Criteria for delineating a new boundary for the Fisher Bay Park Reserve, Manitoba

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1. INTRODUCTION

Historic park boundaries – Anthropogenic attributes

Historically the shape and spatial extent of parks were determined on the basis of economic (e.g., selective logging during the late 1800's under the Dominion lands act), land-use (e.g., agricultural settlement), political (e.g., state, provincial or national boundaries) and scenic attributes (e.g., defining boundaries based on the inclusion of majestic mountain views or lakes; McNamee 1993), with seldom any consideration to ecological principals. As such the boundaries of most parks and park reserves were considered arbitrary delineations characterized by simple geometric shapes (e.g., Prince Albert, and Wood Buffalo; **Fig. 1.1**) (Wright 1984). These boundaries create abrupt linear discontinuities on the landscape dissecting the continuous mosaic of land cover types, affecting wildlife populations and severely altering the frequency of natural disturbances (Weir and Johnson 1998).

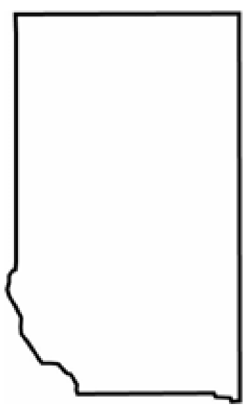


Figure 1.1. Prince Albert National Park (PANP). With the exception of the complex boundary along the south-west corner (as a result of the Sturgeon River), the remainder of the park is characterized as a simple polygon. The park boundaries were delineated on the basis of economic, and/or land-use attributes. The boundaries dissect numerous ecotypes within this Mixedwood Boreal Forest Region.

By the end of the 1960's works by prominent ecologist and environmentalist (e.g., Aldo Leopold and Rachel Carson) began to permeate public opinion and government policy. Over the next 20 years this led to a slow but progressive shift towards the development of ecologically based conservation and management policies which ultimately had important implications for the establishment and management of parks and protected areas.

Ecologically sound boundaries – Biophysical attributes

How did this shift towards a more ecologically sensitive conservation and management paradigm impact the creation or expansion of existing protected areas? In the 1980's several studies were published which examined the delineation of protected areas using biophysical landscape boundaries. The concept of ecologically sound boundaries was introduced by Theberge (1989) and was defined exclusively on natural attributes such as the spatial distribution of vegetation types (e.g., ecotypes), soils, topography, hydrology and wildlife habitat. It should be noted that unlike topography, hydrology and soils (i.e., geophysical attributes), vegetation and wildlife habitat zones (e.g., biological attributes) are non-static (e.g., <100 years). Conceptual models using ESB criteria often result in the creation of large parks with highly fractal (complex) boundaries (**Fig. 1.2** and **Fig 1.3**). Although considered an ideal approach this method has rarely been used in regions where human use, economic/cultural interests and protected areas come in direct conflict. As a result, ESB has only been implemented in more remote areas (e.g., proposed expansion of remote northern parks).

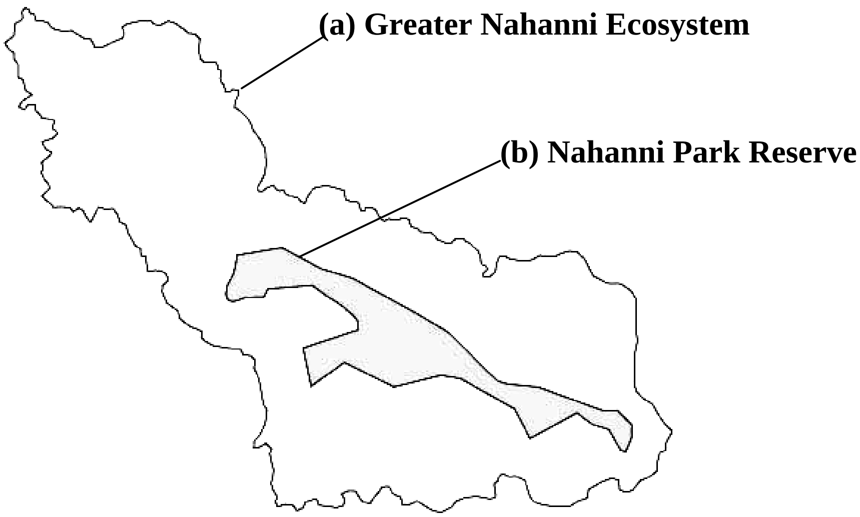


Figure 1.2. Nahanni National Park Reserve (b) compared to the greater Nahanni ecosystem which includes the entire watershed (a); the latter region would delineate the maximum aerial extent of the park using an ESB model. Note the increased perimeter/area (complexity) compared to Prince Albert National Park.

