Tal Avgar, Ph.D.

Assistant professor of Wildlife Movement Ecology
Department of Wildland Resources and Ecology Center,
Utah State University, Logan UT 84322-5200
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Research Interests

Animal movement and space-use ecology, wildlife population biology, consumer-resource interactions, ecological modelling and biometry

Current Research Program

Density-dependent wildlife space-use ecology: investigating the relationship between local population-level processes and individual-level habitat-selection and movement behaviors.

Education

2008 – 2013 Ph.D. research under the supervision of Prof. John Fryxell. Integrative Biology program, University of Guelph, Ontario, Canada. Thesis title: *From diffusion to cognition: analytical, statistical and mechanistic approaches to the study of animal movement*.

2004 – 2007 M.Sc. research under the supervision of Prof. Ran Nathan. Environmental Science program, The Hebrew University of Jerusalem, Israel. Graduated *magna cum laude*. Thesis title: *Linking foraging traits of seed-eating ants to spatial patterns of surviving seeds*.

2001 – 2004 B.Sc. in Geology and Biology, The Hebrew University of Jerusalem, Israel.

Significant Awards and Honours

2021 QCNR Undergraduate Research Mentor of the Year. Utah State University, USA.

2015 The Banting Postdoctoral Fellowship. Federal government, Canada.

2013 The Killam Postdoctoral Fellowship. University of Alberta, Edmonton, Alberta, Canada.

2009 NSERC Vanier Canada Graduate Scholarship. Federal government, Canada.

Research and Teaching Experience (2014-present)

2018 – Assistant professor, Department of Wildland Resources, Utah State University, Logan, Utah, USA. PI – *Wildlife Space-Use Ecology* research group. Courses taught: *Space-Use Ecology*, *Graduate Ecology*, *Ecology of Our Changing World*.

2017 – 2018 Postdoctoral fellow, Department of Integrative Biology, University of Guelph, Canada.

2014 – 2017 Killam and then Banting postdoctoral fellow, Department of Biological Sciences, University of Alberta, Canada. Instructor, Bamfield Marine Science Centre, Canada: *Ecological Models and Data* (grad level).

2013 – 2014 Postdoctoral fellow, Department of Integrative Biology, University of Guelph, Canada.

Publications (* signifies mentees)

Berger*, D., J. Huang*, and **T. Avgar** (in press) Book review: *Species-Habitat Associations: Spatial Data, Predictive Models, and Ecological Insights.* J. Matthiopoulos, J. Fieberg, and G. Aarts. 2020. University of Minnesota Libraries Publishing, Minneapolis, Minnesota, USA. 103 pp. $0.00 online. ISBN: 978-1-946135-68-1. *Journal of Wildlife Management*.

Hart*, R., B.J. Smith*, V. Winter*, and **T. Avgar** (in press) Book review: *Habitat Ecology and Analysis*. J.A. Veech. 2021. Oxford University Press, Oxford, United Kingdom. 215 pp. $49.95 paperback. ISBN: 978-0-19-882941-6. *Journal of Wildlife Management*.

Kashetsky, T., **T. Avgar**, and R. Dukas (in press) The cognitive ecology of animal movement: evidence from birds and mammals. *Frontiers in Ecology and Evolution* (Research Topic: Cognitive Movement Ecology).

Fieberg, J., J. Signer, B.J. Smith*, and **T. Avgar** (2021) A 'How-to' guide for interpreting parameters in resource- and step-selection analyses. *Journal of Animal Ecology*, 90: 1027-1043.

Avgar, T., G. Betini, and J. Fryxell (2020) Habitat selection patterns are density-dependent under the Ideal Free Distribution. *Journal of Animal Ecology*, 89: 2777-2787.

Garland, L., E. Neilson, E. Bayne, **T. Avgar**, and S. Boutin (2020) Random encounter and staying time model testing with human volunteers. *Journal of Wildlife Management*, 84: 1179-1184.

