ABMI Wall-to-wall Land Cover Map circa 2000, Version 2.1: Metadata

August 2012

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Suggested Citation: Alberta Biodiversity Monitoring Institute. 2012. ABMI Wall-to-wall Land Cover Map circa 2000, Version 2.1: Metadata. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca [Date of Download].

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Contact Information

If you have questions or concerns about your data request, please contact:

Information Centre
Alberta Biodiversity Monitoring Institute
CW 405 Biological Sciences Centre
University of Alberta
Edmonton, Alberta, Canada, T6G 2E9
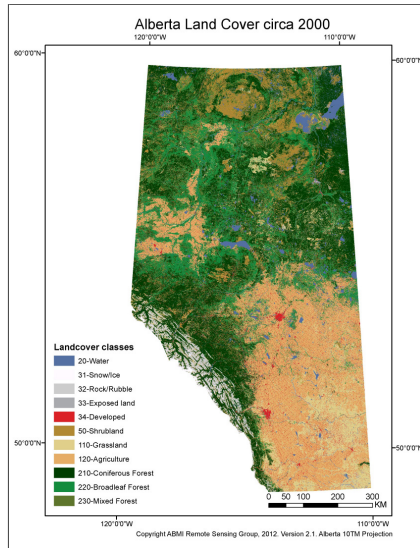Phone: (780) 492-5766
Email: abmiinfo@ualberta.ca

Table of Contents

Summary

The ABMI Wall-to-wall Land Cover (LC) Map (ABMIw2wLCV2000v2.1) is a seamless GIS vector layer with nearly a million polygons describing the spatial distribution of LC across the province of Alberta, circa 2000. It is a blending and generalization of two pre-existing raster land-cover products: the Canadian Forest Service's Earth Observation for Sustainable Development (EOSD) map of the forested region, and Agriculture Agri-Food Canada's (AAFC's) map of the agricultural zone. It is the best-available complete representation of Alberta's land cover currently available. Following an assessment of the initial beta version, the ABMI has made numerous improvements to the overall quality and accuracy of the preliminary product to produce the ABMI Wall-to-wall Land Cover Map Version 2.1.

ABMIw2wLCV2000 file geodatabase, version 2.1

Alberta Land Cover circa 2000

Landcover classes
20-Water
31-Snow/Ice
32-Rock/Rubble
33-Exposed land
34-Developed
50-Shrubland
110-Grassland
120-Agriculture
210-Coniferous Forest
220-Broadleaf Forest
230-Mixed Forest

Copyright ABMI Remote Sensing Group, 2012. Version 2.1. Alberta 10TM Projection

Tags
Land cover

Summary
The Alberta wall to wall land-cover (LC) polygon vector layer circa 2000 (ABMIw2wLCV2000), version 2.1, is a map describing the spatial distribution of LC across the province of Alberta for the reference year 2000. The map legend consists of 11 LC classes (see below), and the map itself (i.e., the landcover Polygons feature class inside this geodatabase) consists of a mosaic of roughly a million non-overlapping polygons of various sizes, from half a hectare (ha) to thousands of ha. 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. The minimum mapping unit (MMU, or minimum polygon size) is 0.5 ha for aquatic features and 2 ha for the rest, and the Minimum Mapping Width (MMW) is two Landsat pixels (60 m). The file format chosen for the ABw2wLCV2000 is ESRI file geodatabase (gdb), and the cartographic projection is Alberta 10 TM. The cartographic scale of reference (i.e., the scale at which the map would be printed if distributed in hardcopy) is 1:125,000. The target positional accuracy of polygon outlines is 0.5 mm at that scale, or 60 m on the ground. The overall thematic accuracy of the map is 75% with 11 classes, and 88% if these classes are grouped into 5 general classes.

Description

This file geodatabase contains the following items, which are further explained in their respective item descriptions:

Landcover_Polygons: A feature class with 977,556 non-overlapping polygons covering exhaustively the Alberta landbase.

ABMIw2wLCV2000_48tiles: A feature class with the frames of the 48 tiles used in the production of the above.

Validation_areas: A feature class with over 12,000 samples that were used to assess the thematic accuracy of the map.

