

3. RESULTS AND DISCUSSION

3.6 Accuracy Assessment

Forty-one map units and 4 map unit groups were assessed for accuracy. The 4 map unit groups were map units representing phases of individual vegetation associations. For example, BSL and BST represent the evergreen and mixed phases of the Black Spruce / Labrador Tea Poor Swamp Association and were assessed together because they represent a single association.

The overall thematic accuracy is 82.4% (Appendix D). For producers' accuracy, 29 of the 45 units (64%) reached at least 80% accuracy. Another 13 units fell below 80% accuracy. However, 80% is included within the confidence interval. Thus, 42 of the 45 units (93%) reached 80% accuracy when the confidence interval is taken into account. Three map units did not meet the Program's goal for producers' accuracy: the Quaking Aspen-Paper Birch Forest (AB, 65% with confidence interval 52-77%), the Spruce-Fir-Aspen Forest (SFA, 67% with confidence interval 54-79%), and the Northern Water Lily Aquatic Wetland (WL, 46% with confidence interval 31-61%).

For users' accuracy, 30 of the 45 units (67%) also reached at least 80% accuracy. Another 14 units fell below 80% accuracy. However, 80% is included within the confidence interval. Thus, 44 of 45 units (98%) reached 80% when the confidence interval is taken into account. One map unit did not meet the Program's goal for users' accuracy: Midwest Pondweed Submerged Aquatic Wetland (PW, 44% with confidence interval 27-62%).

Consideration was given to combining map units that did not meet 80% accuracy. However, it seems more useful to keep the map units separate and explain the errors rather than combine map units together. For example, producers' and users' accuracy for the Trembling Aspen-Balsam Poplar Lowland Forest Map Unit (AL) fell below 80% because it was more difficult to map than expected. This map unit grades into the Quaking Aspen-Paper Birch Forest Map Unit (AB) and other upland forest map units with similar signatures. More than 3,000 h and >1,000 polygons of AL have been mapped. Collapsing AL into AB would improve the accuracy assessment result, but the user would not know of the existence of AL, albeit with a lower degree of confidence.

Table 7 presents results of the accuracy assessment for the map units. The comments column reports the percent of polygons mapped in agreement with the accuracy assessment calls, and reports the types of errors. Nearly all errors occurred when a polygon was mapped as an association very similar to the accuracy assessment call. Many of these errors were related to different estimates of percent cover between the photo interpreter and ground crew (see Comments column in Table 7). The photo interpreter sees canopy crowns at a relatively small scale but over a relatively large area, and the field crew sees the canopy over a relatively small area. These different perspectives frequently lead to different estimates of percent cover, which in turn leads to differing conclusions on determining the vegetation type. When judging canopy cover, it is difficult to say which perspective provides the most accurate cover estimates. This is particularly true for conical crowned species, whose canopy is often widest near the ground. Problems with cover classes are also magnified by the overall structure of the classification system, which depends on percent cover to break forest from woodland. In addition, the finest levels of the classification depend on percent cover of individual species in the lower strata to separate associations from one another. The ability to discriminate vegetation types from aerial photographs using these kinds of criteria can be challenging.

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Table 7. Summary of accuracy assessment results of the vegetation spatial database coverage for Voyageurs National Park and environs.

