OMB Control No. 0648-0362
Expiration Date 3/31/2008

SEA GRANT PROJECT SUMMARY FORM 90-2
DEVELOPMENT PROPOSAL

(1) **INSTITUTION**: Purdue University (1a) **ICODE:**
(2) **TITLE:** A Web-Based Tool to Measure Environmental Quality Standards for Phosphorus in Water at Lake Erie
(3) **PROJECT NUMBER**: (4) **REVISION DATE:**
(5**) PROJECT STATUS**: (6) **INITIATION DATE**: 10/1/09
(7) **COMPLETION DATE**: 9/30/10
(8) **SUB PROGRAM**:

(9) **PRINCIPAL INVESTIGATOR**: Antony, Acushla (9a) **EFFORT**: 50%
(9b**) AFFILIATION**: Purdue University, West Lafayette, Indiana
(9c) **AFFILIATION CODE**:

(10) **CO-PRINCIPAL INVESTIGATOR**: Dr. Engel, Bernard (10a) **EFFORT**:5%
(10b) **AFFILIATION**: Purdue University, West Lafayette, Indiana
(10c) **AFFILIATION CODE**:

(11) **ASSOCIATE INVESTIGATOR** 1: (11a) **EFFORT**:
(11b) **AFFILIATION**:
(11c) **AFFILIATION CODE**:

(12**) ASSOCIATE INVESTIGATOR** 2: (12a**) EFFORT:**
(12b) **AFFILIATION**:
(12c) **AFFILIATION CODE**:

(13) **S.G. FUNDS**: $6,000 (14) **STATE MATCHING FUNDS**:
(15**) LAST YEAR'S SG FUNDS**: (16) **LAST YEAR'S MATCHING FUNDS**:
(17) **PASS-THROUGH FUNDS**: (18) **LAST YEAR'S PASS-THROUGH FUNDS**:
(19) **RELATED PROJECTS**:
(20) **PARENT PROJECTS**:
(21) **SEA GRANT STRATEGIC PLAN CLASSIFICATION**:

(22) **OBJECTIVES:**

- To enhance/develop the NAPRA online web-based decision support tool to assess the impact of phosphorous losses on shallow ground water and surface water at farm and county levels with SSURGO soil data.
- To determine impact of current and future agricultural management practices common near the Great Lakes on phosphorus loads.

Hypothesis

- *There exists a spatial resolution beyond which both STATSGO and SSURGO would predict similar water quality response.*

- *NAPRA WEB tool will help in estimating phosphorus loads by simulating the present and future scenarios.*

(23) **PROBLEM:**

Excessive amounts of nitrogen and phosphorus in water bodies leads to adverse ecological impact. The effects may occur close to the sources of nitrogen and phosphorus pollution or they may be manifested downstream from the sources, sometimes hundreds of miles away. Massive growth of phytoplankton in lakes causes deterioration of water quality, by decreases in transparency, colored water, clogging of sand filters in water treatment plants, taste and odor in finished water and death of aquatic species. These problems occur due to increased phosphorus concentrations in the water bodies. Nitrogen and phosphorus pollution is a significant cause of environmental problems in lakes, reservoirs, rivers, streams, estuaries, and wetlands. It is a persistent threat to water quality. Hypoxic events occurring in the northern Gulf of Mexico, Chesapeake Bay, Long Island Sound, and Lake Erie caused by nitrogen and phosphorus pollution have become a national concern. Population growth, with its accompanying urban, suburban, and agricultural development, increases the sources and magnitude of nitrogen and phosphorus pollution (EPA, 2008). The factors that contribute to discharge of nitrogen and phosphorus pollution are due to overuse of fertilizer in both residential and agricultural settings, runoff flowing over cropland, animal feeding operations and pastures picking up animal waste and depositing it in water bodies and rainfall flowing over urban and suburban areas through parking lots, lawns, rooftops, and roads.

The National Agricultural Pesticide Risk Analysis (NAPRA) SDSS web tool is one such tool that would aid stakeholders including farmers to make pesticide, nutrient, erosion and hydrology based management decisions. It uses water quality simulation models combined with statistical analysis to aid the decision making process. However, the existing NAPRA uses STATSGO soil data which is too generalized for farm or local level decision making.

(24) **RATIONALE (IMPACT OF PROBLEM):**

Nitrogen and phosphorus pollution is a significant cause of environmental problems in lakes, reservoirs, rivers, streams, estuaries, and wetlands. It is a persistent threat to water quality, it leads to massive growth of phytoplankton in lakes that causes deterioration of water quality, by decreases in transparency, colored water, clogging of sand filters in water treatment plants, taste and odor in finished water and death of aquatic species.

