The Society for Conservation GIS

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2006 Society for Conservation GIS and Society for Conservation Biology Integrated Conference

The ninth Annual International Conference for the Society for Conservation GIS (Geographic Information Systems) will be held in conjunction with the Society for Conservation Biology (SCB) 20th Annual Meeting June 24-28 at the San Jose McEnery Convention Center. A shared goal of the conferences is the creation of an international conservation scientist-GIS practitioner community to build conservation capacity and promote geospatial technologies at local, regional, and global levels. The conferences also share a common theme of "Conservation Without Borders", divided into four major threads:

1. Local-level and regional-level conservation
2. Marine and freshwater conservation
3. 21st century conservation
4. Trans-boundary conservation

To derive the most benefit from this unique coordination, the Society for Conservation GIS (SCGIS) and SCB members registering for either conference will be allowed to attend all events (technical and social) of both organizations at no additional cost. Training sessions (with potential additional fees) held by either organization are open similarly to all attendees on a first-come basis.

In this issue:

The Society for Conservation GIS Principles: Science, Community, Technology

Charles Convis, ESRI Conservation Program Coordinator, ecp2@esri.com

The typical non-profit view of technology is office automation, printing and word processing. The current focus of technology granting in the foundation community is internet and web access. SCGIS's view of technology is markedly different. What SCGIS means by technology in the non-profit community can be summed up in one word: Integration.

We focus specifically on a set of technological and scientific tools which includes computers but which extends so much farther beyond hardware that it is more often referred to as a discipline or a field of study than a technology. Put simply, Geographic Information Systems use the spatial characteristics present in nearly all scientific data to allow those data to be integrated into a single environment for analyzing and resolving complex problems. Ecology itself was meant to be the great interdisciplinary field that would answer the call to action of Earth Day 1970, and many academic programs in Ecology became popular in the 70's and 80's. Many of us are the result of those programs.

Unfortunately, as powerful as it was as a discipline, it fell short in application because the management tools needed to interpret and apply complex ecological theories, drawn across so many disciplines in the physical, biological and social sciences, just didn't exist. The same problem existed three centuries earlier when the anomalies in planetary orbits could be seen but not explained. When Newton invented a new predictive tool, calculus, it revolutionized classical mechanics and set the stage for the industrial revolution. Because of its foundation in statistical mathematics and its power in uniting information from very different sources and disciplines, we feel that GIS may be to Ecology what the Calculus was to Mechanics, namely, a tool that helps a body of academic theories to become a profession of practitioners and methods.

Community describes what we are now and what we feel gives this organization its enduring distinctiveness. Fifteen years ago, the career choice of doing GIS for non-profit conservation was a lonely one. Even though GIS had become a well established industry by then, it was still expensive and out of reach of the non-profit community. The GIS industry had little interest in or relationship to non-profits. Those few struggling to introduce GIS integration concepts into NGOs of any size struggled in isolation and obscurity. It's not surprising, therefore, that any chance to meet others of our kind was a profound antidote to the isolation and would always be a powerful motivation for continuing to seek each other out. This is the fundamental reason why this Society has thrived and grown so much in the past decade, without any of the normal trappings that signify a functioning organization such as core funding, paid staff, offices or projects. It's why this Society will continue to grow and thrive regardless of what the future brings. The emotional bonds that unite technologists who happen to be passionate about nature are just too strong to ignore.

Science describes the overwhelming focus of our work and the most difficult challenge we all face. The existence of GIS as a commercial industry, coupled with active non-profit grants, has meant that the tools of GIS are readily available now. Similarly, there is a great deal of academic research and discussion on the problems of conservation biology. Unfortunately, between those 2 areas of interesting and productive activity is a troublesome gulf. It's not unlike the more general issue of theory versus practice, but all the more pressing because land use decisions occur in the thousands every day, with harmful long-term impacts, and frequently without appropriate input from current science. This was the same problem identified by Dr. Michael Soule when he set about to found the Society for Conservation Biology as a "mission-oriented discipline" which he hoped would bridge this gulf. Unfortunately, the gulf has proved more challenging, which is why we are honored that Dr. Soule has agreed to support SCGIS as our science advisor. We have benefited often from his experience and advice in strengthening the SCGIS's own commitment to activism and pragmatism. We hope that the continued growth of a partnership between SCGIS and the Society for Conservation Biology will help diminish the gulf between theory and practice and help ensure that more and more resource decisions and policy are guided by the best that conservation science has to offer.