MAP UNIT CODE	MAP UNIT NAME	CONFIDENCE INTERVAL PRODUCER'S/ USERS	COMMENTS
<p>Producers' accuracy (errors of omission) is the probability that the map actually represents what was found on the ground. Users' accuracy (errors of commission) is the probability that an accuracy assessment point has been mapped correctly. Producers or users' accuracy is considered acceptable when 80% falls within the confidence interval. Errors are explained in the Comment Section.</p>			
Bogs			
<i>Treed Bogs</i>			
BSB	Black Spruce Bog	85-105%	95% of the polygons identified by the accuracy assessment (aa) team as Black Spruce Bog (2485) were mapped correctly as BSB (producers' accuracy). An errors occurred when a polygon was mapped as BSL / BST.
		98-103%	100% of the polygons mapped as BSB were identified as Black Spruce Bog (2485) by the aa team (users' accuracy).
<i>Shrub Bogs</i>			
LBC	Black Spruce/Leatherleaf Semi-treed Bog	74-101%	88% of the polygons identified by the aa team as Black Spruce / Leatherleaf Semi-treed Bog (5218) were mapped correctly as LBC (producers' accuracy). Errors occurred when polygons were mapped as LSF (2 errors) and BSAS (1 error).
		60-90%	75% of the polygons mapped as LBC were identified as Black Spruce / Leatherleaf Semi-treed Bog (5218) by the aa team (users' accuracy). Errors occurred when a polygon was mapped as BSL / BST (3 errors) or LB (4 errors).
LB	Leatherleaf Bog	58-88%	73% of the polygons identified by the aa team as Leatherleaf Bog (2498) were mapped correctly as LB (producers' accuracy). Errors occurred when a polygon was mapped as LBC (4 errors), BBSF (2 errors), AS (1 error), and SMX (1 error).
		71-98%	85% of the polygons mapped as LB were identified as Leatherleaf Bog (2498) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AS (1error), BSAS (1 error), or when identified as Northern Sedge Wet Meadow (2257) by the aa team. Northern Sedge Wet Meadow should have been mapped as BBX or SMX.
BBX	Beaver Basin Break-up Mosaic	75-125%	100% of the polygons identified by the aa team as Northern Sedge Wet Meadow (2257) were mapped correctly as BBX (producers' accuracy).
		75-125%	100% of the polygons mapped as BBX were identified as Northern Sedge Wet Meadow (2257) by the aa team (users accuracy).

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Northern Shrub and Graminoid Fens			
Shrub Fens			
BBSF	Bog Birch-Willow Shore Fen	84-106% 67-98%	95% of the polygons identified by the aa team as Bog Birch - Willow Shore Fen (5227) were mapped correctly as BBSF (producers' accuracy). An error occurred when a polygon was mapped as DS (1 error). 83% of the polygons mapped as BBSF were identified as Bob Birch - Willow Shore Fen (5227) by the aa team (users' accuracy). Errors occurred when polygons were mapped as LB (2 errors), BSL / BST (1 error), and AS (1error).
LSF	Leatherleaf-Sweet Gale Shore Fen	78 – 103% 78 – 103%	90% of the polygons identified by the aa team as Leatherleaf - Sweet Gale Shore Fen (5228) were mapped correctly as LSF (producers' accuracy). Errors occurred when polygons were mapped as SMX (2 errors). 90% of the polygons mapped as LSF were identified as Leatherleaf - Sweet Gale Shore Fen (5228) by the aa team (users' accuracy). Errors occurred when polygons were mapped as LBC (2 errors).
TF	Tamarack Scrub Poor Fen	95-105% 61-105%	100% of the polygons identified by the aa team as Tamarack Scrub Poor Fen (5226) were mapped correctly as TF (producers' accuracy). 83% of the polygons mapped as TF were identified as Tamarack Scrub Poor Fen (5226) by the aa team (users' accuracy). Errors occurred when polygons were mapped as WCS / WCT (2 errors).
Graminoid Fens			
SPF	Northern Sedge Poor Fen	94-106% 94-106%	100% of the polygons identified by the aa team as Northern Sedge Poor Fen (2265) were mapped correctly as SPF (producers' accuracy). 100% of the polygons mapped as SPF were identified as Northern Sedge Poor Fen (2265) by the aa team (users' accuracy).
Wet Meadows			
BJ	Canada Bluejoint Eastern Meadow	86-105% 56-86%	96% of the polygons identified by the aa team as Canada Bluejoint Eastern Meadow (5174) were mapped correctly as BJ (producers' accuracy). Error occurred when a polygon was mapped as DS (1 error). 71% of the polygons mapped as BJ were identified as Canada Bluejoint Eastern Meadow (5174) by the aa team (users accuracy). Errors occurred when polygons were mapped as BJ but identified by the aa team as Northern Sedge Wet Meadow (2257; 7 errors), as Wiregrass Shore Fen (5229; 1 error), and when mapped as WL (1 error).