Confusion_Matrix_Level1: A table with the confusion matrix for the 11 classes in the map.

Confusion_Matrix_Level2: A table with a confusion matrix for 5 genral classes into which the 11

classes in the map can be grouped.

PerClassStats: A table with the number of polygons, total area in sq km and mean polygon size in ha for each of the 11 classes.

NB. This is a substantiallly improved version of the initially distributed ABMIw2wLCV2000beta version. To understand the changes between versions, please see the Accuracy assessment report of the beta version, which can be downloaded from the ABMI website.
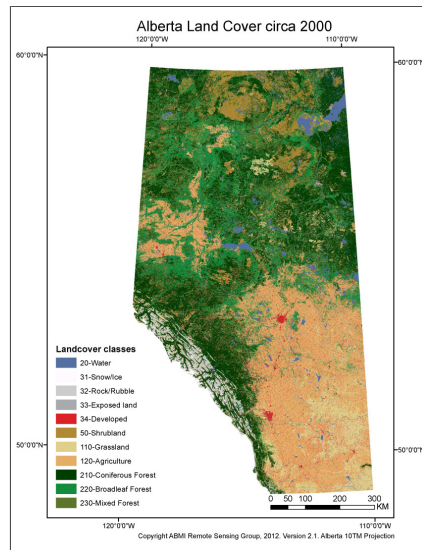
Credits
ABMI Remote Sensing Group, 2012.

Access and use limitations
There are no access and use limitations for this item.

ABMIw2wLCV2000: Landcover_Polygons
File Geodatabase Feature Class

Alberta Land Cover circa 2000

Landcover classes
20-Water
31-Snow/Ice
32-Rock/Rubble
33-Exposed land
34-Developed
50-Shrubland
110-Grassland
120-Agriculture
210-Coniferous Forest
220-Broadleaf Forest
230-Mixed Forest

0 50 100   200   300
KM

Copyright ABMI Remote Sensing Group, 2012. Version 2.1. Alberta 10TM Projection

Tags
Land cover

Summary
The Alberta wall to wall land-cover (LC) polygon vector layer circa 2000 (ABMIw2wLCV2000), version 2.1, is a map describing the spatial distribution of LC across the province of Alberta for the reference year 2000. The map legend consists of 11 LC classes (see below), and the map itself (i.e., this feature class) consists of a mosaic of roughly a million non-overlapping polygons of various sizes, from half a hectare (ha) to thousands of ha. 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. The minimum mapping unit (MMU, or minimum polygon size) is 0.5 ha for aquatic features and 2 ha for the rest, and the Minimum Mapping Width (MMW) is two Landsat pixels (60 m). The file format chosen for the ABw2wLCV2000 is ESRI file geodatabase (gdb), and the cartographic projection is Alberta 10 TM. The cartographic scale of reference (i.e., the scale at which the map would be printed if distributed in hardcopy) is 1:125,000. The target positional accuracy of polygon outlines is 0.5 mm at that scale, or 60 m on the ground. The overall thematic accuracy of the map is 75% with 11 classes, and 88% if these classes are grouped into 5 general classes.

Description

The ABMIw2wLCV2000 was derived by applying a semantic and spatial generalization algorithm (Castilla et al., in preparation) to a combination of two raster datasets: the Canadian Forest Service (CFS) Earth Observation for Sustainable Development (EOSD) LC dataset, and the Land Cover for Agricultural Regions of Canada, circa 2000 (LCARC, a.k.a. NLWIS) dataset of Agriculture and Agri-Food Canada (AAFC). Both datasets were created using digital classification of Landsat 5 and Landsat 7 ortho-images acquired around year 2000, with each Landsat scene classified individually and then mosaicked into the final raster product. NB. Both rasters use the same hierachical classification scheme. This feature class was obtained by merging 48 individual tiles whose frames are provided in the ABMIw2wLCV2000_48tiles feature class. Each tile is completely within a single Landsat scene, and its boundary roughly coincides with the seam lines used to stitch together the EOSD. Each map tile was created as follows:

(0) 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. See the

description of the SOURCE* fields in the ABMIw2wLCV2000_48tiles for further details. Lakes, rivers, pipelines, powerlines, railways and roads from the Government of Alberta (GoA) GIS layers were also 'burned' in this combined raster.

