

From the field to the enterprise using an electronic silviculture system



New Brunswick is the largest of Canada's Maritime provinces and covers 73,440 square kilometres in roughly a rectangle shape about 242 kilometres (150 miles) from east to west and 322 kilometres (200 miles) north to south. It features an abundance of forest lands, occupying 6.2 million of the total 7.2 million hectares of the province, which support a vital forest industry that numerous communities within the province depend upon.

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Danny Crain, Department of Natural Resources, New Brunswick

The province's forest industry consists of three key industries: forestry and logging, wood products, and pulp and paper. It directly contributes \$1.7 billion to the economy, directly employs over 17,000 people, accounts for 30-40% of exports from the province, and generates over \$260 million in tax revenues. For every 100 direct jobs created in New Brunswick's forest industry, 35 jobs are indirectly created in other sectors of the provincial economy.

New Brunswick's Department of Natural Resources (DNR) is the key government agency dedicated to the preservation, protection, effective management, and maintenance of the Province's natural resources. In November 2003, the DNR undertook an initiative aimed at providing means to exchange accurate silviculture information between internal and external stakeholders with the creation of a silviculture application.

Managing a forest industry of this significance poses a number of unique challenges. In particular with regard to the management of large volumes of spatial and non-spatial data – the foundation upon which nearly all resource management decisions are made. To be successful, DNR wanted to ensure that a mechanism was in place that would allow them to disseminate accurate forest information to relevant stakeholders in a timely fashion. In turn, that information was to be leveraged across the enterprise to enable DNR to practice what they and other forest industry experts call Multiple-use Resource Management. Multiple-use Resource Management is the effective management of a forested area to simultaneously provide more than one of the following resource objectives: protec-

tion of fish and wildlife, wood products, and watershed areas, the creation of areas for recreation, aesthetics, and grazing.

Since 1982, DNR has been leveraging GIS technology to help manage a vast amount of spatial data that they use to make resource management decisions. Initially, the GIS was used by a select group of users to create Crown Land Management Plans. Since 1991, the Information Services and Systems (ISS) branch has been responsible for providing a GIS infrastructure for DNR. Initially, this involved ensuring the GIS contained current information, proper hardware, licenses, etc. In 2001, roles within the ISS began to evolve with the migration of part of their architecture to a new ArcSDE framework using an Oracle database.

“The migration to the ArcSDE framework using an Oracle database has positioned DNR to allow more data sharing and increased data usage, as users demand more application specific development support,” said Danny Crain, Manager, GIS Section, Department of Natural Resources, New Brunswick.

While the initial silviculture application addressed a number of administrative requirements DNR had with respect to the collection and submission of field data, it did not provide multi-user access to the most current spatial and non-spatial information. In addition, the previous process for submitting field data proved inefficient because it relied upon the conversion of hard copy data to electronic format and it was prone to human error. With this in mind DNR began to look at improving their collection and submission processes to make it easier to verify information submitted by licensees. Licensees are any person or company that enters into a forest management agreement (FMA) with the government in exchange for permission to harvest resources on Crown Lands.

DNR decided that the core functionality of the silviculture application could be improved by automating the process used for collecting and submitting field data through the development of an electronic silviculture database called ESilv. Core users of the ESilv application include DNR's regional and district staff who use it during the course of their field season which runs from May to November each year.

The initial implementation of the ESilv project gave licensees the ability to submit electronic information, including spatial locations via a web-

based application, which were loaded into an Oracle /ArcSDE database. Initial data submissions formed the basis of a departmental data verification process which in turn provided a means to ensure the accuracy of information. The verification process was converted into a handheld application using Trimble GeoXM receivers and ArcPad software for collecting the spatial information that would be loaded back into the ArcSDE database.

The ESilv handheld application was then deployed to their regional offices and put into production in June 2006. Prior to this implementation Trimble GPS units were used to capture the spatial information and paper forms were utilized to capture the related tabular information. The tabular information was transcribed by regional staff into either MS Excel, MS Access, or MS Word, depending on the region and submitted to the Forestry Management Board (FMB) at the end of each field season. In the field, survey points were located using a predefined grid that would provide 1 point per hectare of treated area. To locate the points, field staff used a compass and string box. The information submitted by licensees, to locate the treatment, was provided either in digital format or as a hardcopy map with the area drawn on by hand.

The new verification process allowed the application to fit a grid to the spatial block submission and then use ArcPad to locate them for sampling. In the current system the data can be collected in the field and uploaded to the system within one to two working days. The application completes calculations on the data and now that the database is centrally located all users who require access, have it.

The previous silviculture monitoring process consisted of four distinct processes for submitting the same information. The process was long and labour intensive, using information that did not incorporate the best use of current technology. The use of handheld units with ArcPad software has allowed the process to be streamlined into a common application that automates the collection of verification information and has eliminated a significant amount of human error.

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