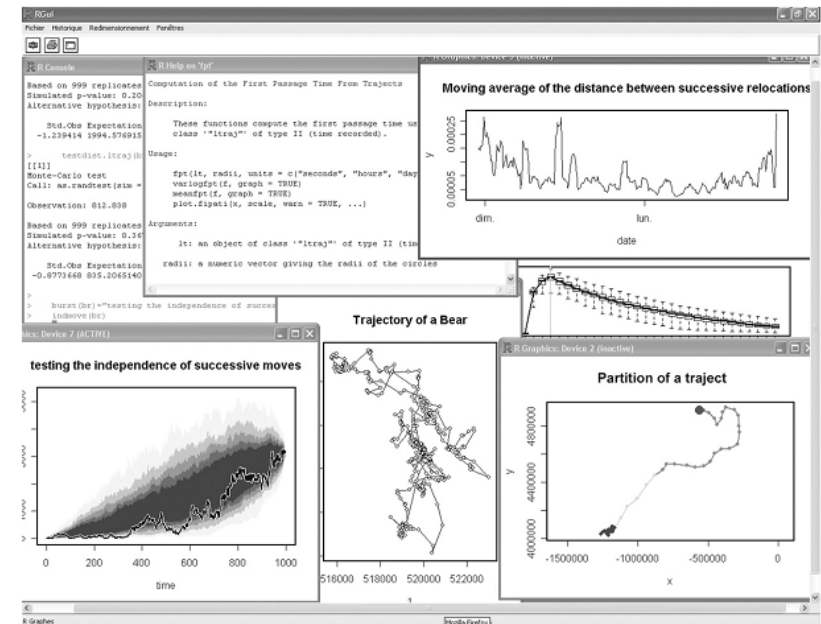
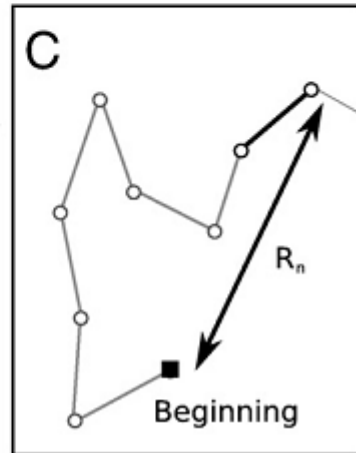
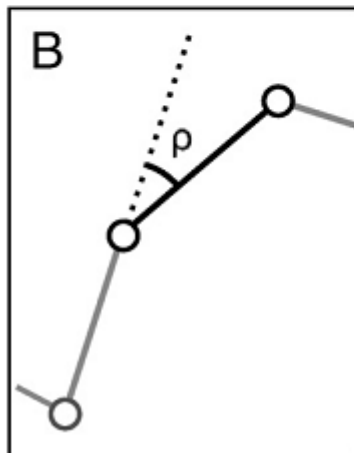
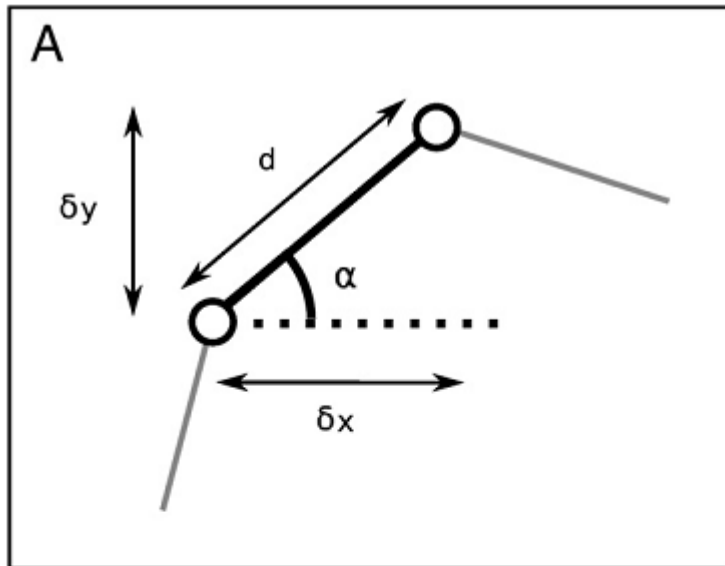


The concept of animals' trajectories from a data analysis perspective

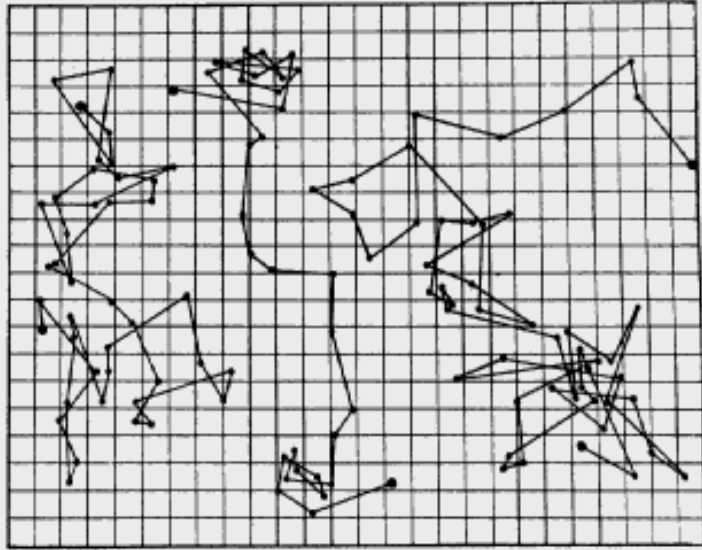
Clément Calenge^{a,b,*}, Stéphane Dray^a, Manuela Royer-Carenzi^a