This essay was first published on the SCGIS List Serve in April 2004.
To find out more about the SCGIS List Serve, visit www.scgis.org and click on Connect.

Preserving Orang-utans and Their Habitat with GIS, Frank S. Razem, GISP, frazem@sfwmd.gov

Adolescent Orangutan

The plight of the wild Orangutan is perilous to say the least. There ever decreasing habitat is disappearing at an astonishing rate. Illegal logging, gold mining and palm oil plantations are putting tremendous pressure on the natural resources available to the Orangutans in the wild. Orangutan populations are dwindling due to illegal pet trade as well, where often the mother is killed and the orphan is taken for trade.

Orangutan Foundation International (OFI) is committed to the preservation the orang-utan and it's habitat in the rain forests. OFI also cares for orang-utans previously captured as pets or otherwise in captivity, as they make their way back to their natural environment.

Background

Orangutan Foundation International was founded in 1986 by Dr. Biruté Galdikas. She began her study of the orang-utan in 1971 in the one last wild places on earth, Indonesian Borneo. It took 3 years, but finally Dr. Louis Leakey, famed Kenyan anthropologist, both inspiration and mentor for Biruté, arranged funding for her to begin her study of the orang-utan, as he had done with Dian Fossey (mountain gorilla) and Jane Goodall (chimpanzee).

Arriving in Tanjung Puting Reserve (now a National Park), Biruté and her then husband, Rod Brindamour, set up camp in what know as "Camp Leakey". Setting off on what has now been the longest continuous study of any wild mammal in the world. Dr. Galdikas is the world's foremost authority on the Orang-utans, twice being featured on the cover of National Geographic magazine.

OFI had a great need to collect field data, but did not have the staff to perform that tasks. So, OFI began a GIS Volunteer Program to fill the need. GIS professionals, students and other interest persons began participating in this program. The program's mission is to collect field data to support of Orangutan Foundation International's development and improvement of their Geographic Information System (GIS). Ultimately, the goal is to map and identify orang-utan habitat and vegetation in Tanjung Puting National Park and adjacent areas, based on spatial assessment and field data collection. This will provide a foundation for mapping, storing and analyzing other spatial and conservation data for the park.

GIS Volunteer Program

The 2005 program attracted individuals from all over the world. The objectives of the project are to map selected features of the park and surrounding areas including trails, orangutan survey locations, nests, rivers, illegal logging activities and locations corresponding to selected pixels on satellite imagery, using Global Positioning System (GPS) and hardcopy mapping techniques. Collecting field data in areas adjacent to the park was one of the primary goals of this year's program mission. Particularly, two orang-utan migration corridors to determine desired locations for future protected areas.

The volunteer group first traveled up the Sekonyer river from Kumai to Camp Leakey for several days of trail mapping. At the beginning of each day, the group would break into teams of 2-3 volunteers and an OFI assistant. Each team would map different trails, using GPS and collect data, consisting of land cover (forest, swamp etc), tree canopy height, percent of canopy cover, orangutan nest and sightings, which trail they were mapping and intersections with other trails.

The assistants, primarily from various Dayak tribes are employed by OFI in a numerous functions. The assistants track certain orangutans, serve at OFI's guard posts and as guides. Their knowledge of the rain forests, vegetation, terrain and orangutan habitat is invaluable. OFI has numerous guard posts around and in Tanjung Puting National Park.

These posts serve to deter illegal loggers and gold miners. The assistants at the posts regularly go out on patrol searching for these illegal activities and notify authorities, when they are found. Some assistants track and follow wild orangutan noting their movements and activities. Others serve to help OFI staff with those orangutans at the Orangutan Care Center while they are being given medical treatment and full care and eventual release back to their natural environment.

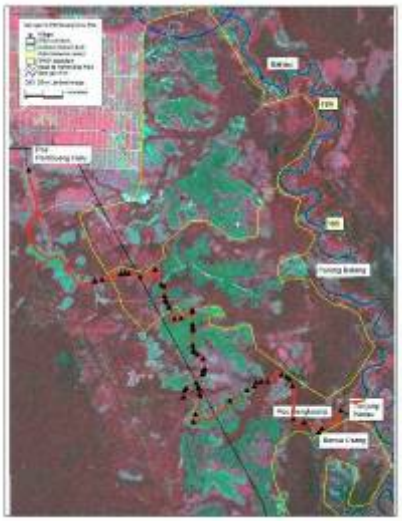
After completing the GIS work at Camp Leakey, the volunteers head out to Pembuang Hulu outside the western boundary of Tanjung Puting N.P.. There the group split up again. 2 volunteers headed South on the Seruyan River and the other headed north. The group headed north lived on Klotoks for several days, taking day trips into the jungles from the boats to collect data. The group heading south would again split up into separate teams. The teams consisted of 1 OFI staff person, 1 GIS volunteer and 2 OFI assistants. Since the areas to be surveyed contained extremely rough terrain and had not been mapped or accessed before, it was decided to contact local villages for guides through these areas

