The Spatial and Temporal Domains of Modern Ecology
OR Ecology's Spatio-temporal Domains
OR Space, Time, and Ecology

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An abstract

The scales at which ecosystems are observed plays a critical role in shaping our understanding of how they are structured and function (*1, 2*). Ecological patterns emerge within temporal and spatial domains that may be coarser or finer than the processes that shape them, which means that investigation across multiple scales is the *sine qua non* for understanding ecological phenomena (*1*). Awareness of the importance of scale has grown rapidly since the 1980s, accelerated by the need to understand how changes in the global climate, ocean, and land systems are affecting everything from individual populations (e.g. cite) to entire biomes (e.g. cite), while technological advances in areas such as remote sensing and genetics are making it ever-easier to quantify ecological features across a broad range of scales (*2, 3*).

Given the importance of multi-scale studies for providing ecological understanding, and the growing ability to undertake them, it is important to rigorously assess whether ecology is becoming a multi-scale discipline. One approach to answering this question is to quantify the spatial and temporal domains within which observations in ecological studies are collected. Observations provide the necessary means for developing and testing the models that explain why ecological patterns vary in time and space (*1, 4*), thus it stands to reason that the temporal and spatial range of ecological observations, and their density within different portions of those ranges, will shed light on modern ecology's progress towards a holistic, predictive understanding of ecosystems (*1, 2*). In this study, we quantified the spatio-temporal domain of current ecological studies, using a representative sample of papers published between 2004-2014 in the top 30 ecological journals (by 2014 impact factor) to extract and quantify two key dimensions of spatial observation, resolution (grain) and total spatial extent, and their temporal corollaries, sampling interval and total temporal duration. We collected this information from 367 ecological observations (*4, defined here as non-manipulated, or "natural"*) reported within a 148 paper subset of 284 (add Tim's also) randomly selected articles .

1. Intro/rationale

2. What we did

    (a) Examined representative sample of papers from top 30 ecology journals–random sample of all titles from 2005-2014. Selected studies having observation component, excluding experimental manipulations, purely theoretical studies, commentaries, etc.

    (b) Extracted information on the spatial resolution of the study, that is, the two-dimensional space that was observed in the study; the temporal analog, which was the interval

between repeat observations; the total spatial extent covered by the observations; the total time period covered.

(c) We recorded the scales that were actually covered by the observations, rather than potential scales that the collected data might represent–this would require information on autocorrelation length, which is not provided.

For spatial resolution, this was the finest unit representing complete spatial coverage, etc. etc.

Limitation for ocean studies, we did not study third dimension, volume (might be more relevant).

3. What we found

(a) We reviewed a total of X randomly selected papers, of which 148 met our inclusion criteria and from which 367 distinct records related to observations made were collected. [Say something about size of sample and amount of time collected???].

(b) Of these, the vast majority (X%) were field-based studies, while Y% involved automated collection of data via instrumentation, and just Z% made use of remote sensing.

(c) From a perspective of temporal resolution, the majority of observations made in ecology are not repeated.

(d) Spatial resolution - most observations are between $10cm^2$ to $10m^2$

(e) Spatial extent

(f) Temporal extent

4. Implications

(a) Although limited sample size, insight into the scales at which science of ecology is making bulk of observations

(b) Despite recognized importance of making observation across scales (*1*), this does not appear to be happening.

(c) Technical capabilities for making observations are not achieving adoption, despite potential of remote sensing to provide multi-scale ecological data (*5, 6*)

Notes: Wheatley and Johnson (2009) citing arbitrariness of scales in wildlife studies (cited by Chave).

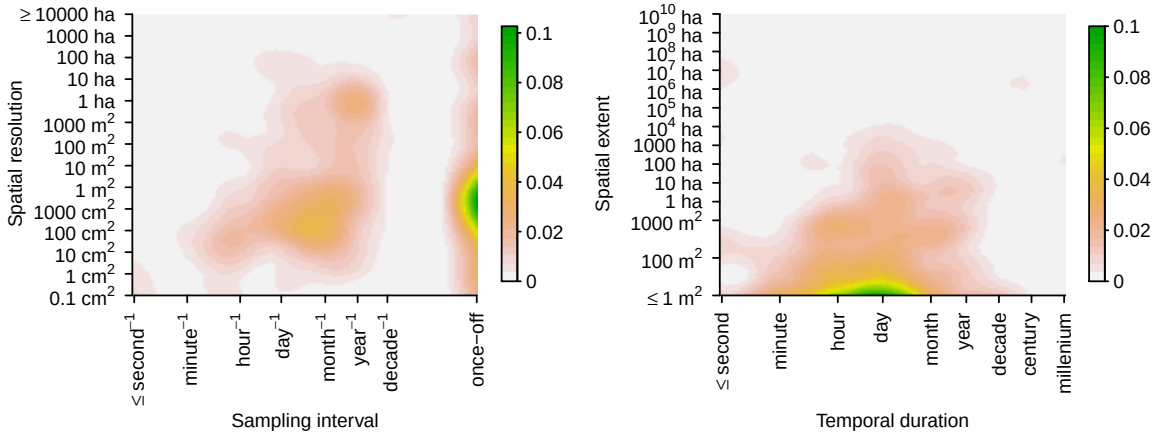

Figure 1:

References and Notes

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