From the Working Group Chair

Welcome to the 2011 summer edition of Remotely Wild, the newsletter of the Spatial Ecology & Telemetry Working Group of the Wildlife Society (SETWG). I hope you are having a productive season of field work and data analyses. We have some great articles in this edition, and this year is proving to be an exciting one for the Working Group as we gear up for the annual Wildlife Society conference in Hawaii. We’ll continue to keep you up to date.

SETWG is proud to sponsor three great conference workshops this year that should have broad appeal to our membership - “Cartographic Design for Wildlife Professionals: Making Better Maps with GIS”, presented by Elizabeth K. Solomon of ADF&G; “Communicating Wildlife Data Using Google Mapping Applications”, presented by Melanie A. Smith, Audubon Alaska, and Geospatial Skills Workshop, presented by Dr Hawthorne Beyer (University of Toronto) and Dr Jacqui Frait (SUNY). We are also co-sponsoring with the Biometrics Working Group a symposium on “Location-Only and Use-Availability Data: Analysis Methods Converge”.

An article by Hawthorne Beyer in this issue of Remotely Wild provides an excellent overview of the growing challenge of accurately quantifying spatial processes and relationships as datasets increase in size and complexity. In his conference workshop, Hawthorne will be demonstrating how the GME program can meet this challenge by considerably improving analytical functionality.

Thanks to those who submitted articles for this issue of our newsletter - if you have an article on wildlife telemetry or a spatial ecology modeling/GIS application that you would like considered for publication in forthcoming issues of Remotely Wild we would love to hear from you!

And thanks to the SETWG membership for your continued support and interest in the Working Group. I hope to see you in Hawaii!

Best regards, James Sheppard (spatialecologist@gmail.com)

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SPATIAL ECOLOGY & TELEMETRY WORKING GROUP

The Spatial Ecology and Telemetry Working Group provides an opportunity for TWS members to address issues of concern to the GIS community and to advance their own skills and understanding of GIS, remote sensing, and telemetry technologies. The Working Group functions as a clearinghouse of information and expertise in the area of GIS, remote sensing, and telemetry for The Wildlife Society Council, TWS sections and chapters, and individual TWS members.
The Spatial Ecology and Telemetry working group of the Wildlife Society is soliciting applications for $500 travel awards to attend the Wildlife Society’s Annual 2011 Conference in Hawaii. A total of four awards will be provided in the following categories:

**2 Graduate Student awards:** Must be a current graduate student or have graduated in 2011.

**1 Undergraduate Student award:** Must be a current undergraduate student or have graduated in 2011.

**1 Young Professional award:** Must have graduated from undergraduate or graduate school within the previous 2 years.

Individual applicants must be a member of the Wildlife Society at the national level. Graduate student and young professional applicants must be presenting a poster or oral presentation at the conference. Preference will be given to applicants whose research emphasizes GIS, remote sensing, or telemetry. Undergraduate applicants are not required to present but should have research interests or experience in the areas of GIS, remote sensing or telemetry. Membership in the Spatial Ecology and Telemetry working group is not a requirement for this travel grant.

To apply for the travel grant, send a copy of your presentation abstract (graduate and young professional applicants) or a description of your research interests (undergraduate applicants), a 1-page CV, and a 1-page letter stating your professional interests and why you should be considered for the award to Marci Johnson (marci_johnson@nps.gov). Make sure to mention which travel grant you are applying for.

Graduate student and young professional award recipients will be asked to write a small piece describing their research for our newsletter. Undergraduate award recipients will be asked to write a paragraph on benefits gained by attending the meetings. The application deadline is August 20, 2011. Award recipients will be notified by September 3, 2011.
CyberTracker Conservation (a.k.a. CyberTracker)

Louis Liebenberg
[Managing Director]
http://www.cybertracker.co.za

Justin Steventon
[Steventon Consulting]
http://www.steventonconsulting.com/CyberTracker.aspx

Carike Pepler,
[Operations Manager]

CyberTracker is a software program that was developed in South Africa to assist in the collection of spatially-explicit, detailed wildlife inventories using GPS-integrated PDAs. The system was originally developed on Palm OS devices, but has evolved to Windows Mobile Pocket PCs and now Smartphones (an Android version may be available by the end of the year). Initially, the system was developed to allow skilled bushmen (but illiterate by our standards) to collect field data using an icon-based GPS system.

