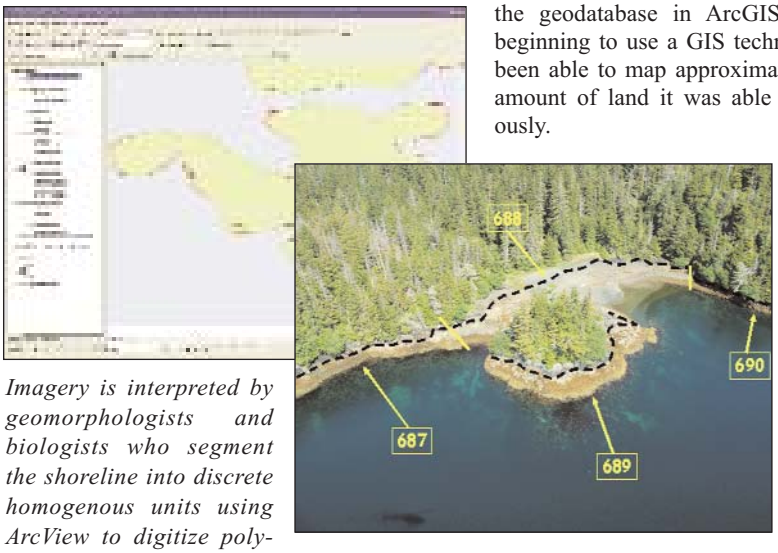
Contiguous coastal mapping provides critical marine information

Coastal and Ocean Resources Inc. (CORI), based in Sidney, British Columbia, has been supplying professional consulting services to the geological and environmental sciences industry since 1987. Their focus is the marine environment from the coastline to the deep sea. Of the many projects this group has undertaken, one of the most significant is the ShoreZone coastal habitat mapping program which has been widely used by the Pacific Northwest over the past fifteen years.



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ShoreZone is a coastal habitat mapping and classification system in which low altitude georeferenced aerial imagery is collected specifically for the interpretation and integration of geological and biological features of the intertidal zone and nearshore environment. ShoreZone datasets and imagery provide a critical backbone for a variety of applications and uses from resource monitoring, planning, protection, and consumption, to hazard mitigation and policy formation. The ShoreZone coastal mapping program is a partnership of scientists, GIS specialists, web specialists, non-profit organizations, and governmental agencies, but it is Coastal and Ocean Resources Inc. that coordinates and executes all field programs, information management, data processing, and product deliveries, with project partner Archipelago Marine Research Ltd., based in Victoria, BC.

The project was originally developed in the early 1980s as a physical habitat mapping system that was applied primarily as an oil spill response tool. Since then, the entire coast of Washington (~5,000 km) and British Columbia (~38,000 km) has been mapped, and an aggressive inventory program is underway in Alaska with approximately 40,000 km of shoreline mapped or in progress.

In the 1980s, ShoreZone consisted of paper maps and associated tables. By the mid 1990s CORI made the decision to convert their entire inventory into a GIS using ArcView, and have continued to move forward with ESRI technology to take advantage of new developments like the geodatabase in ArcGIS Desktop. Since beginning to use a GIS technology, CORI has been able to map approximately ten times the amount of land it was able to process previously.

John Harper, Marine Geologist and CORI President, remarked, "The move to GIS enabled us to capture and manipulate many times the amount of data we were previously able to, and has made the process of data maintenance, analysis, and sharing many times more efficient and accurate. Microsoft Access had been our database of choice for over a decade so the transition to the Personal geodatabase has recently provided another quantum leap in ease of data management allowing us to implement GIS integrity rules and behaviour."

Before moving to a GIS, the database was inherently detached from the maps so linkages were vulnerable. Now, incorrect linkages are immediately flagged saving many hours previously devoted to data proofing while dramatically improving data accuracy.