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			Producers' accuracy (errors of omission) is the probability that the map actually represents what was found on the ground. Users' accuracy (errors of commission) is the probability that an accuracy assessment point has been mapped correctly. Producers or users' accuracy is considered acceptable when 80% falls within the confidence interval. Errors are explained in the Comment Section.
SMX	Wet Meadow/Fen Mosaic/Complex	55-80%	67% of the polygons identified by the aa team as one of the associations of SMX (5174, 2257, 4141, 2233, 5229) were mapped correctly as SMX (producers' accuracy). Errors occurred when polygons were mapped as BJ (8 errors), CM (1 error), DS (1 error), LB (2 errors), PW (1 error), and WL (2 errors).
		64-89%	76% of the polygons mapped as SMX were identified as one of the associations of SMX by the aa team (users' accuracy). Errors occurred when polygons were mapped as DS (1 error), LB (1 error), LSF (1 error), and WL (5 errors).
Marshes			
Emergent Marshes			
PM	Eastern Reed Marsh	27-107%	67% of the polygons identified by the aa team as Eastern Reed Marsh (4141) were mapped correctly as PM (producers' accuracy). Errors occurred when polygons were mapped as BJ (2 errors).
		88-113%	100% of the polygons mapped as PM were identified as Eastern Reed Marsh (4141) by the aa team (users' accuracy).
BM	Freshwater Bulrush Marsh	-28-95%	33% of the polygons identified by the aa team as Freshwater Bulrush Marsh (2225) were mapped correctly as BM (producers' accuracy). Errors occurred when polygons were mapped as WRM (2 errors).
		-28-95%	33% of the polygons mapped as BM were identified as Freshwater Bulrush Marsh (2225) by the aa team (users' accuracy). Errors occurred when polygons were mapped as PM (2 errors).
CM	Midwest Cattail Deep Marsh	98-102%	100% of the polygons identified by the aa team as Midwest Cattail Deep Marsh (2233) were mapped correctly as CM (producers' accuracy).
		86-105%	95% if the polygons mapped as CM were identified as Midwest Cattail Deep Marsh (2233) by the aa team (users' accuracy). Error occurred when a polygon was mapped as LSF (1 error).
WRM	Wild Rice Marsh	72-104%	88% of the polygons identified by the aa team as Wild Rice Marsh (2382) were mapped correctly as WRM (producers' accuracy). Errors occurred when polygons were mapped as WL (1 error) and PW (1 error).
		50-87%	68% of the polygons mapped as WRM were identified as Wild Rice Marsh (2382) by the aa team (users' accuracy). Errors occurred when polygons were mapped as BM (2 errors), PW (4 errors), and WL (1 error).