CyberTracker includes a desktop PC module to develop and test applications, manage data and generate reports. The PC software generates code that can be synched to the pocket PCs for field data collection. Users need not know any programming to customize and develop their own specific application. The tools allow for a wide range of data input, from laser rangefinders streaming data via Bluetooth, GPS, digital photos and more.

The system allows for collecting data for many applications from social surveys, wildlife inventories, and emergency and disaster relief. The system has been implemented for ground and aerial surveys. The desktop module also allows data integration with GIS applications. Data are easily exported to Excel or other programs for input in standard analysis packages (e.g., DISTANCE). CyberTracker can export data as an ArcView shapefile for additional GIS-assisted analyses.

Perhaps the most amazing aspect of the CyberTracker system is that the software is free and is supported for free through web instructions. individuals wanting to collect spatially-explicit data, CyberTracker facilitates implementation and coordination of many users/units compared to a propriety software with licensing like ArcGIS and related products.
SETWG Awards 2011

“Fractal” - A program to analyze animal movement paths

Dr. Vilis O. Nams
Dept Env Sciences, NSAC, Canada

http://nsac.ca/envsci/staff/vnams/ Fractal.htm

The purpose of Fractal is to analyze various features of movement paths of animals, mostly to study the spatial scale of habitat use of animals. Fractal mainly does various forms of fractal analysis, but it also estimates some statistics useful in testing the hypothesis of whether the animal is moving with a random walk.

Fractal does the following:
1. Estimates fractal dimension (D) using the basic divider method.
2. Estimates fractal D, using a resampling version of the divider method.
3. Calculates the VFractal estimator, which estimates fractal D as a function of scale but which also provides error estimates.
4. Uses the VFractal to calculate other estimators that are useful in analyzing how animals react to spatial scale.
5. Estimates Net distance^2 travelled as a function of number of steps, and uses this for a statistical test for deviations from a CRW model.
6. Carries out the scaling test for oriented movement.
7. Transforms movement paths by discretizing or rotating them.

Marxan

Dr. Ian R. Ball
Dr. Hugh P. Possingham
University of Queensland, Australia


Marxan is software designed to aid systematic reserve design on conservation planning. Marxan identifies areas that efficiently meet targets for a variety of conservation and socio-economic goals, providing multiple solutions that attempt to balance competing goals, and is often used in designing reserve areas. With the use of stochastic optimization routines it generates spatial reserve systems that achieve particular biodiversity representation goals.

Marxan is the most widely used systematic reserve planning software in the world, and has most famously been used to create the marine reserve network on the Great Barrier Reef, in Queensland, Australia, the largest marine protected area in the world.

Marxan enables users to do the following:
1. Identify areas that efficiently meet targets for a range of biodiversity features for minimal cost
2. Use the principle of complementarity to select planning units which complement the conservation area network (the whole is more than the sum of its parts);
3. Meet spatial requirements such as compactness of a reserve system;
4. Include data on ecological processes, threats, and condition;
5. Identify tradeoffs between conservation and socio-economic objectives; and
6. Generate a number of very good solutions.
The changing nature of data, questions, and analytical tools

We are awash in an ocean of data. One recent estimate of the world’s digital data capacity is that it exceeds 295 exabytes (295 trillion gigabytes)\(^1\).