The classification and mapping system is based on oblique aerial video imagery and still photography of the shoreline that is georeferenced, time-synchronized, and collected specifically for the project. At the time of capture this imagery is accompanied by continuous, simultaneous commentary by a geologist and biologist aboard the aircraft that is later used to assist with the vector data creation and mapping of the shoreline. Imagery is targeted for low tides during the lowest tides of the year so that most of the intertidal zone is exposed when the imagery surveys are performed. By capturing imagery at extremely low tides CORI is able to capture and map substantially more shoreline information.

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Sue Saupe, Cook Inlet Regional Citizens Advisory Council

The imagery is interpreted initially by geomorphologists who segment the shoreline into discrete units of homogenous morphology (form and substrate type) and exposure. The units are digitized in ArcView, and the physical attributes recorded in the geodatabase. Then the dataset is passed to biologists who interpret and record observed biota (such as intertidal organisms, subtidal algae, and some subtidal fauna) for each shore unit.

Once the data capture process is complete, ShoreZone partners (often government and non-profit organizations) use this data internally and some post it to their online sites using ArcIMS. ShoreZone data provides a spatial framework for coastal and nearshore habitat assessment on local and regional scales. Individual resources, such as eelgrass occurrence in Sitka Sound, can be displayed and plotted, or combinations of resources with multiple attributes can be displayed together to reveal new information, patterns, and trends. For example, substrate type and wave exposure levels are used to predict shorelines sensitive to oil spill retention.

"The dataset is being used in all sorts of applications that we never anticipated," said Dr. Harper. "Recreational users find the online imagery especially useful in trip planning for kayak expeditions; fisheries mangers have linked historical inventories of herring spawn sites to identify shore-zone attributes of high-value spawn sites; and oil spill contingency planners use the data to identify accessibility of the shore to alternative types of response equipment."

These applications are critical to support efforts of online site visitors focused on ecological sus-

tainability, environmental hazard mitigation, and public use of these areas for recreation and education. The ShoreZone dataset is particularly useful for regional marine planning programs such as The Nature Conservancies (TNC) Bering to Baja marine conservation initiative, where sensitive or rare habitats are identified. Using ShoreZone TNC can identify these habitats and add their locations to their land acquisition strategy.

Using GIS, CORI is able to create a standardized digital shoreline so that ShoreZone data integrates seamlessly with clients' thematic data. In addition, a standardized digital shoreline is essential to quickly determining costs, as clients are quoted a unit mapping cost per kilometre of mapped shoreline. The GIS enables the client to immediately see the extent of shoreline to be mapped for their planned level of expenditure.

Sue Saupe, Science Director of the Cook Inlet Regional Citizens Advisory Council and original proponent of ShoreZone in Alaska, summarizes the importance of the ShoreZone project in the following way, "ShoreZone has been a great tool for making the Alaska coast more accessible. By making the imagery and data both web-accessible, ShoreZone has attracted many non-traditional users that don't have access to GIS. At the same time, sophisticated GIS users appreciate the richness of the dataset that now extends over thousands of kilometres of shoreline. This dataset provides a framework that underlies some of our detailed site-specific research and is our tool for tying together a wide range of nearshore studies. Ultimately, the Alaska ShoreZone program has so many applications that it has helped build capacity for our overall coastal programs, and is responsible for developing partnerships among organizations that may not have typically coordinated their goals in the past."

Future Plans

The main emphasis of the program over the past five years has been acquiring imagery and mapping in Alaska. As various pieces of the shoreline are connected, increased opportunities to develop regional models emerge. One exciting new CORI project is to develop a nearshore habitat model using ArcGIS for the Queen Charlotte Strait that is based on observed ShoreZone data. This nearshore model, which predicts substrate, slope, and biotic assemblages of the shallow nearshore area, will serve as a planning framework for nearshore mapping projects, targeting sensitive habitats for seabed multibeam and videography surveys.

CORI will continue to map the Alaska coast, and plans by 2008 to have, in total, over 100,000 kilometres of contiguous shoreline mapped from Washington to Alaska, paving the way for a greater understanding of our precious shoreline resources.

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