Fryxell, J., **T. Avgar**, L. Boyan, A. Rodgers, J. Shuter, I. Thompson, D. Reid, A. Kittle, A. Mosser, S. Newmaster, G. Street, G. Brown, B. Patterson, and J. Baker (2020) Anthropogenic disturbance and population viability of Woodland Caribou in Ontario. *Journal of Wildlife Management*, 84: 636-650.

Betini, G., X. Wang, **T. Avgar**, M. Guzzo, and J. Fryxell (2020) Food availability modulates temperature-dependent effects on growth, reproduction, and survival in *Daphnia magna*. *Ecology and Evolution*, 10: 756-762.

Broadley*, K., C. Burton, **T. Avgar**, and S. Boutin (2020) Density-dependent space use affects interpretation of camera detection-rate indices. *Ecology and Evolution*, 9: 14031-14041.

Dickie*, M., S. McNay, G. Sutherland, M. Cody, and **T. Avgar** (2020) Corridors or risk? Movement along, and use of, linear features vary predictably among large mammal predator and prey species. *Journal of Animal Ecology*, 89: 623-634.

Betini, G., **T. Avgar**, K. McCann, and J. Fryxell (2019) Temperature triggers a non-linear response in resource-consumer interaction strength. *Ecosphere*, 10: e02787.

Signer, J., J. Fieberg, and **T. Avgar** (2019) Animal Movement Tools (amt): R package for managing tracking data and conducting habitat selection analyses. *Ecology and Evolution*, 9: 880-890.

Ladle*, A., **T. Avgar**, G. Stenhouse, M. Wheatley, S. Nielsen, and M.S. Boyce (2019) Grizzly bear response to spatio-temporal variability in human recreational activity. *Journal of Applied Ecology*, 56: 375-386.

Viejou*, R., **T. Avgar**, G.S. Brown, B. Patterson, D. Reid, *et al*. (2018) Woodland caribou habitat selection patterns in relation to predation risk and forage abundance depend on reproductive state. *Ecology and Evolution*, 8: 5863-5872.

Street**,** G.M., **T. Avgar**, and L. Börger (2018) Net displacement and temporal scaling: model fitting, interpretation, and implementation. *Methods in Ecology and Evolution*, 9: 1503-1517.

Scrafford*, M., **T. Avgar**, R. Heeres, and M.S. Boyce (2018) Roads elicit negative movement and habitat-selection responses by wolverines (*Gulo gulo luscus*). *Behavioral Ecology*, 29: 534-542.

Tucker, M.A., K. Böhning-Gaese, W.F. Fagan , J.M. Fryxell, B. Van Moorter, *et al*. (2018) Global reductions in terrestrial mammalian movements in human-dominated landscapes. *Science*, 359: 466-469.

Neilson*, E., **T. Avgar**, C. Burton, K. Broadley, and S. Boutin (2018) Animal movement affects interpretation of occupancy models from camera trap surveys of unmarked animals. *Ecosphere*, 9: e02092.

Avgar, **T.**, S.R. Lele, J.L. Keim, and M.S. Boyce (2017) Relative Selection Strength: quantifying effect size in habitat- and step-selection inference. *Ecology and Evolution*, 7: 5322-5330.

Signer*, J., J. Fieberg, and **T. Avgar** (2017) Estimating utilization distributions from fitted step-selection functions. *Ecosphere*, 8: e01771.

Betini, G., **T. Avgar**, K.S. McCann, and J.M. Fryxell (2017) Daphnia inhibits the emergence of spatial pattern in a simple consumer-resource system. *Ecology*, 98: 1163-1170.

Scrafford*, M., **T. Avgar**, B. Abercrombie, J. Tigner, and M.S. Boyce (2017) Wolverine habitat selection in response to anthropogenic disturbance in the western Canadian boreal forest. *Forest Ecology and Management*, 395: 27-36.

Kittle**,** A.M., M. Anderson, **T. Avgar**, J.A. Baker, G.S. Brown, *et al*. (2017) Landscape-level wolf space use is correlated with prey abundance, ease of mobility and the distribution of prey habitat. *Ecosphere*, 8: e01783.

