

ALTERED LANDSCAPES ACCURACY ASSESSMENT FINAL REPORT

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INTRODUCTION

The Florida Fish and Wildlife Conservation Commission's Center for Spatial Analysis contracted with Avineon, Incorporated (Clearwater, FL) to classify and map areas of Florida identified as "disturbed" or "non-natural." Avineon personnel used LandSat 7 ETM+ imagery to identify 11 land cover and land use classes in the map. An accuracy assessment was performed on an initial draft in February, 2008 (FWCC 2008) which identified areas needing additional attention and potential candidates for compression of classes. This report summarizes and describes the final data product delivered as part of the Altered Landscapes project.

METHODS

We used a set of random points ($n = 1100$) similar to that used in the initial assessment, stratified across classes based on class area and subset variance (see FWCC 2008 for a more complete description of these data). Our previous report stated 1100 points were not enough to correctly assess the accuracy of these data. However, a more comprehensive literature review indicated our sample size per class and overall was sufficient for a statistically robust assessment of accuracy (Congalton and Green 1999).

Although there are 11 land cover types classified in this project, much of Florida is covered by natural land cover classes which were not individually identified in this

effort. Although these classes were not expressly identified, they are effectively classified by their exclusion from the 11 original classes and may contain errors of omission. Therefore, we also checked points ($n = 350$) randomly assigned within this unclassified area, designated as “Other.” Our review of Congalton and Green (1999) indicated this amount is sufficient to robustly sample a land cover class covering a large area.

All 1450 points were checked against 2006-2008 1 ft Digital Orthoimagery Quarter Quadrangles (DOQQs) and classified into 1 of the 12 land cover or land use classes (Table 1). Those areas lacking 1 ft DOQQ coverage were compared to the 2004 1 m DOQQ. We used ArcView 3.3 (Environmental Systems Research Institute, Redlands, CA) and the Cohen’s Kappa and Classification Table Metrics 2.1a extension (Jenness and Wynne 2007) to calculate accuracy statistics, including overall accuracy, the Kappa statistic and producer and user accuracy for each of the 11 classes. Finally, we reduced the number of classes from 12 to 8 by combining similar classes (Table 1) and calculated the accuracy statistics for this model.

RESULTS

Overall accuracy for the 12 class land cover data was 67.0% (KHAT = 0.61, var = 0.0002, $Z = 3.35$, $P < 0.00001$). Producer accuracy ranged from 41.9% (Low Impact Urban) to 92.7% (Citrus). Eight of the 12 classes were $> 70\%$ accurate and 1 was 67% accurate (Extractive). The remaining 3 classes were $< 55\%$ accurate (Table 2). The overall commission error was 3.0%. The accuracy rate of the 8 class data was 74.6% (KHAT = 0.67, var = 0.0002, $Z = 6.179$, $P < 0.00001$). Producer accuracy ranged from

Table 1. Land cover classification scheme and 8 class model group.

Class	8 Class Model Group
Grassland	1
Bare Soil/Clearcut	2
Improved Pasture	1
Unimproved Pasture	1
Sugarcane	3
Citrus	4
Row and Other Field Crops	5
Other Agriculture	5
High Impact Urban	6
Low Impact Urban	6
Extractive	7
Other	8

Table 2. Accuracy of individual land cover classes, 12 class model.

Class	Producer Accuracy	User Accuracy	Commission Error
Other	0.7754	0.8286	0.0558
Grassland	0.5556	0.8824	0.0014
Bare Soil/Clearcut	0.4495	0.5765	0.0268
Improved Pasture	0.7733	0.5949	0.0608
Unimproved Pasture	0.4110	0.8333	0.0044
Sugarcane	0.9091	0.9091	0.0007
Citrus	0.9273	0.6296	0.0215
Row and Other Field Crops	0.7549	0.5385	0.0490
Other Agriculture	0.7667	0.6053	0.0106
High Impact Urban	0.9116	0.5238	0.1182
Low Impact Urban	0.4188	0.8221	0.0257
Extractive	0.6667	0.7500	0.0028

45.0% (Bare Soil/Clearcut) to 92.7% (Citrus). Of the 8 classes, 6 were > 70% accurate and 1 was 67% accurate (Extractive). Commission error was 3.62% (Table 3).

