

The Impact of Dust and Increased Road Use on Wetlands in Western North Dakota



Jessica Creuzer, Christina Hargiss, Jack Norland, Tom DeSutter, Shawn DeKeyser, Frank Casey, Mike Ell

Objective

- Compare wetlands in areas of increased travel due to energy development with typical gravel road traffic (no energy development)
 - Dust loading
 - Water quality
 - Trace element changes in soil
 - Vegetation differences

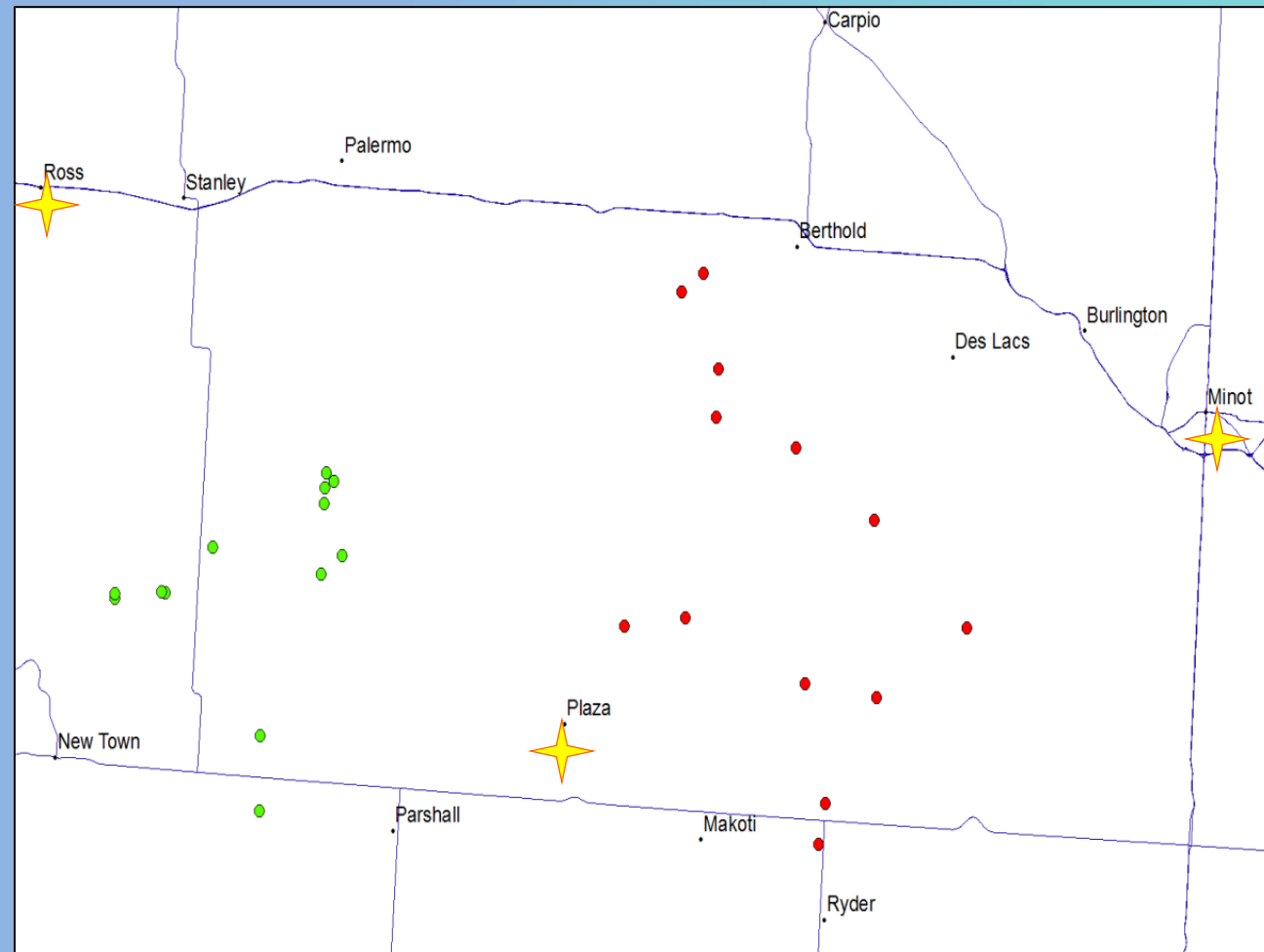


How Sites Were Chosen

- Restricted Randomization
- 10 High Impact sites
 - Road traffic mainly from energy development
- 10 Low Impact sites
 - Typical road traffic
- All sites classified as seasonal

