

## PA View Grant Report (2016-17)

### *Implementing Precision Conservation Methodologies in research & teaching at Bucknell*

#### **Overview:**

Bucknell University received a \$1,250 grant from PA View to support our efforts in the 2016-17 academic year to integrate the use of remotely sensed data into classroom and research projects. We proposed to use the \$1,250 grant to continue the work of integrating Precision Conservation methodologies into teaching and research at Bucknell. Specifically, we chose to award the \$1,250 grant to Prof. Rich Crago (Civil & Environmental Engineering) to support his ongoing work on integrating the use of remote sensing methodologies in his research and teaching. Prof. Crago's leadership and ongoing investment of time, energy and mentorship/supervision for this work has been the most important factor in helping Bucknell maintain momentum in this line of work.

#### **Precision Conservation in Research:**

In fall 2016, student Chanda Singoyi (Civil & Environmental Engineering and Economics '18) worked with Prof. Rich Crago (Civil & Environmental Engineering) on extending the methods Chesapeake Conservancy uses in Precision Conservation to include pollution coefficients and other measures commonly used by hydrologists to quantify impacts of runoff. One of the key research questions they have addressed in their work this year is determining how well NDFI predicts sediment concentration and how it compares to other approaches, such as Topographic Wetness Index (TWI) or Overland Flow Sediment Index (OFSI). Crago & Singoyi presented their work as a [digital storymap poster](#) at two conferences in fall 2016, the Bucknell Digital Scholarship Conference and the Susquehanna River Symposium, and are working on a publication.

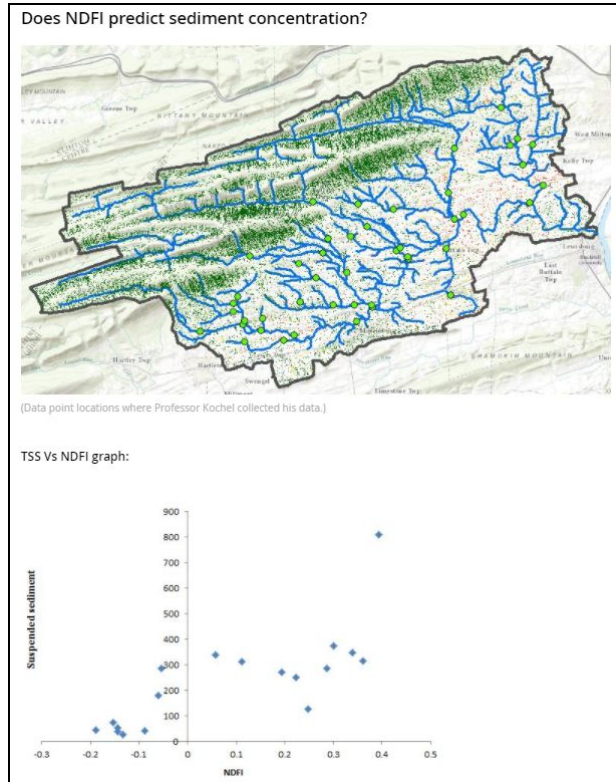


Prof. Crago (back - 2nd from left) and student Chanda Singoyi (right) presenting at Bucknell Digital Scholarship Conference on Nov. 12, 2016.

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Below are some samples of the work done by Crago & Singoyi on this project. The first is a slide from their digital presentation on work done in fall 2016. The second is summary results from a series of regression analyses they did on comparing approaches to predicting sediment concentration.



Suspended Sediment	Area	Area (sq. miles)	NDFI	Coordinates X	Coordinates Y
38	43080.332	0.050	-0.1464	-77.25	40.93433
24	6177394	7.156	-0.0893	-77.18	40.958666
179	4232150.5	4.902	-0.0600	-77.12	40.920276
339	13584618	15.735	0.0569	-77.09	40.915717
311	14002193	16.219	0.0662	-77.08	40.916105
249	23517636	27.241	0.1243	-77.04	40.927327
286	12491193	14.469	-0.0536	-77.06	40.945000
127	4922626	5.702	-0.0838	-77.06	40.957073
40	2225810.8	2.578	-0.0883	-77.09	40.959165
24	6177394	7.156	-0.1302	-77.16	40.958553
42	1155543	12.921	-0.1130	-77.07	40.966298
51	13718194	15.630	-0.1125	-77.06	40.981005
74	175640.88	0.203	-0.118	-77.05	40.979813
285	14209331	16.459	-0.0991	-77.03	40.969562
348	44307540	51.321	0.1113	-77.01	40.957222
810	4028951	4.664	0.2898	-76.98	40.968062
271	18968462	21.655	-0.0108	-76.93	40.982611
374	94703512	109.695	0.0870	-76.93	40.985971
314	9613688	11.136	0.1124	-76.92	40.995763

df	SS	MS	F	Significance F	
Regression	1	533037.1	533037	66.282	2.342E-07
Residual	17	132709.01	7806.41		
Total	18	665746.11			

df	SS	MS	F	Significance F	
Regression	1	56359	56359	15305	0.2243
Residual	17	608787	35811		
Total	18	665746			

df	SS	MS	F	Significance F	
Regression	2	533747	266874	32.349	2E-06
Residual	16	131939	8249.3		
Total	18	665746			