Prokopenko*, C., M.S. Boyce, and **T. Avgar** (2017) Characterizing wildlife behavioural responses to roads using integrated step selection analysis. *Journal of Applied Ecology*, 54: 470-479.

Ladle*, A., **T. Avgar**, M. Wheatley, and M.S. Boyce (2017) Predictive modeling of ecological patterns along linear-feature networks. *Methods in Ecology and Evolution*, 8: 329-338.

Betini, G., **T. Avgar**, and J.M. Fryxell (2017) Why are we not evaluating multiple competing hypotheses in Ecology and Evolution? *Royal Society Open Science*, 4: e160756. [*F1000Prime* recommended].

Prokopenko*, C., M.S. Boyce, and **T. Avgar** (2017) Extent-dependent habitat selection in a migratory large herbivore: road avoidance across scales. *Landscape Ecology*, 32: 313-325.

Street**,** G.M., A.R. Rodgers, **T. Avgar**, L.M. Vander Vennen, and J.M. Fryxell (2017) Comparing resource selection and demographic models for predicting animal density. *Journal of Wildlife Management*, 81: 16-25.

Avgar, T., J.R. Potts, M.A. Lewis, and M.S. Boyce (2016) Integrated step selection analysis: bridging the gap between resource selection and animal movement. *Methods in Ecology and Evolution*, 7: 619-630.

McGreer*, M.T., E.E. Mallon, L.M. Vander Vennen, P.A. Wiebe, **T. Avgar**, *et al*. (2015) Selection for forage and avoidance of risk by woodland caribou (*Rangifer tarandus caribou*) at coarse and local scales. *Ecosphere*, 6: e288.

Street**,** G.M., L.M. Vander Vennen, **T. Avgar**, A. Mosser, M. Anderson, A.R. Rodgers, and J.M. Fryxell (2015) Habitat selection following recent disturbance: model transferability with implications for management and conservation of moose (*Alces alces*). *Canadian Journal of* Zoology, 93: 813-821.

Avgar, T., J.A. Baker, G.S. Brown, J. Hagens, A.M. Kittle, *et al*. (2015) Space-use behavior of woodland caribou based on a cognitive movement model. *Journal of Animal Ecology*, 84: 1059-1070.

Kittle**,** A.M., M. Anderson, **T. Avgar**, J.A. Baker, G.S. Brown, *et al*. (2015) Wolves adapt territory size, not pack size to local habitat quality. *Journal of Animal Ecology*, 84: 1177-1186.

Street**,** G.M., A.R. Rodgers, **T. Avgar**, and J.M. Fryxell (2015) Characterizing demographic parameters across environmental gradients: a case study with Ontario moose. *Ecosphere*, 6: e138.

Mosser, A., **T. Avgar**, G.S. Brown, C.S. Walker, and J.M. Fryxell (2014) Towards an energetic landscape: broad-scale accelerometry in woodland caribou. *Journal of Animal Ecology*, 83: 916-922.

Avgar, T., G. Street, and J.M. Fryxell (2014) On the adaptive benefits of mammal migration. *Canadian Journal of Zoology*, 92: 481-490.

Fagan, W.F, M.A. Lewis, M. Auger-Methe, **T. Avgar**, S. Benhamou, *et al*. (2013) Spatial memory and animal movement. *Ecology Letters*, 16: 1316-1329.

Avgar, T., R. Deardon, and J.M. Fryxell (2013) An empirically parameterized individual based model of animal movement, perception and memory. *Ecological Modeling*, 251: 158-172.

Kuefler, D., **T. Avgar**, and J.M. Fryxell (2013) Density- and resource-dependent movement characteristics in a rotifer. *Functional Ecology*, 27: 323-328.

Avgar, T., A. Mosser, G.S. Brown, and J.M. Fryxell (2013) Environmental and individual drivers of animal movement patterns across a wide geographical gradient. *Journal of Animal Ecology*, 82: 96-106.