Biogeophysical and anthropogenic multi-attribute boundary delineation

Is there as a pragmatic alternative to the ecologically sound boundary approach that not only fulfills conservation objectives (e.g., defining areas of high conservation value) but also satisfies local economic and cultural land use practices? The use of a spatially explicit multi-attribute data model to systematically delineate protected area boundaries has been increasingly used over the past 20 years. This approach is designed as method that first incorporates biogeophysical boundaries to delineate a maximum conservation area (e.g., Greater Nahanni Ecosystem). Spatially defined anthropogenic land use boundaries are then superimposed, in most cases this results in a reduction of the conservation area. Two types of boundary segments are created i) biogeophysical boundaries (complex boundary edges), and ii) anthropogenic boundaries (linear boundary edges).

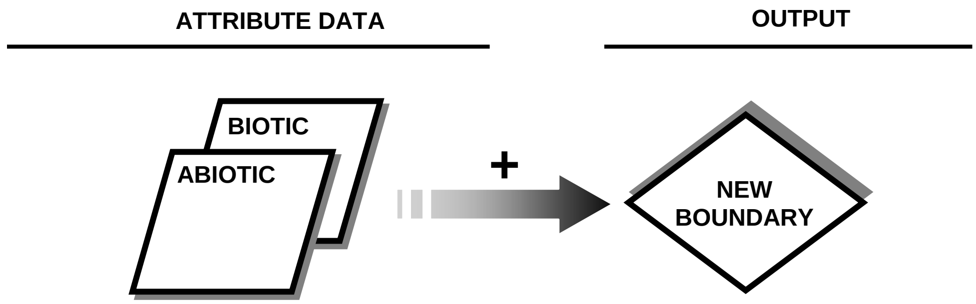


Figure 1.3. Ecologically Sound Boundary (ESB) model for the delineation of park boundaries. Where biotic includes vegetation attributes (e.g., spatial distribution and pattern of forest cover types); abiotic includes environmental attributes (e.g., soils, topography and hydrology). ESB models tend to increase (+) the aerial extent of protected areas (maximum = an entire watershed). The perimeter/area ratio of such parks tend to be greater (i.e., complex shape) compared to parks derived solely based on economic and political attributes.

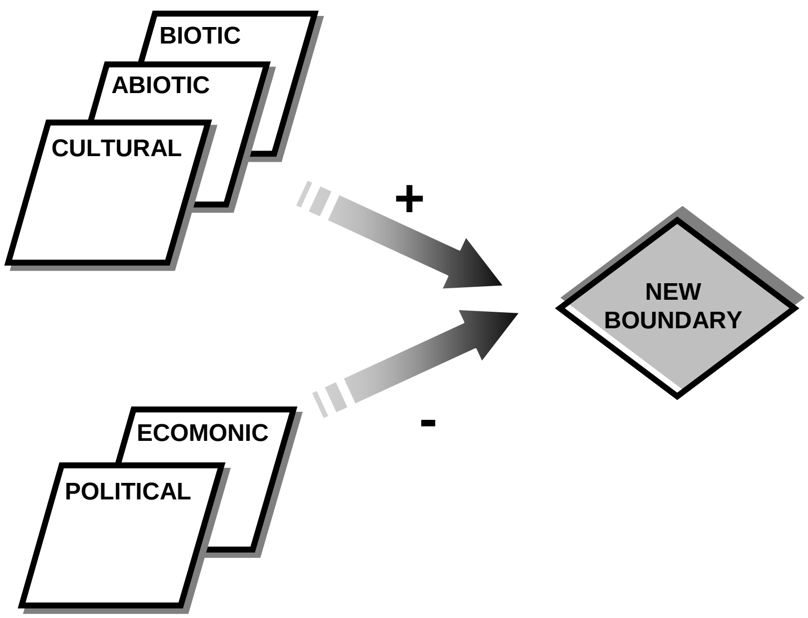


Figure 1.4. Decision based multi-attribute model for the delineation of park boundaries. Where biotic includes vegetation attributes (e.g., spatial distribution and pattern of forest cover types); abiotic includes environmental attributes (e.g., soils, topography and hydrology).

