Applying GIS Applications to Resource Management

Natural Resource Management Steps

- Data requirements
- Data collection
- Data organization and management
- Data interpolation
- Decision making

Analyzing Habitat

- Habitat is a combination of many individual and related environmental characteristics that are important to a species or group of species (ecosystem)
- Data about different characteristics can be collected independently and combined within a GIS
- Characteristics can then be analyzed individually or together

Beginning With Habitat

- Collaboration of Federal, State, Local agencies and NGOs
- Habitat-based approach to wildlife and plant conservation management in Maine
- Compiles habitat information from multiple sources, combines it into one package that can be used by towns, conservation groups, companies, etc.

Beginning With Habitat

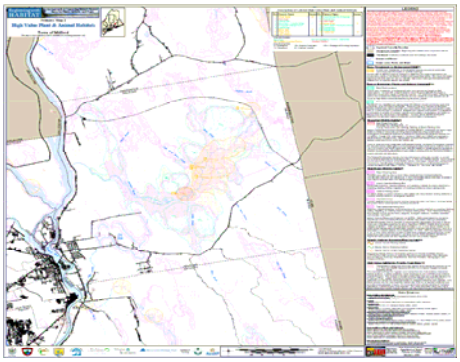
Data Layers used

- Cadastral
- Topological
- Hydrological
- Land cover type (vegetation)
- Aerial Imagery
- Plant & Wildlife habitat requirements

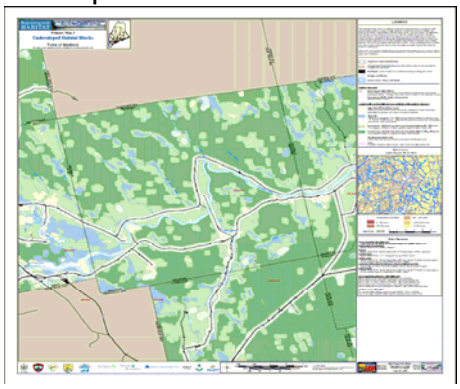
Maps Created

- Water Resources & Riparian Habitats
- High Value Plant & Animal Habitats
- Undeveloped Habitat Blocks
- Public and Conservation Lands
- Wetlands Characterization
- Valuable Habitat for USFWS Priority Trust Species
- Large Areas of Interior Forest

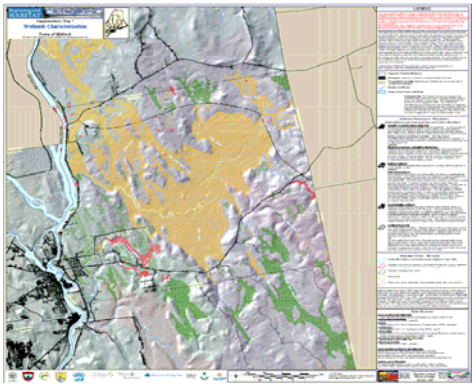
High Value Plant & Animal Habitats for Milford



Undeveloped Habitat Blocks for Milford



Wetlands Characterization for Milford



Beginning With Habitat

"By overlaying maps of the habitat needs of all of Maine's vertebrate species with Maine's primary land cover types (forests, fields, wetlands) in a geographic information system (GIS), the CFWRU (Cooperative Fish and Wildlife Research Unit) reports that 80-95% of all of Maine's terrestrial vertebrate species would likely be present if riparian habitats, high value animal habitats, and large habitat blocks are strategically protected in a landscape that is linked together. "

Beginning With Habitat

Questions that can be answered:

- What areas are critical to at risk species
- Which areas would protect the most biodiversity
- Identify low quality areas where development would have the least impact

Data Interpolation

- Creates assumptions about unknown sites based on actual samples from known sites
- Necessary because sampling everything is not efficient (time, money)
- Many different interpolation tools, choosing one is based on what data you have and what results you need

Data Interpolation

What kind of sampling?

- Systematic: Uniform sampling over an area
- Random: Random sampling throughout study area
- Cluster: Several samples close to each other, clusters can be random or systematic
- Adaptive: More samples in areas of higher variability

Data Interpolation

What type of Interpolation?

