2013 Geospatial Statistics Symposium

May 31, 2013: 9:00 am – 4:00 pm,
Community Room, Oregon Coast Community College
400 SE College Way Newport, OR 97366

Agenda

8:30 – 9:00	Registration
9:00 – 9:15	Introduction and Welcome
9:15 – 9:30	Overview of Geospatial statistics
9:30 – 10:00	Melanie Frazier (EPA) and Lee McCoy (USDA-ARS) – Spatial interpolation techniques using R
10:00 – 10:30	Lee McCoy, Brett Dumbauld (USDA-ARS) and Melanie Frazier (EPA) – Techniques and challenges in model development, selection, and application
10:30 – 11:00	**BREAK**
11:00 – 11:15	Robert Suryan (OSU) – Quantifying variability and persistence in remotely sensed chlorophyll time series data
11:15 – 11:45	Megen Brittell (UO) – Visualization of GPS collar data using R
11:45 – 1:00	**LUNCH**
1:00 – 1:15	Pat Clinton (EPA) – Predicting Change in Eelgrass Distribution Due to Sea Level Rise
1:15 – 2:00	Rebecca Flitcroft (USFS) – How are Streams Different from Landscapes? Evolving Approaches for Data Ananlysis in Stream Networks
2:00 – 2:30	**BREAK**
2:30 – 3:00	Betsy Breyer (PSU) – Exploring local variability in statistical relationships with geographically weighted regression
3:00 – 3:30	Jim Graham (OSU) – Managing Uncertainty in Habitat Suitability Models
3:30 – 4:00	Closing and clean up

Presentations

Spatial interpolation techniques using R

9:30– 10:00

Melanie Frazier (U.S. Environmental Protection Agency), Lee McCoy (U.S. Department of Agriculture-Agriculture Research Service)

Abstract:
Interpolation techniques are used to predict the cell values of a raster based on sample data points. For example, interpolation can be used to predict the distribution of sediment particle size throughout an estuary based on discrete sediment samples. We demonstrate some interpolation techniques using the statistical package R. There are many options for interpolating data, and determining the best approach can be challenging. To provide guidance, we will discuss methods of assessing and comparing the performance of various interpolation methods.

About the Presenter:
Melanie Frazier is an ecologist/statistician at the U.S. Environmental Protection Agency. The primary focus of her research is modeling the distributions of coastal species to describe patterns of species richness and to better understand responses to stressors such as nutrient enrichment, climate change, and pollutants. She is also working on several projects including the development of sampling protocols to ensure that the ballast discharge of ships meets new regulations under the U.S. EPA Clean Water Act, and creating databases and tools to help researchers analyze and visualize U.S. Pacific Coast estuary and watershed data. Melanie has a PhD from the University of Washington, and has over 10 years experience using and teaching the statistical program R.

Techniques and challenges in model development, selection, and application

10:00 – 10:30

Lee McCoy , Brett Dumbauld (USDA-ARS), Melanie Frazier (US EPA)

Abstract:
This presentation will address techniques and challenges involved in model development, selection, and application using, as an example, a project designed to quantify the impacts of oyster aquaculture on the native seagrass Zostera marina in Willapa Bay, WA. This example will use the statistical program R, although the techniques discussed are broadly applicable. Topics covered will include: model development based on several potential predictors of Zostera marina distribution including elevation, distance to mouth, distance to channel, stress, and salinity; model selection using AIC/BIC metrics; application of a model to predict distribution of Z. marina; and comparison of the observed and predicted levels within aquaculture to quantify the impacts of aquaculture and harvest techniques.

About the Presenters:
Lee McCoy works on oyster aquaculture issues and ecology in the Pacific Northwest. His research involves experimental work with shrimp, crabs, and oysters, habitat mapping using aerial photography, GPS, GIS, and statistics. He has become a huge fan of the statistical and programming language R - using it to accomplish as many tasks as possible (including creating calendars and measuring oysters on tiles). He has a MS and BS in Biology from Arizona State University where he explored the mechanisms of colony growth rate differences in Africanized and European honey bees.