The first team stopped at the Dayak village Parang Batang. There they met with the village chief and elders and procured guides from the village. The second team continued South along the river to Tanjung Hanau, another Dayak village. There the Chief himself along with another villager decided to lead the expedition. The Chief's knowledge of the swamps and jungles was impressive. His concern for the rainforest, the deforestation due to illegal logging and palm oil plantations was equally impressive.

Dayak Chief leading the expedition

The primary mission of the group was to map possible migration corridors for the orangutans from TPNP to the Seruyan river. The habitat in the park and near the river is viable habitat for orangutans, but if not connected to the park the orangutans will not travel to the river. The area traveled during this 40 kilometer trek was mixed with swamps, jungles and deforested areas. In places the terrain was so thick the team would be moving at 200 meters per hour or less.

There were problems along the way as well. Aside from leeches and mosquitoes, communications and technical problems arose. To begin with the team ended up ten kilometers south of where they should have been, due to confusion between the expedition's guides and the OFI team members. Loss of data in a professional grade GPS device left the team without the ability to fix there position on a map. Luckily, recreational GPS devices, a hard copy map (without coordinates) and a compass, allowed the team to fall back to the conventional "Dead Reckoning" system to navigation. Knowing the bearing and direct distance to their starting point, the team was able to pinpoint their location on the hard copy map with a compass and ruler. The trek began at Tanjung Hanua and ended at OFI's Pos Pembuang Hulu (OFI Post). The trip was 20 kilometers as the crow flies, although the team traveled over 40 kilometers during this adventure due to impassable swamps, obstacles and of course the extra 10 km mentioned earlier.



Map used in the field for "dead reckoning"

From more information about Orangutan Foundation International, Orangutans and what you can do to help visit: www.orangutan.org

From Paper Notes to Hand-Held Computers: Sea Turtle Nesting Surveys in the 21st Century,

Jennifer Marangos JMarangos@ci.boca-raton.fl.us, Kirt Rusenko KRusenko@ci.boca-raton.fl.us, Rick Householder, ehouseh@sfwmd.gov

The Boca Raton Sea Turtle Conservation and Research Program is responsible for surveying sea turtle nesting activity on the five miles of Boca Raton's beaches. Three species of sea turtle nest at night, the Loggerhead, the Green, and the Leatherback, 80% of the nests deposited are Loggerhead. Surveys for nesting activity begins at sunrise from March 1 to October 31.

Each species is identified by their characteristic crawl and a determination is made if the crawl is actually a nest or a non-nesting emergence (false crawl).

For loggerheads the ratio of nests to false crawls is typically 1:1, if the ratio varies significantly it is generally an indication of a problem in that area. If a nest is too close to the water, it is relocated to a position away from the water to prevent the nest washing out. Boca Raton is unusual among coastal cities as 2.65 miles of the five miles of beach are City or County Parks, which are favored nesting areas for sea turtles.

In 1988 the Florida Department of Environmental Protection (DEP) divided the five miles of Boca Raton beaches into 10 one-half mile zones. These zones were used to provide the State with a "higher resolution" view of nesting activity. Because one half mile is not accurate on a local scale, locations of nests and false crawls (non-nesting emergences) were determined by beachfront features such as condominiums and lifeguard towers. At best, the accuracy for locating a crawl was maybe 200 feet, which is not good enough to demonstrate areas with nesting problems such as lighting on the beach.

In 2001 the Boca Raton Sea Turtle Conservation and Research Program acquired several low cost, recreational grade GPS (Global Positioning System) units that could record the positions of the sea turtle crawls on the beaches in Boca Raton. The new technology brought many positional advantages to locating the turtle crawls and nests. Unfortunately, it also required writing GPS latitude/ longitude positions in field notebooks, which were then transferred to the office notebook, which were then transferred to the computer spreadsheet. As a result, to get data into the computer, handwritten data was transposed three times which left a large margin for error depending on the data entry person's ability to read the handwritten notes. Therefore, with this system, data collected had to go through several verification processes to insure accuracy.