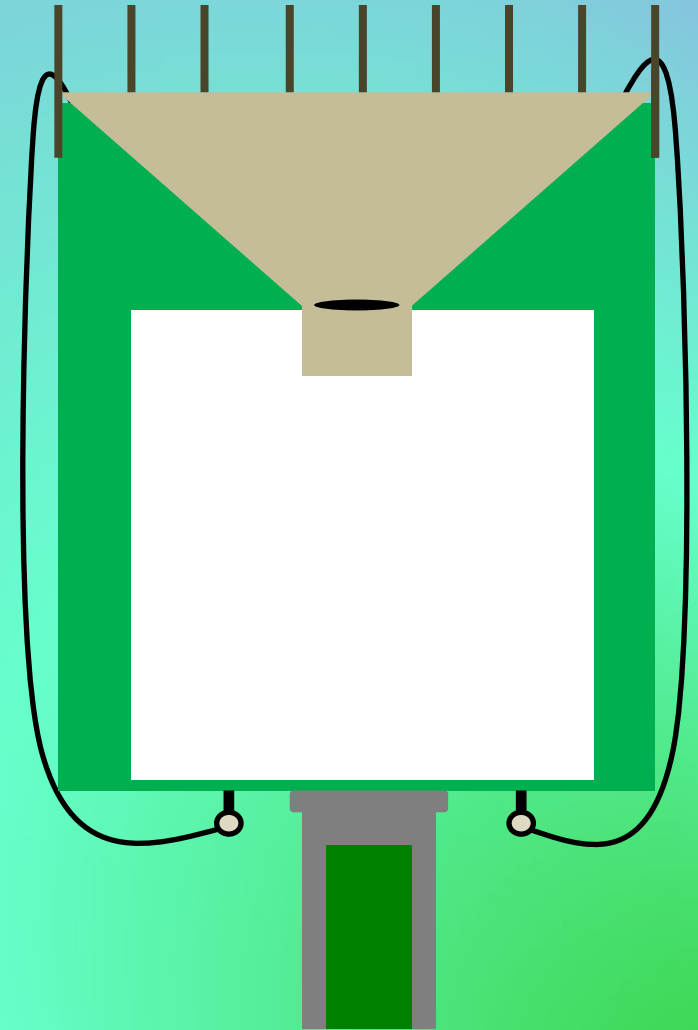


Selected Sites



- High Impact
- Low Impact
- ★ Weather Stations

Quantifying Dust



Quantifying Dust

- Dust collectors set 10m, 40m and 80m from road placed at cardinal directions
- Collected monthly
 - 2012 July-October
 - 2013 May-October
- Samples dried on NDSU campus
- Samples weighed



Water Quality

- ND Department of Health protocols
- Sampled monthly
 - 2012 – July-September
 - 2013 – May-September
- On site – pH, dissolved oxygen, temperature, conductivity
- Lab analysis – Major cations/anions, total suspended solids, total organic carbon, Chlorophyll A/B, trace elements



Soil Sampling

- Soil sampled once a year (2012, 2013)
- Samples collected from 0-0.5 cm and 5-6 cm
- NDSU soil lab for bulk density (BD), pH and electrical conductivity (EC)
- All samples sent to ACME lab for 53 trace element analysis



Index of Plant Community Integrity (IPCI)

- Developed by DeKeyser et al. (2003) and Hargiss et al. (2008)
- Evaluates health of Prairie Pothole Region (PPR) wetlands based on the plant community
- Developed for temporary, seasonal, semi-permanent wetlands in the PPR