The enhanced NAPRA decision support tool can assist stakeholders in assessing impacts of agricultural management systems on nutrient losses and identification of practices to reduce nutrient losses.

(25) **METHODOLOGY:**

The National Agricultural Pesticide Risk Analysis (NAPRA) Spatial Decision Support System web tool would aid stakeholders including farmers to make phosphorus based management

decisions at farm to county levels. It uses the water quality simulation model, Groundwater Loading Effects of Agricultural Management Systems (GLEAMS), combined with statistical analysis to aid the decision making process to assess the impact of practices and management systems on phosphorus reaching Lake Erie. The existing NAPRA uses STATSGO soil data which is too generalized for farm or local level decision making so SSURGO soil data would be incorporated as an option along with STATSGO for detailed farm or county level decision making.

<u>Study Area:</u> Black Creek Watershed and Erie Lake

The Black Creek watershed, northeast Indiana, was identified as a study area as few watersheds with both daily measured water quality data and with detailed information on various implemented BMPs are available. This watershed, located in Allen County, northeast Indiana is an approximately 50 km^2 (12,000 acre) watershed in the Maumee River basin (figure 1). This watershed is selected as the model watershed for the study as the required data are available. The study would be done to assess the level of phosphorus loads from this watershed for current practices and anticipated changes in agricultural management. Historical data from this watershed provide a baseline for comparison. The study would be done for the present scenario as well as for the future scenario when there is an increase in biofeedstock production or livestock production. This watershed was selected for the study as one of the main concerns of Lake Erie to which this watershed eventually drains is phosphorus.

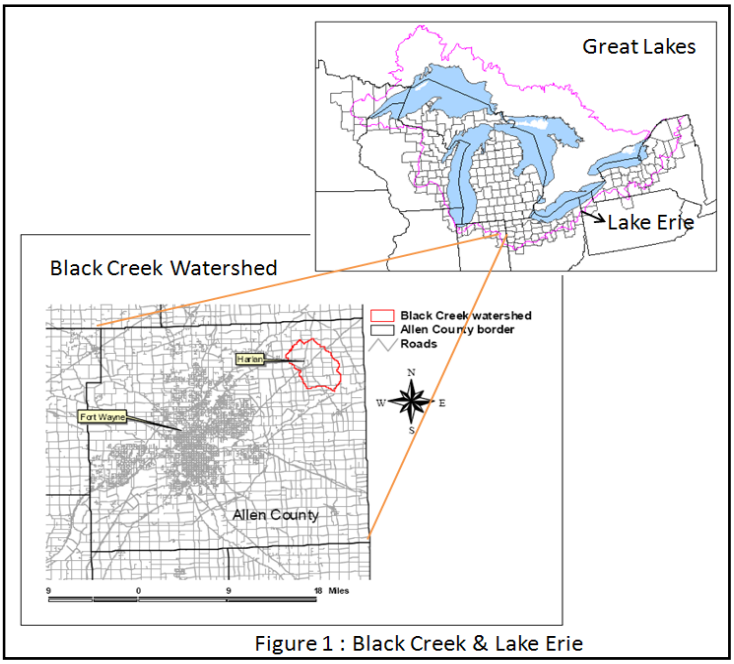

Figure 1 : Black Creek & Lake Erie

Objective 1: To enhance the NAPRA online web-based decision support tool to assess the impact of phosphorous losses on shallow ground water and surface water at farm and county levels with SSURGO soil data.

<u>Tasks to be performed to complete this objective</u>

Task 1.1: Enhance the NAPRA online web-based decision support tool.

Task 1.2: Update the soil database using SSURGO soils suitable for field and county level evaluation.

Task 1.3: Create an effective visualization of the impacts of phosphorous losses at field/county level using Google Maps.

Task 1.1: Enhance the NAPRA online web-based decision support tool

The designed web site "NAPRA Web" contains three main components (Figure 2): the first component serves as the Input Interface to the model using maps and tabular input, the second component consists of the model that does the analysis and the databases that are stored on the server, and the third component would include different tabular and graphical outputs from the model and a color gradient map to show the level of impact of phosphorous. A schematic description of the application architecture is shown in Figure 2.

