Data Request Overview

Delivered Files

ABMI Wall-to-wall Land Cover Map 2010 Version 1.0 (ABMIw2wLCV2010v1.0).

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Alberta Wall-to-wall Land Cover Map circa 2010

The ABMI Wall-to-wall Land Cover Map circa 2010 (ABMIw2wLCV2010v1.0) is a polygon-based representation of Alberta's land cover circa 2010, which is based on digital classification of 30 m spatial-resolution Landsat satellite imagery. This digital map is an ESRI file geodatabase that comes in the Alberta 10 TM projection and describes the spatial distribution of 11 land cover (LC) classes (Table 1) across the province of Alberta. The map consists of approximately 1 million non-overlapping polygons of various sizes with a minimum size of 0.5 hectares (ha) for aquatic features and 2 ha for all others. Each polygon represents a contiguous area relatively homogeneous in terms of LC, where the specific LC class of the polygon is different from that of adjacent polygons except for the case when the polygon corresponds to a new (appearing between 2000 and 2010) disturbance feature that may have an older adjacent polygon with the same land cover class.

The cartographic scale of reference (i.e. the scale at which the map would be printed if distributed in hardcopy) is 1:125,000, with a target positional accuracy for polygon outlines of 60 m on the ground (i.e. the true boundary of the polygon must be within 60 m of the outline 95% of the time). The overall Alberta 'Landcover_Polygons' feature class was obtained by merging 48 individual tiles whose frames are provided in the accompanying 'ABMIw2wLCV_48tiles' feature class. Each tile is fully encompassed in a single Landsat scene, and its frame roughly coincides with the seam lines used to mosaic the original raster datasets.

Accuracy Assessment

The overall thematic accuracy of the map, as estimated by an extensive validation dataset, is 75% with 11 classes and 88% if these classes are grouped into 5 general classes. User and Producer accuracies for the specific classes in each level appear in tables appended to the geodatabase. These accuracies refer to the original 2000 map (ABMIw2wLCV2000V2.1) on which the 2010 map is based. The updated features in the latter come from sources of higher accuracy, therefore the 2010 map can be said to exceed the stated accuracy of the 2000 map. For a detailed description of the accuracy assessment of the latter, see the full report available on the ABMI website.

Caveats:

1) The width of roads has been systematically exaggerated to a minimum of 60 m (two Landsat pixels); therefore the real extent of the Developed class is greatly overestimated.

2) Forest areas harvested or burned between 2000 and 2010 were assigned to the 'Shrub' LC class to differentiate them from their surroundings. They can be identified using the 'MOD_TY' field, which will respectively contain the value 'Cutblock' or 'Burnt'.

3) The accuracy of the shrub class is low (30%). Many shrub polygons are in reality forest (beyond new cutblocks and burnt areas), especially in the North. This was not possible to correct with the input data at hand.

As a relatively coarse depiction of land-cover, the map is not intended for detailed local-level analyses, but rather provides a regional-level representation that is suitable for spatially explicit, long-term trend monitoring.

GIS Data

The ABMIw2wLCV2010v1.0 is an update of the ABMIw2wLCV2000V2.1, which was derived by combining two raster datasets: the Canadian Forest Service (CFS) Earth Observation for Sustainable Development (EOSD) LC dataset, and Agriculture and Agri-Food Canada (AAFC) LC dataset. Both datasets were derived from digital classification of Landsat 5 and Landsat 7 ortho-images acquired circa 2000, and both share the same land cover classes. The EOSD and NLWIS rasters were combined into a single raster according to a ruleset that selects a label for each pixel based on the values for that pixel in the two rasters. In addition, hydrography features from Government of Alberta (GoA) GIS data were used for 'burning in' water bodies and major rivers into the input rasters. The same process was also applied to roads, railways, power lines and pipelines using GoA's access layer, obtained through a data-sharing agreement with Alberta Sustainable Resource Development. Additional GIS data were used for the updating to 2010 (see relevant section below).

Construction of the year 2000 Map

The combined raster dataset was processed by a semantic and spatial generalization algorithm (Castilla et al., in preparation) to create a polygon vector layer depicting land cover variation in a more generalized fashion than the original raster sources. In addition to the land cover raster themselves, the algorithm employs the original satellite imagery that was used as input to the EOSD classification. The process for each tile is as follows:

(1) A morphological segmentation algorithm is applied to the original Landsat image in order to break it down into a mosaic of tiny homogeneous regions (<10 pixels in average) separated by 1-pixel thick boundaries.

(2) Regions having a clearly predominant land cover class (>75% of its pixels belong to that class) are assigned to it, and adjacent regions having the same class are merged together. This results in a large portion of the image, usually more than 90%, already being labeled.

(3) Endmembers, or typical spectral signatures (i.e. mean value in each band of the Landsat image) for each class, are derived from these regions.

(4) Unlabeled regions are assigned to the class of their most similar neighbor, providing the latter is already classified and bears enough similarity to it, otherwise they are assigned to the class with the highest relative abundance within the region, where the latter is abundance weighted by distance in the feature space between the spectral signature of the region and the endmember of each class; once again after the assignment, adjacent regions having the same class are merged together. There are special rules on how to compute abundance for semantically related classes, such as conifer, broadleaf and mixed forest.

(5) Regions are reclassified into the final set of 11 land cover classes using a predefined crosswalk table, after which adjacent regions with the same class are merged together. Note: Treed wetlands (class 81 in EOSD) greater than 100 ha are assumed to be black spruce and thus conifer. Smaller treed wetlands are assigned to the class of the closest forest endmember.