Study Justification

The study arose out of need to increase the aerial extent of the Fisher Bay Park Reserve. Areas of interest initially proposed by Fisher Bay Cree Nation were excluded by the provincial government when the region was designated a protected area in 1999. The current legislated boundaries only protect shoreline communities, excluding vast areas of old-growth deciduous stands, valuable marsh wetlands and conifer dominated boreal bogs and fen communities. Many of these excluded regions have the potential for mining as well as softwood timber exploitation both of which could seriously impact wildlife conservation, traditional land-use practices, and eco and cultural tourism opportunities. Thus a robust and ecologically based methodology will have to be implemented in order to redraw the current boundaries of the Fisher Bay Park Reserve in a manner that fulfills the conservation and land-use concerns initially put forth by Fisher Bay Cree Nation.

Objectives

The objectives of this report are:

- To expand the current legislated aerial extent of the Fisher Bay Park Reserve.

- To implement a decision based multi-attribute model to delineate a new boundary.

2. METHODS

Study area

The Fisher Bay Park Reserve (FBPR) was initially designated as a protected area 1n 1999. Its “designation period” was extended in 2005 while consultations with First Nations and input from stakeholders and the public continues.

The Park Reserve is located about 200 kilometers North of Winnipeg, Manitoba situated within the interlake region (northwest of Lake Winnipeg). The legislated park reserve occupies an area of about 890 km^2 (almost the size of Grasslands National Park), with nearly 70% of it on water (e.g., Fisher Bay, Lake St. Peter. Jackhead Lake as well as numerous wet lands). The remainder (around 30%) is composed of terrestrial land cover that includes several islands (e.g., Moose Island, Little Moose Island and Tamarack Island).

The current legislated boundary of the FBPR was created by the Government of Manitoba and is significantly smaller than the boundary proposed by Band Council of Fisher River Cree Nation. The current area excludes a culturally important site located around Goldeye Lake as well as a vast lowland conifer/fen region west of Moose Lake (See **Fig. 2.1**).

Data

No published ecological studies have been done in the Fisher Bay region. Biophysical data was acquired using a combination of remotely sensed Landsat data, geo-rectified aerial photos, and the Forest Resource Inventory (FRI). Cultural and ecological attributes were derived from the CIER Ecological Significance Study (2005).

Deriving a multi-attribute database

Landsat satellite data was obtained freely from the Manitoba Land Initiative (MLI) site. These data were used to create a landcover map for the Fisher Bay study area. A maximum likelihood supervised classification algorthmn was implemented using the remote sensing package Multispec © (version 3.3). Over 40 training sites (e.g., water, marsh, conifer) were selected based on information derived from the Forest Resource Inventory (FRI) (using Forest management units 40 and 41). In addition, Landcover maps for the Riverton region (south of the study site) were used to relate Landsat reflective classes with ground cover; no landcover data is currently available for Fisher Bay. The supervised classification produced several landcover classes (see **Fig. 2.3**). The supervised output was saved as a geotiff image and imported to ArcMap 9.1. Additional data layers were superimposed on the classified image (e.g., 1:20,000 topographic map) in order to create a multi-attribute database.