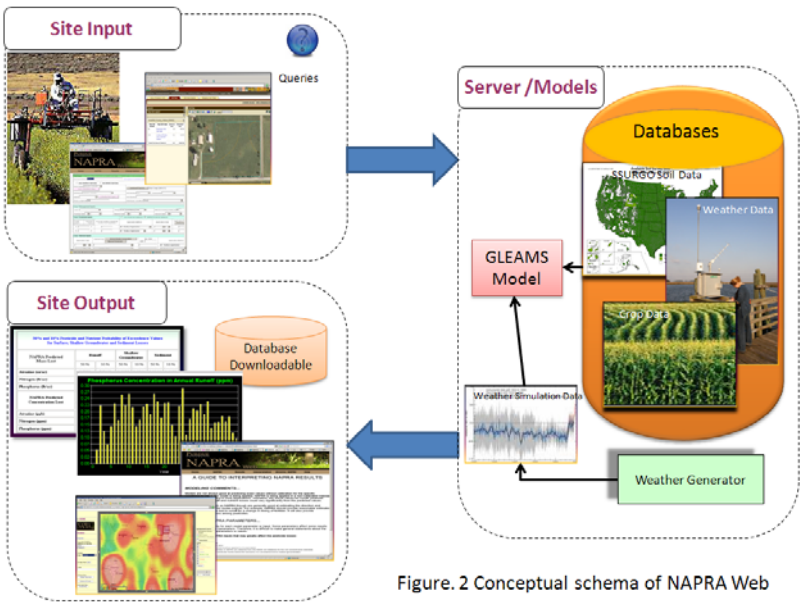

Figure. 2 Conceptual schema of NAPRA Web

Task 1.2: Update the soil database using SSURGO soils suitable for field and county level evaluation.

The original NAPRA WWW system simulated the effects of different agricultural management on hydrology, erosion, pesticides and nutrient for farm level using the STATSGO database but STATSGO soil data was not designed for farm level. The SSSURGO soil database is basically designed for farm level, so it would be more accurate in its data than the STATSGO soil database. The STATSGO database will be updated to include SSURGO soil properties for the states included in this project. The SSURGO soil properties needed by NAPRA will be obtained from the online web soil survey for SSURGO and incorporated in the NAPRA database. This will enable NAPRA users to select SSURGO soils when making NAPRA model runs and thereby obtain results that are more applicable to field and small watershed scales. If the size of the study was large could still use the STATSGO database.

Task 1.3: To create an effective visualization of the impacts of phosphorous losses at field/county level using Google Maps.

The Google Maps API was used to represent the spatial data in NAPRA Web, because it provides flexibility and an easy-to-use interface for map-based applications. The features of Google Maps were incorporated like the address search capability; that made it easy for users to input the address, nearby town, or other place name to find locations, the zoom facility (in, out) and the panning to recognize the clear boundaries of the field or the locality that are affected. The NAPRA Web would help to visualize the spatial variations of atrazine, phosphorous and nitrogen losses using the Google Map interface. A simple, familiar interface like Google Maps interface (http://maps.google.com/) would make the site even more intuitive and useful. The gradient shapefile is created using GIS software and overlaid on the Google Map. KML would be used for Google map based programming. The concentration of phosphorus load is represented on the map using Google Maps.

***Objective 2: Evaluate current and future agricultural management practices common near the Great Lakes on phosphorus loads*.**

Tasks to be performed to complete this objective

Task 2.1: Assess the level of phosphorus reaching water with the existing cropping management systems.

Task 2.2: Assess the change in phosphorus level due to increase in biofeedstock production.

Task 2.3: Assess the change in phosphorus level due to intensive livestock production.

Task Details

Task 2.1: Assess the level of phosphorus reaching water with the existing cropping management systems

Studies have shown that cropping systems, such as corn-soybean rotations, can serve to protect the environment and maintain the economic viability of producers. Consequently, in model simulations two cropping management systems would be considered, continuous corn and corn-soybean rotation. Cropping management input data such as planting date, harvesting date, maturity dates, method of fertilizer application, fertilizer type and tillage method would be the same for both scenarios. Planting, harvesting and maturity dates will be based on data obtained from the Indiana Agricultural Statistics Report (Indiana Agricultural Statistics, 2000-2004). Based on the two cropping patterns, the simulation would be done using NAPRA to identify the phosphorus at the Wildcat Creek watershed. Total phosphorus would be determined by the sum of the 50% annual probability of exceedence for phosphorus loading to runoff, leached and sediment transport. The level of phosphorus loss with respect to the standards would be evaluated by taking the difference between the simulated values and the standard value. This would help to understand the level of phosphorus loss with respect to the existing cropping pattern and access its impact on the environment. It would help to measure progress as well as maintain the water quality.

Task 2.2: Assess the change in phosphorus level due to increase in biofeedstock production.