^aUniversité de Lyon, université Lyon 1, CNRS, UMR 5558, Laboratoire de Biométrie et Biologie Evolutive, 43 boulevard du 11 novembre 1918, Villeurbanne, F-69622, France

^bOffice national de la chasse et de la faune sauvage, 95 rue Pierre Flourens, 34000 Montpellier, France

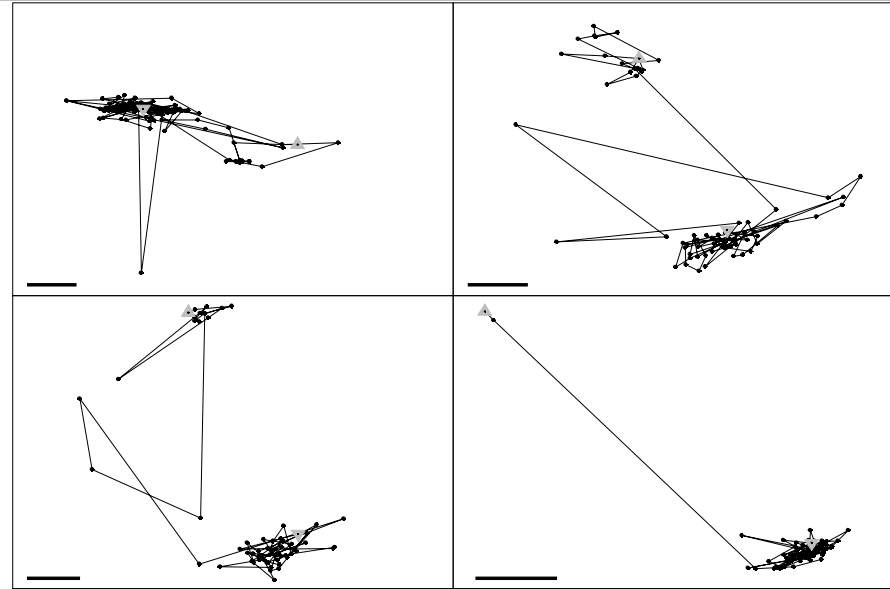


Concepts: The movement path → behaviour?

