MOVEMENT ECOLOGY • TELEMETRY • CONSERVATION

Advanced Animal Movement Modelling Training Workshop

From telemetry data to ecological inference and conservation action

DATE

16–17 September 2026

VENUES

- NITheCS Seminar Room
  Merensky Building
  Stellenbosch University
  South Africa
- Online

LEAD FACILITATOR

Dr Josh A. Cullen
(University of California Santa Cruz, USA)

OVERVIEW

Animal movement ecology has advanced rapidly over the past decade, driven by improvements in wildlife telemetry, remote sensing, environmental data products, and statistical modelling. Modern movement analyses increasingly integrate behavioural processes, habitat selection, and space use to address fundamental ecological questions and inform conservation planning.

This workshop provides hands-on training in contemporary movement ecology workflows using R and introduces advanced modelling frameworks that link animal decision-making, movement behaviour, habitat use, and conservation outcomes.

It combines conceptual lectures, practical coding sessions, and collaborative research discussions using a real African wildlife telemetry dataset.

WHO SHOULD ATTEND?

Postgraduate students in ecology, zoology, conservation biology, statistics, mathematics, data science, and related fields.

Quantitative ecologists and wildlife researchers.

Wildlife telemetry and tracking practitioners.

Conservation NGOs and protected area managers.

REGISTER TO ATTEND

Register **for free by 11 September 2026**.
In-person places are limited and will be allocated on a first-come, first-served basis.
Participants should have a **working knowledge of R and basic statistical modelling**.

Reserve an in-person place:
Email Dr Katharina von Dürckheim:
kat@sun.ac.za

Register to attend online:
Visit https://bit.ly/4bTYNVX
Or scan the QR code below:

Hosted by Stellenbosch University Department of Mathematical Sciences, Wildlife Free to Roam, NITheCS and UC Santa Cruz.

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WORKSHOP GOALS

- Build regional capacity in modern animal movement modelling.
- Bridge ecological theory with quantitative and statistical modelling approaches.
- Introduce contemporary frameworks for analysing movement, behaviour, habitat selection and space use.
- Develop practical skills in reproducible R-based telemetry workflows.
- Extract environmental data from static and/or time-matched dynamic layers.
- Explore emerging approaches in Bayesian modelling and machine learning for movement ecology.
- Connect movement analyses to conservation planning and management applications.
- Foster collaboration among students, researchers, conservation practitioners, NGOs, and wildlife managers.

PREPARE AND PARTICIPATE

WORKSHOP PREPARATION

- Telemetry datasets (hourly elephant telemetry data) and environmental covariates will be provided.
- Participants will receive preparatory materials and installation instructions before the workshop, including data-cleaning workflows, environmental data acquisition tutorials, and introductory R scripts.
- Participants should have a working knowledge of R and basic statistical modelling. This is not an introductory R course.

WHAT YOU WILL LEAVE WITH

- A complete workflow for telemetry data analysis.
- Experience with modern movement ecology methods.
- Practical skills in habitat selection, behavioural modelling, and space use estimation.
- Exposure to Bayesian and machine-learning approaches.
- Reproducible code and teaching materials for future use, with links to R code, lectures, and course content on the GitHub repositories and YouTube channels of Josh Cullen and Wildlife Free to Roam.
- New collaborations across African movement ecology and conservation networks.

RELEVANT SOFTWARE AND R PACKAGES

Software

- R and RStudio (or Positron/VS Code)
- Account for Google Earth Engine (*recommended*)
- GeoLibre (in-browser GIS)
- Stan

R Packages

Movement Analysis

- move
- amt
- ctmm
- aniMotum
- bayesmove

Behavioural Modelling

- momentuHMM
- aniMotum

Spatial Analysis

- sf
- terra
- exactextractr

Habitat Selection

- amt
- glmmTMB
- survival
- INLA
- inlabru

Bayesian Modelling

- brms
- bayesplot
- INLA
- inlabru
- shinystan
- posterior

Data Science & Visualisation

- tidyverse (dplyr, ggplot2, readr, tidyr, stringr, forcats, purrr, lubridate, tibble)
- tidyterra
- viridis
- MetBrewer
- furrr
- future
- units

Earth Observation

- rstac
- geodata

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PROGRAMME

DAY 1 | 16 SEPTEMBER 2026

Animal Movement Patterns

08:30–10:15	**Session 1: Foundations of Movement Ecology** • The movement ecology paradigm • Wildlife telemetry systems and sampling design • Example applications to conservation • **Hands-on coding:** Data exploration, cleaning, and processing
10:15–10:30	TEA BREAK
10:30–12:15	**Session 2: Space Use Estimation** • Utilisation distributions and ecological interpretation • Occurrence versus range distributions • KDE, dynamic Brownian bridge movement models, and AKDE approaches • Individual- and population-level space use estimation • Measuring spatial overlap • **Hands-on coding:** Estimate space use using multiple methods at the individual and population levels
12:15–13:15	LUNCH
13:15–15:45	**Session 3: Behavioural State Modelling** • Defining behavioural states, selecting an appropriate method, and understanding the influence of temporal resolution • Discrete versus continuous states • Hidden Markov models (HMMs) and state-space models (SSMs) • Interpreting estimated states and drawing ecological inferences • Integrating accelerometer and auxiliary sensor data • **Hands-on coding:** Regularise tracks, estimate behavioural states using HMMs and SSMs, and interpret model estimates
15:45–16:00	TEA BREAK
16:00–16:30	Q&A Session
18:00–21:00	SOCIAL: Drinks at a Stellenbosch wine farm (TBC)

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DAY 2 | 17 SEPTEMBER 2026

Environmental Data Acquisition, Habitat Selection and Emerging Methods

08:30–10:00	**Session 4: Environmental Data Access and Extraction** • Remote sensing products for movement ecology • Land-use/land-cover data, vegetation indices, temperature, and dynamic water layers • Local geoprocessing and cloud-based workflows via Google Earth Engine • Environmental annotation of movement tracks • **Hands-on coding:** Download and process remote-sensing data, manage large datasets, and extract time-matched environmental layers for telemetry data.
10:00–10:15	TEA BREAK
10:15–12:45	**Session 5: Species–Habitat Associations** • Defining and comparing approaches to habitat-selection analysis • Resource selection functions (RSFs), step selection functions (SSFs), integrated SSFs (iSSFs) • Scale dependence in habitat selection • Behavioural state-specific habitat selection • **Hands-on coding:** Fit simple RSF, SSF, and iSSF models; interpret results, generate spatial predictions, and compare inferences
12:45–13:45	LUNCH
13:45–15:15	**Session 6: Bayesian Modelling for Ecological Inference** • Crash course in Bayesian modelling and model checking • Advantages and limitations of implementing Bayesian models • *Post hoc* Bayesian analyses of space use and behavioural states using Stan and brms • Bayesian hierarchical RSF/SSF models using INLA • Including spatial random effects in RSFs using INLA • **Hands-on coding:** Complete a Bayesian workflow, then explore faster implementations of advanced models using INLA
15:15–15:30	TEA BREAK
15:30–16:00	**Session 7: Machine Learning and Emerging Directions** • Machine learning applications in movement ecology • Behavioural classification and habitat selection • Random forests, gradient boosting machines, and Gaussian processes • Deep learning applications for accelerometer data and SSFs • Emerging directions in movement ecology and predictive modelling
16:00–16:30	Q&A Session
18:00–21:00	SOCIAL: Drinks at a Stellenbosch wine farm (TBC)