Corn-stover is considered one of the best-suited biofeedstocks based on regional transportation and economic analyses. Due do the focus on biofeedstock production, there is a need to quantify the environmental effects due to the increase in biofeedstock production. The environmental effect due to phosphorus loss due to increase in biofeedstock production can be assessed using the NAPRA model. The model will be used to quantify the phosphorus loss associated with corn silage and other biofeedstock production to meet bioenergy feedstock demands. Harvesting techniques and conversion processes are key drivers to biofeedstock selection and characteristics. The model would be used to simulate a hypothetical increase in the biofeedstock. Based on its impact decision makers can control or increase the biofeedstock production in a location.

Task 2.3: Assess the change in phosphorus level due to intensive livestock production

In many areas of intensive, confined animal production, manures are normally applied at rates

designed to meet crop nitrogen requirements. This often results in a buildup of soil test phosphorus above amounts sufficient for optimal crop yields. The amount of phosphorus added in average applications of dairy manure (8 to 10 tons/acre and 0.5 percent phosphorus) and poultry litter (4 tons/ acre and 1.5 percent phosphorus) are considerably greater than what is removed in harvested crops; the result is an accumulation of soil phosphorus. Many livestock operations use nutrient-rich animal manure as fertilizer on pastures and in crop production. Soil test phosphorus levels on pastures and crop fields have become a serious issue for livestock producers who use animal manure as fertilizer. The NAPRA tool would simulate a hypothetical increase in livestock as a future scenario to determine the effect on the level of phosphorus losses. It would facilitate the farmers in recognizing the extent of phosphorus loss and in taking necessary steps to implement the required BMPs to overcome the problem. The implementation of BMPs can reduce the risk for phosphorus loss to a great extent. BMPs vary depending on site specific criteria that the model can capture. BMPs such as reduced fertilizer and manure phosphorus applications, changes in the timing and method of application, soil conservation (through reduced tillage), and installation of conservation buffers will be considered.

(26) **EXPECTED RESULTS AND IMPACT:**

Deliverables:

- A Web-Based tool to simulate the future and present scenarios for phosphorus and nitrogen loads.

- An assessment of agricultural management systems on phosphorus and nitrogen loads from common agricultural production systems in the Western Lake Erie basin.

This tool would help farmers and other stakeholders identify the phosphorus losses due to changing watershed conditions like increased biofeedstock production or increased livestock production as well as for present scenarios. It would help in recognizing the BMPs that would be most effective in the reduction of phosphorus loss in that locality. This tool would be free and easily accessible by any farmer or other stakeholder. The tool utilizes the latest technologies to ensure reliability, ease of use and effective presentation of the results. It would enable increasing the involvement of stakeholders in the decision-making and planning processes. It would motivate them to take a decision to implement BMPs based on the scenarios they consider with the tool.

OMB Control No. 0648-0362
Expiration Date 3/31/08

SEA GRANT BUDGET FORM 90-4

GRANTEE: Purdue University			**GRANT/PROJECT NO.:**	
PRINCIPAL INVESTIGATOR Acushla Antony Co-PI: Bernard Engel			**DURATION:** 12 months **10/01/09 - 09/30/10**	
A. SALARIES AND WAGES:	**man-months**			
	No. of People	**Amount of Effort**	**Sea Grant Funds**	**Matching Funds**
1. Senior Personnel				
a. (Co) Principal Investigator:	0	0	0	0
b. Associate (Faculty or Staff):	0	0	0	0
Subtotal:	**0**	**0**	**0**	**0**
2. Other Personnel				
a. Professionals:	0	0	0	0
b. Research Associates:	0	0	0	0
c. Res. Asst./Grad Students:	0	0	0	0
d. Prof. School Students:	0	0	0	0
e. Pre-Bachelor Student(s):	0	0	0	0
f. Secretarial-Clerical:	0	0	0	0
g. Technicians:	0	3	0	0
h. Other:	0	0	0	0
Total Salaries and Wages:	**0**	**0**	**0**	**0**
B. FRINGE BENEFITS:			0	0
Total Personnel (A and B)			**0**	**0**
C. PERMANENT EQUIPMENT:			**0**	**0**
D. EXPENDABLE SUPPLIES AND EQUIPMENT:			**1912**	**0**
E. TRAVEL:				
1. Domestic			2500	0
2. International			0	0
Total Travel:			**2500**	**0**
F. PUBLICATION AND DOCUMENTATION COSTS:			**0**	**0**
G. OTHER COSTS:				
1. Communications			0	0
2. Copying			0	0
3. Postage/Mailing			0	0
4. Contractual Services			0	0
5. Membership/Sponsorship Fees			0	0
6. Training/Continuing Education			0	0
7. Project/Person Recognition			0	0
8. Housing/Board/Research			0	0
9. Tuition Remission			0	0
10. Other			0	0
11. Other:			0	0
Total Other Costs:			0	**0**
TOTAL DIRECT COST (A through G):			**4412**	**0**
INDIRECT COST	On campus	36.00%	1588	0
	Off campus	0.00%	0	0
Total Indirect Cost:			**1588**	**0**
TOTAL COSTS:			**6000**	**0**

Budget Justification

A total of $1912 is budgeted for expendable supplies and equipment for use in this project. These resources will be spent on: hard disk space for the web application ($1200), programming books ($450), and supplies for a large format printer to create posters of the results for use when interacting with stakeholders ($262).