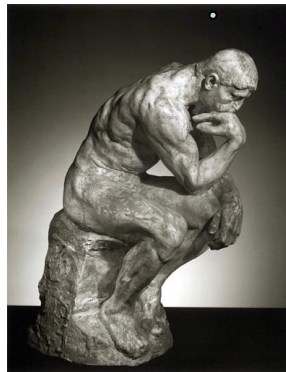


Brownian motion

J.B. Perrin 1926
R. Brown 1827



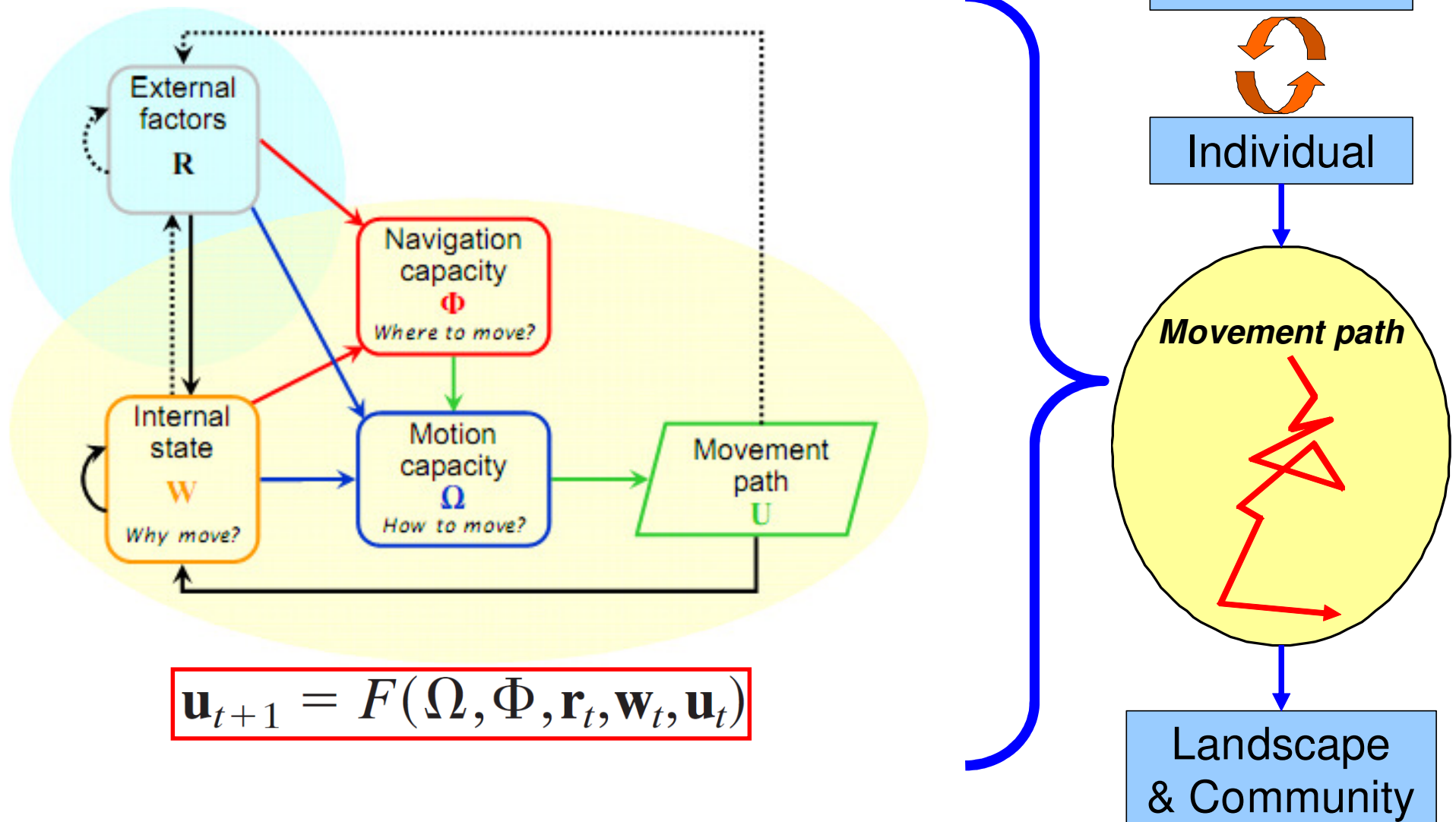
Elk movement



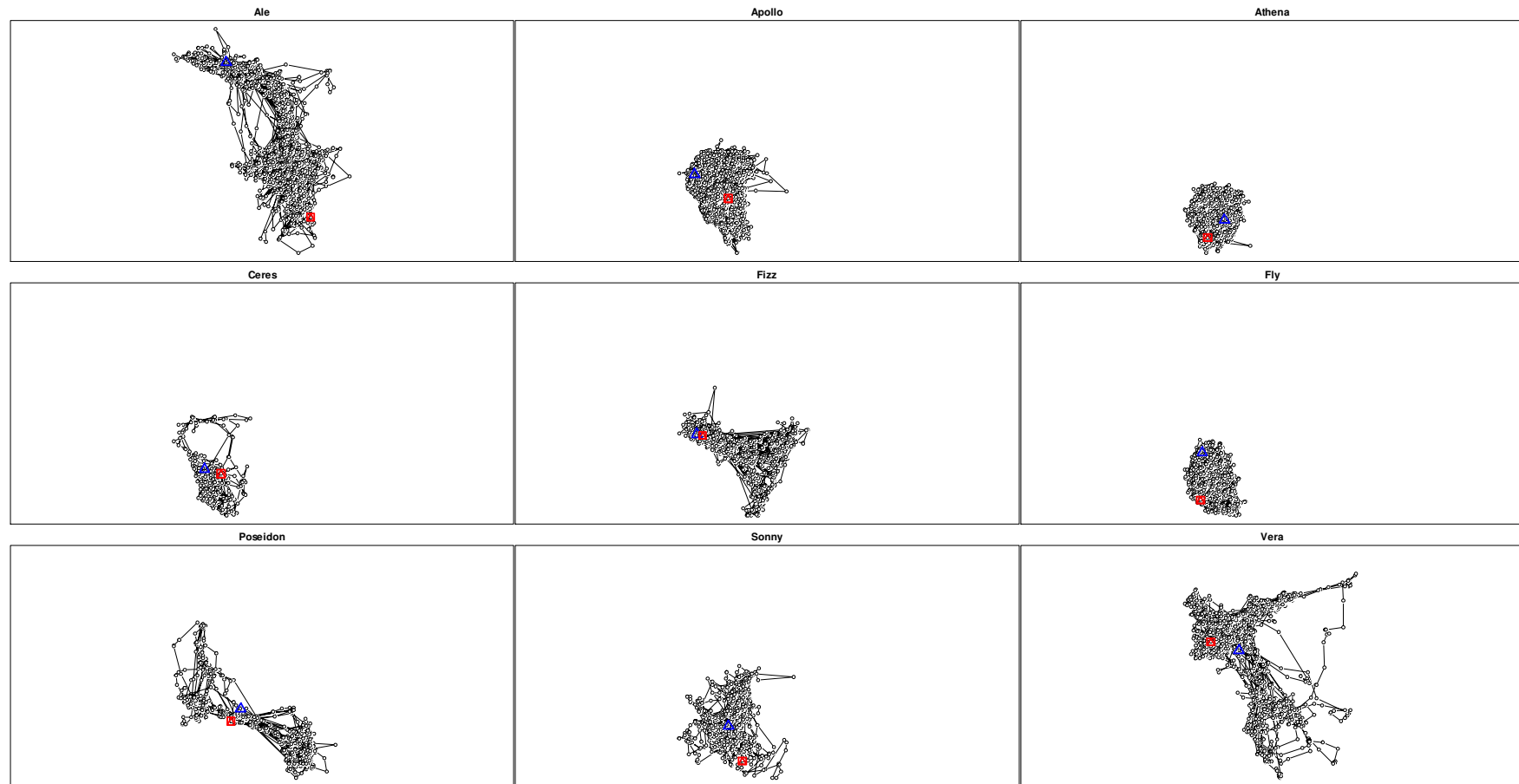
Purely stochastic processes can lead to the emergence of distinct spatial patterns in movement paths

