Center’s research goal is to enhance and validate the Environmentally Sensitive Maintenance (ESM) practices, which are at the core of the Center’s education, outreach, and technical assistance.

- Sediment Quantification
- Dust Quantification
- Driving Surface Aggregate
Real-time Dust Monitoring:

- Compare dust loads from DSA to 2A, 2RC and Native surface roads
- Explore the effects of canopy cover on dust production
- Test dust suppressant effectiveness
Initial Testing

Scotia Road Dust Monitoring - 2015

- 17.5 mg/m³
- 53.3 mg/m³
- 7.0 mg/m³
## Results – Laurel Run, Rothrock State Forest

<table>
<thead>
<tr>
<th>Aggregate Type</th>
<th>Particle Size (PM)</th>
<th>Maximum Conc. mg/m³</th>
<th>Minimum Conc. mg/m³</th>
<th>Average Conc. mg/m³</th>
<th>Percent Decrease from 2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSA1 - 2012</td>
<td>2.5</td>
<td>5.2</td>
<td>0.16</td>
<td>1.2</td>
<td>44%</td>
</tr>
<tr>
<td>DSA1 - 2012</td>
<td>10</td>
<td>14.3</td>
<td>0.28</td>
<td>3.4</td>
<td>49%</td>
</tr>
<tr>
<td>DSA2 - 2015</td>
<td>2.5</td>
<td>0.85</td>
<td>0.05</td>
<td>0.23</td>
<td>89%</td>
</tr>
<tr>
<td>DSA2 - 2015</td>
<td>10</td>
<td>2.1</td>
<td>0.11</td>
<td>0.63</td>
<td>91%</td>
</tr>
<tr>
<td>DSA3 - 2015</td>
<td>2.5</td>
<td>2.7</td>
<td>0.05</td>
<td>0.63</td>
<td>71%</td>
</tr>
<tr>
<td>DSA3 - 2015</td>
<td>10</td>
<td>8.4</td>
<td>0.18</td>
<td>1.8</td>
<td>73%</td>
</tr>
<tr>
<td>2A</td>
<td>2.5</td>
<td>9.7</td>
<td>0.34</td>
<td>2.2</td>
<td>X</td>
</tr>
<tr>
<td>2A</td>
<td>10</td>
<td>31.9</td>
<td>1.1</td>
<td>6.7</td>
<td>X</td>
</tr>
</tbody>
</table>

* All values mg/m³, all differences between 2A and DSA are statistically significant
All DSA road sections significantly outperformed the 2A road section in suppressing vehicle generated dust.
- Real-time road surface temperature monitoring
- Up to 55 degree temperature swings
- Temperature and dust correlated
- Surrogate for canopy
Laurel Run Dust and Road Temperature Monitoring

- Dust PM10
- Road Surface Temp F

PM1.0 (mg/cubic meter)

Road Surface Temperature (degrees F)

Data Point
Collaboration with College of Ag - remote sensing of canopy and road surface using LiDAR

- Vehicle and Drone Mounted
Collaboration with College of Ag:

• Stiltgrass effects on road maintenance and compaction
Rainfall Simulator

- 100 feet long
- 11 ten foot risers
- 2 rotary nozzles per riser
- 3” - 6hp water pump
- Equivalent to 0.6” rainfall in 30 minutes (1.9 month)
• **Grab Samples**: taken at regular intervals. Analyzed in lab for sediment.

• **Flow Samples**: timed bucket filling at regular intervals allows flow calculation.

• Flow and sediment concentration used to determine total sediment in runoff for event.
ANF Sediment Quantification (2012)

• 14 gas well access roads averaged 1,300 lb. of sediment per mile.

• Greater road slopes, widths, and use levels increase sediment production rates.

• >1/2 the sediment in the first 10 min.

• DSA reduced sediment by ~90%.
Driving Surface Aggregate Benefits

Existing road – 14.9 lbs

>90% Reduction in Sediment

DSA Placement – 0.8 lbs
Coordinated Technology Implementation Program - Economic and Environmental Benefits of DSA

• Comparison Study of existing roads to newly placed DSA roads, Sediment and Dust.
• Sites in Indiana and Vermont
• USFWS, USDA FS, USGS, Center for Dirt and Gravel Road Studies
Susquehanna River Basin Commission (SRBC) - Reducing impacts of road sediment on streams in the Marcellus Shale Region of Susquehanna River Basin

CDGRS Involvement

• Road assessment and Evaluation of Best Management Practices
Rural Road Ecology and Maintenance:

• Special topic - ERM/FOR 497 – Fall 2016
• Enrollment 23 students (6 majors)
• Foundation of the course is the current 2-day ESM training taught by the Center
• Practical, hands on course that focuses on proper road maintenance techniques
• Students were ESM certified
• Funded for Fall 2017
Questions?
Eric Chase - ehc111@psu.edu