- ◆ Low Prairie
- ◆ Wet Meadow
- ◆ Shallow Marsh

IPCI

- Creates a comprehensive species list
- 9 metric system
- Total score between 0-99
- Condition categories based on final score



North Dakota Rapid Assessment Model (NDRAM)

- Quickly assesses PPR wetlands based on plant and landscape characteristics (Hargiss 2009)
- Approximately 20 minutes to conduct survey
- Final scores on a scale of 0-100
- Groups wetlands based on final score



Hydrogeomorphic Model (HGM)

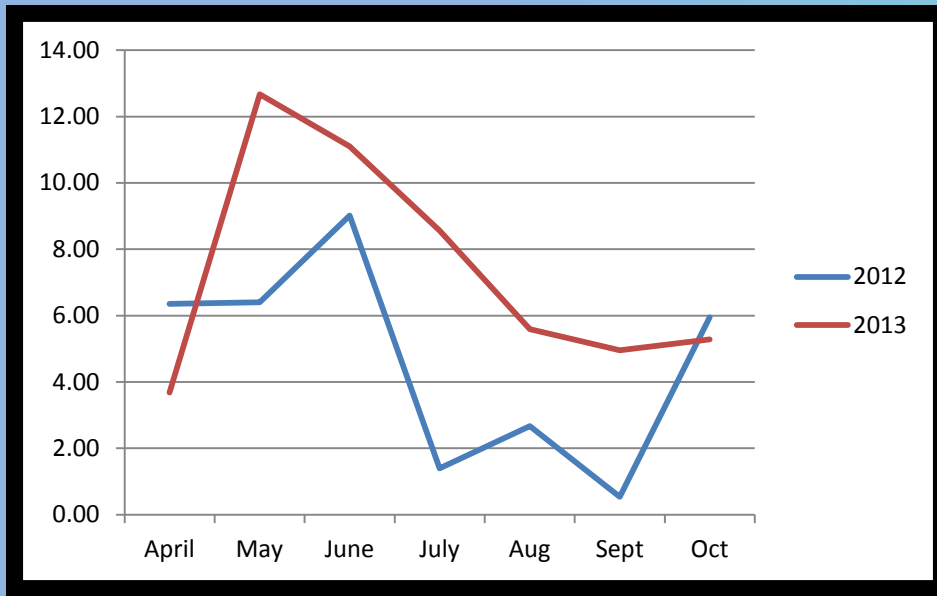
- **Assesses the physical traits and functional characteristics of each wetland**
 - Incorporates physical characteristics, land-use information, soil data, biological data, and GPS and GIS information
 - Calculates six Functional Capacity Indices (FCI) for each wetland(Gilbert et al. 2006)