	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	239.53622	20.402624	11.7404	1E-09	196.45002	282.58	196.43	282.58
X Variable 1	1454.9626	116.07947	8.26329	2E-07	1063.4789	1826.4	1063.5	1826.4

	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	179.56	54.12	3.3179	0.0041	65.361	293.75	65.361	293.75
X Variable 1	2.2421	1.7778	1.2612	0.2243	-1.509	5.9326	-1.509	5.9326

	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	244.69	27.352	8.9459	1E-07	186.71	302.67	186.71	302.67
X Variable 1	-0.266	0.915	-0.293	0.773	-2.208	1.6711	-2.208	1.6711
X Variable 2	1475.5	134.09	7.8022	1E-06	1064.1	1887	1064.1	1887

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#### Precision Conservation in Teaching:

In fall 2016 and spring 2017, Prof. Crago supervised Singoyi in a series of independent study courses designed to continue their research from summer 2016. Also in the fall of 2016, Prof. Crago offered the second iteration of CENG420, Hydrology including the Precision Conservation service learning lab, field trip and assignment. As they did in fall 2015, students did a series of lab exercises to learn the Precision Conservation work flow and then partnered with a local farmer to use Precision Conservation to identify an area of the farmer's property in need of intervention to improve water quality.

In spring 2017, students in a senior level capstone course, Environmental Community Projects (ENST411), met with GIS Specialist Janine Glathar about their interest in using Precision Conservation to complete an analysis for the community organization they were partnered with, Union County Conservation District, for their ENST411 project. Their goal was to learn the Precision Conservation work flow so they could generate an NDFI analysis for the UCCD's study area. The students worked with GIS Specialists Janine Glathar and Luyang Ren on learning the basics of the Precision Conservation work flow and used the documentation created for students in CENG420 as a resource guide. They [presented their findings to the UCCD](#) in May 2016, highlighting a list of 15 areas warranting intervention based on the Precision Conservation analysis.

## Preliminary Prioritized Sites from New Map

Lead Parcel Information	Addresses	Area (Square Yards)	Score	Type of Business	Score	Proximity to Streams	Score	Pollutants	Score	TOTAL
014-053-070 A0000	2693 Old Rt. 15 New Columbia PA	15005.84994	20	Moran Industries	5	pretty far	2	Tri Reporter in parcel	2.5	28.5
006-046-042 00010	120 AUK Blvd Lewisburg PA	14342.85657	12	Walmart	5	Extremely close to river	8	Tri Reporter and SOG in parcel	5	30
014-054-042 10000	2621 Old Rt. 15 New Columbia PA	10361.89638	12	Thermal Product Solutions	7	River runs through parcel	9	Tri Reporter in parcel	2.5	30.5
014-054-045 30000	2669 Old Rt. 15 New Columbia PA	5442.94557	6	Estee Express Line	7	close to a river	7	far from any pollutants	0	20
014-054-042 40000	2727 Old Rt. 15 New Columbia PA	5381.94618	6	Remove from list doesn't appear to be anything	0	Not close	2	Close to a Tri Reporter	1	9
006-046-047 30000	191 Haler Rd Lewisburg PA	3998.96001	2	Country Clubboard	5	Pond in parcel and near river	9	Moderately far to Biosolids and POTW	0	16
002-037-012 B0000	1601 Industrial Blvd Lewisburg PA	3828.96171	2	Union County Community Services Center	5	close to rivers and streams	7	1 SOG in parcel	2.5	16.5
002-042-007 00000	499 Fairground Road Lewisburg PA	3525.96474	2	Lewisburg Farmers' Market	5	Extremely close to rivers and streams	8.5	close to a SOG	1	16.5
002-036-142 10000	224 Hardwood Drive Lewisburg PA	3400.96599	2	Glant and Building behind it	5	Close to stream and moderately close to a pond	6.5	moderately far from a SOG	0.5	14
014-053-074 30000	300 Commerce Park Drive New Columbia PA	3284.96715	2	Quality Inn	5	far from a stream	2	far from any pollutant	0	9
014-054-045 00000	2285 Old Route 15 New Columbia PA	3284.96715	2	Conway Freight/XPO Logistics LTL	7	Stream runs through parcel	9	far from any pollutant	0	16
002-037-013 00000	612 Fairground Rd Lewisburg PA	2577.97422	2	Some sort of gas/fuel station	7	moderately close to streams and ponds	5	SOG in parcel	2.5	16.5
014-053-026 00000	170 Old Route 15 New Columbia PA	2476.97523	2	Susquehanna Meter Co., Inc.	7	moderately far to a stream	3	not close to any pollutant	0	12
006-046-036 00000	211 River Breeze Ave Mtfield PA	3455.96544	2	standard house-remove from list	0	moderately far to a stream	3	sandwiched between pollutants (pollutants in parcels on either side)	2	7
006-046-056 20000	130 HALPER RD Lewisburg PA	2362.97637	2	Lewisburg Builders Supply Co	5	close to a stream	7	far from biosolids and POTW	1	15

Contribution scores for sites in the second round of groundtruthing