Bernie Engel, Ph.D.
Senior Associate Dean of Agricultural Research and Graduate Education
Glenn W. Sample Dean of Agriculture-Elect
Purdue University

Bernie Engel, Ph.D., is the senior associate dean of agricultural research and graduate education and, on July 15, he will assume the role of Glenn W. Sample Dean of Agriculture at Purdue University. Engel is a leading global expert in the development and application of water quality models and environmental decision support systems. The models address agricultural, rural, urban and mixed land-use watersheds and a range of constituents including nutrients, pesticides and soil erosion. Based on the citations of his research, he is in the top 1% of his field globally.

In his current role, Dr. Engel has strategic leadership and oversight responsibilities for research, graduate education, facilities, special initiatives, and innovation & entrepreneurship for the College of Agriculture, a top five globally ranked agriculture and forestry university according to the QS rankings. He oversees Hatch and McIntire-Stennis capacity resources and their use. He works closely with faculty in their pursuit of competitive funding from various sources including USDA NIFA. During his tenure as senior associate dean, the college has received over $85 million in external research funding for two consecutive years.

Prior to serving as senior associate dean in the college, Engel was department head of Agricultural and Biological Engineering from 2005-2019. Under his leadership, ABE undergraduate and graduate programs were each repeatedly ranked the country's No. 1 biological/agricultural engineering program by U.S. News and World Report. During that time, the number of both undergraduate and graduate students in the department doubled and research expenditures more than tripled.

He has received numerous recognitions from the American Society of Agricultural and Biological Engineering (ASABE) over the course of his career, including: Outstanding Young Researcher Award in 1999 and ASABE Fellow in 2014. He was also honored as the Purdue College of Agriculture's Outstanding Researcher and Outstanding Graduate Educator, University Scholar and received Engineering's Best Teacher Award.

After earning his undergraduate and master's degrees from the University of Illinois and his PhD in agricultural engineering from Purdue, Engel joined the faculty at Purdue University in 1988.

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Education

Ph.D. 1988, Purdue University, Department of Agricultural Engineering. Dissertation: *An artificial intelligence approach to soil erosion modeling.*

M.S. 1985, University of Illinois, Department of Agricultural Engineering. Thesis: *Crop coefficients for irrigation scheduling in Illinois.*

B.S. 1984, University of Illinois, Department of Agricultural Engineering.

Professional Positions

Senior Associate Dean for Agricultural Research and Graduate Education, Purdue University (January 2019-present)

Founding Director, Purdue University Discovery Park Center for the Environment (July 2005-September 2006)

Head of Agricultural and Biological Engineering (ABE), Purdue University (May 2005-January 2019)

Interim Head of ABE, Purdue University (August 2004-May 2005)

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)

Awards and Honors

State Scholarship, Illinois, 1980-1984

Johnathan Baldwin Turner Scholarship, 1980-1984

School of Agriculture Fellowship, University of Illinois, 1984-1985

USDA National Needs Fellow, 1985-1988

ASAE Educational Aids Blue Ribbon Award, *Dam Site Selection Expert System*, 1987

ASEE NASA Summer Fellow, Kennedy Space Center, Florida, 1992-1993

ESCOP/ACOP Leadership Fellow, 1996-1997

Engineering Best Teacher Award, Agric. and Biological Engineering, Purdue University, 1996

School of Agriculture Outstanding Researcher, Purdue University, 1998

University Scholar, Purdue University, 1999-2003

ASAE Outstanding Young Researcher Award, 1999

Horwood Critique Honorable Mention Prize for 1999, 2001 and 2002 from the Urban and Regional Information Systems Association (URISA) for GIS and Hydrologic/Water Quality Modeling Papers

Outstanding Graduate Educator, College of Agriculture, 2006

Food Systems Leadership Institute Fellow, 2012

ASABE Fellow, 2014
Recognized among the 8 most productive authors globally in nonpoint source pollution modeling research (Li et al. 2014, JSWC 69(4), doi:10.2489/jswc.69.4.121A).
Gilley Academic Leadership Award, ASABE, 2016
Distinguished Faculty for Research, Purdue University Residential Academics Initiative, 2018
Hancor Soil and Water Conservation Engineering Award, ASABE, 2019
Team Award, Tipping Point Planner Team, College of Agriculture, Purdue University, 2020
Top 2% of researchers globally based on citations and metrics derived from citations (Stanford analysis), 2021

ADMINISTRATIVE AND LEADERSHIP EXPERIENCE

Dr. Engel has served in significant leadership roles for the past 18.5 years as head and senior associate dean, impacting all of Purdue's mission areas. These roles include providing strategic vision; financial oversight and management; building successful teams and partnerships; leading complex projects; internal and external stakeholder engagement; advocating for support; and building external recognition for units he led. Brief highlights and accomplishments are provided below.