Fryxell, J.M., and **T. Avgar** (2012) Animal migration: catching the wave. *Nature*, 490: 182-183.

Berger-Tal, O., and **T. Avgar** (2012) The glass is half-full: overestimating the quality of a novel environment is advantageous. *PLoS ONE,* 7: e34578.

Kuefler, D., **T. Avgar**, and J.M. Fryxell (2012) Rotifer population spread in relation to food, density and predation risk in an experimental system. *Journal of Animal Ecology*, 81: 323-329.

Avgar, **T.**, D. Kuefler, and J.M. Fryxell (2011) Linking rates of diffusion and consumption in relation to resources. *American Naturalist*, 178: 182-190. [*F1000Prime* recommended].

Mari, L., R. Casagrandi, M. Gatto, **T. Avgar**, and R. Nathan (2008) Movement strategies of seed predators as determinants of plant recruitment patterns. *American Naturalist*, 172: 694-711.

Avgar, **T.**, I. Giladi, and R. Nathan (2008) Linking traits of foraging animals to spatial patterns of plants: social and solitary ants generate opposing patterns of surviving seeds. *Ecology Letters*, 11: 224-234.

Avgar, **T.**, N. Horvitz, L. Broitman, and R. Nathan (2008) How movement properties affect prey encounter rates of ambush versus active predators: a comment on Scharf *et al*. *American Naturalist*, 172: 593-595

Manuscripts under review or undergoing revision

Prokopenko*, C., **T. Avgar**, A. Ford, and E. Vender Wal. Trait-mediated functional response: antipredator traits drive prey switching in multi-prey systems. *Ecology*.

Betini, G., **T. Avgar**, E. Miller, and J.M. Fryxell. Body size mediates the effects of external environmental conditions on Daphnia movement rates. *Ecology*.

Vilk, O, E. Aghion , **T. Avgar** , C. Beta , O. Nagel , A. Sabri , R. Sarfati , D. Schwartz , M. Weiss , D. Krapf , R. Nathan , R. Metzler, and M. Assaf. Unravelling the origins of anomalous diffusion: from molecules to migrating storks. *Science Advances*.

Dickie*, M. R. Serrouya, **T. Avgar**, P. McLoughlin, R.S. McNay, C. DeMars, S. Boutin, and A. T. Ford. Resource exploitation efficiency collapses the home range of an apex predator. *Ecology*.

Doden, E., P. Budy, **T. Avgar**, and J. Young. Movement patterns of resident and translocated beavers at multiple spatiotemporal scales in desert rivers. *Frontiers in Conservation Science* (Research Topic: Animal Behavior After Translocation into Novel Environments)

Berger*, D.J., D.W. German, C. John, R. Hart*, T.R. Stephenson, and **T. Avgar**. Seeing is be-Leaving: perception drives seasonal migration in Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*). *Frontiers in Ecology and Evolution* (Research Topic: Cognitive Movement Ecology).

Avgar, T., and O. Berger-Tal. Biased learning as a simple adaptive foraging mechanism. *Frontiers in Ecology and Evolution* (Research Topic: Cognitive Movement Ecology).

Grants Awarded (bald text signifies lead PI**)**

2021 California Department of Fish and Wildlife: $167,071 granted to **T. Avgar** (in collaboration with M. Conner and T. Stephenson) by the Sierra Nevada Bighorn Sheep Recovery Program. Title: *Sierra Nevada Bighorn space-use ecology*. Start date: 05/01/2021. End date: 05/01/2024.

2020 USDA-NIFA: $495,230 granted to **K. Veblen**, T. Avgar, and M. Duniway (in collaboration with E. Thacker, J. Villalba, M. Garcia, and S. Reed) by USDA-NIFA. Title: *Criollo cattle as a strategy to maintain output of ecosystem services under a changing climate*. Start date: 06/01/2021. End date: 12/31/2025.

State grant: $124,825 granted to **T. Avgar** and **L. Yocom** by the Utah Division of Wildlife Resources. Title: *Wildlife space-use and post-fire habitat dynamics*. Start date: 01/01/2021. End date: 12/31/2023.