In 2002 an Environmental Excellence Award from Cooper Electronics allowed the Sea Turtle Conservation and Research Program to purchase 3 Compaq IPAQ hand-held computers fitted with Ambicon GPS Navigation Compactflash Card (model GPS-pro) and ESRI ArcPad software. This new technology gave the staff the ability to collect turtle crawl data with GPS located points that were directly loaded into a shapefile in the ArcPad application. The handheld units paired with GPS and ArcPad mapping allowed the turtle research staff to go from manual GPS point collection to true mobile mapping.

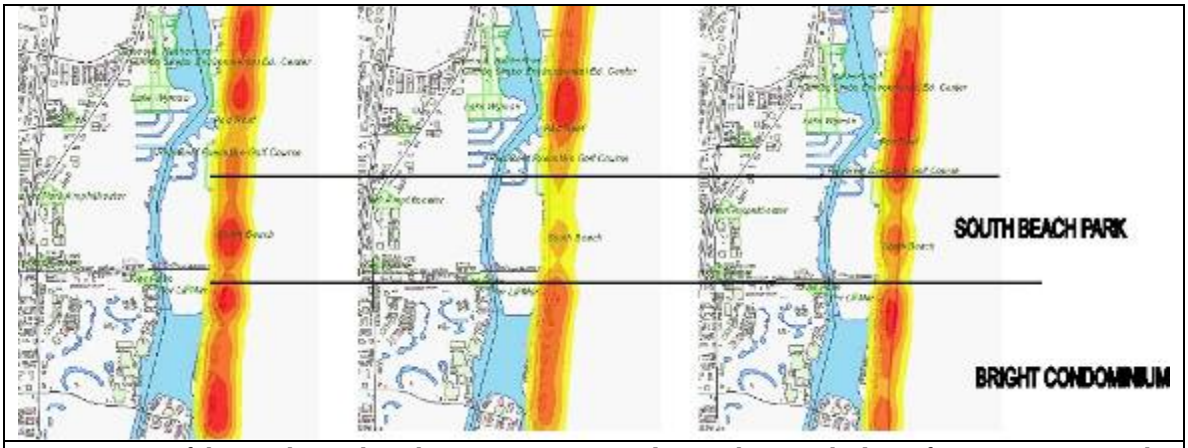
Rick Householder, owner of Xpedition Geosciences was contracted to generate forms for ArcPad 6.03, which standardized the data collection format using ArcPad Studio. Three different forms were created, one for crawls, one for relocated nests, and one for "other" which is used to enter streetlights visible on the beach, strandings of dead or injured sea turtles or marine mammals, and positions of any significant survey markers. The crawl forms allow rapid entry of the date, species, zone, location, and 20 other attributes for each nest or false crawl through the use of drop boxes and check boxes. Since a relocated nest essentially has two locations to record, where the nest was deposited and where it was moved to, the relocated form was created to collect data on the

Figure 1. ArcPad Custom Forms for Data Collection

site to which the nest was moved. In this case, the crawl form contains only the date, species, zone, location, and GPS data. Because all of the required attributes are listed in the custom forms,

In Figure 1, the "CRAWL" form pages showing the attributes collected. The "RELOCATED" form is identical except for the replacement of "location" with "relocated to" and a new attribute recording the number of eggs moved. The "OTHER" form has five 256-character "comment" lines to record just about anything else.

These forms created the attributes that are associated with each point in the ESRI shapefile. That shapefile is loaded from ArcPad to a desktop computer with ESRI's ArcGIS 9.1 with the Spatial Analyst 9.1 extension. Once imported the mobile data is used to create density maps of sea turtle nesting activity with Spatial Analyst. Density mapping is useful in showing where point features i.e. turtle nests, are concentrated. By calculating these densities we can show the distribution of an event. Using density mapping our Scientists can begin to see nesting patterns and postulate theories about the changes in the patterns over time. Some additional benefits have been that the technology gives sea turtle researchers an accurate and clear view of nesting behavior, the graphic representation of the data easily convinces condominium managers that a problem exists, and disorientations can be easily mapped and displayed.



Density maps of the South Beach Park area 2003, 2004, and 2005 showing the loss of nesting activity in the Park area in 2004. To the south of the Park there are tall condominiums and to the north is Red Reef Park, which has a very high (30+ feet) dune with many tall trees. Also seen is a dropout of nesting activity in front of a condominium whose pool lights reflect off the building making the beachfront side of the building bright. This essentially makes the building invisible with the sky glow behind it.

