

### **Assignment #1: Landscape Ecology**

Rodríguez-Echeverry et al use landscape ecology practices to determine the relationship between levels of landscape biodiversity and the provisioning of ecosystem services in Chile. Ecosystem services are defined as environmental processes carried out in an ecosystem which benefit humans. The authors contend that these services are necessarily related to the spatial distribution of the diversity of native forest habitats in the study area. The ecosystem services they focus on are erosion control, water supply, and organic matter accumulation, all of which are found to respond to changes in native forest area loss, fragmentation, and decreases in diversity. The methods Rodríguez-Echeverry et al employ to come to these conclusions involved the analysis of several factors using of ArcGIS 9.3 and Fragstats. The study area was divided into 262 subwatersheds ranging from 500- 4000 hectares in size. The study compares data from 1986, 2001, and 2011 and was retrieved at a resolution of 30 x 30m. The research begins with a biodiversity analysis of the landscape in which diversity of native forest habitats, vegetation types, climate zones, and soil types are considered. Maps of each of these factors were then used to derive a map of native forests. The inter patch diversity of the native forests habitats across the landscape was then calculated through the Shannon Diversity Index (SHDI) using Fragstats, obtaining SHDI values for each subwatershed. Using these results the impact of land use change on the spatial patterns of the diversity of native forest habitat is determined by looking at changes of total area, number of patches, index richness of habitat patches, and the SHDI. To determine the effect of these changes on ecosystem services the N-Spect (No point source pollution and erosion tools) model is used as an extension in ArcGIS. The model uses data on landcover, soil type, and precipitation to estimate runoff volumes after filtering and retention of water and uses the Revised Universal Soil Loss Equation to calculate erosion. The output of the model is a series of maps

showing estimates of those values. The parameters used by Rodríguez-Echeverry et al were a 30 x 30m DEM, a land use map, maps of annual precipitation and erosivity, values of vegetation cover, a coefficient of soil erodibility, and values for hydrological groups for each soil type. The model was then used to estimate the ecosystem services and was then validated with data from four precipitation and sediment stations in the study area. Finally, the relationship between the calculated changes in spatial patterns of the diversity of native forest habitats and provisioning of ecosystem services was determined using a generalized linear model with ecosystem services as the dependent variable and changes in spatial patterns of: total area, total number of patches, index richness of habitat patches, and the SHDI as independent variables. The methods are appropriate for a study of landscape change at this scale, although more detailed analysis and description of native forest patch structure would have strengthened the results. Further, comparing ecosystem provisioning of specific native forest patch structures against exotic forest plantations could have expanded on the relationship between erosion and forest type. The research team's results substantiate the hypothesis that landscape level diversity of native forest patches is associated with ecosystem service provisioning. The results indicate that over the study period the area experiences a 12% loss in native forest habitat, an increase in patchiness from 17,031 to 26,352 patches covering less area and a decrease in the SHDI by 0.20. In relation to these findings the ecosystem services under study decrease by 346%, 41%, and 11% for erosion control, organic matter accumulation, and water supply. The claims made by the researchers appear to be valid with exception of the water supply results, which is affected by a large reduction in annual precipitation. The main critiques of the report are that the definition of diversity lacks coherency (and measure of diversity is important to the argument) and the maps presented are unclear because of the grey scale colour scheme. Taking this into account our rating for this article is 7/10.

Work cited:

Rodríguez-Echeverry, J., Echeverría, C., Oyarzún, C., & Morales, L. (2018). Impact of land-use change on biodiversity and ecosystem services in the Chilean temperate forests. *Landscape Ecology*. doi:10.1007/s10980-018-0612-5