Statistical Analysis of Soil and Water

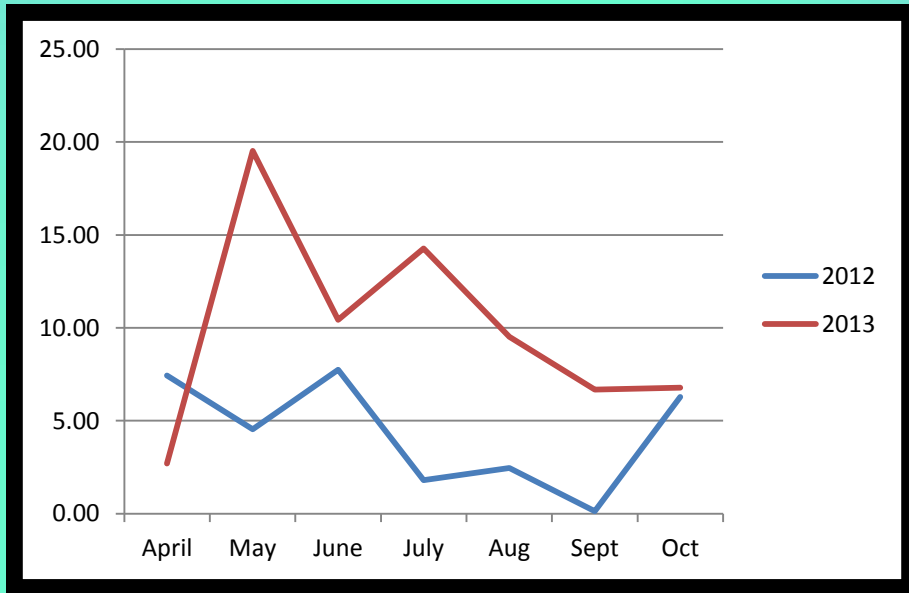
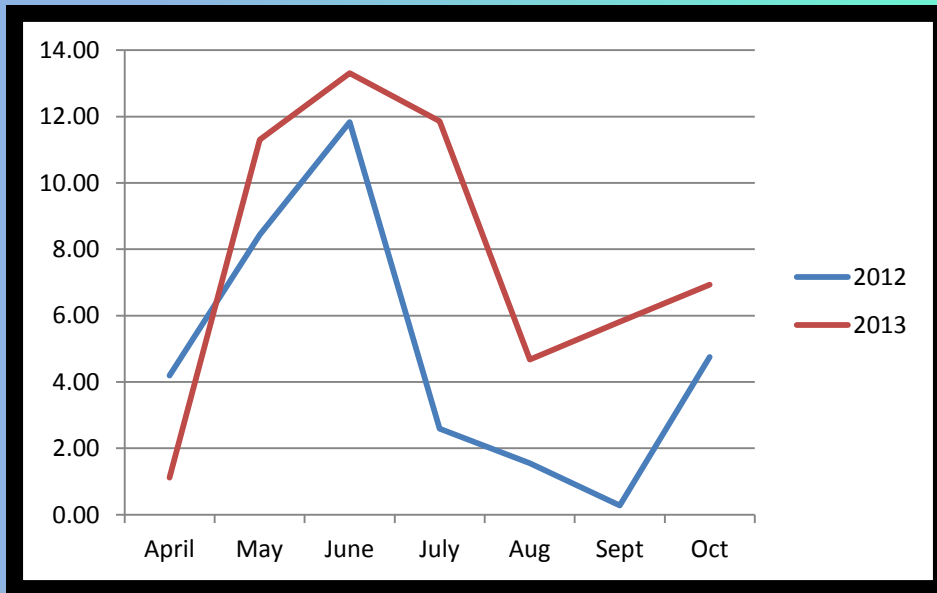
- Non-metric Multidimensional Scaling (NMS) as the ordination procedure
 - Euclidian for water data
 - Relative Euclidian for soil data
- Multi-Response Permutation Procedure (MRPP) for both water and soil samples
 - Used to test if high impact and low impact and years were different