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DMX	Deep Marsh Mosaic/Complex	90-103% 98-102%	<p>Producers' accuracy (errors of omission) is the probability that the map actually represents what was found on the ground. Users' accuracy (errors of commission) is the probability that an accuracy assessment point has been mapped correctly. Producers or users' accuracy is considered acceptable when 80% falls within the confidence interval. Errors are explained in the Comment Section.</p> <p>97% of the polygons identified by the aa team as one of the associations of DMX (4141, 2225, 3344, 2382, 5258, 2562, 2282) were mapped correctly as DMX (producers' accuracy). An error occurred when a polygon was mapped as CM.</p> <p>100% of the polygons mapped as DMX were identified as one of the associations within DMX by the aa team (users accuracy).</p>
Rooted and Floating Aquatic Marshes			
PW	Midwest Pondweed Submerged Aquatic Wetland	49-92% 27-62%	<p>71% of the polygons identified by the aa team as Midwest Pondweed Submerged Aquatic Wetland (2282) were mapped correctly as PW (producers' accuracy). Errors occurred when polygons were mapped as WRM (4 errors), and WL (1 error).</p> <p>44% of the polygons mapped as PW were identified as Midwest Pondweed Submerged Aquatic Wetland (2282) by the aa team (users accuracy). Errors occurred when polygons were mapped as WL (13 errors) and WRM (1 error). 1 error occurred when a polygon was mapped as PW but was identified by the aa team as Northern Sedge Wet Meadow (2257).</p>
WL	Northern Water Lily Aquatic Wetland	31-61% 64-97%	<p>46% of the polygons identified by the aa team as Northern Water Lily Aquatic Wetland (2562) were mapped correctly as WL (producers' accuracy). Errors occurred when polygons were mapped as PW (13 errors), SMX (5 errors), WRM (1 error), and BJ (1error).</p> <p>81% of the polygons mapped as WL were identified as Northern Water Lily Aquatic Wetland (2562) by the aa team (users' accuracy). Errors occurred when polygons were mapped as PW (1 error) and WRM (1 error). 2 polygons were mapped as WL but were identified by the aa team as Northern Sedge Wet Meadow (2257).</p>
Northern Conifer and Hardwood Swamps			
Rich Hardwood Swamps			
BA	Black Ash-Mixed Hardwood Swamp	56-86% 75-101%	<p>71% of the polygons identified by the aa team as Black Ash - Mixed Hardwood Swamp (2105) were mapped correctly as BA (producers' accuracy). Errors occurred when polygons were mapped as AB (1 error), AL (1error), BO (1error), SFA (1 error), and WCBA (5 errors).</p> <p>88% of the polygons mapped as BA were identified as Black Ash - Mixed Hardwood Swamp (2105) by the aa team. Errors occurred when polygons were mapped as AL (1 error), BO (1error), and WCBA (1 error).</p>

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WCBA	White Cedar-Black Ash Swamp	67-96% 64-93%	81% of the polygons identified by the aa team as White Cedar - Black Ash Swamp (5165) were mapped correctly as WCBA (producers' accuracy). Errors occurred when polygons were mapped as BA (1 error), WCA (1 error), and WCS / WCT (3 errors). 79% of the polygons mapped as WCBA were identified as White Cedar - Black Ash Swamp (5165) by the aa team (users' accuracy). Errors occurred when polygons were mapped as BA (5 errors), and AS (1 error).
Rich Conifer Swamps			
BSAS	Black Spruce/Alder Rich Swamp	59-94% 46-82%	76% of the polygons identified by the aa team as Black Spruce / Alder Rich Swamp (2452) were mapped correctly as BSAS (producers' accuracy). Errors occurred when polygons were mapped as BSL / BST (3 errors), LB (1 error), TA (1 error). 64% of the polygons mapped as BSAS were identified as Black Spruce / Alder Rich Swamp (2452) by the aa team (users' accuracy). Errors occurred when polygons were mapped as BSL / BST (4 errors), LBC (1 error), and WCS / WCT (4 errors).
TA	Northern Tamarack Rich Swamp	94-102% 72-90%	98% of the polygons identified by the aa team as Northern Tamarack Rich Swamp (2471) were mapped correctly as TA (producers' accuracy). Error occurred when a polygon was mapped a WCS / WCT (1 error). 81% of the polygons mapped as TA were identified as Northern Tamarack Rich Swamp (2471) by the aa team (users' accuracy). Errors occurred when polygons were mapped as BSL / BST (10 errors), BSAS (1 error), and AS (1 error).
WCS / WCT	White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase and peatland phase)	55-82% 71-96%	68% of the polygons identified by the aa team as White Cedar - (Mixed Conifer)/Alder Swamp (2456) were mapped correctly as WCS or WCT (producers accuracy). Errors occurred when polygons were mapped as BSAS (4 errors), BSL / BST (4 errors), TF (2 errors), and WCU (2 errors). 84% of the polygons mapped as WCS / WCT were identified as White Cedar - (Mixed Conifer)/Alder Swamp (2456) by the aa team (users' accuracy). Errors occurred when polygons were mapped as WCU (1 error), WCS / WCT (3 errors), TA (1 error).