- Global vs. Local
- Exact vs. Inexact
- Deterministic vs. Stochastic

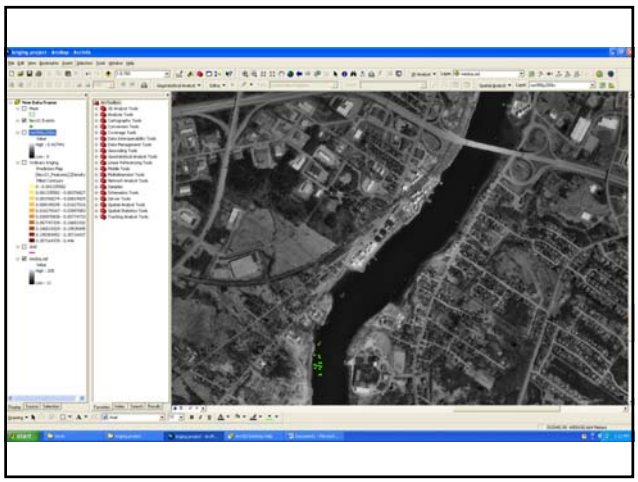
Population Interpolation

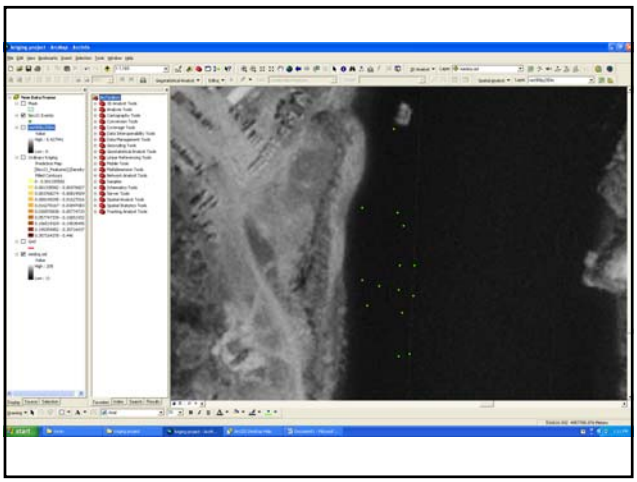
Study conducted on Kennebecasis River to determine overwintering Shortnose Sturgeon Population (Li et al. 2007)

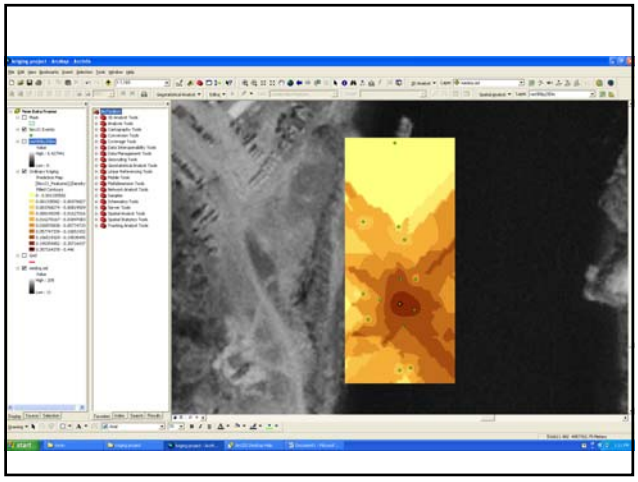
- Used underwater video camera, drilled holes in ice to get fish densities at sample sites
- Used ArcGIS software to conduct Kriging interpolation

Population Interpolation

- Conducted similar study in fall 2008 on the Penobscot River
- Kriging was used because
  - Random sample points
  - High autocorrelation







Data Interpolation

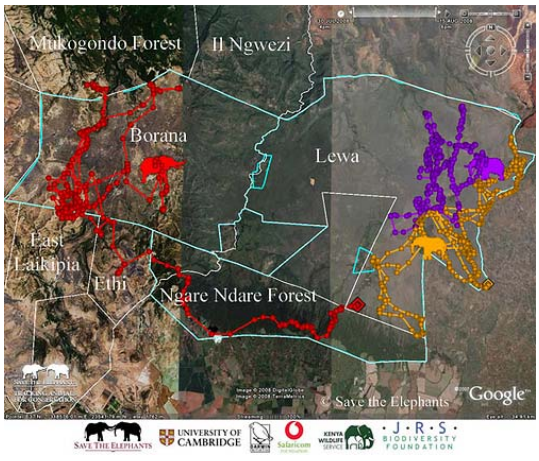
- Determining population size is important for managing species
- Population size is not easy to determine (especially for species that live on the bottom of dark rivers)
- Many options for interpolators allows for flexible analyses based on each situations sampling regime

Save the Elephants with GIS!

- “Problem Elephants” live in protected areas, raid local community farms for food
- Fences were ineffective, farmers in danger when trying to protect their crops
- Problem elephants usually had to be put down to stop the raids (approx. 25 per year in Kenya)

Save the Elephants with GIS!

- Problem elephants fitted with GPS collars
- “Virtual Fence” created around preserves using a GIS
- GPS collars transmit the elephants position to satellites hourly
- When the elephants approached the virtual fence, preserve rangers were automatically alerted via text message



Save the Elephants with GIS!

- Kimani was a known problem elephant
- Equipped with a collar
- Rangers were alerted and headed off Kimani 15 times
- He learned his lesson – 4 months without incidents

Save the Elephants with GIS!

- Elephant example shows the wide range of situations that GIS can be applied to
- Not just for data management and decision making, but also for active, everyday management
- Relatively simple system used to solve complicated problems

Final Words

- A GIS is a tool
- Tools are only useful if people know how to use them
- Creative thinking can lead to creative solutions
- Natural resource management involves many different types of information that can be pulled together efficiently within a GIS