Research Questions

2025-11-28

Table of contents

Below are some examples of research questions that could be explored with the dingo GPS data set. These are just suggestions to get you thinking - feel free to come up with your own questions too!

The focus of papers that have previously analysed this data focused on broad-scale behaviours like home ranges (Newsome, Ballard, Dickman, Fleming, and Howden 2013) and landscape-scale resource selection (Newsome, Ballard, Dickman, Fleming, and Ven 2013), but there are a number of other research questions that could be addressed, particularly at fine-scales.

Some suggestions are:

How do dingo behaviours differ between individuals at mine sites and those elsewhere?

- Do non-mine dingoes spend more time in higher energy foraging states?
- When do they switch behaviours, how does that differ between mine/non-mine IDs

Methods

- Hidden Markov models (Langrock et al. 2012; McClintock et al. 2012)
- Behavioural change point analysis (BCPA) (Gurarie, Andrews, and Laidre 2009; Gurarie 2013; Gurarie et al. 2016)

What is the influence of the surrounding environment on the dingoes' movement?

- Do they select for linear features such as roads?
- Does their movement and habitat selection differ between mine and non-mine sites?

Methods

- Step selection functions (SSFs) (Fortin et al. 2005; Thurfjell, Ciuti, and Boyce 2014; Johannes Signer, Fieberg, and Avgar 2019)

How do dingoes' behaviours change across the day?

- Are there temporal dynamics in their movement and habitat selection?
- Does the probability of switching behaviours vary throughout the day?

Methods

- Descriptive (summarising data across the day)
- Temporally dynamic SSFs (Forrest et al. 2024; Klappstein et al. 2024)
- HMMs with a temporal covariate on state transition matrix

How do dingoes connect through the landscape?

- What are their connectivity pathways and movement corridors?
- Would adding more roads increase or decrease their landscape connectivity?

Methods

- Step selection functions with simulations (J. Signer et al. 2023; Hofmann et al. 2023; Forrest et al. 2024; Cowan et al. 2025)
- Connectivity analyses
  - Betweenness/connectivity (Hofmann et al. 2023; Cowan et al. 2025)
  - Least-cost paths (Etherington 2016),
  - ConScape (Dorber et al. 2023; Van Moorter et al. 2023)
  - CircuitScape https://circuitscape.org/

Do dingoes near mines have a higher probability of disease transmission?

- Do dingoes near mines revisit the same sites more often, such as dumps?
- Which dingoes interact more often with other individuals?
- Are dingoes at mine sites have more connected social networks?

Methods

- Social network analysis
- Revisitation (Bracis, Bildstein, and Mueller 2018)

References

Bracis, Chloe, Keith L Bildstein, and Thomas Mueller. 2018. "Revisitation analysis uncovers spatio-temporal patterns in animal movement data." *Ecography* 41 (November): 1801–11. https://doi.org/10.1111/ecog.03618.

Cowan, Mitchell A, Scott W Forrest, Samantha A Setterfield, Judy A Dunlop, Lesley A Gibson, and Dale G Nimmo. 2025. "The impact of mining on animal movement and landscape connectivity revealed through simulations and scenarios." *Ecological Applications* 35 (October): e70134. https://doi.org/10.1002/eap.70134.

Dorber, Martin, Manuela Panzacchi, Olav Strand, and Bram van Moorter. 2023. "New indicator of habitat functionality reveals high risk of underestimating trade-offs among sustainable development goals: The case of wild reindeer and hydropower." *Ambio* 52 (April): 757–68. https://doi.org/10.1007/s13280-022-01824-x.

Etherington, Thomas R. 2016. "Least-Cost Modelling and Landscape Ecology: Concepts, Applications, and Opportunities." *Current Landscape Ecology Reports* 1 (March): 40–53. https://doi.org/10.1007/s40823-016-0006-9.

Forrest, Scott W, Dan Pagendam, Michael Bode, Christopher Drovandi, Jonathan R Potts, Justin Perry, Eric Vanderduys, and Andrew J Hoskins. 2024. "Predicting fine-scale distributions and emergent spatiotemporal patterns from temporally dynamic step selection simulations." *Ecography*, December. https://doi.org/10.1111/ecog.07421.