It streams in continuously, and often in vast quantities, from sources such as satellites, weather stations, a variety of automated sensors (e.g. GPS telemetry collars), censuses, crowd-sourced digitizers (e.g. OpenStreetMap), the scanning of historical records (e.g. Google Books Library), mobile devices, and an enormous population of professionals devoted to creating digital data. Furthermore, many of these data can be accessed via the internet within seconds.

We do not make as much use of these data as we could, however, for two reasons. First, although the information content of these data is high, we often lack the analytical tools needed to rigorously process and analyze them. Second, the data that are most readily available are often only indirectly related to the information we are actually interested in.

One reason we need new analytical tools is that the types of questions we are asking are changing. Experimentation (requiring control, randomization, and replication) is still the bedrock of scientific investigation. Many of the questions we are interested in addressing, however, are not amenable to experimentation.
In ecology we are often interested in processes enacted at large scales, among many species, or over long time periods. For instance, it is not possible to replicate Yellowstone National Park, and develop a controlled, randomized design to study trophic cascades resulting from the reintroduction of wolves.

While more traditional (frequentist) statistical methods focused on detecting differences (e.g. is one sample different than another, or is this parameter different than 0?), more recent modeling approaches focus on quantifying the strength and form of effects. There is a growing trend away from simple, correlative, phenomenological analyses, to more mechanistic, ecological process based analyses. Useful improvements in computational power have facilitated the development of statistical machinery (e.g. MCMC) that allows us to fit these complex models.

Furthermore, statistical methods such as state-space models also help resolve the problem that the data available is only indirectly linked to the variable of interest. This is achieved by fitting two models in parallel: a data model that relates the observed variable to the variable we are really interested in, and a process model that describes the ecological system. For instance, I have used this approach to quantify spatial transmission dynamics of rabies in Tanzania when only a proxy indicator (hospital bite records) of rabies occurrence was available\textsuperscript{2}.

Thus, there have been important advances in statistical and computational tools. Conversely, developments in geospatial analytical functionality in the last two decades have lagged behind other technological improvements. Much of the analytical functionality currently available in commercial geospatial software is the same functionality that was available 20 years ago: storage, viewing, querying, overlay, raster algebra, clipping, buffering, etc.

\textit{Improvements in resolution, temporal frequency, spectral bands, and the diversity of platforms result in the accumulation of vast amounts of imagery data. Stronger analytical techniques are needed, however, to extract knowledge from raw data. (Pictured: near-infrared, false color, 15 cm resolution image of vegetation and bison in Yellowstone National Park).}
Improving analytical functionality requires a greater diversity in options for quantifying spatial relationships. Even simple techniques, such as vector-based visibility analysis (pictured), can help us to model spatial processes.

Yet analytical innovation has been occurring. The statistical software R is perhaps the most impressive example of this. So there appears to be an unfortunate lag between the development and adoption of new analytical techniques.

The Geospatial Modeling Environment³ (GME) is a software application that provides access to both basic and advanced analytical functionality in a framework that facilitates automation, scripting, and sharing of workflows. Importantly, it also provides a link between R and ArcGIS that creates new opportunities to exploit analytical innovation in R in a geospatial context.

Dr. Jacqueline Frair (SUNY) and I are offering a one day Geospatial Skills workshop at the TWS annual conference in Hawaii this November. The workshop will combine brief presentations about conceptual advances in geospatial analysis with hands-on exercises using the Geospatial Modeling Environment and R. No previous experience with GME or R is required, but a basic working knowledge of ArcGIS would be useful. The focus of the workshop will be on concepts rather than details of any particular software package.

Note: Registrants will be required to bring a laptop with ArcGIS 10 installed. As an internet connection will not be available in the workshop you must also "check out" an ArcGIS 10 license from your server for this workshop (ArcView, ArcEditor or ArcInfo licenses are equally satisfactory). Contact your license server administrator if you need assistance with this task. You will also need to pre-install R, StatConn and GME. See the GME website³ for further details.

