**ESM 215 Exercise 4  
Edge and road effects in the landscape**

The purpose of this exercise is to acquaint you with commonly used approaches and metrics for estimating and mapping edge effects at the landscape scale. You will be testing the sensitivity of species’ habitat assessments to assumptions about habitat edges and road edges.

*To complete this exercise you will need data files in the class directory ‘burmes’*  (e.g. H:\ ESM 215\data\burmes). You will also need the fragstats and ArcGIS software.

For this exercise you will evaluate habitat and edge effects for [Blainville's horned lizard, *Phrynosoma blainvillii.*](http://www.californiaherps.com/lizards/pages/p.blainvillii.html)This species has been grouped under the *P. coronatum* (Coast horned lizard) complex, but recent analyses have led to re-classification of this taxon as a separate species that is endemic to central and southern California (Leache et al. 2009). The species is of growing conservation concern as a result of habitat loss and fragmentation and reduction in food supply (native ants) due to the invasive Argentine ant. Suarez et al. (1998) found that Argentine ants can extend up to 200m from urban edges and can follow roads deep into wildland habitats.

The analysis is focused on the western Burton Mesa. Before beginning, please spend some time viewing the maps that you will be analyzing by double-clicking on the ArcGIS project file ‘bmes\_datavu.mxd’ in your class directory (e.g. H:\ESM 215\data\burmes\bmes\_datavu.mdx). When opening this file, you may note that many of the layers have a broken link to their data source; this is an unintended consequence of copying our data files from the R to H drive in the beginning of the course. For our purposes, these layers don’t matter. To view layers we will use in this exercise, click the second tab under the Table of Contents ‘List by Source’, and the files of interest to this lab will appear at the top, with unbroken source links.

**Data files** include:

* **burmesveg15.tif**, land use/land cover classified as CA wildlife habitat types. 28m grid
* **r029\_whr**, habitat suitability scores for the California Horned Lizard (*Phrynosoma coronatum frontale*), 28m grid, based on the [California Wildlife Habitat Relationships](https://wildlife.ca.gov/Data/CWHR) (CWHR) database. Habitats are scored for feeding, resting and breeding suitability, with scores ranging from 0 (unsuitable) to 100 (highly suitable) for the three activities combined. (R029 is the species code for *P. coronatum* in the CWHR database).
* **r029\_hab.tif**, a binary map of habitat/non-habitat for P. blainvillii with habitat defined as habitat with a suitability score of at least 45.
* **r029\_habrd40.tif**, the r029\_hab map of habitat except that all areas within 40m of the nearest road have been classified as non-habitat.
* **r029\_habrdurb.tif**, the r029\_hab map of habitat except that areas within 150m of a road or within 200m of an urban edge have been classified as non-habitat.
* **subveg15\_classes.fcd**, a class descriptors file for **burmesveg15.tif** formatted for fragstats.
* **r029\_edgedepth.fsq,** the pair-specific depth of edge effects for habitat types in **burmesveg15.tif**, formatted for fragstats. Only classes with non-zero habitat suitability are specified for edge effects. Depths range from 200m for urban edges to 100m for irrigated agriculture, 60m for barren areas or grasslands, 30m or 0m for other habitat pairs depending on how different they are in suitability for horned lizards
* **r029\_edgecontrast.fsq,** the pair-specific edge contrast for habitat types in **burmesveg15.tif**, formatted for fragstats and based on differences in habitat suitability scores.

**Part 1. Sensitivity of core area estimates to the specification of edge depth (use 4-neighbor rule)**

Input layers for your analysis must include **burmesveg15.tif** , **subveg15\_classes.fcd**, **r029\_edgedepth.fsq,** and **r029\_edgecontrast.fsq**.

The most highly suitable native habitat types for horned lizards in the study area are coastal sage scrub, mixed chaparral, coast oak woodland, closed-cone pine-cypress, and valley foothill riparian. Calculate the magnitude of edge effects for these wildlife habitat types in the study area based on the following metrics:

a. total core area (core area calculations require the edge depth file)

b. core area as a % of the landscape

c. number of disjunct core areas

d. contrast-weighted edge density (this metric requires the edge contrast file)

e. One other metric that you think helps reveal the magnitude of edge effects on these types.

Summarize your results in a table. Interpret your results by discussing the meaning of each pattern metric and what explains the differences between classes based on an examination of how these habitats are arranged across the landscape.

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**Part 2. Accounting for road and urban edge effects (4-neighbor rule)**

Input layers for this analysis include **r029\_hab.tif**, **r029\_habrd40.tif**, **r029\_habrd105.tif**, and **r029\_habrdurb.tif**. You will also need **r029\_classes.fcd** -the class descriptor file for the binary habitat grid - and **r029\_hab\_edgedepth.fsq** - the edge depth file (in this case the edge depth is set at 0).

According to Laudenslayer and Parisi (2007) a patch of at least 200 hectares is required to consider an area highly suitable for persistence of a horned lizard population. Patches 40-200 hectares in extent are considered low suitability for persistence. Patches <40 ha are considered unsuitable for persistence. Based on the binary habitat grids provided, estimate the following.

a. Calculate and compare the amount of horned lizard habitat, the number of disjunct habitat patches, and habitat edge density for:

- habitat assuming no road or urban edge effects (r029\_hab.tif)

- habitat assuming 40m edge effects from roads (r029\_habrd40.tif)

- habitat assuming 80m edge effects from roads (r029\_habrd80.tif)

- habitat assuming 150m edge effects from roads and 200m edge effects from urban areas (r029\_habrdurb.tif)

Summarize your results in a table, and discuss the implications of these results in terms of potential consequences of road networks and urban development for fragmentation of wildlife habitats in general and for coast horned lizards on the Burton Mesa in particular.

b. Calculate the number of patches at least 200 ha in size (requires patch metrics (patch area)) for:

- habitat assuming no road or urban edge effects

- habitat assuming 150 m edge effects from roads and 200 m edge effects from urban edges.

Tabulate your results and discuss their implication for estimating the extent and location of conservation core areas for this species.

**Literature Cited**

Laudenslayer, W. and M. Parisi. 2007. Species Notes for

Coast Horned Lizard (Phrynosoma coronatum): California Wildlife Habitat Relationships (CWHR) System Level II Model Prototype. [https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=7143](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwjRmtWZ9KrfAhWaHzQIHXGmDTgQFjAAegQICBAC&url=https%3A%2F%2Fnrm.dfg.ca.gov%2FFileHandler.ashx%3FDocumentID%3D7143&usg=AOvVaw1RFvcyezXZEsCV7r_V6CEb)

Leache et al. 2009. Quantifying ecological, morphological, and genetic variation to delimit species in the coast horned lizard species complex (Phrynosoma). PNAS 106 (30): 12418-12423.

Suarez et al. 1998. Effects of fragmentation and invasion on native ant communities in coastal southern California. Ecology, 79(6): 2041–2056.