A total of $2500 is budgeted for travel. These resources will be spent on: 3 trips to the study watershed (3 trips @ $300 each = $900; 1 trip to meet with Midwest decision support system partnership team in Chicago at $500; and 1 trip to a professional meeting to present results of the work at $1100).

A total of $1588 is budgeted for the indirect costs on the direct costs portion of the budget. The indirect cost rate is the same rate charged to all outreach projects.

Acushla Antony

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antony@purdue.edu
765-418-6528

EDUCATION

Doctorate of Philosophy (Ph. D)(ASM), 2007 (**continuing**)
Purdue University, West Lafayette, Indiana, U.S.A.
Major Professor: Dr.Bernard Engel

Master of Philosophy (Computer Science), 2006
Mother Teresa Women's University, Kodaikanal, T.N, India
Dissertation: Analytical Study Of The Different Software Products In The Area Of Aquaculture
Major Professor: Dr.Sateesh Pradhan

Master of Computer Application, 1996
Osmania University, A.P, India
Dissertation: Purchase Order Management System for Hindustan Aeronautics Limited, Hyderabad
Major Professor: Er.Siddi Prasad

Bachelor of Science (Computer Science), 1993
Osmania University, A.P, India
Dissertation: Library Management System

PROGRAMMING SKILL

C, C++, C Shell Programming, Python, Visual Basic, Fortran, XML, ASP.Net, C#, Perl, Php

RELATED EXPERIENCE

Research

Master of Philosophy (Computer Science) , Mother Teresa Women's University, Kodaikanal, T.N, India

- Analytical Study Of The Different Software Products In The Area Of Aquaculture

Scientist (Computer Science), Central Institute for Research on Cotton technology, ICAR, Mumbai, Maharastra, India (2004-till present)

- An Efficient Database Management System For Running A Modernized Ginnery *as Project leader*

Computer (Computer Science), Central Institute for Freshwater Aquaculture, ICAR, Bhubanewar, India (2000-2004)

I)Survey of softwares developed in the area of aquaculture /fisheries *as Project leader*.
2)Biotechnological Information System on Aquaculture *as Project leader*
3)Integrated National Agricultural Research Information System *as Project leader*

- GIS for Fisheries Statistics database system
- Fisheries Technologies database system

4)Agricultural Research Information System *as Project leader*

- Database Management System on socio-economic status of fish farmers
- Database Management System on Aquafeed for pond ecosystem

- Database Management System for Commercial Hatching of Freshwater Prawn

Teaching

Computer Lecturer, **Loyola Academy P.G and Degree College, Old Alwal, Secunderabad, India (1996-2000)**

RECENT WORKSHOPS AND POSTER PRESENTATIONS

Acushla Antony, Presented a paper on ”Web-Based Decision Support Tool for Nutrient and Pesticide Analysis” in the 2009 ASABE Annual International Meeting on June 21 – June 24, 2009, Grand Sierra Resort and Casino, Reno, Nevada.

Acushla Antony, Presented a poster on ”Online Mapping Tool to Inform Pesticide Applicators of Sensitive Areas” in the 2008 ASABE Annual International Meeting on June 29 – July 2, 2008, Rhode Island Convention Center, Providence, Rhode Island.

Acushla Antony, Attended a workshop on “SWAT Developer's workshop” from July 10- 11, 2008 at ABE, Purdue University, Indiana.

Acushla Antony, Presented a poster on ”Online Mapping Tool to Inform Pesticide Applicators of Sensitive Areas” in the ESE Symposium "Keeping the world green: An interdisciplinary approach to sustainability" on November 9,2007 at STEW, Purdue University, Indiana.

Acushla Antony, Presented a poster on ”Online Mapping Tool to Inform Pesticide Applicators of Sensitive Areas” for “GIS Day 2007" on November 15, 2007 at PMU, Purdue University, Indiana.

RECENT PUBLICATIONS

Antony. A, Bernard Engel, Larry Theller, Leighanne Hahn and Kyoung Jae Lim (2008). **“**An Online Mapping Tool to Inform Pesticide Applicators of Sensitive Areas” for ASABE Annual International Meeting, ASABE Paper No. 084519,. St. Joseph,Mich.: ASABE.