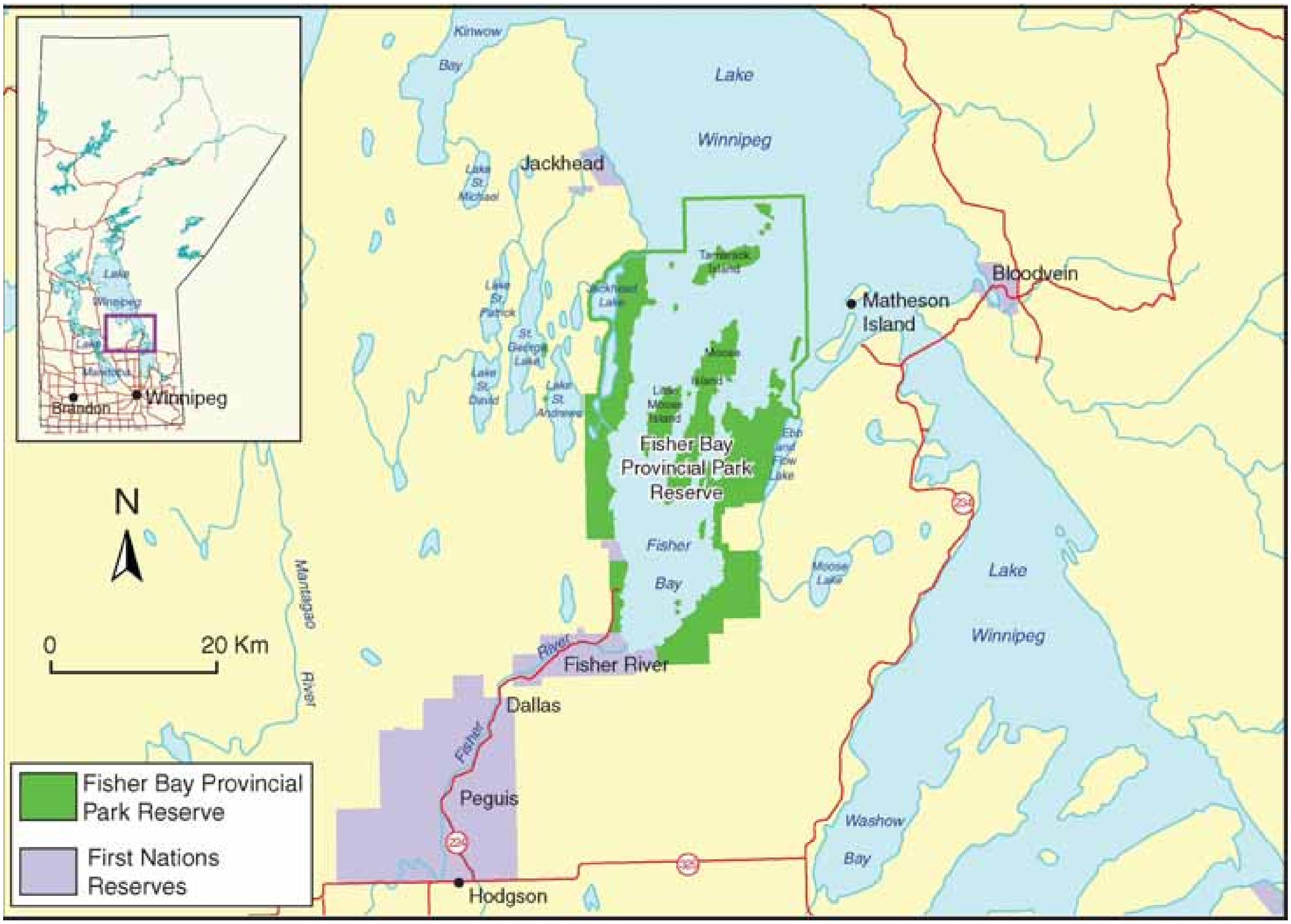


Figure 2.1. Fisher Bay Park Reserve. Dark green boundary corresponds to the protected area delineated by the provincial government in 1999.