When the 2004 nesting season data was viewed with ArcGIS, it was immediately noticed that nesting activity in one of the City Parks, South Beach Park, was dramatically reduced. Analysis demonstrated a 75% drop in crawls in the Park compared to the ten-year average for the area. Typically reductions of crawls are due to human activity or beachfront lighting problems, neither of which is a factor in South Beach Park. The only other explanation for the reduction of nesting activity was sky glow (or urban glow), which has prevented urban residents from seeing the stars at night for many years. The dune in the park area is low and even, which would cause a nearsighted turtle emerging from the water to perceive the sky glow as a bright horizon. For two hundred million years sea turtles have used the brightest horizon to locate the ocean, the sky glow is causing the emerging female to think that water is in front of her and that would be a bad place to nest. As a result, the female leaves the area before fully emerging from the water so no tracks are found the next morning when the beach is surveyed. This is reinforced by the density map of the Park area where an island of activity exists in front of three 60-foot tall Australian Pine trees that serve to cast a shadow on the beach. Additionally, nesting activity is seen to be quite dense in front of tall beachfront condominiums that also serve to block the sky glow.

We have only begun to explore the uses of GIS with our visiting sea turtle population. Presently we are exploring the clustering of crawl activity in front of tall condominiums and trees. Later we will begin to break the analyses down to species and their nests versus false crawls that will explore species-specific information and problems. We have also used GIS to locate problem lights with the pole numbers so the power company can be alerted to the problem and hopefully turn the light off, as well as, to record strandings of injured or dead sea turtles and marine mammals. In the future, the nesting information will be posted on the City's website so anyone can check on that nest they saw when they visited, or that nest in front of their condominium. Hopefully this technology will help alert and educate the public to the dangers of sky glow with many environmental issues. The realized power of this technology, for turtle research, is that it makes the data more accessible and intelligible to non-biologists. For sea turtles, the females may not be returning to Boca Raton or South-east Florida in ten years or so if we do not seek ways to reduce sky glow. Because South-east Florida is the number two loggerhead nesting site in the world, this is no small loss.

Sea Turtle Habitat Conservation and Population Surveys, Rick Herren, Indian River County and InWater Research Group, rherren@ircgov.com.

Indian River County
Habitat Conservation Plan
Rick Herren is the Habitat Conservation Plan Coordinator for Indian River County, Florida. Rick coordinates with County Coastal Engineers to issue permits for emergency shoreline protection – from sea walls to sand bags and dune restoration. Permits are typically issued due to coastal erosion in an effort to protect homes, and also where sea turtle nesting is vulnerable due to high erosion rates.

Rick patrols 60% of the beachfront in the County with a GPS-equipped ATV, looking for new nests and false crawls, and checking up on nests that have already been located. He also coordinates nesting surveys among other groups, including 12 volunteers, in the remaining 40% of the county. Rick also does nighttime surveys to look for light shining on the beach. Nesting females avoid beaches with lights, and any hatchlings that emerge may be disoriented and head towards the lights instead of towards the water.

The county is building an Access database of nest locations and false crawls with unique Crawl IDs, and point locations of properties that violate lighting regulations. The database is used to create annual reports and maps showing locations of nests and non-nest emergences (false crawls) to show where nests are more frequent and less frequent.

InWater Research Group
Rick also is a co-founder of InWater Research Group, a non-profit organization dedicated to sea turtle conservation. InWater includes 5 members, and a group of volunteers. Rick is a co-investigator on projects, and also helps the group obtain grants for doing work on sea turtles in lagoons, bays and offshore areas in state of Florida. The group is issued State and Federal permits to capture sea turtles in support of this research. All data gathered by the group goes to State and Federal organizations.

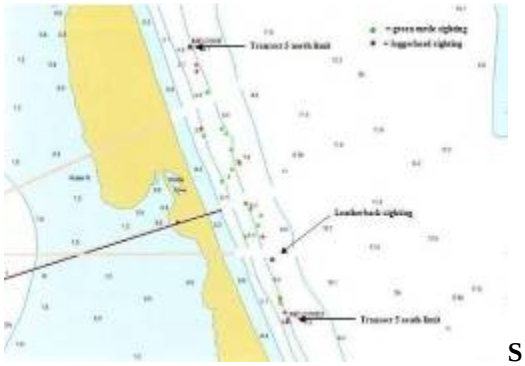
Baseline population studies
A lot of research in the past 30 years has been done on nesting beaches. There, only adult females come ashore – adult males and juveniles in general do not come ashore. Baseline Population studies are important because you are looking at the areas where these animals spend most of their time - in the water. There is a need to know more about where turtles exist, what types frequent what locations, and how healthy the populations are.