(6) Regions smaller than the minimum mapping unit (MMU: 0.5 ha for water and 2 ha for the rest) are merged to their most similar adjacent neighbour.

(7) Isolated regions smaller than 25 ha that show a low contrast with the encompassing region are eliminated, as they were found in a previous version to mainly correspond to spurious polygons.

(8) Using the center of boundary pixels as initial vertices, the result is converted to an ESRI polygon shapefile using a line simplification algorithm.

Once all tiles were ready, the final product was created by merging and dissolving the individual tiles into a seamless layer. After dissolving, a few seam lines were still visible due to split polygons having a different label on each side of the seam. The labels of polygons affected by these inconsistencies were harmonized using semi-automated GIS procedures, after which a final 'dissolve' was performed.

Updating to year 2010

The circa 2000 map was updated to circa 2010 conditions using a hybrid procedure that included a combination of change detection and GIS techniques. The map was updated for new features appearing in the 2000-2010 period of the following types: forestry cutblocks, wildfires, surface mines, roads and urban development. Cutblocks were extracted from the cumulative ABMI cutblock layer. A difference image ($NDVI_{2000} - NDVI_{2010}$) was computed, and statistics for each cutblock polygon were derived. Cutblocks harvested between 2000 and 2010 were preselected by thresholding and those close to the threshold were visually inspected before the final selection. The wildfires were extracted from GoA's Historical Wildfire Perimeter Dataset using a similar procedure than for the cutblocks. Mines, roads and urban were extracted from the 2010 ABMI Human Footprint dataset using GIS overlay operations that compared these with preexisting features of this type in the 2000 map. The different types of new features were integrated into a single disturbance layer, the outlines of this layer were generalized to give them a similar appearance than those of the 2000 map, the disturbance layer was stamped on top of the 2000 map, and slivers (small polygons resulting from boundary mistmatches) were removed.

Land Cover Classes

Table 1: ABMI Wall-to-wall Land Cover Map Class Descriptions

LC Class Code	LC Class	LC Class Description
20	Water	Lakes, lagoons, rivers, canals, and artificial water bodies. Shallow open water is included in this category, unless there is more than 20% vegetation cover, in which case it belongs to the relevant vegetated class.
31	Snow/Ice	Areas permanently covered by snow or ice, including glaciers.
32	Rock/Rubble	Bedrock, rubble, talus, blockfield, lava beds, or other natural impervious surfaces.
33	Exposed Land	Bare soil (barren, non-agricultural), river sediments and cut banks, pond or lake sediments, reservoir margins, beaches, landings, recently burned areas, mudflat sediments, surface mining, or other non-vegetated (less than 6% trees, or less than 20% shrub/herb) surfaces.
34	Developed	Urban and built-up areas (including industrial sites), impervious artificial surfaces (e.g. airport runaways), railways and roads. Acreages and farmsteads are included in this class. Oil and gas well pads are included in this class if connected to a road and not abandoned or under reclamation. Urban terrain under development is included in this class, even if the land is exposed. Urban green areas are excluded from this class if larger than 2 ha and if they have less than 2 buildings per hectare.
50	Shrubland	At least 20% ground cover which is at least one-third shrub, with no or little presence of trees (<10% crown closure). Examples of plants belonging to this class are alder, willow, juniper, and sagebrush. Shrubby fens and other non-tree woody wetlands, usually associated with floodplains and the shores of lakes and streams, belong to this class. Includes cutblocks where trees are still < 2m height, and recently

LC Class Code	LC Class	LC Class Description
		burned forest areas
110	Grassland	Predominantly native grasses and other herbaceous vegetation with a minimum of 20% ground cover; may include some shrub cover (but less than a third of the vegetated area) or a few trees (but the tree cover cannot exceed 10%). Land used for range or native unimproved pasture (e.g., rough fescue) is included in this class. Alpine meadows fall into this class. Marshes and other non-woody wetlands with at least 20% vegetation cover (sedges, cattails, or moss) belong to this class. Note: A forestry cutblock harvested more than a year ago containing seedlings with less than 10% cover, belongs to this class. If the cutblock had no successful regeneration and is covered by more than 20% shrubs, it would belong to the 'Shrubland' class.
120	Agriculture	Annually cultivated cropland, tame pastures (fields planted or sown with non-native grasses/legumes where livestock is directly grazing on them), forage crops (same as tame pasture, but instead cut for hay) and woody perennial crops (fruit orchards and vineyards). Includes annual field crops, vegetables, summer fallow, orchards and vineyards. Bare agricultural soil (i.e., tilled) belongs to this class.
210	Coniferous Forest	Treed areas with at least a 10% crown closure of trees, where coniferous trees (spruce, pine, fir, larch) are 75% or more of the crown closure. Providing crown closure is more than 10% and dominated by conifers, young plantations or regenerating cutblocks, and treed wetlands (e.g. black spruce bogs and fens) are included in this class providing mean tree height exceeds 2 m.
220	Broadleaf Forest	Treed areas with at least a 10% crown closure of trees, where broadleaf trees (trembling aspen, balsam poplar and white birch) are 75% or more of the crown closure. Providing crown closure is more than 10% and dominated by broadleaf trees, young plantations or regenerating cutblocks, and treed swamps along floodplains or wetlands are included in this class providing mean tree height exceeds 2 m.
230	Mixed Forest	Treed areas with at least a 10% crown closure of trees, where neither coniferous nor broadleaf trees account for 75% or more of crown closure.

References

Castilla, G., et al. (in preparation). Generation of a wall to wall land cover polygon layer for Alberta, Canada.