

SEFS 521b Ecological Scaling

Autumn Quarter 2018

Monday, 13:30-15:20

Room: AND 304/306

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DESCRIPTION AND OBJECTIVES:

This seminar provides an introduction to fundamental concepts about spatial and temporal scaling of ecological patterns and processes in relation to human perception and technology. Emphasis is on understanding and applying principles of ecological scaling to students' individual research projects (sampling design, analysis, and interpretation of results).

FORMAT:

Instructor lectures and leads discussions on concepts and readings; students participate in class discussions and give presentations and lead group discussions pertaining to the readings and their application in ecological studies.

REQUIREMENTS:

- **Attendance and active contribution** in group discussions on readings, concepts, and their application to individual research projects.
- **Individual oral assignment:** Students give PowerPoint presentations and lead group discussions on "problems of scale" in their current or proposed research projects with specific reference to a paper or papers selected from either the class readings or another "scaling-related" scientific source.

READINGS:

Students are responsible for locating and obtaining weekly readings that can be downloaded from the UW library. Book chapters and difficult-to-find papers are provided for downloading by the instructor (<http://faculty.washington.edu/cet6/pub/Temp/CFR521e>), and by students who choose to discuss papers not listed below.

GRADING:

Grades are determined by students' completion of course requirements and the depth and breadth of understanding that they demonstrate in class discussions and in their presentations.

SCHEDULE:

Week	Topic	Readings
TBD	Introduction; landscape perspectives	(Meinig 1979, Allen 1998)
TBD	Problems of scale in ecology	(Wiens 1989, Levin 1992)
TBD	Grain, extent, and scope	(Chapter 6 in Schneider 1994a, Schneider 2001)
TBD	Hierarchical scaling	(Stommel 1963, Wu 1999)
TBD	Biodiversity and community structure	(Menge and Olson 1990, Chase and Leibold 2002)
TBD	Species-habitat relationships	(Schneider 1994b, Mayor et al. 2009)
TBD	Time, space, and causality	(Schumm and Lichty 1965, Frissell et al. 1986)
TBD	Lecture by Josh Lawler	To be determined
TBD	Semivariograms, Part I: A gentle introduction	(Ettema and Wardle 2002, Palmer 2002)
TBD	Semivariograms, Part II:	(Mandelbrot 1967, Bradshaw and Spies 1992,

	Inferring multiscale processes from spatial patterns; wavelets and fractals	McIntire and Fajardo 2009, McGuire et al. 2014)
TBD	Student presentations	No additional readings

READINGS:

- Allen, T. F. H. 1998. The landscape "level" is dead: Persuading the family to take it off the respirator. Pages 35-54 *in* D. Peterson and T. Parker, editors. *Ecological scale: Theory and applications*. Columbia University Press, New York, USA.
- Bradshaw, G. A., and T. A. Spies. 1992. Characterizing canopy gap structure in forests using wavelet analysis. *Journal of Ecology* 80:205-215.
- Chase, J. M., and M. A. Leibold. 2002. Spatial scale dictates the productivity-biodiversity relationship. *Nature* 416:427-430.
- Ettema, C. H., and D. A. Wardle. 2002. Spatial soil ecology. *Trends in Ecology and Evolution* 17:177-183.
- Frissell, C. A., W. J. Liss, C. E. Warren, and M. D. Hurley. 1986. A hierarchical framework for stream habitat classification: Viewing streams in a watershed context. *Environmental Management* 10:199-214.
- Levin, S. A. 1992. The problem of pattern and scale in ecology. *Ecology* 73:1943-1967.
- Mandelbrot, B. 1967. How long is the coast of Britain? Statistical self-similarity and fractional dimension. *Science* 156:636-638.
- Mayor, S. J., D. C. Schneider, J. A. Schaefer, and S. P. Mahoney. 2009. Habitat selection at multiple scales. *Ecoscience* 16:238-247.
- McGuire, K.J., Torgersen, C.E., Likens, G.E., Buso, D.C., Lowe, W.H., Bailey, S.W., 2014, Network analysis reveals multi-scale controls on streamwater chemistry: *Proceedings of the National Academy of Sciences*, v. 111, no. 19, p. 7030-7035, <http://dx.doi.org/10.1073/pnas.1404820111>.
- McIntire, E. J. B., and A. Fajardo. 2009. Beyond description: The active and effective way to infer processes from spatial patterns. *Ecology* 90:46-56.
- Meinig, D. W. 1979. The beholding eye: Ten versions of the same scene. Pages 33-48 *in* D. W. Meinig, editor. *The interpretation of ordinary landscapes*. Oxford University Press, New York.
- Menge, B. A., and A. Olson. 1990. Role of scale and environmental factors in regulation of community structure. *Trends in Ecology and Evolution* 5:52-57.
- Palmer, M. W. 2002. Scale detection using semivariograms and autocorrelograms. Pages 129-144 *in* S. E. Gergel and M. G. Turner, editors. *Learning landscape ecology: A practical guide to concepts and techniques*. Springer, New York, USA.
- Schneider, D. C. 1994a. *Quantitative ecology: Spatial and temporal scaling*. Academic Press, San Diego, California.
- Schneider, D. C. 1994b. Scale-dependent patterns and species interactions in marine nekton. Pages 441-467 *in* P. S. Giller, A. G. Hildrew, and D. G. Raffaelli, editors. *Aquatic ecology: Scale, pattern and process*. Blackwell Science Ltd, Oxford, U.K.
- Schneider, D. C. 2001. The rise of the concept of scale in ecology. *BioScience* 51:545-553.
- Schumm, S. A., and R. W. Lichty. 1965. Time, space, and causality in geomorphology. *American Journal of Science* 263:110-119.
- Stommel, H. 1963. The varieties of oceanographic experience. *Science* 139:572-576.
- Wiens, J. A. 1989. Spatial scaling in ecology. *Functional Ecology* 3:385-397.
- Wu, J. 1999. Hierarchy and scaling: Extrapolating information along a scaling ladder. *Canadian Journal of Remote Sensing* 25:367-380.