Plaza



Rainfall Totals (cm) for collection months Minot

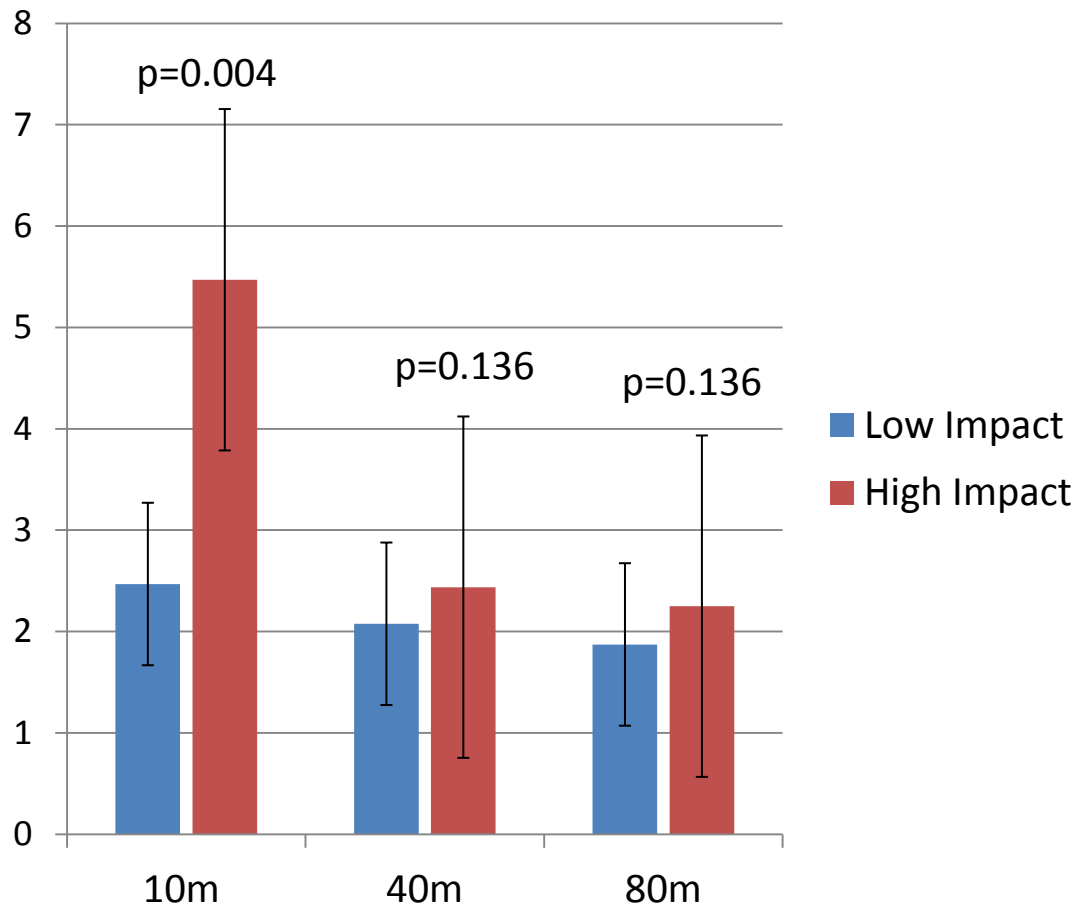
Ross



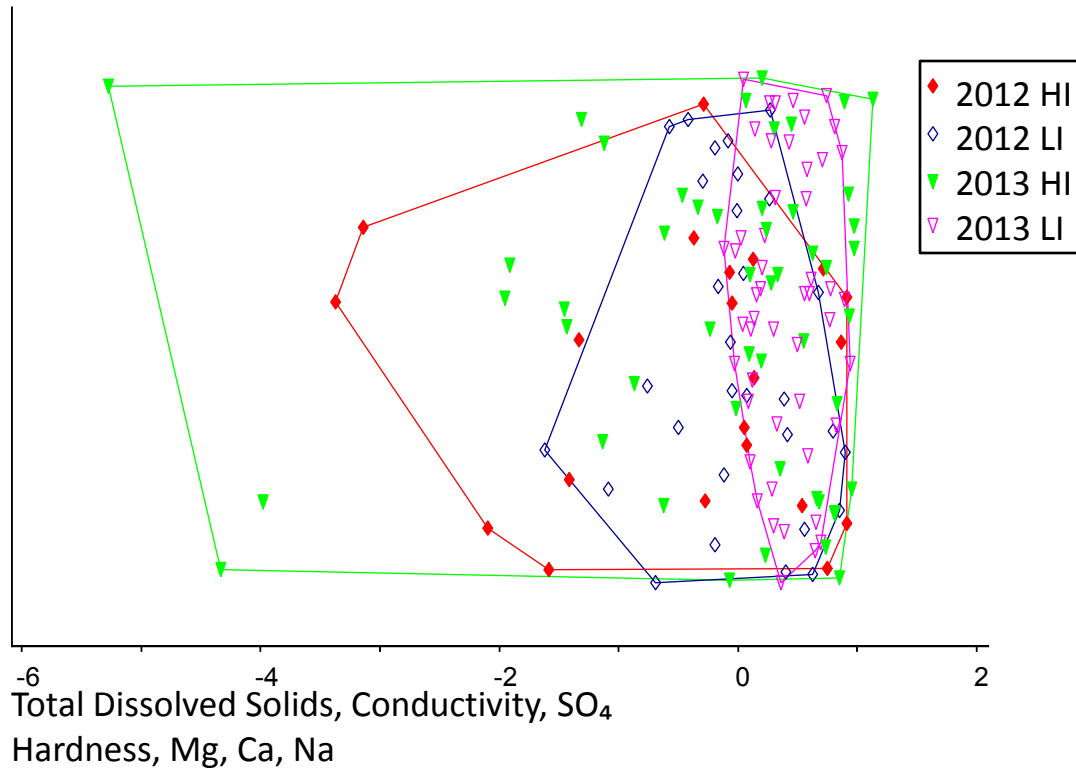


Preliminary Results: Dust (2012 only)

- Loading at 10m is significantly different ($p=0.04$)
- Deposition rate ~ 0.6 lbs/m² per year
- 40m and 80m not significantly different



Preliminary Results: Water