(1) A morphological segmentation algorithm is applied to the gradient magnitude (a sort of 'edge' image) of the original Landsat image used to derive the EOSD, in order to break it down into a mosaic of tiny homogeneous regions (mean segment size around 10 pixels) separated by 1-pixel thick boundaries. NB. The edges of the features copied from the GoA's layers area are enhanced in the gradient magnitude image so as to preserve their shape in the output segmentation.

(2)Regions having a clearly predominant landcover class (more than 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 big portion of the image (usually more than 90%) being already 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 the most similar neighbour, providing the latter is already classified and bears enough similarity to it, ortherwise they are assigned to the class with the highest relative abundace 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, adjacent regions having the same class are merged together after the assigment. NB. There are special rules on how to deal with semantically related classes, such as conifer, broadleaf and mixed forest.

(5) Regions are reclassified into the final set of 11 landcover classes using a predefined crosswalk table, after which adjacent regions having the same class are merged together. NB. 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 endmembers.

(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 were 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 differing classifications in the adjoining tiles. The labels of polygons affected by these inconsistencies were harmonized using semi-automated GIS procedures, after which a final 'dissolve' was performed.

Landcover class definitions:

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 cutbanks, pond or lake sediments, reservoir margins, beaches, landings, fresh (less than 1yr) cutblocks, recently burned areas, mudflat sediments, surface mining, or other non-vegetated (less than 10% 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 of 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 (shrub: a woody plant not considered a tree), with no or little presence of trees (less than10% crown closure). Examples of plants belonging to this class in Alberta are alder, willow, juniper, and sagebrush. Shrubby fens and other non-treed woody wetlands, usually associated with floodplains and the shores of lakes and streams, belong to this class. NB. A dense patch of regenerating young trees is still considered forest and not shrub, no matter that the trees are still small.

110 - Grassland: Predominantly native grasses and other non-woody vegetation (e.g., forbs) 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 with native unimproved grasses (a.k.a. rough pasture) 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. NB. A forestry cutblock harvested more than year ago that contains seedlings, but where the latter cover less than 10% of the area of the cutblock, belongs to this class. If the cutblock had no successful regeneration and was covered by more than 20% shrubs, then it would belong to the 'shrubland' class.

120 - Agriculture: annually cultivated crops, tame pastures (fields planted or sown with non-native grasses/legumes where livestock is directly grazing on them in the summer), forage crops (same as the previous, but instead of grazed, cut for hay) and woody perennial crops (fruit orchards and vineyards). Bare agricultural (i.e., tilled) soil belongs to this class and not to 'exposed land'.

210 - Coniferous Forest: Treed areas with at least a 10% ground cover of trees (a.k.a. crown closure), where coniferous trees (spruce, pine, fir, larch) are 75% or more of the crown closure. Young plantations or regenerating cutblocks of conifer trees belong to this class no matter that the trees are less than 5 m tall, providing crown closure has reached 10%. Treed wetlands (e.g., black spruce bogs and fens) are included in this class providing they are conifer dominated and crown closure exceeds10%.

220 - Broadleaf Forest: Treed areas with at least a 10% ground cover of trees, where broadleaf trees (trembling aspen, balsam poplar, white birch) are 75% or more of the crown closure. Young plantations or regenerating cutblocks of broadleaf trees belong to this class no matter that the trees are less than 5 m tall, providing crown closure has reached 10%. Treed swamps along river floodplains and other treed wetlands are included in this class providing they are broadleaf dominated and crown closure exceeds 10%.

230 - Mixed Forest: Treed areas with at least a 10% ground cover of trees, where neither coniferous nor broadleaf trees account for 75% or more of crown closure.

The overall thematic accuracy of the map, as estimated by an extensive validation dataset (see description of the relevant feature class) is 75% with 11 classes, and 88% if these classes are grouped into 5 general classes. User and Producer accuracies for specific classes in each level appear in tables appended to this geodatabase.

Caveats:

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

2) Roads and other access features refer to 2007 conditions. This means that there can be segments of roads that appear in the map but were not yet constructed by 2000.

