What I learned while creating the Critical Dune Tool:

Opportunities for improving critical dune policy and management

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Project Goals

• Build a *spatial decision support tool* within Michigan MIV

➢ **Science**
  Provide a more comprehensive picture of the landscape

➢ **Technology**
  Improve process & Increase efficiency

✓ **Research Question:**
  *Can the MDEQ provide staff with a tool that enables them to exhaust fewer resources in the field, while providing them with more site information?*
Implications for the MDEQ

- Quickly and efficiently gather information needed during the permit process
- Provide additional site knowledge to the agent
- GIS can act as a permanent database of site-specific measures and applicant information
Map of the Three Field Sites selected by the Project Team
Critical Dune Tool Design

Reviewed...
the application and site inspection form
Solicited...
feedback from MDEQ agents
Evaluated...
digital data sources/quality
Designed
the tool to mimic this information w/additional information about the site
### Critical Dune Tool Design

#### DEM Elevation (30-meter points)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEM Elevation (mean)</td>
<td>682 feet</td>
</tr>
<tr>
<td>DEM Elevation (minimum)</td>
<td>666</td>
</tr>
<tr>
<td>DEM Elevation (maximum)</td>
<td>705</td>
</tr>
<tr>
<td>Relief</td>
<td>39</td>
</tr>
<tr>
<td>Points</td>
<td>13</td>
</tr>
<tr>
<td>DEM Slope (within 200 feet)</td>
<td>Mean: 9.15%</td>
</tr>
<tr>
<td></td>
<td>Minimum: 0 - 5%</td>
</tr>
<tr>
<td></td>
<td>Maximum: 30 - 36%</td>
</tr>
</tbody>
</table>

#### LiDAR Elevation (2-meter contour)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiDAR Elevation (mean)</td>
<td>623</td>
</tr>
<tr>
<td>LiDAR Elevation (minimum)</td>
<td>587</td>
</tr>
<tr>
<td>LiDAR Elevation (maximum)</td>
<td>695</td>
</tr>
<tr>
<td>Relief</td>
<td>108</td>
</tr>
<tr>
<td>Points</td>
<td>2,825</td>
</tr>
</tbody>
</table>

#### Site Assessment

- **Application**:
  - Site:
    - Aspect: East
    - Slope: 15 - 22%
- **Soils**:
  - **DEM Slope (within 200 feet)**:
    - Mean: 9.15%
    - Minimum: 0 - 5%
    - Maximum: 30 - 36%
  - **LiDAR Slope (within 200 feet)**:
    - Mean: 32 - 40%
    - Minimum: 0 - 15%
    - Maximum: 93 - 177%
Critical Dune Tool Design

• Two additional tools aid in visualizing the terrain at a site
  – The Elevation Profile Graph
  – The 3-D Elevation Graph
Critical Dune Tool Design

- Collectively called the *Critical Dune Site Assessment*

- Information provided for and by the user appears in a **report** and in a user **database**
Digital Data

- Elevation & Terrain Derivatives
  LIDAR (2m) vs. NED (30m)

- Land use/land cover
  2002 (sub-acre) vs. 1978 (2.5 acre)

- Soils
  SSURGO (5 acres) vs. STATSGO (1544 acres)

- Parcels w/PIN
  for locating and tracking
<table>
<thead>
<tr>
<th>Location</th>
<th>Field Site 1</th>
<th>Field Site 2</th>
<th>Field Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lake Township, Berrien County</td>
<td>Laketown Township, Allegan County</td>
<td>Spring Lake Township, Ottawa County</td>
</tr>
<tr>
<td>Elevation Data</td>
<td>LIDAR 2-meter, NED 30-meter</td>
<td>NED 30-meter</td>
<td>NED 30-meter</td>
</tr>
<tr>
<td>Soils Data</td>
<td>SSURGO</td>
<td>STATSGO</td>
<td>STATSGO</td>
</tr>
<tr>
<td>Additional Data</td>
<td>Parcels w/PIN</td>
<td>Parcels w/PIN</td>
<td>NA</td>
</tr>
<tr>
<td>Overall Data Quality</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>
Field Data Collection

- Trimble Pro XRS GPS Unit
- Compass, w/built in slope indicator
- Soil Auger
- Observation
<table>
<thead>
<tr>
<th></th>
<th>Sand OTB</th>
<th>Ctrl. Hardwood</th>
<th>Sgl. Family</th>
<th>Beaches &amp; Riverbanks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sand OTB</strong></td>
<td>15</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Ctrl. Hardwood</strong></td>
<td>4</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sgl. Family</strong></td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Beaches &amp; Riverbanks</strong></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
<td>23</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Producer Accuracy</strong></td>
<td>78.95%</td>
<td>56.52%</td>
<td>100.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>User Accuracy</strong></td>
<td>68.18%</td>
<td>76.47%</td>
<td>71.43%</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>Overall Accuracy</strong></td>
<td>70.21%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Source</td>
<td>County</td>
<td>RMSE</td>
<td>MAE</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Elevation</td>
<td>LIDAR</td>
<td>Berrien</td>
<td>1.658</td>
<td>1.182</td>
</tr>
<tr>
<td>Elevation</td>
<td>NED</td>
<td>Allegan</td>
<td>17.913</td>
<td>15.092</td>
</tr>
<tr>
<td>Slope</td>
<td>LIDAR</td>
<td>Berrien</td>
<td>14.907</td>
<td>9.87</td>
</tr>
<tr>
<td>Slope</td>
<td>NED</td>
<td>Allegan</td>
<td>27.80</td>
<td>21.61</td>
</tr>
</tbody>
</table>
Conclusions…

• While not yet omitting fieldwork, there is potential for the use of this tool in policy management
  – High resolution data sets are a necessity if the tool is to be used
  – Parcels w/PIN are critical for locating/tracking sites
So, what did I learn?

- There are some steep, yet stable slopes out there
- There is little accountability when it comes to CZM:
  - Not one state employs a database on coastal statistics or resources affected by permits or policies (Bernd-Cohen and Gordon 1999)
  - In Michigan, relatively few sites ever receive follow-up visits
Research shows that Michigan is not alone…

- ALL coastal managers are overburdened with IMPLEMENTATION…
  -the focus is on the current decision processes, not monitoring and evaluating past actions.

- In order for a coastal program to change or improve, program managers must have the time and resources available to evaluate the state of coastal resources

(Bernd-Cohen and Gordon 1999; Hershman et al. 1999)
Thank you all for attention…. 

And a special thanks to all who helped make this project a success, including Matt Warner (MDEQ), Justin Booth (MSU RS&GIS), and Jeff Schlueter (field assistant).