frontline EXPRESS
Canadian Forest Service, Great Lakes Forestry Centre

Bulletin No. 15

AERIAL PHOTOGRAPHY IN SILVICULTURE DECISION MAKING

INTRODUCTION:

Spatial data are becoming increasingly important for forest vegetation management prescription development and decision making. This is particularly true with current emphasis on ecosystem-based management, escalating silvicultural treatment costs, rapidly evolving decision support tools, and widespread reliance on Geographic Information Systems. In 1995, a gathering of forestry and remote sensing experts reviewed remote sensing technologies for their potential to supplement field-collected data in forest vegetation management prescription development and decision making. Stemming from recommendations made at this workshop, several studies were initiated to test aerial photography and digital frame camera (DFC) applications in forest vegetation management.

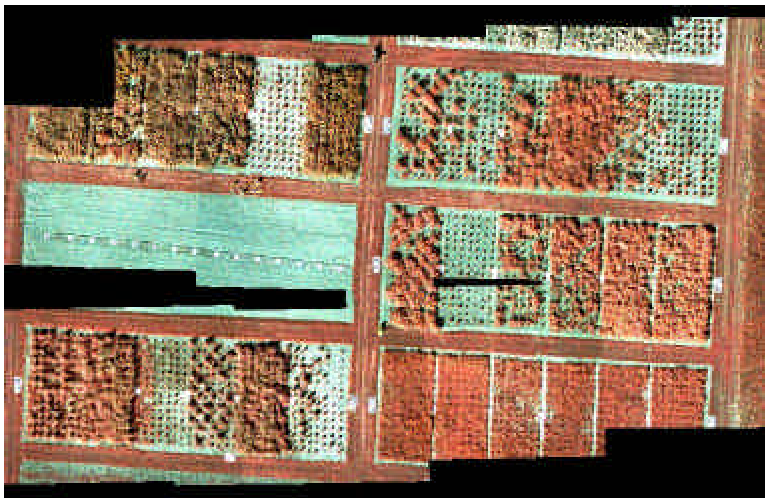

Figure 1. Digital frame camera image mosaic of research site

LOCATION/SITE:

This study has involved vegetation assessments at a variety of locations including Sault Ste. Marie and Thunder Bay, Ontario, Fredericton, New Brunswick, Savannah, Georgia, and Auburn, Alabama.

RESULTS AND MANAGEMENT IMPLICATIONS:

After a thorough review of available sensors, participants at the 1995 Workshop on Remote Sensing in Forest Vegetation Management concluded that aerial photographs offer the most suitable combination of characteristics needed for vegetation assessment, including high spatial resolution, stereo coverage, a full range of image scales, a variety of film, lens, and camera options, capability for geometric correction, and moderate cost (1). For decision making at the stand level, the group recommended supplemental 1:5000-(medium) scale aerial photo (MSP) coverage of cutover blocks for stratifying and mapping areas requiring silvicultural treatment. Large-scale photo sampling (LSP) at scales of 1:500 to 1:1000 was recommended for verifying stratification and quantifying mapped polygons.

Building on these workshop recommendations and previous work illustrating the accuracy of vegetation assessments from LSP (2, 3, and 4), a sequence of MSP and LSP were used to map and quantify a range of early seral vegetation conditions following several operational conifer release treatments. Digital maps depicting and quantifying areas of uniform vegetation composition and structure were constructed from the MSP, with a patch boundary accuracy of ±2m (Fig. 1). Individual quantitative estimates of early seral vegetation cover supported margins of error between 2-10% cover, 70% of the time, for vegetation classes such as tree, shrub, herbaceous, and grass (5). These digital maps could be used to answer operational queries regarding the success of vegetation management treatments, current status of forest crops or wildlife habitat, and the need for subsequent treatments to meet management objectives. Manual interpretation of MSP and LSP may effectively bridge the gap between coarse remote sensing overviews (e.g., satellite imagery) and field sampling.

Workshop participants also recommended the testing of DFCs as eventual replacements for film-based cameras. DFC systems offer a number of advantages over conventional cameras, including low-cost, direct digital images without film processing, in-flight viewing of results, and computer-based image enhancement and processing. A 1996 study evaluated low cost, high-resolution, colour infrared (CIR) airborne digital camera imagery for use in forest regeneration assessment and vegetation management decision making. Airborne imagery with 2.5-cm pixel size was acquired for a forest vegeta-

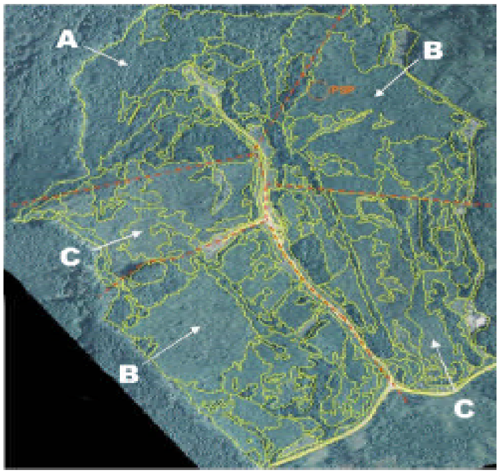

Figure 2. Digital map of conifer release areas. (A-Tall shrub-dominated (untreated), B-Mid shrub-dominated (cut), C-Grass/herb aceous-dominated (Herbicide treated)

tion management research site (Fig. 2). Automated crop tree counts and stocking estimates were possible in situations of low to moderate competition levels or when competing vegetation cover was in leaf-off condition (6). Predictions of vegetation leaf area index and cover could be made from primary spectral measures and some secondary measures, such as image texture. It appears that operational compromises must be made between objectives relating to conifer crop and deciduous competing vegetation, since each is best discriminated at different times of the year.

SOURCES OF RELEVANT INFORMATION:

1. Pitt, D.G.; Wagner, R.G.; Hall, R.J.; King, D.J.; Leckie, D.G.; Runesson, U., 1997. Use of remote sensing for forest vegetation management: A problem analysis. For. Chron. 73(4): 459-477.
2. Pitt, D.G.; Glover, G.R., 1993. Large-scale 35-mm aerial photographs for assessment of vegetation-management research plots in eastern Canada. Can. J. For. Res. 23(10): 2159-2169.
3. Pitt, D.G.; Glover G.R., 1996. Measurements of woody plant attributes from large-scale aerial photographs. New Zeland J. For. Sci. 26(1/2): 53-73.
4. Pitt, D.G.; Glover, G.R.; Jones, R.H., 1993. Two-phase sampling of woody and herbaceous plant communities using large-scale aerial photographs. Can. J. For. Res. 26(4):509-524.
5. Pitt, D.G.; Runesson, U.; Bell, F.W., 2000. Application of large- and medium-scale aerial photographs to forest vegetation management: A case study. The For. Chron. 76(6): 903-913.
6. Haddow, K.A.; King, D.J.; Pouliot, D.A.; Pitt, D.G.; Bell, F.W., 2000. Early regeneration conifer identification and competition cover assessment using airborne digital camera imagery. For. Chron. 76(6): 915-926.

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