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Poor Conifer Swamps			
BSL / BST	Black Spruce/Labrador Tea Poor Swamp (evergreen phase & mixed phase)	69-85%	77% of the polygons identified by the aa team as Black Spruce /Labrador Tea Poor Swamp (2454) were mapped correctly as BSL or BST (producers' accuracy). Errors occurred when polygons were mapped as BBSF (1 error), BSAS (4 errors), BSF (1 error), LBC (3 errors), and TA (10 errors).
		82-96%	89% of the polygons mapped as BSL / BST were identified as Black Spruce /Labrador Tea Poor Swamp (2454) by the aa team (users' accuracy). Errors occurred when polygons were mapped as BSAS (3 errors), BSB (1 error), and WCS / WCT (4 errors).
Northern Shrub Swamps			
DS	Dogwood-Pussy Willow Swamp	72-98%	85% of the polygons identified by the aa team as Dogwood - Pussy Willow Swamp (2186) were mapped correctly as DS (producers' accuracy). Errors occurred when polygons were mapped as AS (2 errors), SMX (1 error), and UBS (1 error).
		68-96%	82% of the polygons mapped as DS were identified as Dogwood - Pussy Willow Swamp (2186) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AS (2 errors), BBSF (1 error), and BJ (1 error), and when 1 polygon was mapped as DS but was identified by the aa team as Northern Sedge Wet Meadow (2257).
AS	Speckled Alder Swamp	67-92%	79% of the polygons identified by the aa team as Speckled Alder Swamp (2381) were mapped correctly as AS (producers' accuracy). Errors occurred when polygons were mapped as AL (1 error), BBSF (1 error), DS (2 errors), LB (1 error), TA (1 error), WCBA (1 error).
		76-99%	87% of the polygons mapped as AS were identified as Speckled Alder Swamp (2381) by the aa team (users' accuracy). Errors occurred when polygons were mapped as DS (2 errors), LB (1 error), and UBS (1 error).

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Rock Barrens			
Treed Rock Barrens			
JPW / JPM	Boreal Pine Rocky Woodland (jack pine phase and mixed pine phase)	61-83% 99-101%	72% of the polygons identified by the aa team as Boreal Pine Rocky Woodland (2483) were mapped correctly as JPW or JPM (producers' accuracy). Errors occurred when polygons were mapped as BSF (1 error), JPL (1error), JPAX (1 error), MPHW (9 errors), and SFA (2 errors). 100% of the polygons mapped as JPW / JPM were identified as Boreal Pine Rocky Woodland (2483) by the aa team (users' accuracy).
JPL	Jack Pine/Lichen Rocky Barrens	97-103% 68-101%	100% of the polygons identified by the aa team as Jack Pine / Lichen Rocky Barrens (2491) were mapped correctly as JPL (producers' accuracy). 84% of the polygons mapped as JPL were identified as Jack Pine / Lichen Rocky Barrens (2483) by the aa team (users' accuracy). Errors occurred when polygons were mapped as ABW (2 errors), and JPW / JPM (1 error).
ABW	Mixed Aspen Rocky Woodland	61-101% 51-85%	85% of the polygons identified by the aa team as Mixed Aspen Rocky Woodland (2487) were mapped correctly as ABW (producers' accuracy). Errors occurred when polygons were mapped as JPL (2 errors), and MPHW (1 error). 68% of the polygons mapped as ABW were identified as Mixed Aspen Rocky Woodland (2487) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AB (5 errors), MPHW (1 error), and SFA (2 errors).
JPOM / MPHW / OW	Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (jack pine-oak phase, mixed pine-oak phase, and deciduous phase)	96-102% 79-92%	99% of the polygons identified by the aa team as Northern Pin Oak-Bur Oak - (Jack Pine) Rocky Woodland (5246) were mapped correctly as JPOM, MPHW, or OW (producers' accuracy). Error occurred when a polygon was mapped as ABW (1 error). 86% of the polygons mapped as JPOM, MPHW, or OW were identified as Northern Pin Oak-Bur Oak - (Jack Pine) Rocky Woodland (5246) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AB (1 error), ABW (1error), and JPW / JPM (9 errors).