3) The accuracy of the shrub class is low (30%). Many shrub polygons are in reality forest, especially in the North. This was not possible to correct with the input data at hand.
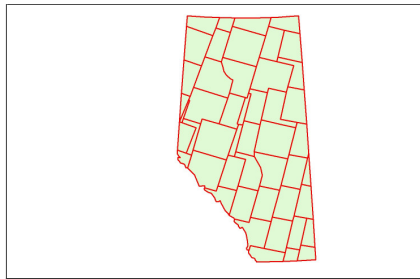
Credits
ABMI Remote Sensing Group 2012, based on the EOSD and NLWIS raster datasets and on hydrography and acces GIS layers from the Government of Alberta.

Access and use limitations
There are no access and use limitations for this item.

ABMIw2wLCV2000, tiles

File Geodatabase Feature Class

Tags
Map sheet frames, map tesselation

Summary
This polygon feature class contains the boundaries of each of the 48 tiles that were used in the production of the Alberta wall to wall landcover polygon layer circa 2000 (ABMIw2wLCV2000). This is layer is provided as ancillary information about the actual date and raster data source each area of the map was derived from.

Description

This polygon feature class contains the boundaries of each of the 48 tiles that were used in the production of the Alberta wall to wall landcover polygon layer circa 2000 (ABMIw2wLCV2000). Each tile is fully encompassed within a single Landsat scene. Each tile has a 5-digit identifier, where the 1st two digits correspond to the Path and the last three to the Row of the corresponding Landsat scene. The following user-defined fields are included:

ACQ_DATE: Acquisition date of the Landsat image used to create the initial partition for the spatial generalization algorithm. This image is the same used in the original raster classification of the EOSD. NB. For the NLWIS, three dates (of the same year) per scene were used, and where available, one of these dates were used for the initial partition.

UTM_Z: Zone of the NAD83UTM projection in which this tile was produced.

TID: Tile identifier

KM2: Extent in sq km of each tile

SOURCE1: Indicates the landcover raster dataset used as primary input data source for the producution of this tile. This can be either the Canadian Forest Service (CFS) Earth Observation for Sustainable Development (EOSD) LC dataset, or the National Land and Water Information Service (NLWIS) LC dataset of Agriculture and Agri-Food Canada (AAFC). Both raster datasets, freely available in the internet, were created using digital classification of Landsat 5 and Landsat 7 ortho-images acquired around year 2000. They both use the same landcover classification scheme. When for a given pixel both rasters disagree and the pair of classes is not covered by any of the combination rules (see SOURCE2, the chosen class is that appearing the raster nominated as primary source for the tile. NLWIS was chosen as primary source for all tiles with at least a 10% of agriculture (31 out of 48 tiles).

SOURCE2: Indicates the landcover raster dataset used as secondary input data source for the producution of this tile. This secondary source is used to refine the info of the primary source when the latter comes at a coarser level than reuired (eg. in EOSD both agriculture (class 120) and grassland (110) appear as 'herbaceous' (100), while they are differentiated in NLWIS. Contrariwise,

some areas may be labelled in NLWIS just 'forest' (200), without specifying whether they are coniferous (210), broadleaf (220), or mixed (230). When for a given pixel the parent classes in EOSD and NLWIS disagree, there is a set of rules to decide what label to retain. For example, the class 'Developed' is retained if present in one of the two calls, and forest classes are prefered over shrub (due to the high confusion of shrub with forest detected in the previous version of the map). For combinations where no rule applies, the choice depends on the primary source indicated in SOURCE1. NB. There are 13 tiles out of the 48 that do not have a value inthis field because either the EOSD or the NLWIS are not available for those tiles.
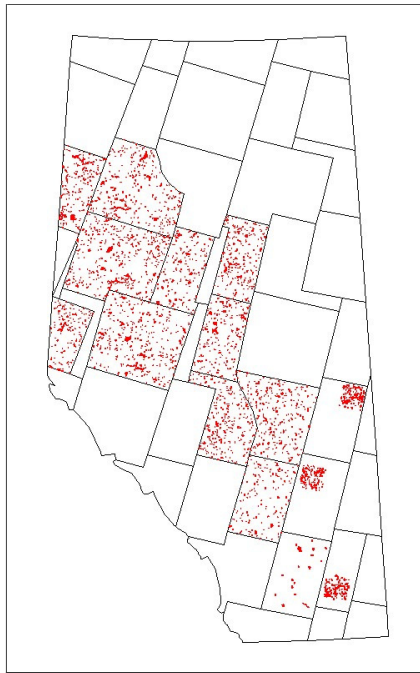
Credits
ABMI Remote Sensing Group, 2012. Based on the FinalMergeLayer_all.shp of the EOSD mosaic for UTM 11 and 12, reshaped as to remove the overlap between tiles.