Mississippi State University: $111,000 granted to **T. Avgar** (in collaboration with G. Street) by the High Performance Computing Collaboratory. Title: *Using camera traps to monitor deer density at high resolution through space and time*. Start date: 09/01/2020. End date: 08/31/2022.

State grant: $171,300 granted to **T. Avgar** (in collaboration with K. Hersey and D. Olson) by the Utah Division of Wildlife Resources. Title: *Understanding and mapping mule deer migration across Utah*. Start date: 07/01/2020. End date: 06/30/2024.

State grant: $86,144 granted to **T. Avgar** (in collaboration with D. Olson) by the Utah Division of Wildlife Resources. Title: *Quantifying the impacts of anthropogenic movement barriers on ungulate space-use patterns in Utah*. Start date: 07/01/2020. End date: 06/30/2022.

State contract: $8,000 granted to **T. Avgar** by Utah Division of Wildlife Resources. Title: *Demonstrating the utility of wildlife cameras in monitoring deer and elk demographic parameters*. Start date: 07/01/2020. End date: 12/31/2020.

Utah State University's Public Lands Initiative grant: $58,642 granted to **T. Avgar** (in collaboration with E. Thacker and D. Olson) by the Utah Agricultural Experiment Station. Title: *Pronghorn space-use ecology in Utah: a key to effective management and conservation*. Start date: 07/01/2020. End date: 06/30/2022.

2019 Utah State University's Research Catalyst seed grant: $20,000 granted to **T. Avgar** by the Office of Research. Title: *Coupling individual and population perspectives to enhance understanding and management of wildlife space-use pattern*. Start date: 01/01/2019. End date: 12/31/2019.

2018 Moose Stewardship Study Program: $230,000 granted to **E. Vander Wal**, T. Avgar, and G. Street by Manitoba Hydro. Title: *Disentangling the effects of local and regional factors that promote occupancy and abundance of moose*. Start date: 09/01/2018. End date: 08/31/2022.

Current Graduate Students

Danielle Berger (PhD)

Courtney Check (M.Sc; joint supervision with G. Street)

Ronan Hart (M.Sc)

Jennifer Hogg (M.Sc; joint supervision with E. Vander Wal & G. Street)

John Huang (PhD)

Randall McBrid (M.Sc)

Brian Smith (PhD; joint supervision with D. MacNulty)

Megan Whetzel (M.Sc; joint supervision with Larissa Yocom)

Veronica Winter (M.Sc)

Current Postdoctoral Fellows

Dr. Sean Boyle (joint supervision with E. Vander Wal & G. Street)

Lab Alumni

Tatum Del Bosco (M.Sc)

Steven Handtke (Undergraduate Research)

Conference Presentations and Invited Talks (2012-present**)**

2021 Invited lecture, University of Alberta's MathBio Seminar. Zoom.

2020 Webinar, Canadian Section of The Wildlife Society.

Keynote lecture, The 3rd Moving2Gather workshop, Rennes, France.

2019 Full day workshop, TWS National Annual Conference, Reno, Nevada, USA.

Short lecture, TWS National Annual Conference, Reno, Nevada, USA.

Short lecture, The MacArthur Academy Meeting, USU, Logan, Utah, USA.

Invited lecture, the WILD seminar series, USU, Logan, Utah, USA.

Invited lecture, the Applied Math seminar series, USU, Logan, Utah, USA.

Invited lecture, UDWR's Brown-Bag seminar series, UDWR main office, Salt-Lake City, Utah, USA.

2018 Invited short lecture, the Interdisciplinary Research Forum, the Ecology Center, USU, Logan, Utah, USA.

Invited short lecture, The Statistical Society of Canada annual meeting, McGill University, Montreal, Quebec, Canada.

Short lecture, the 13th CSEE Annual Meeting, Guelph, Ontario, Canada.

Short lecture, NACCB, Toronto, Ontario, Canada.