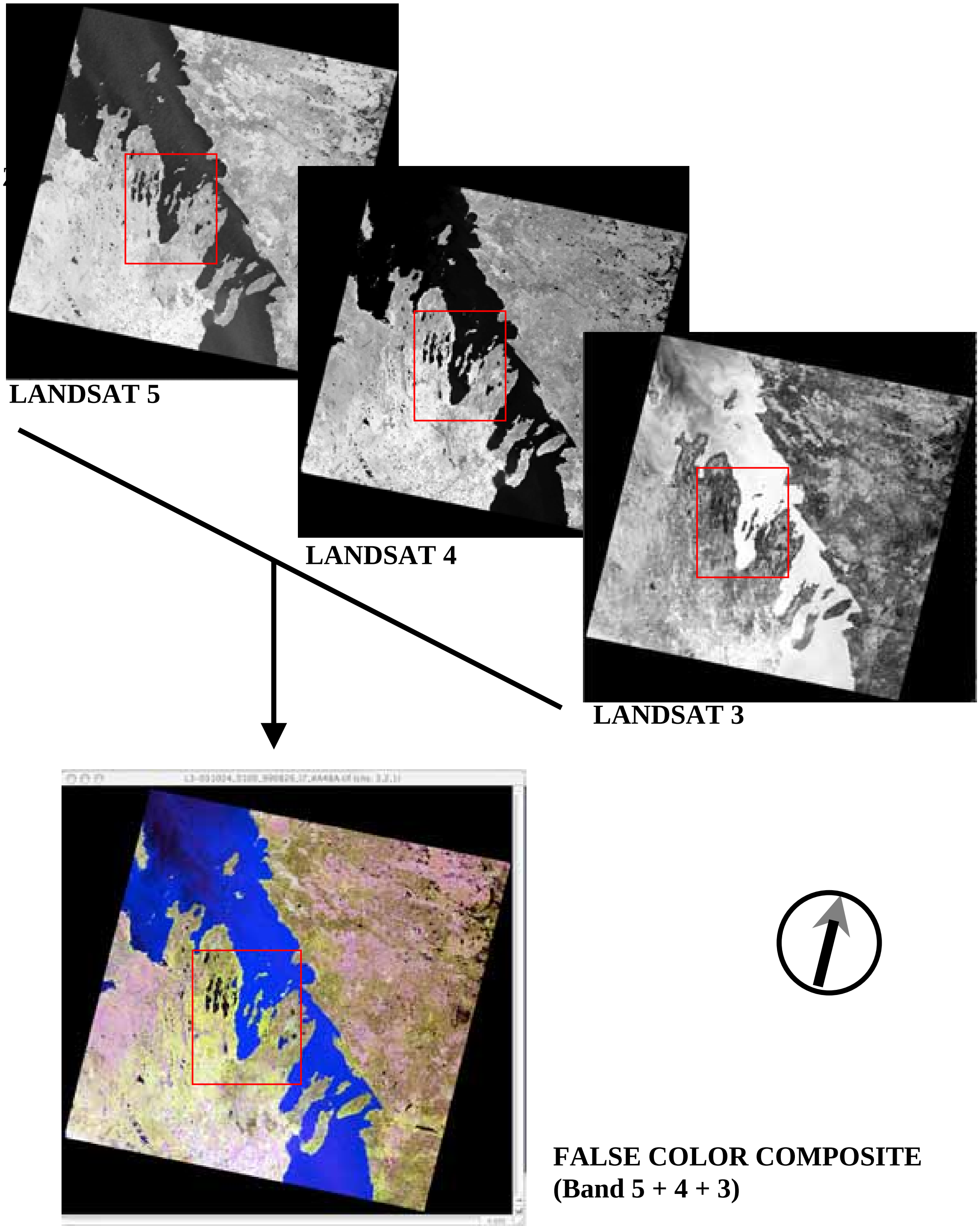


Figure 2.2. LANDSAT bands 5, 4, and 3

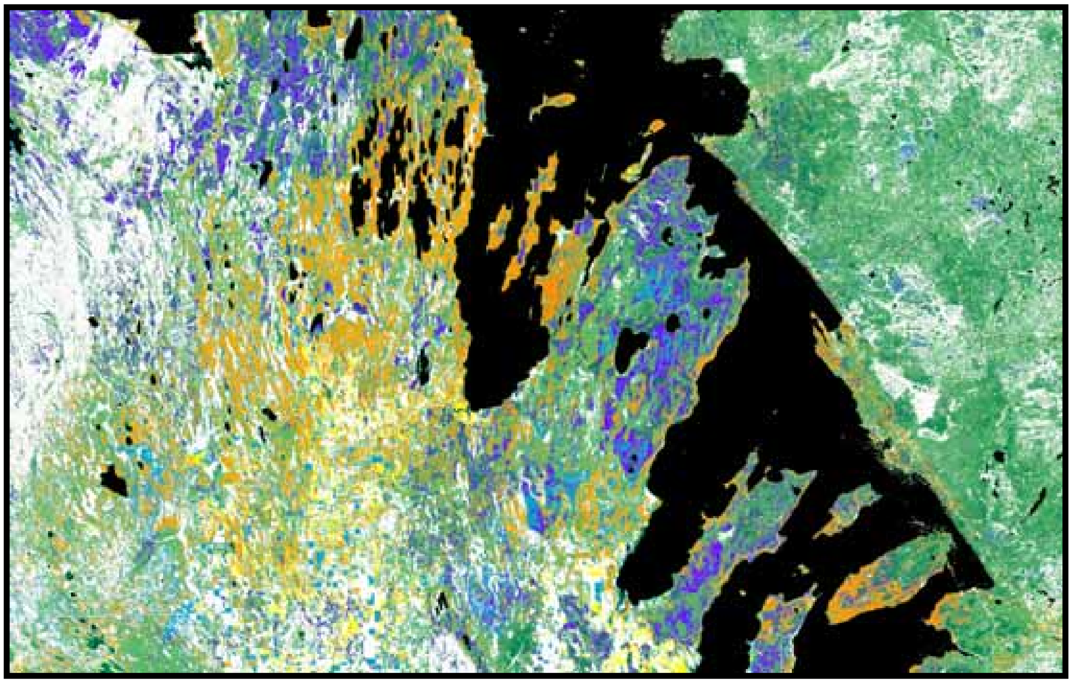
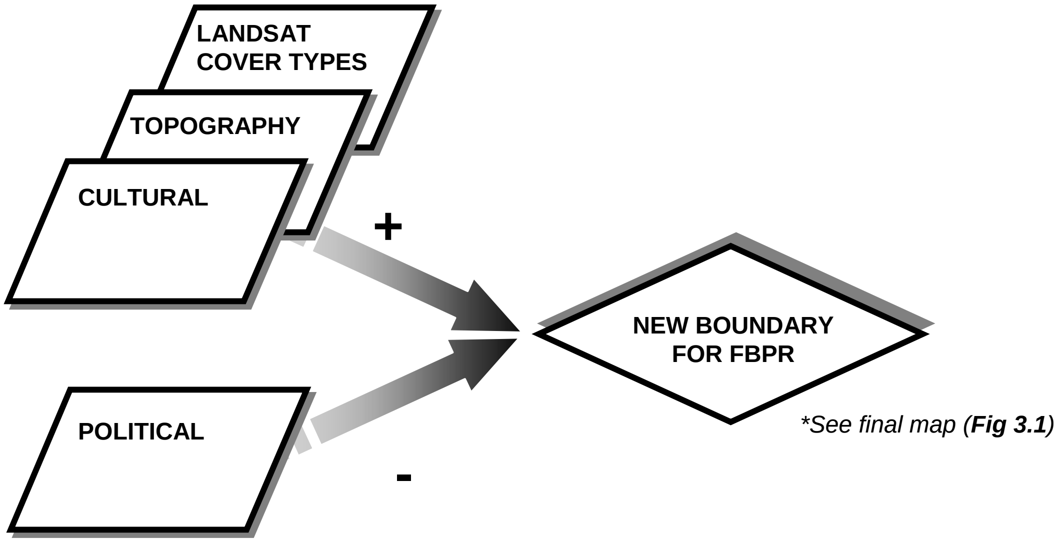


Figure 2.3. Supervised image classification of a false color composite LANDSAT image. Where **green** = upland conifer stands (e.g., white spruce), **blue** = lowland conifer stands (e.g., black spruce and balsam fir), **purple** = bog/fen, orange = **deciduous stands** (e.g., trembling aspen), **yellow** = graminoid dominated wetland, **white** = dolomite/limestone or granite outcrop and **black** = water.

3. RESULTS AND DISCUSSION

The new Park Reserve boundary was based on the following attribute data:



These data were used as attribute layers to delineate a new Park Reserve boundary. The newly proposed boundary (**Fig. 3.1**) for the Fisher Bay Park Reserve incorporates biogeophysical and cultural features as well as political boundaries. The new boundary can be subdivided into four landscape segments (boundaries on water are excluded):

- **Segment 1**. Corresponds to the western boundary segment and is derived from a Digital Elevation Model (DEM) of the region. The western boundary marks the edge of the Fisher Bay watershed. **Segment 2**. Delineates to the northern banks of Fisher River.