Quantifying variability and persistence in remotely sensed chlorophyll time series data	11:00 – 11:15
Robert M. Suryan, Jarrod A. Santora (Oregon State University) and William J. Sydeman (Farallon Institute for Advanced Ecosystem Research)	

Abstract:
Satellite remotely-sensed data are a primary resource for quantifying habitat characterizes at large ecosystem to global scales. One common application of these data is identifying "hotspots" of biological productivity. Hotspot persistence over time, however, is rarely quantified. Therefore, we developed a temporally- and spatially-explicit chl a variance metric – the Frequency of Chlorophyll Peaks Index (FCPI) – using SeaWiFS ocean color data. The FCPI quantifies the frequency of chl a anomalies which exceed 1 standard deviation for the mean, relative to a "global" spatial model for the ecosystem. Using the FCPI, we identified locations of high chl a anomaly persistence amidst considerable habitat heterogeneity from British Columbia, Canada, to Baja California, Mexico. To assess its biological relevance, we tested the hypothesis that FCPI could predict marine bird movements and distributions and provide insight into persistent seabird hotspots. The FCPI explained up to twice the variation (90%) in seabird distributions compared to using mean chl a values alone. By incorporating variability and persistence, we suggest that the FCPI integrates time lags, physical forcing, and food web processes that have, in the past, thwarted attempts to link primary production and predator distribution in pelagic ecosystems. This analytical approach may have broader application to other spatially -explicit time series data.

About the Presenter:
Robert Suryan is an Associate Professor – Senior Research in the Department of Fisheries and Wildlife at Oregon State University's Hatfield Marine Science Center. Rob received a Ph.D. from Oregon State University in wildlife science with an emphasis in marine ecology and oceanography in 2006, a M.S. from Moss Landing Marine Laboratories focusing on marine mammal studies in 1995, and a B.S. from Humboldt State University studying wildlife management in 1989. For the past 20 years, Rob has studied the effects of environmental forcing on the reproductive biology, foraging ecology, and population dynamics of marine birds and mammals. He specializes in integrated ecosystem studies working with physical, biological, and fisheries oceanographers and developing programs to integrate and model predator response to changing prey availability or ocean climate. He has used state of the art electronics to study foraging, migration, and dive patterns of seabirds and integrated these data with in-situ and remotely-sensed measures of prey resources or their proxies. Rob applies results from many of these studies to address seabird-fishery interactions, identification of marine important bird areas, and marine reserve planning.

Visualization of GPS collar data using R   11:15 – 11:45
Megen Brittell (University of Oregon)

Abstract:
Location data from GPS radio collars inform our understanding of animal movements and behaviors. Visualizations in the form of both geographic maps and data graphics play a primary role in understanding this data and communicating its meaning to a broad audience. This presentation will describe a recent effort to visualize movement data for mule deer as they migrate through areas of energy development in western Wyoming. It will outline and illustrate the data formatting and initial graphic rendering that were performed in R, an open source statistics package with library support for spatial data and analysis.

About the Presenter:
Megen Brittell has an MS in Computer and Information Science from the University of Oregon and is currently pursuing her PhD specializing in Human Computer Interaction. She works with the Spatial and Map Cognition Research Lab in the Department of Geography where she developed a minimal GIS that uses an auditory display to convey information. She has also worked with the InfoGraphics lab where she has contributed to the development of maps and data graphics as part of the upcoming Atlas of Wildlife Migration: Wyoming's Ungulates.

Predicting Change in Eelgrass Distribution Due to Sea Level Rise   1:00 – 1:15
Pat Clinton (U.S. Environmental Protection Agency)

Abstract:
The eelgrass species Zostera marina is the dominant estuarine seagrass on the Pacific Northwest coast of North America and provides important ecosystem services and functions. The loss of eelgrass bed acreage due to environmental pressures is of world-wide concern, yet predicted spatial redistribution of intertidal eelgrass beds under climate change induced sea-level rise is largely unexplored through spatially explicit modeling. Here, we construct a model predicting the spatial redistribution of the intertidal eelgrass Zostera marina under varying sea-level rise scenarios in three estuaries on the Oregon coast using ArcGis tools. Using remarkably few spatial datasets, the model exploits known relationships between eelgrass and physical constraints to bed expansion to provide coefficients to a predictive regression. At this stage of development, the model dubbed BATHTUB (Bathymetry Affecting Tidal Habitats Toward Upland Boundaries) explores only the effects of bathymetric changes and not other climate change induced effects in temperature, salinity or precipitation.

About the Presenter:
Pat Clinton is a Geographer in Newport, Oregon for the Pacific Coastal Ecology Branch of the U.S Environmental Protection Agency's Office of Research and Development. He has been applying geographic information science to estuarine ecological studies for 20 years in support of the EPA's mission to safeguard human health and ecosystem integrity. Major tasks include habitat mapping and modeling, scientific sample design and GIS tool development. Pat holds a Master of Science in Resource Geography from Oregon State University.