References
The Natural Resources Communication Workshop, sponsored by the Western Section of The Wildlife Society, will be held at California State University, Chico from January 9-13, 2012.

The week-long workshop is designed to help natural resource workers more effectively communicate with general as well as technical audiences through personal presentations using computer-generated PowerPoint images. A variety of topics are covered including selecting communication strategies for specific audiences, creating computer-generated graphics, avoiding PowerPoint presentation “pitfalls,” handling difficult questions, and solving equipment problems.

Application deadline is October 28, 2011 and tentative registration fee is $749.

Applying for the workshop is easy. On letterhead, applicants should describe: (1) their current position within their agency/organization, (2) how they would use the training, (3) any special reasons why they feel they should be chosen as a participant, and (4) if they already have official agency/organization approval to attend. Applicants should include their address, phone number, fax number, and email address with their application.

Professional Credit: Participants receive 1-unit CSUC Continuing Education credit. The workshop is worth 42 contact hours in Category I of The Wildlife Society’s Certified Wildlife Biologist Renewal/Professional Development Certificate Program.

Submit applications to: Dr. Jon K. Hooper, Dept. Recreation and Parks Management, Calif. State University, Chico, CA 95929-0560. For more information, contact Jon by calling (530) 898-5811, faxing (530) 898-6557, or e-mailing jhooper@csuchico.edu.

Linking the extraordinary functionality of R with geoanalytical software provides a wealth of new analytical opportunities. Here, for instance, the RandomFields R library is used to create hypothetical landscapes (GIS raster datasets) with different spatial structure. When combined with stochastic simulation (e.g. movement models) this can be a useful framework for understanding the link between spatial structure and ecological processes result in distribution patterns. The ways in which R could advance geospatial analysis are essentially unlimited.
Between 8 – 10% of the general population experience some sort of color blindness, causing them to have either partial or total inability to perceive colors in some part of the visible spectrum. For some quick background, the eye contains two general types of light-sensing cells including Rod cells (more active in low-light conditions) and Cone cells (more active in bright light). Human eyes typically have three types of cone cells, each of which are sensitive to different regions of the visible spectrum.

- The “S” cone cells are sensitive to short wavelengths in the Blue region, and are also called Blue cone cells.

- The “M” cone cells are sensitive to medium wavelengths in the Yellow-green range, and are also called Green cone cells.

- The “L” cone cells are sensitive to longer wavelengths in the Yellow region, and are (somewhat counter-intuitively) called Red cone cells.

- Many animal species (especially some fish, birds, amphibians, insects and reptiles) have a fourth class of cone cells that would allow them to perceive colors that humans would not be able to distinguish. Some of these species are able to see farther into the ultraviolet range.

The color that our brain perceives is based on how all three types of cone cells sense the light, similar to how we perceive millions of colors on a computer monitor based on different brightness levels of red, green and blue pixels. If a light is viewed as bright by the “S” cone cells, and dim by the “M” and “L” cone cells, then our brain will perceive that color as blue.

There are several variations of color blindness, almost all of which are caused by problems in one or more of these classes of cone cells.
Protanopia is the condition where “L” (Red) cone cells are all missing or nonfunctional. Protanomaly is the case where the red cells are at least partially functional, or are more sensitive to a different frequency than most of the population. People with these conditions have trouble distinguishing between red and green. Approximately 2.6% of males and 0.04% of females experience these conditions.

Deuteranopia is the condition where the “M” (Green) cone cells are missing or nonfunctional, and Deuteranomaly is the condition where the green cells are partially functional or shifted to a different frequency. As with Protanopia and Protanomaly, people with these conditions have trouble distinguishing between red and green. Approximately 6.1% of males and 0.04% of females experience these conditions.

Tritanopia is the condition where the “S” (Blue) cone cells are missing or nonfunctional, and the milder condition is Tritanomaly. People with these conditions have trouble distinguishing between blue and yellow. Approximately 0.01% of males and 0.36% of females experience these conditions.