- **Segment 3**. Southern boundary delineated by cultural/political considerations

- **Segment 4**. The eastern boundary segment corresponds to a discontinuity between closed conifer bog community and open and or tree-less bog **o**r fen.

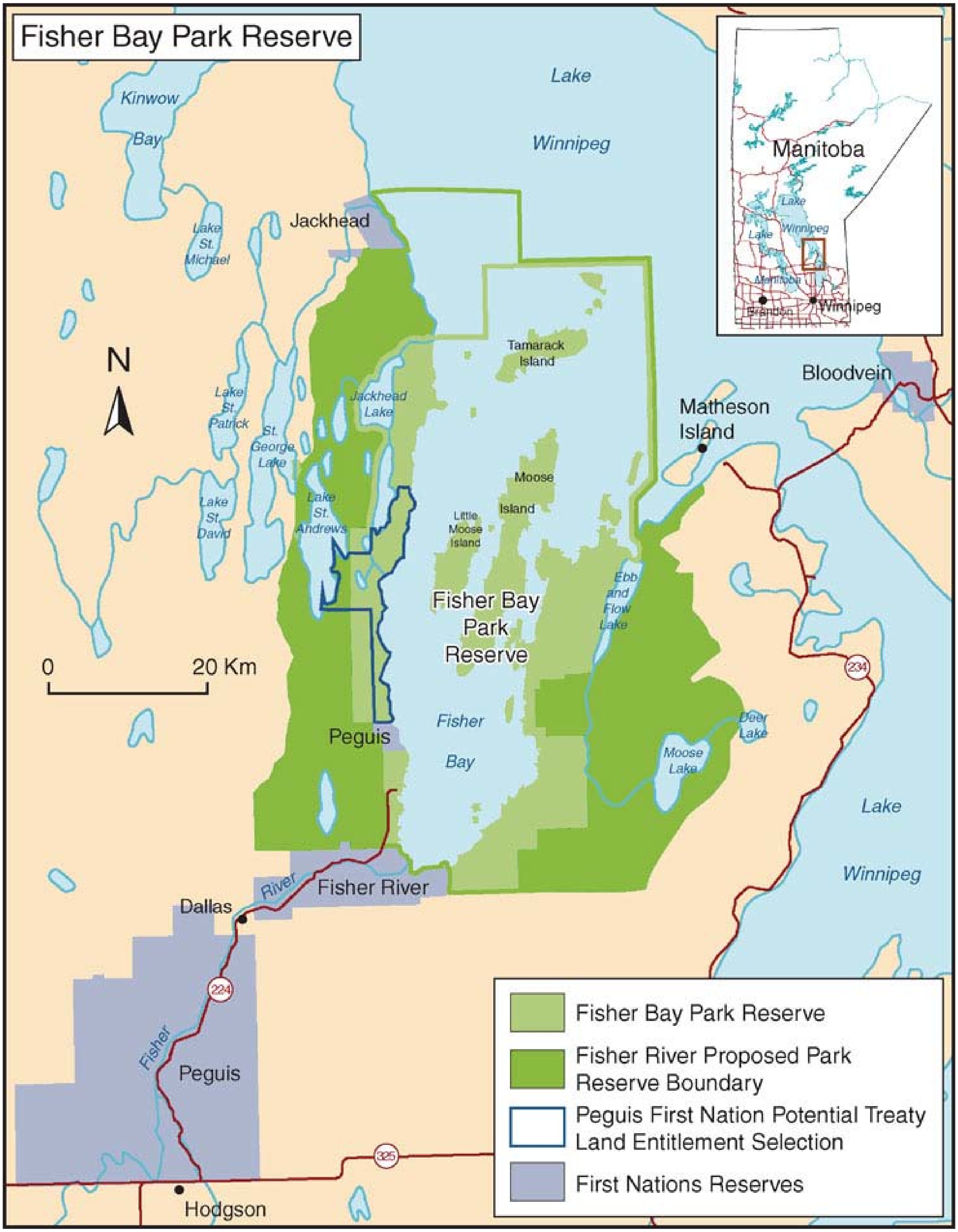


Figure 3.1. New boundary for the Fisher Bay Park Reserve developed using a decision based multi-attribute model.

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