Quantification of Sawgrass Biomass in the Coastal Everglades

Caiyun (Karen) Zhang
Department of Geosciences
Florida Atlantic University
Introduction

- Traditional biomass data collection
  - Labor-intensive, time-consuming, and limited plots/area

- Everglades
  - Sawgrass: cover 70% of the Florida Everglades
  - No remote sensing efforts have been made

- Objective
  - To develop remote sensing models for sawgrass biomass estimation
Study site and data

• Study site: Turkey Point Nuclear Generating Station of FPL
• Data
  • Field-based sawgrass quarterly biomass data during 2011-2014
  • Landsat imagery for model development
    • A week window of the field data: Nov. 2011, Nov. 2013, and May 2014
  • Landsat imagery for mapping
    • April 2014 and Nov. 2014
    • May 2016 and Oct. 2016
## Results: Model performance

Table 1 Model performance for live and total biomass estimation based on 4-fold cross validation.

<table>
<thead>
<tr>
<th></th>
<th>Live Biomass Modeling</th>
<th>Total Biomass Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pixel-based</strong></td>
<td></td>
<td></td>
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<tr>
<td>Statistical Metrics</td>
<td></td>
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<tr>
<td>CC ($r$)</td>
<td>0.92</td>
<td>0.91</td>
</tr>
<tr>
<td>MAE (g/m²)</td>
<td>17.21</td>
<td>15.74</td>
</tr>
<tr>
<td>RMSE (g/m²)</td>
<td>20.79</td>
<td>20.35</td>
</tr>
<tr>
<td><strong>Object-based</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC ($r$)</td>
<td>0.92</td>
<td>0.94</td>
</tr>
<tr>
<td>MAE (g/m²)</td>
<td>18.54</td>
<td>31.55</td>
</tr>
<tr>
<td>RMSE (g/m²)</td>
<td>29.97</td>
<td>36.27</td>
</tr>
</tbody>
</table>

CC: Correlation Coefficient ($r$); MAE: Mean Absolute Error; RMSE: Root Mean Squared Error; MLR: Multiple Linear Regression; SVM: Support Vector Machine; RF: Random Forest; k-NN: k-Nearest Neighbor; ANN: Artificial Neural Network.
Figure 4 Scatter plots and regressions of in-situ measures. ANN and SVM estimations of live and total sawgrass biomass.
Figure 5: Live biomass maps for two harvest seasons in 2014 at scales of 50, 100, and 150, respectively, from an ensemble analysis of ANN and SVM estimations.

Figure 6: Live biomass maps for two harvest seasons in 2016 at scales of 50, 100, and 150, respectively, from an ensemble analysis of ANN and SVM estimations.
Figure 7: Total biomass maps for two harvest seasons in 2014 at scales of 50, 100, and 150, respectively.

Figure 8: Total biomass maps for two harvest seasons in 2016 at scales of 50, 100, and 150, respectively, from ANN estimation.
Uncertainty map for live biomass estimation using ANN and SVM

Figure 9 Uncertainty maps for live sawgrass biomass estimation derived from ANN and SVM models for two harvest seasons in 2014 and 2016, respectively.
Summary and Conclusions

- Developed object-based ensemble approach for biomass modeling
- Non-parametric modeling is better than parametric modeling
- Object-based modeling is a good alternative to the pixel-based modeling
- Ensemble modeling is promising in biomass estimation

Thanks for your attention! Questions or comments?