Movement Ecology

→ unified modelling framework



Movement paths



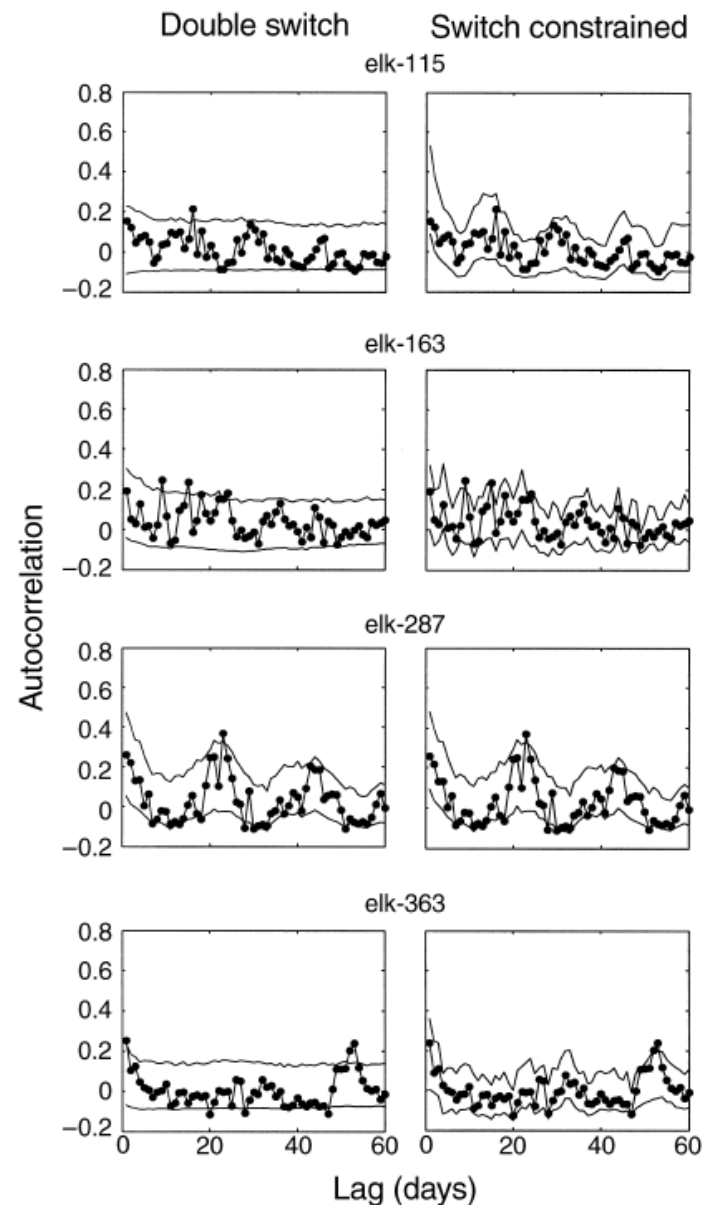
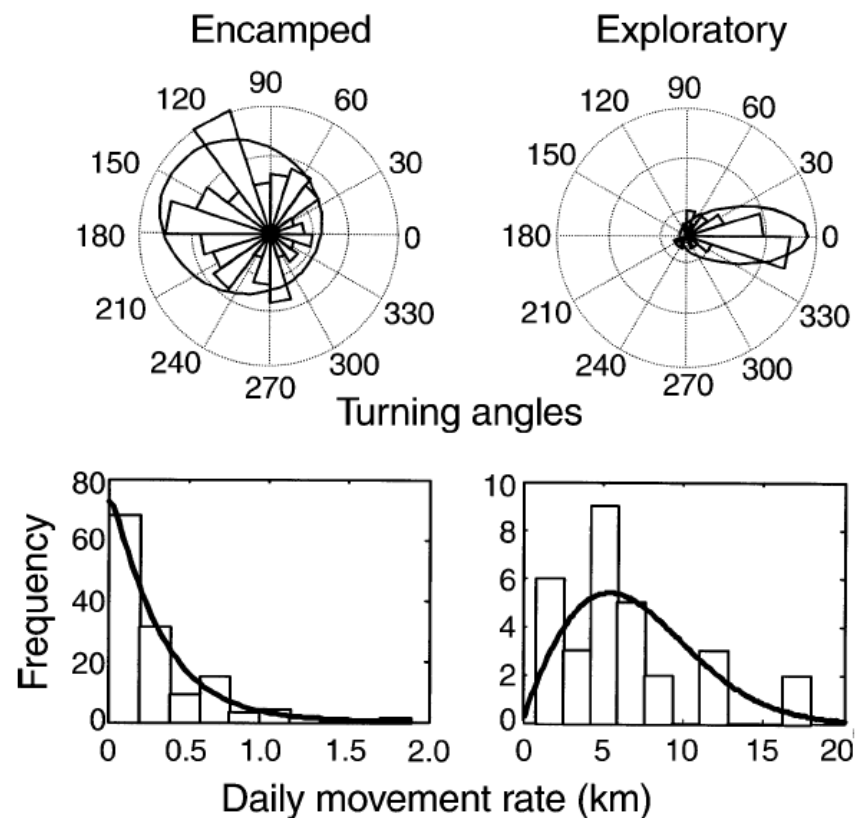
EXTRACTING MORE OUT OF RELOCATION DATA: BUILDING MOVEMENT MODELS AS MIXTURES OF RANDOM WALKS

JUAN MANUEL MORALES,^{1,4} DANIEL T. HAYDON,² JACQUI FRAIR,³ KENT E. HOLSINGER,¹
 AND JOHN M. FRYXELL²

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 Storrs, Connecticut 06269-3043 USA*

²*Department of Zoology, University of Guelph, Guelph, Ontario, Canada N1G 2W1*

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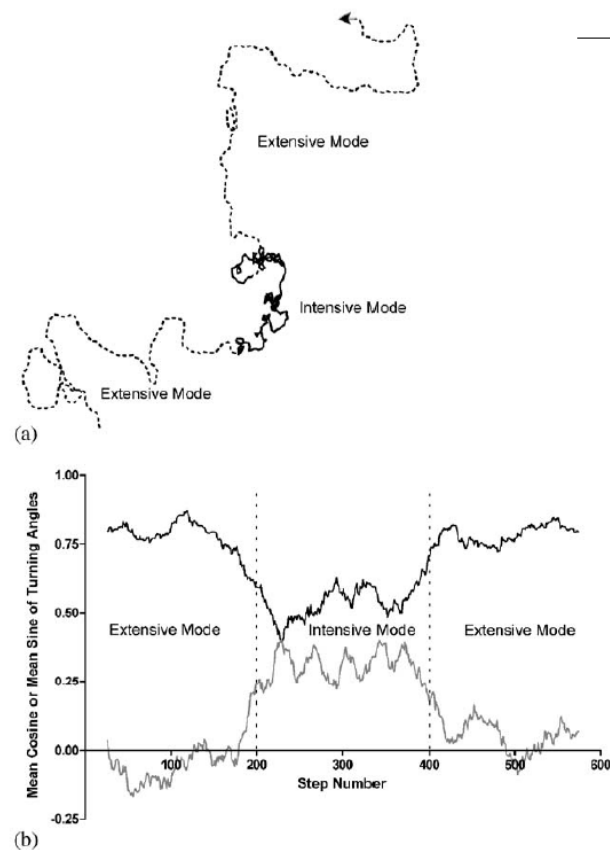


How to reliably estimate the tortuosity of an animal's path: straightness, sinuosity, or fractal dimension?