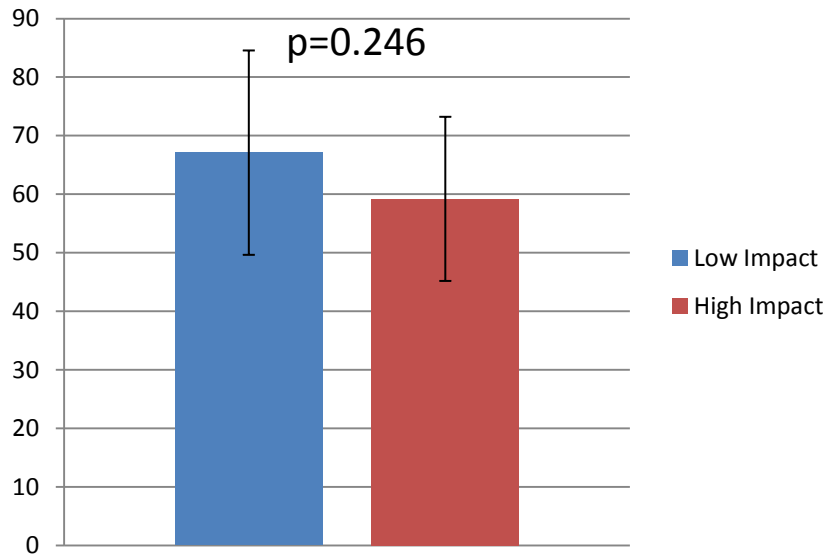
- One axis significant
 - Represents 99% of variation in data
- Unclear if dust is affecting water quality

Preliminary Results: Soil



- No significant difference in depth
- Difference in EC and Sulfur
 - Rainfall and landscape position likely most important factors
- Year impact is more telling than high or low impact or depth