Predictive ability of the 8 class model was significantly higher than the 12 class model ($\chi^2 = 8.15$, $df = 1$, $P = 0.004$).

The most common errors of commission in the 12 class model were found in the Low Impact Urban class (Table 4). That is, Low Impact Urban areas were misclassified more than any other class, as reflected in the low producer accuracy for this class. Areas were misclassified as High Impact Urban more than any other class, i.e., High Impact Urban was the most common error of omission for all classes resulting in the lowest user accuracy of all classes. In the 8 class model, the Urban group was the most common error of omission and commission for all other groups (Table 5).

DISCUSSION

Overall accuracy of the Altered Landscapes classification improved from initial drafts from 48% to 67%. The largest improvements in accuracy were found in Sugarcane (66% improvement) and Unimproved Pasture (34% improvement). Conversely, the accuracy of Grassland, Bare Soil/Clearcut and Extractive declined by approximately 25% ea. The quantification of the accuracy of the “Other” class also contributed to the rise in overall accuracy, as that class impacted the accuracy of the original draft through commission errors despite not being actively sampled. The classification model using 8 classes was naturally more accurate than either 12 class model due to its more coarse class resolution.

Although these results do not meet the accuracy benchmarks as established in our report on the initial draft for some of the classes, they are markedly improved. Most

classes are sufficiently accurate (> 65-70%) and all but 1 of those that are < 65% accurate are improved by aggregation into groups consisting of similar habitat types. Therefore, these data are sufficient for our intended use and will likely be useful in furthering our understanding of Florida's wildlife ecology. We accept these classified data and consider this contract fulfilled. No further work by Avineon Inc. staff is required.

LITERATURE CITED

Congalton, R. G. and K Green. 1999. Assessing the accuracy of remotely sensed data: principles and practices. CRC Press, Boca Raton, Florida, USA.

Florida Fish and Wildlife Conservation Commission. 2008. Altered landscapes accuracy assessment report. Tallahassee, Florida, USA.

Table 3. Accuracy of land cover classes, 8 class model.

Group (#)	Producer Accuracy	User Accuracy	Commission Error
Grassland/Pasture (1)	0.7320	0.7379	0.0542
Bare Soil/Clearcut (2)	0.4495	0.5765	0.0268
Sugarcane (3)	0.9091	0.9091	0.0007
Citrus (4)	0.9273	0.6296	0.0215
Agriculture (5)	0.7803	0.5691	0.0592
Urban (6)	0.7665	0.8033	0.0991
Extractive (7)	0.6667	0.7500	0.0028
Other (8)	0.7754	0.8286	0.0558

Table 4. Most common errors of commission and omission among land cover classes, 12 class model.

Class	Omission Error	Commission Error
Other	High Impact Urban	Bare Soil/Clearcut
Grassland	Other, Imp. Pasture	Unimp.Pasture, Row Crops
Bare Soil/Clearcut	Other	Other
Improved Pasture	High Impact Urban	Low Impact Urban
Unimproved Pasture	Improved Pasture	Other
Sugarcane	Low Impact Urban	Low Impact Urban
Citrus	Improved Pasture	Low Impact Urban
Row/Field Crops	High Impact Urban	Low Impact Urban
Other Agriculture	Citrus	Low Impact Urban
High Impact Urban	Row and Field Crops	Low Impact Urban
Low Impact Urban	High Impact Urban	Other
Extractive	Bare Soil/Clearcut	Other

Table 5. Most common errors of commission and omission among land cover classes, 8 class model.

Group (#)	Omission Error	Commission Error
Grassland/Pasture (1)	Urban	Urban
Bare Soil/Clearcut (2)	Urban	Urban
Sugarcane (3)	Urban	Urban
Citrus (4)	Grassland/Pasture	Urban
Agriculture (5)	Urban	Urban
Urban (6)	Agriculture	Other
Extractive (7)	Bare Soil/Clearcut	Other
Other (8)	Urban	Grassland/Pasture