Fortin, Daniel, Hawthorne L Beyer, Mark S Boyce, Douglas W Smith, Thierry Duchesne, and Julie S Mao. 2005. "Wolves influence elk movements: Behavior shapes a trophic cascade in Yellowstone National Park." *Ecology* 86 (May): 1320–30. https://doi.org/10.1890/04-0953.

Gurarie, Eliezer. 2013. "Behavioral Change Point Analysis in R: The bcpa package." *Behavioural Change Point Analysis in R: The Bcpa Package*, 1–16.

Gurarie, Eliezer, Russel D Andrews, and Kristin L Laidre. 2009. "A novel method for identifying behavioural changes in animal movement data." *Ecology Letters* 12 (May): 395–408. https://doi.org/10.1111/j.1461-0248.2009.01293.x.

Gurarie, Eliezer, Chloe Bracis, Maria Delgado, Trevor D Meckley, Ilpo Kojola, and C Michael Wagner. 2016. "What is the animal doing? Tools for exploring behavioural structure in animal movements." *The Journal of Animal Ecology* 85 (January): 69–84. https://doi.org/10.1111/1365-2656.12379.

Hofmann, David D, Gabriele Cozzi, John W McNutt, Arpat Ozgul, and Dominik M Behr. 2023. "A three-step approach for assessing landscape connectivity via simulated dispersal: African wild dog case study." *Landscape Ecology* 38 (February): 981–98. https://doi.org/10.1007/s10980-023-01602-4.

Klappstein, Natasha J, Théo Michelot, John Fieberg, Eric J Pedersen, and Joanna Mills Flemming. 2024. "Step selection functions with non-linear and random effects." *Methods in Ecology and Evolution*, June. https://doi.org/10.1111/2041-210x.14367.

Langrock, Roland, Ruth King, Jason Matthiopoulos, Len Thomas, Daniel Fortin, and Juan M Morales. 2012. "Flexible and practical modeling of animal telemetry data: hidden Markov models and extensions." *Ecology* 93 (November): 2336–42. https://doi.org/10.1890/11-2241.1.

McClintock, Brett T, Ruth King, Len Thomas, Jason Matthiopoulos, Bernie J McConnell, and Juan M Morales. 2012. "A general discrete-time modeling framework for animal movement using multistate random walks." *Ecological Monographs* 82 (August): 335–49. https://doi.org/10.1890/11-0326.1.

Newsome, Thomas M, Guy-Anthony Ballard, Christopher R Dickman, Peter J S Fleming, and Chris Howden. 2013. "Anthropogenic resource subsidies determine space use by Australian arid zone dingoes: an improved resource selection modelling approach." *PloS One* 8 (May): e63931. https://doi.org/10.1371/journal.pone.0063931.

Newsome, Thomas M, Guy-Anthony Ballard, Christopher R Dickman, Peter J S Fleming, and Remy van de Ven. 2013. "Home range, activity and sociality of a top predator, the dingo: a test of the Resource Dispersion Hypothesis." *Ecography* 36 (August): 914–25. https://doi.org/10.1111/j.1600-0587.2013.00056.x.

Signer, J, J Fieberg, B Reineking, U Schlägel, B Smith, N Balkenhol, and T Avgar. 2023. "Simulating animal space use from fitted integrated Step-Selection Functions (iSSF)." *Methods in Ecology and Evolution*, December. https://doi.org/10.1111/2041-210x.14263.

Signer, Johannes, John Fieberg, and Tal Avgar. 2019. "Animal movement tools (amt): R package for managing tracking data and conducting habitat selection analyses." *Ecology and Evolution* 9 (January): 880–90. https://doi.org/10.1002/ece3.4823.

Thurfjell, Henrik, Simone Ciuti, and Mark Boyce. 2014. "Applications of step-selection functions in ecology and conservation." *Movement Ecology* 2 (February): 4. https://doi.org/10.1186/2051-3933-2-4.

Van Moorter, Bram, Ilkka Kivimäki, Andreas Noack, Robin Devooght, Manuela Panzacchi, Kimberly R Hall, Pierre Leleux, and Marco Saerens. 2023. "Accelerating advances in landscape connectivity modelling with the ConScape library." *Methods in Ecology and Evolution* 14 (January): 133–45. https://doi.org/10.1111/2041-210x.13850.