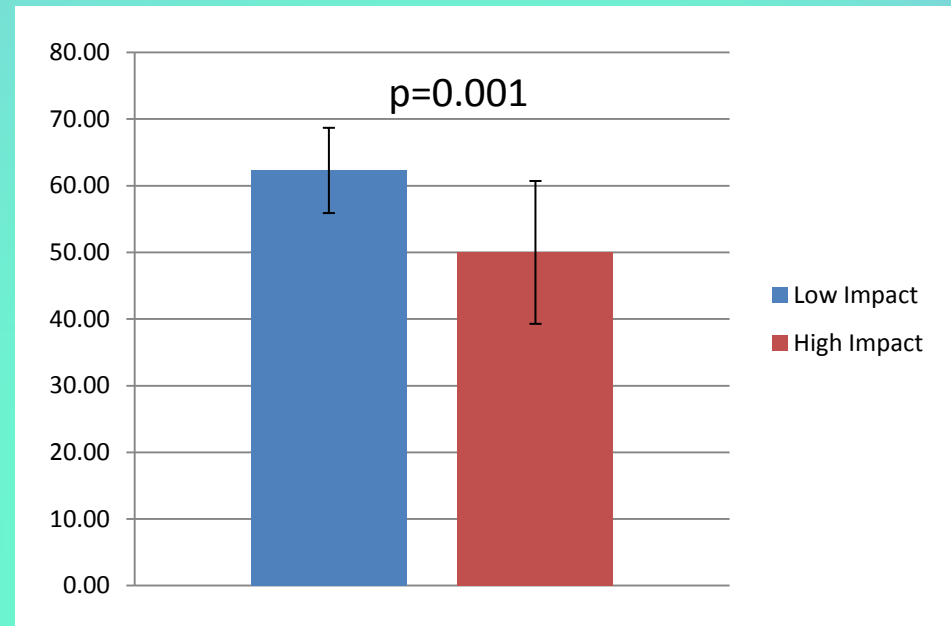
Preliminary Results: IPCI



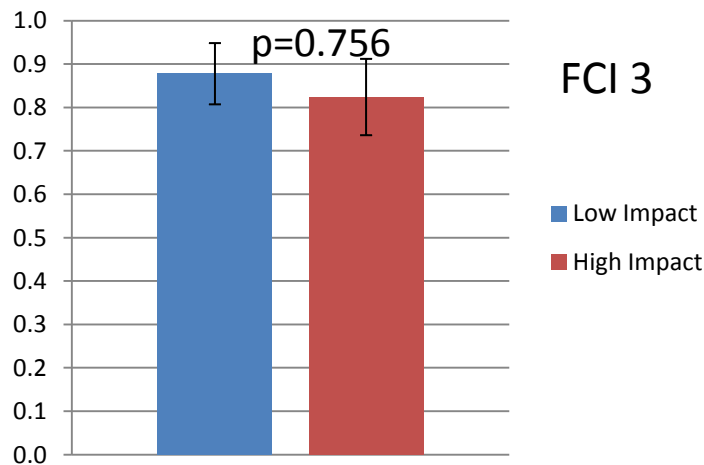
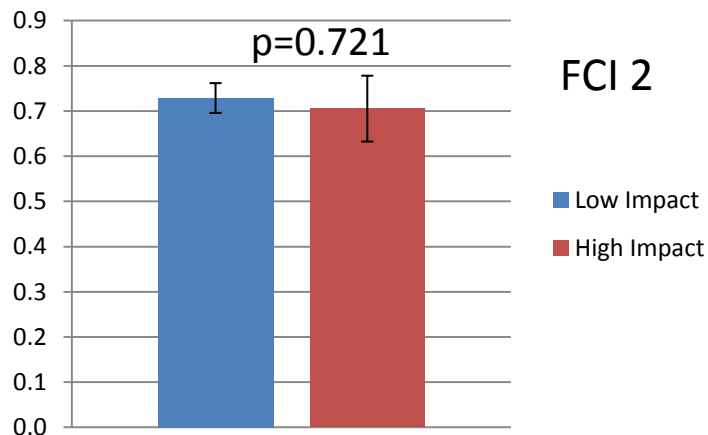
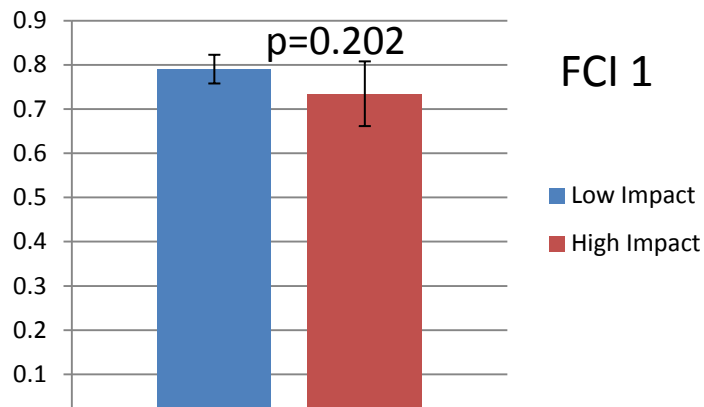
- There are differences in condition at sites
 - Not significant

Preliminary Results: NDRAM

- There are differences in condition at sites
- NDRAM a more subjective measurement of condition