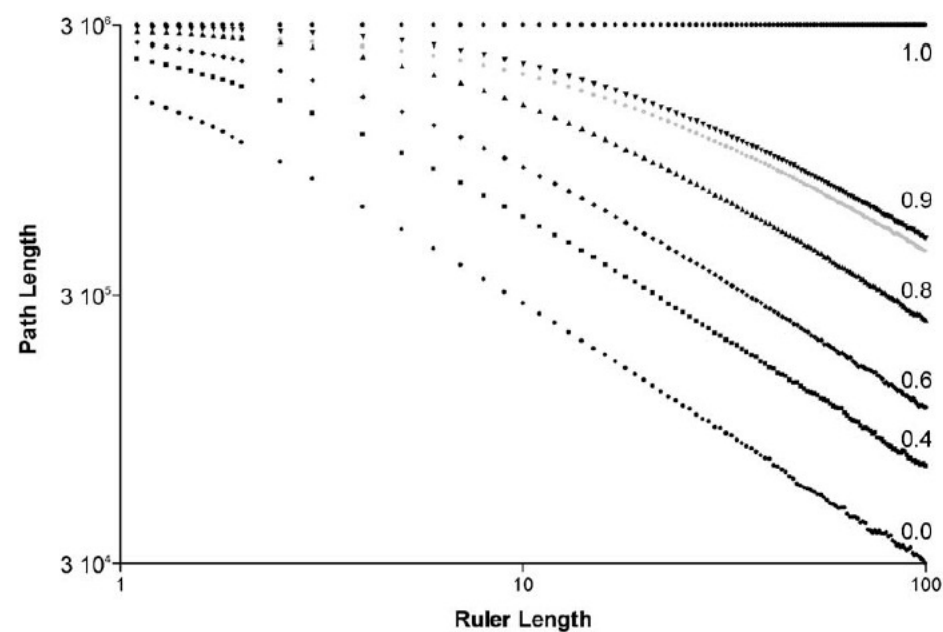
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Received 14 November 2003; received in revised form 19 March 2004; accepted 26 March 2004



S. Benhamou / Journal of Theoretical Biology 229 (2004) 209–220



IDEA AND PERSPECTIVE

Of scales and stationarity in animal movements

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Évolutive, CNRS UMR 5175, Mont-
pellier, France

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E-mail: simon.benhamou@cefe.cnrs.fr

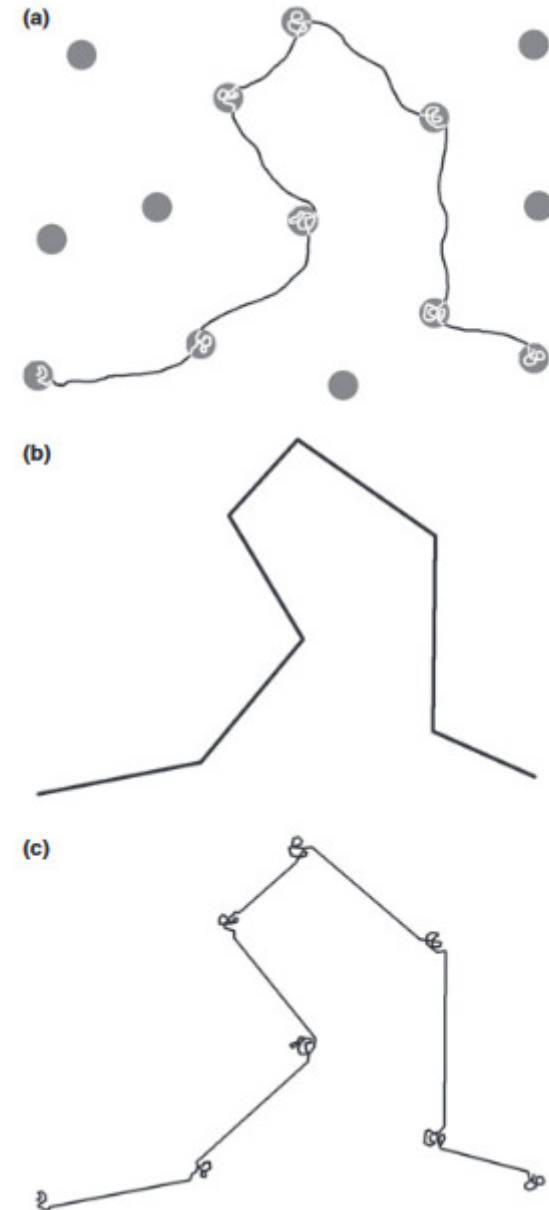
Abstract

With recent technological advances in tracking devices, movements of numerous animal species can be recorded with a high resolution over large spatial and temporal ranges. This opens promising perspectives for understanding how an animal perceives and reacts to the multi-scale structure of its environment. Yet, conceptual issues such as confusion between movement scales and searching modes prevent us from properly inferring the movement processes at different scales. Here, I propose to build on stationarity (i.e. stability of statistical parameters) to develop a consistent theoretical framework in which animal movements are modelled as a generic composite multi-scale multi-mode random walk model. This framework makes it possible to highlight scales that are relevant to the studied animal, the nature of the behavioural processes that operate at each of these different scales, and the way in which the processes involved at any given scale can interact with those operating at smaller or larger scales. This explicitly scale-focused approach should help properly analyse actual movements by relating, for each scale and each mode, the values of the main model parameters (speed, short- and long-term persistences, degree of stochasticity) to the animal's needs and skills and its response to its environment at multiple scales.