Antony. A, Bernard Engel (2009). ” Web-Based Decision Support Tool for Nutrient and Pesticide Analysis” for ASABE Annual International Meeting, ASABE Paper No. 096994,. St. Joseph,Mich.: ASABE.

WEBSITES (Involved in)

Course group project :http: //cgtmm1.tech.purdue.edu/456/group06s09/default.aspx
Drift Watch (Initial Phase): http://driftwatch.agriculture.purdue.edu/index.html
Modification in L-thia Model: https://engineering.purdue.edu/~lthia/

GRANTS RECEIVED

- Department of Biotechnology(DBT) funding, Ministry of Science and Technology, India
- National Agricultural Technology Project(NATP) funding, India

AWARDS

Best presentation award 2002-2003 in 5th Indian Agricultural Scientist and Farmers Congress

Bernard A. Engel, Ph.D., P.E., Biographical Sketch

Professional Preparation

University of Illinois	Agricultural Engineering	B.S.	1984
University of Illinois	Agricultural Engineering	M.S.	1985
Purdue University	Agricultural Engineering	Ph.D.	1988

Appointments

Head, Agric. & Bio. Engineering, Purdue University (2004-present)
Interim Head, Discovery Park Center for the Environment, Purdue University (2005-2006)
Professor, Purdue University (1996-present)
Research Engineer, Sabbatical Leave at NASA Kennedy Space Center (KSC), KSC, FL and US Army Construction Engineering Research Laboratory, Champaign, IL (1994-95)
Associate Professor, Purdue University (1992-1996)
Assistant Professor, Purdue University (1988-1992)

Publications related to present project

1. Bracmort, K.S., B.A. Engel, and J.R. Frankenberger. 2004. Evaluation of structural best management practices 20 years after installation: Black Creek Watershed, Indiana. Journal of Soil and Water Conservation 191-196.
2. Choi, J-Y, B. A. Engel, and R. Farnsworth. 2005. Web-based GIS and spatial decision support system for watershed management. Journal of Hydroinformatics 7(3):165-174.
3. Frimpong, E.A., T. M. Sutton, K.J. Lim, P. J. Hrodey, B. A. Engel, T. P. Simon, J. G. Lee, and D.C. Le Master. 2005. Determination of optimal riparian forest buffer dimensions for stream biota–landscape association models using multimetric and multivariate responses. Can. J. Fish. Aquat. Sci. 62: 1–6 (2005).
4. Tang, Z., B.A. Engel, B.C. Pijanowski, K.J. Lim. 2005. Forecasting land use change and its environmental impact at a watershed scale. Journal of Environmental Management 76(1):35-45.
5. Mitchell Adeuya, R. K., K. J. Lim, B. A. Engel, M. A. Thomas. 2005. Modeling the average annual nutrient losses of two watersheds in Indiana using GLEAMS-NAPRA. Transactions of the ASAE Vol. 48(5): 1739−1749.
6. Frimpong, E., T. Sutton, B. Engel, T. Simon. 2005. Spatial-Scale Effects on Relative Importance of Physical Habitat Predictors of Stream Health. Environmental Management 36(6):899-917.
7. Tang, Z., B. A. Engel, K. J. Lim, B. C. Pijanowski, and J. Harbor. 2005. Minimizing the impact of urbanization on long term runoff. Journal of the American Water Resources Association 1347-1359.
8. J.-Y. Choi, B. A. Engel, L. Theller, J. Harbor. 2005. Utilizing web-based GIS and SDSS for hydrological land use change impact assessment. TRANS of ASAE 48(2):815-822.
9. Muthukrishnan, S., J. Harbor, K. J. Lim, and B. A. Engel. 2006. Calibration of a Simple Rainfall-runoff Model for Long-term Hydrological Impact Evaluation. Journal of Urban and Regional Information Systems Association 18(2):35-42.
10. Arabi, M., R. S. Govindaraju, M. M. Hantush, and B. A. Engel. 2006. Role of watershed subdivision on modeling the effectiveness of best management practices with SWAT. Journal of American Water Resources Association 42(2):513-528.