The turtles in the Key West National Wildlife Refuge (KWNWR) are a mix of male and female, juveniles and adults living in large shallow areas. InWater Research Group began surveying sea turtles in the KWNWR for the US Fish and Wildlife Service, and continues to do this work with grants from the USFWS, National Marine Fisheries Service, the Sea Turtle Grants Program, the Norcross Foundation, and the Florida Marine Research Institute.

Turtle Rodeo
Turtle Rodeo, a technique pioneered by Col Limpus in Australia, is used by Inwater Group to gather information about sea turtle populations. When a researcher sights a turtle from the boat, a GPS is used to take the Latitude/Longitude of the position. A researcher then dives into the water to capture the turtle. Once captured, the group gathers basic morphological data about the turtle,

including a look at the general health of the animal, photographs, measurements, and blood samples for DNA analysis. The blood is sent out to Universities for DNA testing. DNA is used to determine the natal beach of each turtle, based on the maternal haplotype – a marker in genetic code that matches known markers for nesting beaches. Within statistical reason, DNA testing can link juveniles to nesting population.

Prior to release, the turtle is tagged with two types of tags. One is a metal flipper tag; the other tag is transponder just under the scales of the flipper that can be scanned. The metal tags tend to fall off; after a year and a half, more than half the metal tags will be gone. The transponders are more long lasting.
In addition to the KWNWR, InWater Research Group also conducts research projects in the Indian River Lagoon, Lake Worth Lagoon, Port Canaveral area, and Hutchinson Island.



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Species Composition and Relative Abundance
Sea turtle censuses are taken by counting sightings of sea turtle species along transects at varying locations offshore. An average number of turtle species seen on each transect are compared to counts for other transects, to come up with a count of relative abundance at varying locations in the water and distances offshore.

The data is put into reports for agencies like the National Marine Fisheries Service (NMFS), State of Florida Fish and Wildlife Research Institute (FWRI) and the Florida Fish and Wildlife Conservation Commission (FWC).

Upcoming Research
InWater plans to use GIS to map sea turtle locations on top of babitat types. Overlaying sea turtle hotspots with habitat types, such as sea grasses and sponge gardens, will lead to better understanding of the importance of specific habitats for sea turtles. Also coming up is a project to equip sea turtles with GPS devices to track their movements.

For more information on InWater Research Group, go to www.inwater.org or contact Rick Herren at rherren@inwater.org.

ProPeninsula Holds Workshop on GIS and Turtle Conservation at Grupo Tortuguero 2006 Annual Conference

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Pro Peninsula volunteer and technical consultant Miguel Castrence held a workshop entitled “GIS: An Introductory Workshop for Sea Turtle Conservation”. at the 8th Annual Meeting of the Grupo Tortuguero, held on January 27-29 in Loreto, Baja California Sur, Mexico.

The objective of the workshop was to educate participants, including people from fishing communities, about what GIS is and how it is used in Sea Turtle conservation. The workshop explained how community monitoring and telemetry data can be utilized, for creating maps and for analyzing spatial characteristics to guide decisions in marine resource management.

The lecture covered basic concepts about spatial data collection, management and analysis, followed by examples of applied GIS research in marine science.

Publications:
One Planet, Many People: Atlas of Our Changing Environment

In celebration of World Environment Day on June 3, 2005 the United Nations Environment Programme (UNEP) in cooperation with NASA, United States Geological Survey (USGS) and University of Maryland launched One Planet, Many People: Atlas of our Changing Environment--a publication that provides visual evidence of environmental change using satellite images, graphics and text. The focus is on the status and trends over several decades, both in physical and human geography. The 334-page hardbound Atlas discusses human influences on our Earth including changes in land use, biological diversity, and climate. One Planet presents visual evidence of global environmental changes – both the good and the bad -resulting from natural processes and human-induced activities including those of the atmosphere, coastal areas, waters, forests, croplands, grasslands, urban areas, and tundra and Polar regions. The Atlas demonstrates how our growing number of people and their consumption patterns are shrinking our natural resource base. The challenge is how do we satisfy human needs without compromising the health of ecosystems. One Planet, Many People is an additional wake-up call to this need. You may access the Atlas on line at www.na.unep.net or you may purchase a hard copy from www.earthprint.com.

Information on this publication was contributed by H. Gyde Lund, Forest Information Services, gyde@comcast.net