Monochromacy is the condition where two or all three classes of cone cells are damaged or nonfunctional. Vision is reduced to shades of gray. Approximately 0.00001% of males and 0.00001% of females experience this condition.

I am no expert on color blindness, but I do care about making maps that tell a clear story. Unfortunately, one of my favorite color ramps (from red to yellow to green), is difficult to perceive for approximately 9% of the population (those with Protanopia, Protanomaly, Deuteranopia or Deuteranomaly).

Because I have been fortunate enough not to have to deal with color blindness myself, I rarely think about it when I am making maps and I am quick to throw my favorite color ramp on a map without thinking that some people might have trouble with it. For example, what looks good to me would completely fail for people with Protanopia, Deuteranopia or Monochromacy.
So how can we tell if our map might cause problems? I recently stumbled across some great free software tools to show how any image would be seen by a person with the most extreme cases of color blindness. Color Oracle (http://colororacle.cartography.ch/) was created by cartographers in Switzerland, and can switch your entire monitor temporarily to a Protanopia, Deuteranopia or Tritanopia view, and is available for Windows, Mac and Linux. The Fujitsu Color Doctor (http://www.fujitsu.com/global/accessibility/assistance/cd/) is available for Windows and makes it easy to generate snapshots (like those shown above). Many more tools are listed at http://colororacle.cartography.ch/links.html. Tools such as these will help us to create easily-readable maps that work for a greater proportion of readers, and I highly recommend them.
By the beginning of the twentieth century, the Louisiana black bear had become rare in east Texas and by the 1940's was considered extirpated from the state. Beginning in the late 1970s, reliable black bear sightings have been recorded in east Texas with increasing occurrence. In 1973 restrictions were placed on black bear hunting with the eventual statewide prohibition and a listing of the black bear to the Texas endangered species list in 1987. In January of 1992, with mounting concerns that the Louisiana black bear population was approaching the minimum viable threshold due to human-related mortality and increased habitat destruction, the U.S. Fish and Wildlife Service classified the Louisiana black bear as a threatened species under the Endangered Species Act of 1973.

Much of the current research within the historic range of the Louisiana black bear focuses on identifying and quantitatively describing potential or occupied habitats and current habitat use. Reports indicated that east Texas contains some of the largest blocks of forested habitat suitable for but currently unoccupied by black bears in the southeast. Research in the 1990s confirmed that suitable black bear habitat exists in portions of east Texas. However, despite reliable bear sightings over the past 30 years and the existence of suitable habitat, stable breeding populations apparently do not exist.

In 2009, in an effort to meet the recovery goals set forth by state and federal Louisiana black bear recovery plans, Stephen F. Austin State University in partnership with the Texas Parks and Wildlife Department, the Black Bear Conservation Coalition, and the East Texas Black Bear Task Force (ETBBTF), began a 3-year study researching the current occupancy and suitability of habitats for the Louisiana black bear in east Texas.
Previous research in Texas utilized established habitat suitability index (HSI) models to quantify habitats for specific political or administrative boundaries. However, in order to assess the suitability of habitat for the entire south recovery zone of the ETBBTF recovery plan (Figure 1), we incorporated components from three established HSI models to develop a landscape-scale HSI model for 19 counties of the Pineywoods ecoregion in east Texas.

Habitat suitability index models have been used since the early 1980s to quantify wildlife habitat based on known life requisite variables and habitat requirements. Habitat variables (e.g. fall food production) are evaluated on a suitability index (SI) scale from 0 (unsuitable habitat) to 1 (optimum suitability). Final HSI scores are typically the weighted mean of the multiple SI scores calculated according to the hypothesized relationship between variables. Because of the coarseness of most GIS data, HSI models are well suited for habitat generalists and species with large spatial requirements such as black bears.