Access and use limitations
There are no access and use limitations for this item.

Validation_areas
File Geodatabase Feature Class

Tags
Accuracy Assessment

Summary
Polygon feature class containing the areas used for validating the ABMIw2wLCV2000

Description

This polygon feature class contains the boundaries of each of the 12,000 areas that were used to assess the accuracy of the Alberta wall to wall landcover polygon layer circa 2000 (ABMIw2wLCV2000). These areas were inspected using ortho-rectified aerial true color photography of 1m resolution acquired circa 2000 by North West Geomatics and distributed by Valtus Imagery Services Limited (hereafter the Valtus 2000 mosaic). The validation was therefore constrainedto regions where this Valtus 2000 mosaic was available. Each feature was given one (sometimes two, when the setting and appearance were ambiguous) landcover call based on appearance in the valtus 2000 mosaic, which is recorded in the LC_corr field (and the second call, where needed, in the LC_corr2 field). The landcover classes used in the validation are slightly different than those in the Lancover Polygons feature class of this geodatabase. The latter were aggregated in some cases due to the low accuracy observed in the non-agregated classes. The crosswalk between classes in this feature class that are not identical to classes in the Landcover Polygons feature class is as follows:

wetland-treed (81): conifer (210), broadleaf (220) or mixed forest (230)

wetland-shrub (82): shrub (50)

wetland-herb (83): grassland (110)

cropland (121): agriculture (120)

pasture/hay (122): agriculture (120)

conifer dense (211): conifer (210)

conifer open (212): conifer (210)

broadleaf dense (221): broadleaf (220)

broadleaf open (222): broadleaf (220)

mixedwood dense (231): mixed forest (230)

mixedwood open (232): mixed forest (230)

Other classes not listed here are the same as in Landcover Polygons (see the description of this feature class). The full accuracy assessment report of the beta version of the ABMIw2wLCV2000 can be downloaded from the abmi website.

Credits
ABMI Remote Sensing Group, 2012.

Access and use limitations
There are no access and use limitations for this item.

ABMIw2wLCV2000: Confusion Matrix Level 2

Tags
Accuracy Assessment

Summary

This is the confusion matrix describing the level of agreement (at level 2 of the classification, 11 classes; see the item description of the Landcover Polygons for class definitions) between the ABMIw2wLCV2000 and the reference data corresponding to over 12 thousand photo-interpreted locations totaling some 300 thousand hectares across Alberta (a 0.5% of the landbase). The overall accuracy is 75%.

Description

Except for the TOTAL row and column, and the PA% row and UA% column, each cell contains the total number of hectares that were labelled in the reference with the class indicated by the column and that have in the map the class indicated by the row. The UA% column is the user accuracy, i.e., 100 minus the percent error of commission of each class, where this error is the percent area covered by this class in the map that in reality belongs to a different class. The PA% row is the producer accuracy, i.e., 100 minus the percent error of omision of each class, where this error is the percent area of this class in the reference that appeared in the map as belonging to other classes. The overall accuracy (OA= 75%) is the last cell of the table an represents the percent of land base that was correctly classified.

NB1. These statistics were derived by intersecting the Landcover Polygons feature class with the Validation Areas feature class.

NB2. The Snow, Rock and Barren classes are under-represented in the validation dataset and thus their class-specific accuracies are likely underestimated. The same applies to the Developed class, which for the most part consists of roads, which were not included in the validation.

NB3. There were some 20 kHa (a 6% of the total validation area) belonging to the Wetland-treed class (81) in the reference that could not be used for this matrix because they lacked a secondary call indicating whether they were conifer, broadleaf or mixed. Notwithstanding, they are included in the Level 1 matrix, where there is a single 'forest' class.