How are Streams Different from Landscapes? Evolving Approaches for   1:15 – 2:00
Data Ananlysis in Stream Networks
Rebecca Flitcroft (U.S. Forest Service)

Abstract:
What makes analysis of streams different from other landscapes? Why should we consider the network configuration of a stream system in our analysis? These are both important questions. The stream network is the foundation upon which stream systems are organized. This organization introduces complexity for movement of organisms and inorganic material due to directions of flow, variable velocity, and scale-dependent effects. Further, movement of aquatic dependent species is constrained to the stream channel reducing potential directions of movement. This contrasts with terrestrial environments in which habitats are arranged in contiguous, two-dimensional planar landscapes. Commonly used and available spatial statistical tools were designed to take advantage of spatial autocorrelation in landscape settings. Unfortunately for those analyzing freshwater systems, the network that forms the frame for organismal dispersal, also confounds the autocorrelation structure of spatial statistics designed for landscapes. However, work is currently under way that includes network structure and river discharge in analyses. Emerging statistical techniques and tools are becoming available that have the potential to change the analysis of processes and organisms in stream networks.

About the Presenter:
Becky Flitcroft is a research fish biologist with the USDA Forest Service, PNW Research Lab, located in Corvallis, Oregon. Her research centers around salmon ecology and understanding patterns of salmon distribution and habitat at riverscape scales. Using a combination of GIS skills, geostatistics, and Bayesian methods, she works to understand and describe variation and processes at multiple spatial scales. Becky has a BS in Environmental Science and Economics from Willamette University, and an MS in Natural Resource Geography and PhD in Fisheries Science from Oregon State University

Exploring local variability in statistical relationships with geographically weighted regression	2:30 – 3:00
Betsy Breyer (Portland State University)	

Abstract:
Geographically weighted regression (GWR) is a technique to explore and characterize spatial nonstationarity in statistical relationships. In contrast to global or 'whole map' statistical techniques, GWR specifies regression coefficients for each feature in a spatial dataset, allowing variation in the strength of statistical relationships to be estimated and mapped. This talk will focus on implementing GWR in the ArcGIS environment, highlighting new tools for model development available in ArcGIS 10.1. Required and optional parameters of the GWR tool, including kernel type, bandwidth method, and spatial weights, will be covered. Strengths and limitations of GWR will be discussed.

About the Presenter:
Betsy Breyer is a geographer based in Portland, Oregon. Her research centers on spatial analysis of food and water provisioning in cities. A research assistant at Portland State University, Betsy's work examines statistical relationships between residential land use and water use patterns as part of a study on climate change adaptation funded by the National Oceanic and Atmospheric Administration. As lead researcher on the Grocery CART PDX project, Betsy's previous work used spatial regression to analyze socio-economic and demographic covariates of food price variation. Betsy holds a B.A. in Economics from Reed College and is pursuing a M.S. in Geography from Portland State University (anticipated completion Fall 2013). She is a founding cabinet member of the Oregon Urban and Regional Information System (OR-URISA) Young Professionals.

Managing Uncertainty in Habitat Suitability Models   3:00 – 3:30
Jim Graham (Oregon State University)

Abstract:
Habitat Suitability Modeling, also referred to as Ecological Niche Modeling and closely related to Species Distribution Modeling, has seen a rapid growth in methods over the last ten years. Methods range from traditional regression to more complex machine learning approaches. Existing methods validate models against sub-sets of the original data which can hide over-fitting the models. Limiting features and properly setting regularization for programs like Maxent can help manage over fitting. The Hyper Envelope Modeling Interface (HEMI) is a relatively simple approach that has produced good results without over-fitting. Typically with Habitat Suitability Modeling and other areas of spatial modeling, the uncertainty in the field data and the predictor variables is ignored. Methods such as "perturbing" the inputs to models have the potential to model uncertainty throughout the modeling process.

About the Presenter:
Jim Graham's research focuses on Habitat Suitability Models but spills over into a wide range of geospatial environmental science and natural resource management issues. His expertise in spatial modeling begins with data collection, through data evaluation, integration, modeling, and dissemination. He is one of the creators of the International Biological Information System which provides support to a variety of spatially-enabled websites at the Natural Resource Ecology Laboratory at Colorado State University where he maintains a research scientist position. Jim has been a visiting professor at Oregon State University for the last two years where he has been teaching the bulk of the graduate-level GIS courses. He will be taking an associate professor position at Humboldt State University this fall where he will be leading the geospatial program.

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Please join us for a social event following the meeting at Rogue Ales Brewery
Brewer's on the Bay: 2320 SE OSU Drive Newport, OR 97365

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The Central Coast GIS Users Group (CCGISUG) promotes networking, idea exchange, and education between GIS professionals, students, and others on the Central Oregon Coast involved in mapping and geospatial technologies.
We meet bimonthly on the second Wednesday from 12:15 to 1:45. Membership is free!
To join our listserv, please contact Sandy Gruber (Sandy@lincolncity.org).
For more information please visit http://www.orurisa.org/ccgisug