Keywords

diffusion-advection, home range, Lévy walk, navigation, pattern and process, random walk, searching modes, space use.

Ecology Letters (2014) 17: 261–272

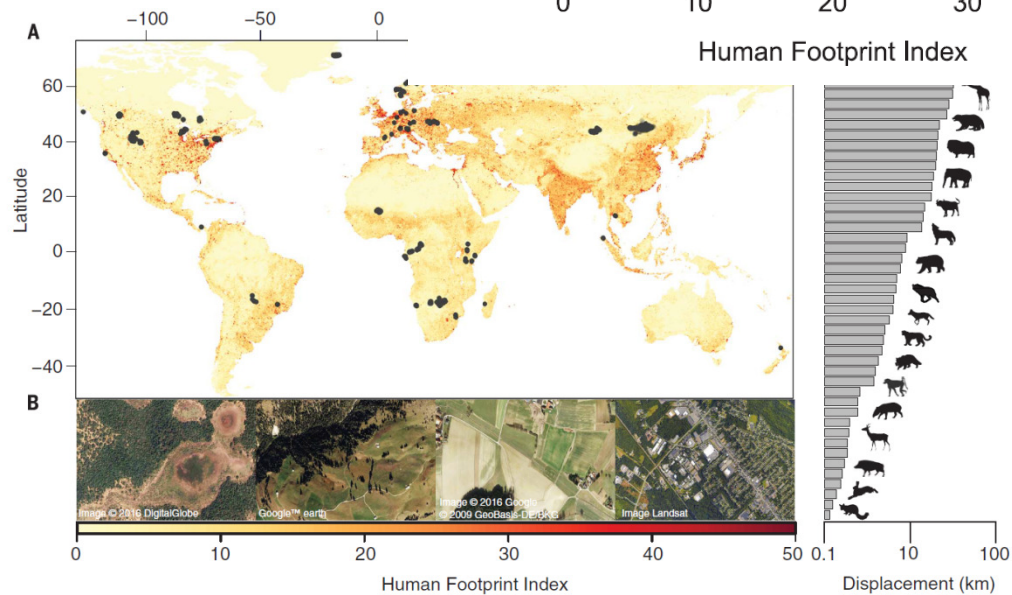
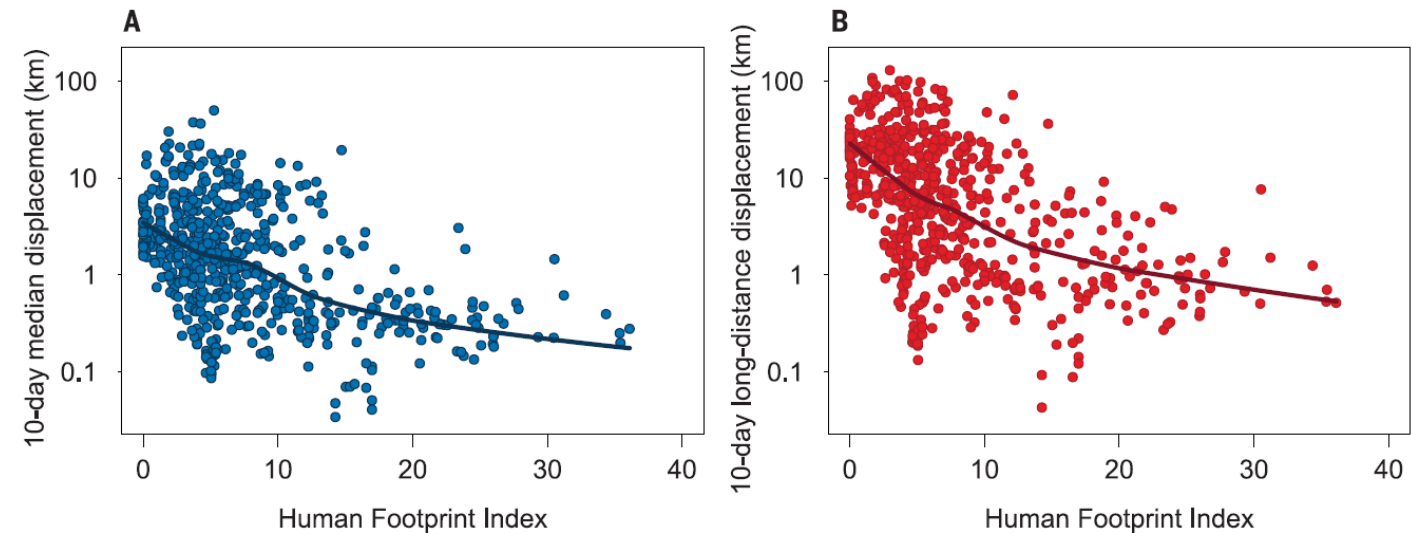


