

# ESM 215 - Landscape Ecology, Winter 2015

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## Logistics

- Instructor: Ben Best (bbest@nceas.ucsb.edu)
- Meeting times and locations, from January 5th to March 12th, 2015.
  - Lecture: Tuesdays 2:30 - 3:45 in Bren Hall 1424 (classroom)
  - Lab: Thursdays 2:30 - 3:45 in Bren Hall 3035 (GIS lab)
  - Office hours: Tuesdays noon - 2pm in GIS lab or Bren 3524

- Required textbook:

Turner, M. G., Gardner, R. H., & O'Neill, R. V. (2001). *Landscape Ecology in Theory and Practice: Pattern and Process*. New York: Springer.

## Overview

The real voyage of discovery consists not in seeking new landscapes, but in seeing with new eyes.  
– Marcel Proust

Rather than cataloguing the variety of landscapes or ecosystems on earth, the field of Landscape Ecology (LE) provides methods to describe the interaction between spatial patterns and ecological processes for any landscape. We'll begin our "voyage of discovery" into this unique geographic perspective by exploring scaling issues, causal agents (physical, biotic and human) and metrics to quantify landscape pattern. Landscapes are hardly static, so understanding disturbance regimes and impacts is essential. Then we'll build up from habitats of individual species and connectivity across the landscape, to a multi-species community perspective, culminating in evaluating conservation plans that integrate LE concepts. Finally we'll review unique LE applications across disparate ecosystems, including seascapes and soundscapes.

## Format

Our two weekly meeting times will be broken into lecture on Tuesdays in Bren Hall 1424 and labs on Thursdays in the GIS lab.

## Lectures and Readings

Lectures (other than the first) will begin with a brief quiz on the assigned readings from the primary literature (not the textbook chapters). For the last 15 minutes of lecture, these assigned readings will be discussed. Discussions are to be led by one student per reading who will posit questions to the class, with the possibility of using visual aids (eg PowerPoint presentation). It is encouraged to highlight strengths and weaknesses in the paper, while providing contextual relevance to landscape ecology fundamentals and modern conservation applications. Students assigned to a reading can suggest an alternate reading up to a week before the lecture. In order to be approved it must be relevant to that week's lecture topic and be of sufficient quality.

For the remainder of lecture I will present concepts and examples from the textbook and primary literature, welcoming questions and comments throughout for a conversational tone.

## Labs and Group Project

Weekly labs will apply analytical techniques towards Santa Barbara County as the backyard study area, and relate concepts from the preceding lecture. The first two labs will orient you to ArcGIS and R while conducting tasks related to assessing and forecasting landcover. I will provide introductions to these software. Those with past experience are encouraged to help their neighbor with less experience navigate the software (but not complete the assignment). Each student will build distribution and connectivity models for different species, all of which will be collated for use in the community lab.

The final conservation planning lab will be conducted as a group project. Each group will present on a different objective in the final lab meeting and turn in a report by the end of the following week.

During our scheduled Thursday lab sessions and besides the final lab reserved for presentation of group projects, I will introduce labs briefly, leaving as much time as possible to work through instructions and provide hands-on help. Colored stickies slapped to the top of a monitor will let you quietly flag whether you need help (red) or successfully completed a given step (green). Labs are due the following Wednesday at noon.

## Field Trip

An optional weekend day trip to northern Santa Barbara County will allow us to seek these LE patterns and processes in the field. You'll get extra credit for attending and are encouraged to further sign up as a field guide by choosing a topic (geology, fire, birds, trees, etc), creating a one page field guide specific to Santa Barbara county and highlight objects on site.

In the modern vein of citizen science and crowd sourcing, expect to digitally record species observations via GPS enabled camera (ie smartphone) for submission to iNaturalist. Might enlist a quadcopter drone to capture aerial photography for comparison with satellite data.

## Grading

item	points (% total)	#	total (% total)
present reading	5 (4%)	1	5 (4%)
quizzes	3 (2%)	9	27 (20%)
labs	10 (8%)	8	80 (61%)
group project	20 (15%)	1	20 (15%)

Extra credit points:

- field trip: +3
- field guide: +3

## Makeup

Please notify me if you cannot attend or arrive late to a lecture. To make up points for the quiz, you will need to provide a summary of the readings and textbook chapters within the following week. You should define key concepts and present overall results, and it must be limited to 1 page. Outline form is acceptable.