2017 Invited lecture, Department of Wildland Resources, Utah State University, Logan, Utah, USA.

Invited lecture, Department of Natural Resource Sciences, McGill University, Montreal, Quebec, Canada.

Poster presentation, Living on the Precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems, Waterloo, Ontario, Canada.

Poster presentation, Gordon Research Conference on the Movement Ecology of Animals, Ventura, California, USA.

Invited lecture, The University of Alberta Ecology and Evolution Seminar Series, Edmonton, Alberta, Canada.

2016 Invited lecture, workshop on Measuring and Analyzing Interactions among Mobile Entities, University of Texas-Austin, Austin, Texas, USA.

Invited lecture, National Wildlife Research Center, Carleton University, Ottawa, Ontario, Canada.

Short lecture and invited lecture, the 11th CSEE Annual Meeting, St John's, Newfoundland, Canada.

2015 Invited seminar, Statistical Physics and Anomalous Dynamics of Foraging Advanced Study Group, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.

Short lecture and an organised symposium, the 22nd TWS Annual Conference, Winnipeg, Manitoba, Canada.

Invited lecture, The University of Alberta Ecology and Evolution Seminar Series, Edmonton, Alberta, Canada.

Invited lecture and an organised symposium, the 10th CSEE Annual Meeting, Saskatoon, Saskatchewan, Canada.

2014 Short lecture and a tutorial, The Symposium on Animal Movement and the Environment, Raleigh, North Carolina, USA.

Invited lecture, The University of Alberta Mathematical Biology Seminar Series, Edmonton, Alberta, Canada.

2013 Plenary lecture, Movement and Dispersal Conference, Aberdeen, Scotland.

Short lecture, the 8th CSEE Annual Meeting, Kelowna, British Colombia, Canada.

2012 Invited lecture, the Animal Movement and Memory Focused Research Group, the Banff International Research Station for Mathematical Innovation and Discovery, Banff, Alberta, Canada.

Short lecture, the 14th International Behavioral Ecology Congress, Lund, Sweden.

Poster presentation, post-congress symposium: The Behavioural Ecology of Animal Movement, the 14th International Behavioral Ecology Congress, Lund, Sweden.

Invited short lecture, CNEFR Woodland Caribou Research Workshop, Barrie, Ontario, Canada.

Journal Review Activities

- American Naturalist (3)
- Animal Behaviour (4)
- Animal Conservation (1)
- Basic and Applied Ecology (1)
- Behavioral Ecology (5)
- Biological Conservation (2)
- Biological Reviews (1)
- Conservation Biology (1)
- Ecology (4)
- Ecology Letters (11)
- Ecology and Evolution (1)
- Ecological Applications (1)
- Ecological Modelling (1)
- Ecological Monographs (2)
- Forest Ecology and Management (1)
- Functional Ecology (3)
- Global Ecology and Conservation (1)
- Israeli Journal of Ecology and Evolution (1)
- Journal of Animal Ecology (10)
- Journal of Applied Ecology (1)
- Journal of Biological Research (1)
- Journal of Ecology (1)
- Journal of Mammalogy (1)
- Journal of Mathematical Biology (1)
- Journal of Wildlife Management (1)
- Methods in Ecology and Evolution (6)
- Movement Ecology (4)
- Oecologia (3)
- Oikos (2)
- Philosophical Transactions of the Royal Sociey B (1)
- PLoS ONE (2)
- Proceedings of the Royal Society B (1)
- Royal Society Open Science (2)
- Science (1)
- Scientific Reports (3)
- Theoretical Ecology (1)
- Wildlife Biology (1)

Editorial Activities

Topic editor (together with E. Gurarie), *Cognitive Movement Ecology*, Frontiers in Ecology and Evolution.

Funding Review Activities

2021 National Science Foundation panelist

2020 National Science Foundation panelist

2019 Undergraduate Research and Creative Opportunities grants, Utah State University

2018 Deutsche Forschungsgemeinschaft (German Research Foundation)