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Shrub and Herb Rock Barrens			
UBS	Boreal Hazelnut-Serviceberry Rocky Shrubland	80-101%	90% of the polygons identified by the aa team as Boreal Hazelnut - Serviceberry Rocky Shrubland (5197) were mapped correctly as UBS (producers' accuracy). Errors occurred when polygons were mapped as AS (1 error), AL (1 error), and SFA (1 error).
		76-99%	88% of the polygons mapped as UBS were identified as Boreal Hazelnut - Serviceberry Rocky Shrubland (5197) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AB (1 error), AL (1 error), BO (1 error), and DS (1 error).
MGF	Poverty Grass Granite Barrens	83-117%	100% of the polygons identified by the aa team as Poverty Grass Granite Barrens (5157) were mapped correctly as MGF (producers' accuracy).
		83-117%	100% of the polygons mapped as MGF were identified as Poverty Grass Granite Barrens (5157) by the aa team (users' accuracy).
Northern White Cedar-(Hardwood) Forests			
WCU	White Cedar-Boreal Conifer Mesic Forest	75-101%	88% of the polygons identified by the aa team as White Cedar - Boreal Conifer Mesic Forest (2449) were mapped correctly as WCU (producers' accuracy). Errors occurred when polygons were mapped as WCS, WCT (1 error), and WCA (2 errors).
		76-101%	88% of the polygons mapped as WCU were identified as White Cedar - Boreal Conifer Mesic Forest (2449) by the aa team (users' accuracy). Errors occurred when polygons were mapped as WCS / WCT (2 errors), and WRM (1 error).
WCA	White Cedar-Yellow Birch Forest	84-103%	93% of the polygons identified by the aa team as White Cedar - Yellow Birch Forest (5165) were mapped correctly as WCA (producers' accuracy). Errors occurred when polygons were mapped as AL (1 error), and WP (1 error).
		67-92%	79% of the polygons mapped as WCA were identified as White Cedar - Yellow Birch Forest (5165) by the aa team (users' accuracy). Errors occurred when polygons were mapped as AB (1 error), AL (1 error), SFA (2 errors), WCT / WCS (1 error), and WCU (2 errors).

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Northern Pine-(Hardwood) Forests			
JPAX	Jack Pine-Aspen Forest Mosaic	66-94%	83% of the polygons identified by the aa team as associations included in JPAX (2437, 2467, 2466, 2518) were mapped correctly as JPAX (producers' accuracy). Errors occurred when polygons were mapped as BSF (1 error), JPF (3 errors), and WRPA (1 error).
		66-94%	80% of the polygons mapped as JPAX were identified by the aa team as associations included in JPAX. Errors occurred when polygons were mapped as JPW / JPM (1 error), and SFA (5 errors).
JPF	Jack Pine/Balsam Fir Forest	82-103%	93% of the polygons identified by the aa team as Jack Pine / Balsam Fir Forest (2437) were mapped correctly as JPF (producers' accuracy). Errors occurred when polygons were mapped as RP (1 error), and AB (1 error).
		65-92%	78% of the polygons mapped as JPF were identified by the aa team as Jack Pine / Balsam Fir Forest (2437). Errors occurred when polygons were mapped as BSF (3 errors), WP (3 errors) and when polygons were mapped as JPF but were identified by aa team as Jack Pine - Aspen / Bush Honeysuckle Forest (2518, 3 errors).
WRPA	White Pine-Red Pine-Quaking Aspen-Paper Birch Forest	74-96%	85% of the polygons identified by the aa team as associations included in WRPA (2443, 2445, 2467, 2466, 2520, 2479) were mapped correctly as WRPA (producers' accuracy). Errors occurred when polygons were mapped as WP (2 errors), AB (2 errors), RP (1 error), and WCU (1 error).
		87-102%	94% of the polygons mapped as WRPA were identified by the aa team as associations included in WRPA. Errors occurred when polygons were mapped as JPW/JPM (1 error) and JPAX (1error).
RP	Red Pine/Blueberry Dry Forest	72-98%	85% of the polygons identified by the aa team as Red Pine / Blueberry Dry Forest (2443) were mapped correctly as RP (producers' accuracy). Errors occurred when polygons were mapped as AB (1 error), and WP (3 errors).
		76-101%	88% of the polygons mapped as RP were identified by the aa team as Red Pine / Blueberry Dry Forest (2443). Errors occurred when polygons were mapped as JPF (1 error), WP (1 error) and WRPA (1 error).