## Schedule

### 1. Introduction

<i>Jan 4</i>	<i>Lecture</i>	Introduction to Landscape Ecology: history, overview
<i>Jan 6</i>	<i>Lab</i>	Touring landcover using ArcGIS

### 2. Scale

<i>Jan 13</i>	<i>Lecture</i>	Scaling issues in space and time
.	<i>Readings</i>	(Chave, 2013; D. L. Urban, O'Neill, & Shugart, 1987; Wiens, 1989) [Turner ch 1 & 2]
<i>Jan 15</i>	<i>Lab</i>	Landuse change over time using a Markov model in R

### 3. Agents

<i>Jan 20</i>	<i>Lecture</i>	Agents of landscape pattern: physical, biotic, human (Davis, Dozier, & others, 1990; Swanson, Kratz, Caine, & Woodmansee, 1988; Wu, 2013) [Turner ch 4]
.	<i>Readings</i>	
<i>Jan 22</i>	<i>Lab</i>	Physical controls on landscape vegetation using ArcGIS

### 4. Metrics

<i>Jan 27</i>	<i>Lecture</i>	Landscape metrics: geostatistics, fractals, percolation theory, neutral models, fragmentation processes (Li & Wu, 2004; Swanson et al., 1988; Watt, 1947) [Turner ch 5 & 6]
.	<i>Readings</i>	
<i>Jan 29</i>	<i>Lab</i>	Measuring edge effects in the landscape using FragStats

### 5. Disturbance

<i>Feb 3</i>	<i>Lecture</i>	Disturbance regimes: processes, succession and metrics (Reice, 1994; Romme, Turner, Wallace, & Walker, 1995; Scheller & Mladenoff, 2007) [Turner ch 7]
.	<i>Readings</i>	
<i>Feb 5</i>	<i>Lab</i>	Simulating fire regimes on forests using LANDIS

### 6. Species

<i>Feb 10</i>	<i>Lecture</i>	Organisms and landscape pattern: habitat selection, species distribution modeling (J. Elith & Leathwick, 2009; Guisan et al., 2013; Robinson et al., 2011) [Turner ch 3 & 8]
.	<i>Readings</i>	
<i>Feb 12</i>	<i>Lab</i>	Species distribution modeling using Maxent

### 7. Connectivity

<i>Feb 17</i>	<i>Lecture</i>	Connectivity of organisms in the landscape: species dispersal, metapopulation source-sink dynamics, graph theory, landscape genetics, agent-based models (McRae, Dickson, Keitt, & Shah, 2008; D. L. Urban, Minor, Treml, & Schick, 2009; With & King, 2001) [Turner ch 8]
.	<i>Readings</i>	
<i>Feb 19</i>	<i>Lab</i>	Connectivity modeling using Circuitscape

### 8. Communities

<i>Feb 24</i>	<i>Lecture</i>	Communities: species-area curves, island biogeography, beta gradients, diversity metrics, trophic interactions
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.	<i>Readings</i>	(Fortin et al., 2005; Lamanna et al., 2014; D. Urban, Goslee, Pierce, Lookingbill, & others, 2002) [Turner ch 9]
<i>Feb 26</i>	<i>Lab</i>	Quantifying species diversity using Vegan in R

## 9. Planning

<i>Mar 3</i>	<i>Lecture</i>	Conservation planning in the context of landscape ecology: ecosystem services, coupled social-ecological systems, compensatory mitigation, climate change
.	<i>Readings</i>	(Groot, Alkemade, Braat, Hein, & Willemen, 2010; Nelson et al., 2009; Watson, Grantham, Wilson, & Possingham, 2011) [Turner ch 10]
<i>Mar 5</i>	<i>Lab</i>	Conservation planning using Marxan (group project)

## 10. Applications

<i>Mar 10</i>	<i>Lecture</i>	Case studies across urban, agricultural and coastal ecosystems, sustainable forestry, urban-wildland interface, future directions
.	<i>Readings</i>	(Grimaldi et al., 2014; Rouget, Cowling, Lombard, Knight, & Kerley, 2006; Thompson et al., 2014) [Turner ch 10 & 11]
<i>Mar 12</i>	<i>Lab</i>	Group project presentations

## Readings

Chave, J. (2013). The problem of pattern and scale in ecology: What have we learned in 20 years? *Ecology Letters*, 16, 4–16. doi:10.1111/ele.12048

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