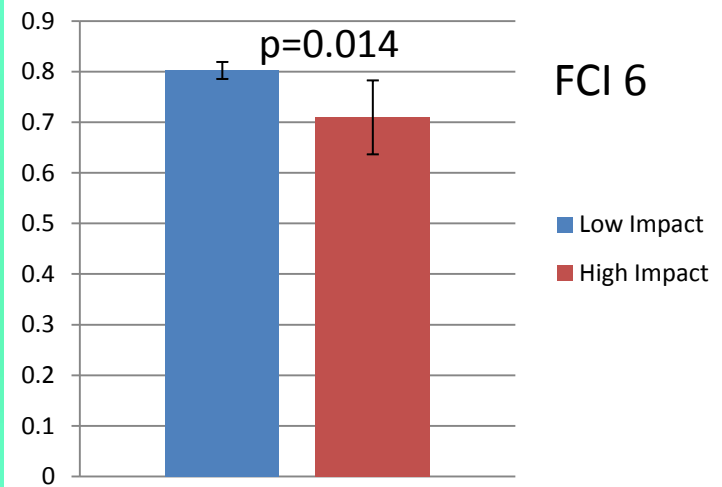
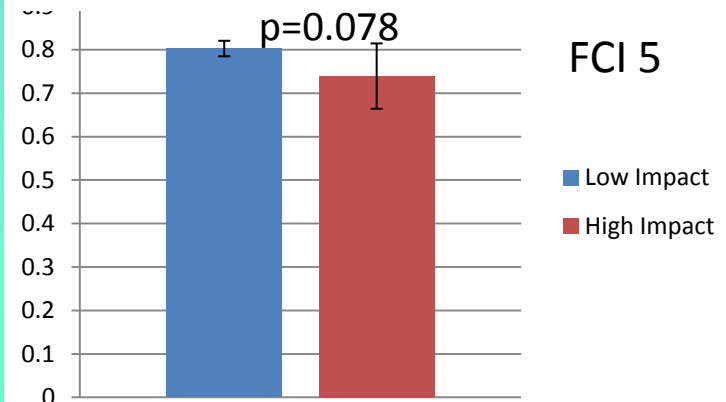
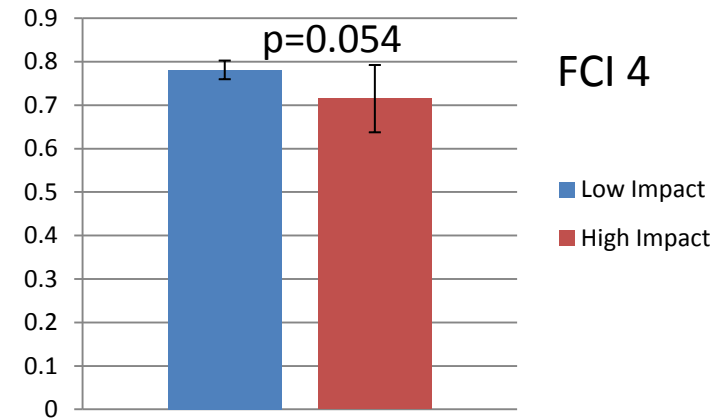
Preliminary Results: HGM



- Low impact sites function better than high impact sites but not significant
- More an effect of sites chosen, not necessarily from dust

Preliminary Results: HGM

- Low impact sites function better than high impact sites but not significant
- More an effect of sites chosen, not necessarily from dust



Conclusion

- Preliminary results indicate:
 - Dust is significant only at 10m
 - Water quality and soil data most affected by rainfall and landscape position
 - Difference of condition and function, but not significant between high and low impact sites
 - Impact of site selection not dust



Moving Forward

- Still analyzing data
 - Final results expected Fall of 2014
- Future research
 - This information provides baseline data
 - Future analysis could indicate change over time
 - Other impacts (dust particle size, element analysis, etc)
 - Focus within 40m distance from road

Acknowledgements

- NDDoH/EPA
- Mike Ell (NDDoH)
- Mike Hargiss (NDDoH)
- Kevin Horsager
- Larry Settler
- Landowners
- State of ND and ND Game & Fish
- Felix Fernando, Zach Sager, Kory Bonnell

Questions???