Credits
ABMI Remote Sensing Group, 2012.

Access and use limitations

There are no access and use limitations for this item.

Confusion Matrix Level 2
REFERENCE

MAP	WATER	SNOW	ROCK	BARREN	DEVELP	SHRUB	GRASSL	AGRIC	CONIFR	BROADL	MIXF	TOTAL	UA%
WATER	18205.59	0	0	3.73	0	181.8	400.28	72.52	102	271.13	80	19317.05	94.25
SNOW	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCK	0	0	11.28	753.35	0	0	22.18	0	0	0	0	786.81	1.43
BARREN	4.89	0	31.3	98.43	22.27	43.44	104.44	8.98	13.11	0	25.61	352.46	27.93
DEVELP	9.31	0	0	25.8	485.5	44.75	124.22	116.49	6.54	114.76	8.72	936.11	51.86
SHRUB	63.89	0	3.74	311.65	92.29	5719.32	2566.5	925.42	4554.77	1759.2	873.37	16870.14	33.9
GRASSL	104.91	0	22.79	546.67	1167.37	2809.81	17084.71	3976.81	882.3	2428.3	496.22	29519.9	57.88
AGRIC	116.93	0	0	640.42	539.77	995.97	4249.91	99790.2	69.07	2062.02	114.91	108579.2	91.91
CONIFR	120.82	0	7.33	519.51	53.59	1949.96	729.87	86.9	29879.34	3638.75	8509.37	45495.44	65.68
BROADL	111	0	0	689.43	75.96	2493.81	816.45	781.95	1923.04	44822.21	6987.03	58700.88	76.36
MIXF	20.24	0	0	58.07	23.01	1105.74	193.55	25.35	1661.11	2544.78	4863.68	10495.53	46.34
TOTAL	18757.59	0	76.43	3647.07	2459.76	15344.6	26292.12	105784.6	39091.27	57641.16	21958.91	291053.5	
PA%	97.06	0	14.75	2.7	19.74	37.27	64.98	94.33	76.43	77.76	22.15	OA%=	75.92

ABMIw2wLCV2000: Confusion Matrix Level 1

Tags
Accuracy Assessment

Summary

This is the confusion matrix describing the level of agreement (at level 1 of the classification, 5 classes: water, non-vegetated, shrub, herbaceous, forest) between the ABMIw2wLCV2000 and the reference data corresponding to over 12 thousand photo-interpreted locations totaling some 300 thousand hectares across Alberta. The overall accuracy at this level is 88%.

Description

Except for the TOTAL row and column, and the PA% row and UA% column, each cell contains the total number of hectares that were labelled in the reference with the class indicated by the column and that have in the map the class indicated by the row. The UA% column is the user accuracy, i.e., 100 minus the percent error of commission of each class, where this error is the percent area covered by this class in the map that in reality belongs to a different class. The PA% row is the producer accuracy, i.e., 100 minus the percent error of omision of each class, where this error is the percent area of this class in the reference that appeared in the map as belonging to other classes. The overall accuracy (OA= 88%) is the last cell of the table and represents the percent of land base that was correctly classified.

NB. These statistics were derived by intersecting the Landcover Polygons feature class with the Validation Areas feature class.

Credits
ABMI Remote Sensing Group, 2012

Access and use limitations
There are no access and use limitations for this item.

Confusion Matrix Level 1
REFERENCE

MAP	WATER	NON_VEG	SHRUB	HERB	FOREST	TOTAL	UA%
WATER	18205.59	3.73	181.8	472.79	488.05	19351.97	94.08
NON_VEG	14.2	1456.56	70.88	365	182.07	2088.71	69.73
SHRUB	58.97	396.11	5994.33	3318.05	8873.06	18640.52	32.16
HERB	154.52	2749.61	3364.95	125848.7	7121.41	139239.2	90.38
FOREST	215.93	1043.68	4903.62	2552.09	121869.2	130584.5	93.33
TOTAL	18649.21	5649.7	14515.57	132556.6	138533.8	309904.9	
PA%	97.62	25.78	41.3	94.94	87.97	OA%=	88.21