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WP	White Pine/Mountain Maple Mesic Forest	77-101% 63-91%	<p>Producers' accuracy (errors of omission) is the probability that the map actually represents what was found on the ground. Users' accuracy (errors of commission) is the probability that an accuracy assessment point has been mapped correctly. Producers or users' accuracy is considered acceptable when 80% falls within the confidence interval. Errors are explained in the Comment Section.</p> <p>89% of the polygons identified by the aa team as White Pine / Mountain Maple Mesic Forest (2445) were mapped correctly as WP (producers' accuracy). Errors occurred when polygons were mapped as JPF (1 error), SFA (1 error), and RP (1 error).</p> <p>77% of the polygons mapped as WP were identified by the aa team as White Pine / Mountain Maple Mesic Forest (2445). Errors occurred when polygons were mapped as RP (3 errors), SFA (1 error), WCA (1 error), and WRPA when polygons were identified by aa team as pine-aspen mixed forest types (2479/2520, 2 errors).</p>
Northern Spruce-Fir-(Hardwood) Forests			
SFA	Spruce-Fir-Aspen Forest	54-79% 59-83%	<p>67% of the polygons identified by the aa team as Spruce - Fir - Aspen Forest (2475) or as Black Spruce - Aspen Forest (5116) were mapped correctly as SFA (producers' accuracy). Errors occurred when polygons were mapped as ABW (2 errors), AL (1 error), JPAX (5 errors), MPHW (1 error), SF (4 errors), WCA (2 errors) and WP (1 error).</p> <p>71% of the polygons mapped as SFA were identified by the aa team as Spruce - Fir - Aspen Forest (2475) or as Black Spruce - Aspen Forest (5116). Errors occurred when polygons were mapped as AB (5 errors), AL (1 error), BA (1 error), BSF (1 error), JPW / JPM (2 errors), SF (1 error), UBS (1 error), WP (1error).</p>
BSF	Black Spruce/Feathermoss Forest	65-93% 72-98%	<p>79% of the polygons identified by the aa team as Black Spruce / Feathermoss Forest (2447) were mapped correctly as BSF (producers' accuracy). Errors occurred when polygons were mapped as JPF (3 errors), SF (2 errors), and SFA (1 error).</p> <p>85% of the polygons mapped as BSF were identified by the aa team as Black Spruce / Feathermoss Forest (2447). Errors occurred when polygons were mapped as BSL / BST (1error), JPAX (1error), JPW / JPM (1 error), and SF (1 error).</p>
SF	Spruce-Fir/Mountain Maple Forest	80-103% 64-93%	<p>92% of the polygons identified by the aa team as Spruce Fir - Mountain Maple Forest (2446) or Balsam Fir - Paper Birch Forest (2474) were mapped correctly as SF (producers' accuracy). Errors occurred when polygons were mapped as BSF (1 error), and SFA (1 error).</p> <p>79% of the polygons mapped as SF were identified by the aa team as Spruce Fir - Mountain Maple Forest (2446) or Balsam Fir - Paper Birch Forest (2474). Errors occurred when polygons were mapped as BSF (2 errors), and SFA (4 errors).</p>