11. Bracmort, K. S., M. Arabi, J. R. Frankenberger, B. A. Engel, and J. G. Arnold. 2006. Modeling long-term water quality impact of structural BMPs. TRANS of ASABE 49(2):367-374.
12. G. Vazquez-Amabile, B. A. Engel, D. C. Flanagan. 2006. Modeling and risk analysis of nonpoint-source pollution caused by atrazine using SWAT. TRANS of ASABE 49(3): 667−678
13. Mercuri, P., B. Engel, C. Johannsen. 2006. Evaluation and accuracy assessment of high-resolution IFSAR DEMs in low-relief areas. International Journal of Remote Sensing 27(13):2767-2786.
14. Lim, K.J., B.A. Engel, Z. Tang. 2006. Identifying regional groundwater risk areas using a WWW GIS model system. *Int. J. Risk Assessment and Management Vol. 6(4/5/6):316-329.*
15. Larose, M., G. Heathman, L.D. Norton, B. Engel. 2007. Hydrologic and atrazine simulation of the Cedar Creek watershed using the SWAT model. Journal of Environmental Quality 36:521-531.
16. Arabi, M., R. S. Govindaraju, B. Engel, and M. Hantush. 2007. Multiobjective sensitivity analysis of sediment and nitrogen processes with a watershed model, Water Resour. Res., 43, W06409, doi:10.1029/2006WR005463.
17. Miller, P. S., R. H. Mohtar, and B. A. Engel. 2007. Water quality monitoring strategies and their effects upon mass load calculation. TRANS of ASABE 50(3):817-829.
18. Thomas, M., B. Engel, M. Arabi, T. Zhai, R. Farnsworth, J. Frankenberger. 2007. Evaluation of nutrient management plans using an integrated modeling approach. TRANS of ASABE 23(6):747-755.
19. Gaffer, R., D. Flanagan, M. Denight, B. Engel. 2008. Geographical information system erosion assessment at a military training site. Journal of Soil and Water Conservation 63(1):1-10.
20. Rochon, G., C. Johannsen, D. Landgrebe, B. Engel, J. Harbor, S. Majumder, and L. Biehl. 2008. Remote sensing as a tool for achieving and monitoring progress toward sustainability. Clean Technologies and Environmental Policy 5(3-4):310-316.
21. Quansah, J., B.A. Engel, I. Chaubey. 2008. Tillage practices usage in early warning prediction of atrazine pollution. TRANS of ASABE 51(4):1311-1321.
22. R. S. Govindaraju, B. Engel, D. Ebert, B. Fossum, M. Huber, C. Jafvert, S. Kumar, V. Merwade, D. Niyogi, L. Oliver, S. Prabhakar, G. Rochon, C. Song, and L. Zhao. 2009. Vision of Cyberinfrastructure for End-to-End Environmental Explorations (C4E4), J. Hydrologic Engrg. Volume 14, Issue 1, pp. 53-64.

Synergistic Activities

Professor Engel has developed numerous web-based spatial decision support systems that include web GIS, model and database components (http://pasture.ecn.purdue.edu/~watergen/). The Long-Term Hydrologic Impact Assessment (L-THIA) system allows users to model the impacts of land use change on runoff and water quality for any location in the US. A watershed delineation application allows users to select a location on a web-based map and have the watershed draining to that location identified and characterized. These and numerous other web-based decision support tools have been used within classes to help students better understand and quantify spatial and ecological concepts. These tools have also developed extensive user bases among citizens, government agencies and environmental consultants.

Academic Transcript

017912138 Acushla Antony
Aug 04, 2009 05:09 pm

This is not an official transcript. Courses which are in progress may also be included on this transcript.

Institution Credit Transcript Totals Courses in Progress

Transcript Data

STUDENT INFORMATION

Student Type: Continuing

Curriculum Information

Current Program
Doctor of Philosophy

Program:	Agric Biol Engr-PHD
College:	Graduate Studies
Campus:	West Lafayette
Major:	Agricultural & Biological Engr
Major Concentration:	Agricultural Systems Mgt

***Transcript type:EXTL External is NOT Official ***

DEGREE AWARDED

Sought: Doctor of Philosophy **Degree Date:**

Curriculum Information

Primary Degree

Program:	Agric Biol Engr-PHD
College:	Graduate Studies
Campus:	West Lafayette
Major:	Agricultural & Biological Engr
Major Concentration:	Agricultural Systems Mgt

INSTITUTION CREDIT -Top-

Fall 2007

College:	Graduate Studies
Major:	Agricultural & Biological Engr
Academic Standing:	Continued Good Standing

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ABE	69100	West	GR	Environ Data Handling	A	3.000	12.00	

		Lafayette					
ABE	69700	West Lafayette	GR	Seminar	S	0.000	0.00
ASM	59100	West Lafayette	GR	Gis Applications	A	3.000	12.00
MGMT	54400	West Lafayette	GR	Database Mgmt Systems	A	3.000	12.00

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	9.000	9.000	9.000	9.000	36.00	4.00
Cumulative:	9.000	9.000	9.000	9.000	36.00	4.00

Unofficial Transcript

Spring 2008

College: Graduate Studies
Major: Agricultural & Biological Engr
Academic Standing: Continued Good Standing

