Appendix 1: A review of the edge response literature from 2005 to 2015

We did a follow-up review of the empirical edge literature. We restricted our search to papers that measured changes in an environmental metric (abiotic, abundance, behavior, interaction, process) with respect to the edge. We did our review in two steps, a general search to find papers from the last ten years and then a more in-depth look at certain segments of the literature.

METHODS:

Initial Review and Categorization

We did a web of science search (Oct. 6th) using the terms “edge”, “boundary”, “ecotone” in the title and the search was filtered to accept only papers published 2005 and later[[1]](#footnote-1). The search returned 2,950 results. Other reasons for being disqualified at this level is that the paper was not peer-reviewed or was an abstract only. To these papers, we added a limited number of papers that were missed by our search, but that we were aware and we felt were particularly relevant. This resulted in 919 number of papers that we included in our review (Fig. 1a).

For these papers, we first placed them in four major categories: 1) empirical studies on edge responses (specifically some environmental response variable with respect to the presence of edges), 2) concept/review papers (introducing new theoretical constructs or reviews of past work on edges), 3) edge dynamics or detection (studies of automated detection of edges in landscapes or movement (dynamics) of edges, and 4) using edge concepts in management or to make large-scale extrapolations of dynamics using edge responses as an input). The proportion of papers categorized into each topic is shown in Fig. 1a.

Next, we took the 674 papers that were categorized as empirical studies and put determined the types of studies that were done each year over the review period (results in Fig. 1b). We used the following categories:

1. ABIOTIC: Those that only measured abiotic changes at edges without relating them to any specific organism or group of organisms. If an abiotic metric was specifically linked to ecosystem function (like nitrogen cycling), that was put into a different category (see below). Also excluded as part of this category were studies of forest structure (e.g., canopy cover, stem density) - since the main goals here are to measure the structural strata of the forest - and not species themselves. In general, we did not focus on studies of abiotic gradients for this review.
2. AQUATIC: We separated aquatic papers out because we did not focus on them for the substantive part of our review. However, the expansion of edge effects concepts into the aquatic literature is an interesting one to note and by keeping these papers in the formal review, we are able to quantify this trend as well as draw on the results when
3. COMM: Studies of terrestrial ecological communities with respect to edges, including richness, diversity, composition or species x species abundances (meaning that all the species in the community were measured separately as to their response to edges)
4. NE: Studies of natural enemies (either distribution or attack rates)
5. MOVE: Studies focused on the role of edges in mediating movement especially relative to boundary permeability and landscape connectivity (although studies that included movement as a potential mechanism underlying observed gradients in abundance across edges were placed in the single species category)
6. ESP: Studies that focused on ecosystem services or processes (including pollination, production, nutrient cycling, etc.) that are not related to natural enemies
7. OTHER: Combination of three categories: 1) multi-trophic interactions (excluding predation only), 2) single species studies, 3) studies of evolution, genetic structure or phylogenetic diversity with respect to habitat edges

In depth review of the recent (2013-2015) literature

A subset of studies was chosen for a more in-depth review, largely to assess the current standards for designing edge studies and whether some criticisms of the past (sample size, ignoring interactions, etc.) have been addressed. We chose the three most recent years (2013-2015) to ensure that we were capturing the most up-to-date methods. We focused exclusively on terrestrial studies that included at least one biotic variable (so purely abiotic studies were excluded). The only exception was that we allowed studies on ecosystem services, so this may have included nutrient cycling since that is mediated through biotic pathways. Therefore, of the above categories of empirical papers, the following were included in our in-depth study: COMM, NE, ESP, OTHER. Note that we only retained studies that measured edge responses with respect to edge distance. We excluded studies on edge density since those rarely distinguish between edge types and are therefore difficult to compare. A total of 151 papers met these criteria and they are listed at the end of this appendix.

For each paper, we scored the following information about the study system:

* Study location
* Focal taxa
* Information about edge types (focal and adjacent habitat and whether data were collected on one or both sides of the edge)
* The response type measured (community, species-level, process)

We also scored information about study design:

* Maximum distance from edge for which data were collected. This was separated into three types of studies based on the precision of the distance category:
  + The minimum distance in the maximum category (“minimum maximum distance”). For instance, if the maximum edge distance for each transect was “>100m” then the furthest response measurement occurred at least 100m from the edge (but the exact distance is unknown)
  + Maximum zone. In this case, a finite zone where the maximum distance of each transect was specified (e.g., between 100-200m from the edge) – but it was unknown within that range where the maximum distance was
  + Set maximum distance. This is when the maximum distance of each transect was set and precise (e.g., 500m from the edge)
* Number of distance classes
* Did the authors report DEI (Distance of Edge Influence), MEI (Magnitude of Edge Influence), Neither or Both
* How many blocks units (e.g., transects) and replicates within blocks were set up

Table S1. Articles used in 2013-2015 review of the empirical literature, numbered alphabetically. Each paper was scored in terms of scope and design.

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1. Web of Science search parameters: **TITLE:** (edge or edges or boundary or boundaries or ecotone or ecotones) **Refined by:** **WEB OF SCIENCE CATEGORIES:** (EVOLUTIONARY BIOLOGY OR PLANT SCIENCES OR ECOLOGY OR ENVIRONMENTAL SCIENCES OR ZOOLOGY OR FORESTRY OR BIODIVERSITY CONSERVATION) **Timespan:** 2005-2015. **Indexes:** SCI-EXPANDED [↑](#footnote-ref-1)