In the past most HSI models were used to develop a single habitat suitability score for distinct political or administrative boundaries such as a national forest. Because of the large spatial requirements for, and increasing confirmed reports of, black bears throughout east Texas, our objective was to develop a landscape-scale HSI model that could be used to evaluate year-round habitat requirements and direct conservation efforts region-wide. Research suggests that more simple black bear models consisting of food and cover components reflect habitat selection better at a population level and that resource availability is more important to black bear habitat quality than abiotic components such as slope and aspect. Our model thus incorporates food, cover, and human-impact components.

**Figure 1.** Historic distribution for the Louisiana black bear in east Texas and south recovery zone of the East Texas Black Bear Task Force recovery plan.
Using the 2009 Texas Vegetation Classification Project land classification model (TVCP; a product of remote sensing of LandSat satellite imagery, aerial photo interpretation, digital soil surveys, and digital elevation models consisting of 119 ecological classifications at 10 meter resolution), TVCP interpretive booklet, existing HSI model equations (Van Manen 1991, Mitchell 2002), and literature review from previous habitat studies in east Texas and surrounding region, we assigned SI scores for summer food availability, fall food availability, fall food diversity, fall food productivity, protection cover, and tree den availability to 98 habitat classifications and calculated food and cover component indices in ArcGIS 9.3.1 (Figure 2 and 3).

Roads affect habitat quality at a relatively large spatial scale. Research has shown that bears avoided areas <1600 meters from gravel roads when establishing summer and fall home ranges and males and females avoided areas <800 meters during the summer and fall respectively. We incorporated a distance to road variable and buffered all state and county roads and assigned SI scores according to the equation developed by Mitchell (2002; \( x = \) distance to roads; when \( 0 < x < 1.6 \) km, \( SIR = 0.156x + 0.195x^2 = 0.25 \); when \( x > 1.6 \) km, \( SIR = 1.0 \)).

Since the TVCP model includes low and high density urban classes, we incorporated a human-bear conflict zone variable (Bowman 1999). We buffered low (1.1 km) and high (3.9 km) density urban areas based on the home range size for female Louisiana black bears and assigned SI scores (within urban buffer zones \( SIHD = 0 \); outside urban buffer zone \( SIHD = 1 \)). We combined the distance to roads and human-bear conflict zone variables and calculated a human-impact component index (Figure 4).

We combined food, cover, and human-impact components to calculate overall a priori HSI scores (\( HSI = (CIFOOD \times 2 + CICOVER + CIHUMAN IMPACT) / 4 \)). Rather than apply HSI scores to compartment boundaries, we calculated HSI scores per pixel to develop a landscape-scale HSI model (Figure 5). Currently, we are conducting detailed vegetation analysis per habitat class of the TVCP in order to develop SI scores per class and evaluate the accuracy of our model. By evaluating our a priori model using independent habitat analysis, we can provide a level of precision that could not otherwise be attained using field data that was incorporated into the development of the TVCP. We will readjust our SI scores accordingly to develop a final model consistent with the results of detailed vegetation survey and measurement.

References:


Figure 2. Food component with suitability index scores ranging from unsuitable (SI = 0.00; blue) to high suitability (SI = 0.89; red).

Figure 3. Cover component with suitability index scores ranging from unsuitable (SI = 0.00; blue) to high suitability (SI = 1.00; red).

Figure 4. Human impact component with suitability scores ranging from unsuitable (SI = 0.00079; blue) to high suitability (SI = 1.00; red).

Figure 5. Landscape-scale a priori habitat suitability index model for the south recovery zone of the East Texas Black Bear Task Force recovery zones. The model was developed at 10 meter resolution for 19 counties in east Texas with HSI scores ranging from 0.00 (unsuitable habitat) to 0.82 (high suitability).
Spatial Ecology & Telemetry Working Group

On the Web at:

http://joomla.wildlife.org/spatialecology/

2011 Working Group Executive

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Upcoming Events