Moving in the Anthropocene: Global reductions in terrestrial mammalian movements

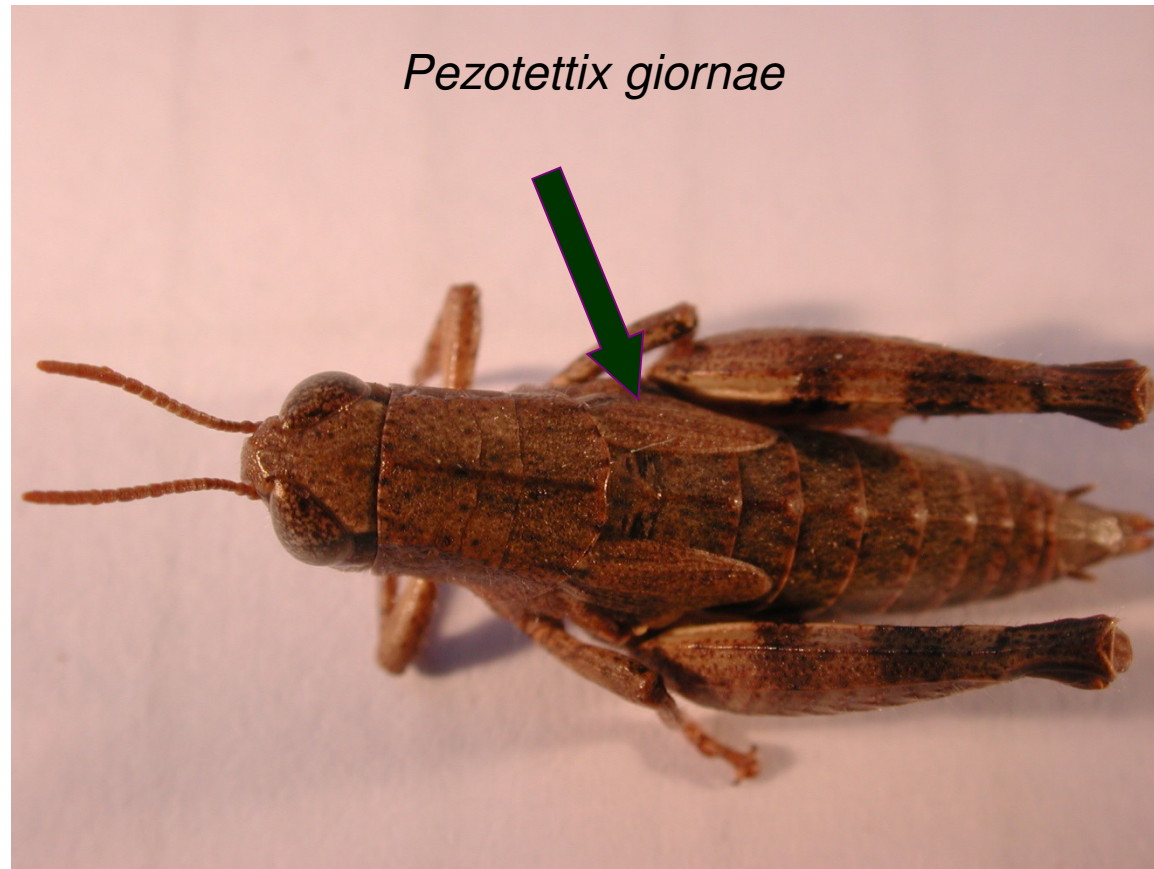
Marlee A. Tucker^{1,2,*}, Katrin Böhning-Gaese^{1,2}, William F. Fagan^{3,4}, John M. Fryxell⁵, Bram Van Moo...

+ See all authors and affiliations

Science 26 Jan 2018:
Vol. 359, Issue 6374, pp. 466-469
DOI: 10.1126/science.aam9712



3.Land use effects on movement capacity & endurance? *Study species & sampling design*



8 fields (4 old/stable grasslands, 4 young/disturbed)

10 individuals (5 female, 5 male)/field – 79 total

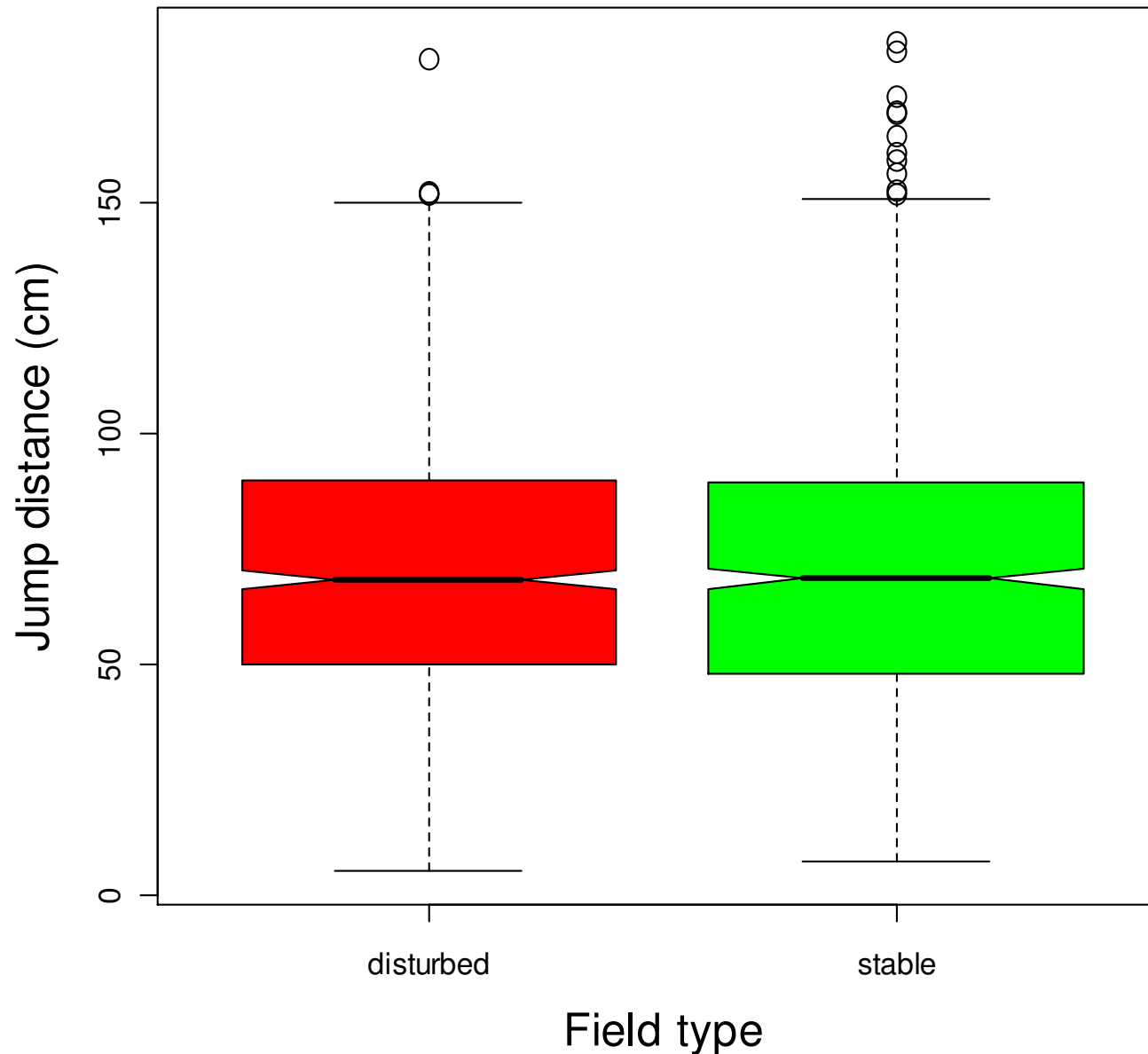
30 escape jumps (simulated attacks)