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MAP UNIT CODE	MAP UNIT NAME	CONFIDENCE INTERVAL PRODUCER'S/ USERS	COMMENTS Producers' accuracy (errors of omission) is the probability that the map actually represents what was found on the ground. Users' accuracy (errors of commission) is the probability that an accuracy assessment point has been mapped correctly. Producers or users' accuracy is considered acceptable when 80% falls within the confidence interval. Errors are explained in the Comment Section.
Boreal Hardwood Forests			
AB	Quaking Aspen-Paper Birch Forest	52-77% 72-95%	65% of the polygons identified by the aa team as Aspen - Birch / Boreal Conifer Forest (2466) or Aspen - Birch - Red maple Forest (2467) were mapped correctly as AB (producers' accuracy). Errors occurred when polygons were mapped as ABW (5 errors), AL (3 errors), BO (1 error), MPHW (1 error), SFA (5 errors), UBS (1 error), and WCA (1 error). 84% of the polygons mapped as JPF were identified by the aa team as Jack Pine / Balsam Fir Forest (2437). Errors occurred when polygons were mapped AL (1 error), BA (1 error), JPF (1 error), and RP (1 error). One polygon mapped as AB was identified by the aa team as White Pine - Aspen - Birch Forest (2479).
PB	Paper Birch/Fir Forest	41-119% 88-113%	80% of the polygons identified by the aa team as Paper Birch / Fir Forest (2463) were mapped correctly as JPF (producers' accuracy). An errors occurred when a polygon was mapped as AL (1 error). 100% of the polygons mapped as PB were identified by the aa team as Paper Birch / Fir Forest (2463)
AL	Trembling Aspen-Balsam Poplar Lowland Forest	57-93% 44-81%	75% of the polygons identified by the aa team as were mapped correctly as AL (producers' accuracy). Errors occurred when polygons were mapped as AB (1 error), BA (1error), SFA (1 error), UBS (1 error), and WCA (1 error). 63% of the polygons mapped as AL were identified by the aa team as Trembling Aspen - Balsam Poplar Lowland Forest (5036). Errors occurred when polygons were mapped as AB (3 errors), AS (1 error) BA (1 error), WCBA (1 error).
Northern Hardwood Forests			
BO	Northern Bur Oak Mesic Forest	84-102% 84-102%	93% of the polygons identified by the aa team as Northern Bur Oak Mesic Forest (2072) were mapped correctly as BO (producers' accuracy). Errors occurred when polygons were mapped as BA (1 error), and UBS (1 error). 93% of the polygons mapped as BO were identified by the aa team as Northern Bur Oak Mesic Forest (2072). Errors occurred when polygons were mapped as AB (1 error), and BA (1 error).

3.7 Recommendations for Future Projects

Several ideas for improving the mapping process have surfaced as a result of the Voyageurs project. Improving the mapping process in ways suggested herein would save time and money, and provide for more accurate mapping.

Accuracy Assessment

Accuracy assessment forms need to be standardized throughout the mapping program. The data sheets need to include finer resolution of cover scales for species and for strata. Vegetation types are typically separated from one another based on percent cover, and the right information needs to be recorded so that the data sheets can be re-evaluated if necessary during the accuracy assessment analysis. For the Voyageurs project, several errors were discovered when cover estimates were incorrect for the vegetation types listed. However, for several other data sheets, the cover scales used were often too broad to evaluate whether the correct vegetation type had been selected.

Front-loading accuracy assessment is *not* recommended if at all possible. For Voyageurs, this led to two different approaches for fieldwork and caused confusion, controversy, and extra effort of everyone involved. The digital data is important to complete before the accuracy assessment teams work in the field so that a digital map of the polygons can be provided.

Better methodologies for selecting accuracy assessment points need to be developed. While stratified random selection may continue as the preferred approach, many other considerations need to be built into an automated program that is beyond the expertise of the mapping team. A statistician who understands logistical and spatial issues in addition to proper application of statistical methodologies should be available to every park. Further, a statistician could build the proper statistical programs for running analysis of the accuracy assessment data.