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ABE	69900	West Lafayette	GR	Research PhD Thesis	S	9.000	0.00	I
CE	54200	West Lafayette	GR	Hydrology	A	3.000	12.00	
CE	59700	West Lafayette	GR	Geographic Info Systms	B	3.000	9.00	
STAT	51100	West Lafayette	GR	Statistical Methods	B	3.000	9.00	

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	18.000	18.000	18.000	9.000	30.00	3.33
Cumulative:	27.000	27.000	27.000	18.000	66.00	3.67

Unofficial Transcript

Summer 2008

College: Graduate Studies
Major: Agricultural & Biological Engr
Academic Standing: Continued Good Standing

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ABE	69900	West Lafayette	GR	Research PhD Thesis	S	9.000	0.00	I

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	9.000	9.000	9.000	0.000	0.00	0.00
Cumulative:	36.000	36.000	36.000	18.000	66.00	3.67

Unofficial Transcript

Fall 2008

College: Graduate Studies
Major: Agricultural & Biological Engr
Academic Standing: Continued Good Standing

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ABE	69900	West Lafayette	GR	Research PhD Thesis	S	18.000	0.00	I

	Attempt	Passed	Earned	GPA	Quality	GPA

	Hours	Hours	Hours	Hours	Points	
Current Term:	18.000	18.000	18.000	0.000	0.00	0.00
Cumulative:	54.000	54.000	54.000	18.000	66.00	3.67

Unofficial Transcript

Spring 2009

College: Graduate Studies
Major: Agricultural & Biological Engr
Academic Standing: Continued Good Standing
Last Academic Standing: Continued Good Standing

Subject	Course	Campus	Level	Title	Grade	Credit Hours	Quality Points	R
ABE	69900	West Lafayette	GR	Research PhD Thesis	S	15.000	0.00	I
CGT	45600	West Lafayette	GR	Adv Web Prog, Dev&Data	B	3.000	9.00	

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Current Term:	18.000	18.000	18.000	3.000	9.00	3.00
Cumulative:	72.000	72.000	72.000	21.000	75.00	3.57

Unofficial Transcript

TRANSCRIPT TOTALS (GRADUATE) -Top-

	Attempt Hours	Passed Hours	Earned Hours	GPA Hours	Quality Points	GPA
Total Institution:	72.000	72.000	72.000	21.000	75.00	3.57
Total Transfer:	0.000	0.000	0.000	0.000	0.00	0.00
Overall:	72.000	72.000	72.000	21.000	75.00	3.57

Unofficial Transcript

COURSES IN PROGRESS -Top-

Summer 2009

College: Graduate Studies
Major: Agricultural & Biological Engr

Subject	Course	Campus	Level	Title	Credit Hours
ABE	69900	West Lafayette	GR	Research PhD Thesis	9.000

RELEASE: 7.2

PURDUE
UNIVERSITY

DEPARTMENT OF AGRICULTURAL
AND BIOLOGICAL ENGINEERING

August 4, 2009

Dear Proposal Evaluation Committee:

I am pleased to write this letter in support of Acushla Antony's proposal titled "A Web-Based Tool to Measure Environmental Quality Standards for Phosphorus in Water at Lake Erie". I am serving as her major professor for her graduate studies.

The work Acushla proposes builds on a significant base of work in which my group has built very successful environmental decision support tools. Several of these tools (http://engineering.purdue.edu/~watergen) are widely used for environmental decision making. Other tools have been very useful to the research efforts of my group in addressing challenging watershed issues.

Acushla's work will extend the capabilities of the NAPRA tool (National Agricultural Pesticide Risk Assessment). Note NAPRA models nutrient losses in addition to pesticide losses. Using the enhanced NAPRA, she is proposing to explore the impacts of management practices common in the Black Creek watershed on phosphorus losses. Black Creek drains to the Maumee which eventually drains to Lake Erie. She also plans to assess the impact of potential future management systems within this watershed to determine the impacts of these systems on phosphorus losses. The results will provide guidance regarding the likely impacts of both current and future management in watersheds within the western Lake Erie basin on phosphorus losses. In addition, the tool she is developing will allow others within the Great Lakes basin to assess impacts of agricultural management on nutrient and pesticide losses.

Acushla has prepared a draft of her Ph.D. research proposal that is being finalized this month (August 2009). It will be shared with her advisory committee this month.

Acushla is supported by a USDA project. The work she is proposing extends the application of the decision support tool into Great Lakes basin watersheds. As highlighted above, the application of the tool will provide valuable insight into the management of phosphorus in these watersheds.

Sincerely,

Bernard A. Engel
Professor and Department Head