2281 jumps

Börger (unpubl.)

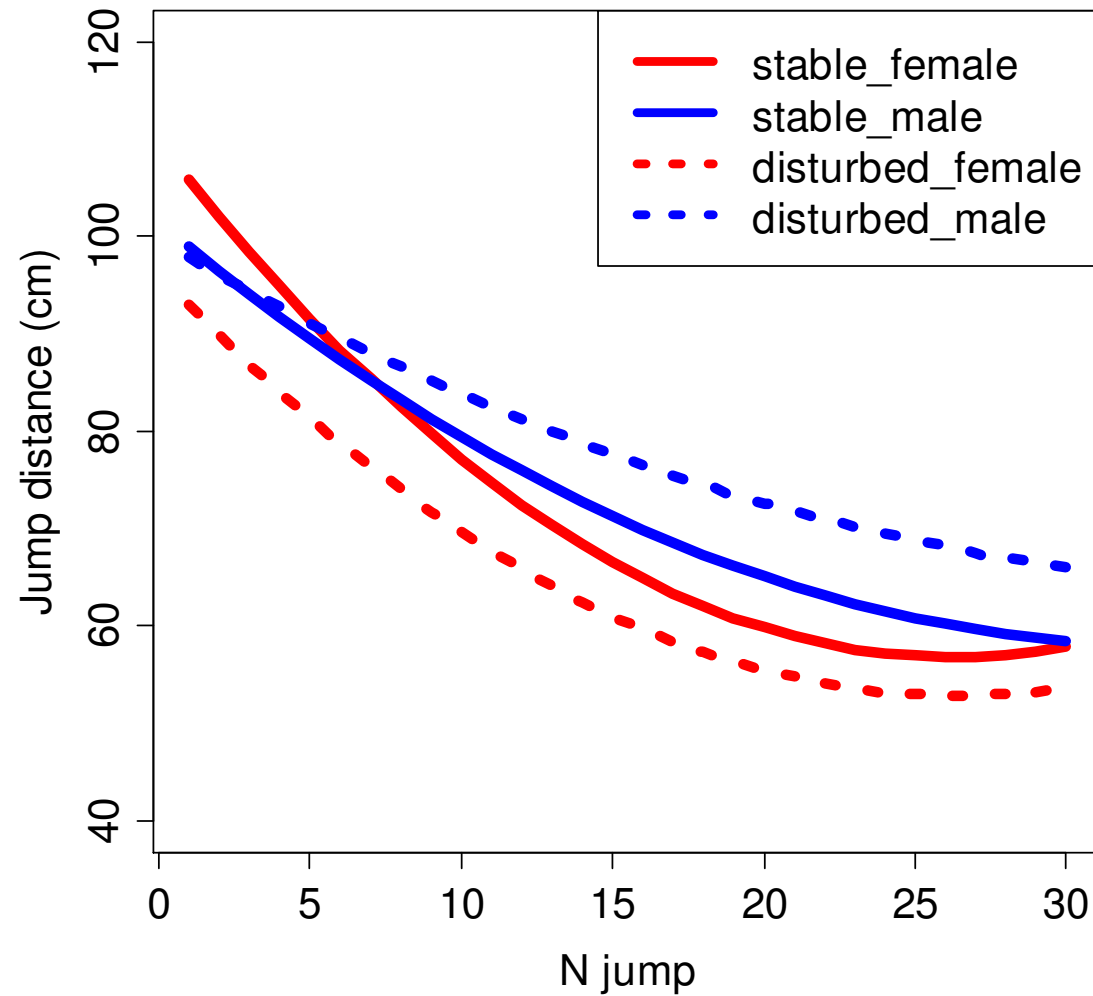
3.Land use effects on movement capacity & endurance?

Results: mean escape distance



3.Land use effects on movement capacity & endurance?

Results: endurance



3.Land use effects on movement capacity & endurance?

Results: total distance covered