Senior Associate Dean for Agricultural Research and Graduate Education

In this role, Dr. Engel has strategic leadership and oversight responsibilities for research, graduate education, facilities, special initiatives, and innovation & entrepreneurship.

Research: Provide leadership for research within the College of Agriculture including the Indiana Agricultural Experiment Station. Oversee use of USDA capacity funding to support research. Responsible for compliance and reporting associated with research. External research support has grown from $62.3M in FY 18-19 to a record $85.6M in FY 21-22 (current 3-year average of $79.4M). Current FY support will likely set a new record.

Modified and improved approaches to align seed funding and other investments to enhance ability to leverage external resources. These include Ag-Eng and Ag-Polytechnic (initiatives to create new collaborations between Ag and Engineering and Polytechnic faculty, respectively), Agriculture of 2030 Big Ideas teams, AgSEED (increased emphasis on leveraging external resources), and Ross-Lynn assistantships (focused use on leveraging strategic priorities). Help build faculty connections to partners at Purdue, other universities and in industry. Building interdisciplinary teams. Facilitate and support teams in pursuit of large grants. Work with faculty, staff, heads and central groups to remove barriers and improve support for research.

Research Publications, Citations, Associated Metrics: Prepared large data set on publications, citations and other citation-based metrics for faculty in college for past 4 years. Working with department heads in using these data to improve publication numbers, citations and h-indices. Publication data; grant submission and success data; teaching data; and other data are being used to enhance competitiveness of faculty. Event created to recognize faculty with largest changes annually in citations and h-index change. Tracking metric changes as part of college strategic plan. Citations increased 11% from 2019 to 2020 and 16% from 2020 to 2021.

Research Facilitation during COVID: Worked closely with department heads and vice president for research to create policies during first year of COVID pandemic to ensure agricultural/life science-based research could continue without interruption. Polices developed working with heads were adopted more broadly at Purdue to help maintain high research activity levels.

Engagement with External Partners: Work closely with key agricultural stakeholder groups in the state and beyond including the Indiana Soybean Alliance (soybean checkoff) and the Indiana Corn Marketing Council (corn checkoff) to ensure research and Extension needs are met by connecting faculty and staff to opportunities including funding. Secured $1.5M for endowed chair from ISA and $4.2M in support of facilities and equipment from Ag Alumni Seed and other partners. Support and engage checkoff programs associated with mint, turkey, sheep & wool, wine & grape, and Indiana pork producers. Engage with farm organization and other partners including Farm Bureau. Work with Purdue's Office of Industry Partnerships to connect corporate partners with faculty to address industry research needs.

Graduate Programs: Provide college level leadership, oversight, management and facilitate collaboration across graduate programs in College of Agriculture departments for approximately 700 graduate students. Improved approach to target ARGE diversity assistantships to enhance recruiting underrepresented minority graduate students. Work with college partners in recruiting diverse graduate students. Adopted new approach to better use graduate school provided assistantships in recruiting. Developed program to use ARGE research support to ensure new incoming graduate students have university provided computers.

College of Agriculture Facilities: Oversee college level master planning; facility renovation and restoration; and individual facility planning, design and construction. Completing master plan that includes 5 departments; oversee renovation and restoration of 6-8 spaces per year (approximately $2.5M/yr); oversee 4-7 capital projects per year (approximately $3.7M/yr); in detailed design phase of phenotyping greenhouse with construction planned to start later in 2023 ($20M); completed planning, design and construction of TPAC machine and chemical storage shed ($1.9M); completed planning, design, and construction of ABE building ($80M) (planning and detailed design completed in prior role).

Purdue Agricultural Centers (PACs): Provide oversight, including fiscal oversight, for the 8 PACs that encompass more than 11,000 acres. More than 450 faculty led projects are completed at the PACs annually involving corn, soybeans, fruits, vegetables, livestock and forestry. Worked with PAC Director and PAC location superintendents to improve fiscal status of PACs.

Core Facilities: Oversee college level core facilities including Ag Alumni Seed Phenotyping Facility, Indiana Corn and Soybean Innovation Center, Agricultural Data Services, electron microscopy, and bioinformatics.

Commercialization: Provide leadership for college intellectual property commercialization. Created college level innovation and entrepreneurship fellow position to engage faculty, staff and graduate students in commercialization efforts. Worked with Office of Technology and Commercialization in re-design of university strategy for commercialization. Oversee Ag-Celerator, which is a $2 million agricultural innovation fund designed to provide critical startup

support of up to $100,000 per company for Purdue innovators who wish to commercialize patented intellectual property or Purdue technologies related to agriculture. Expanded Ag-Celerator to be inclusive of all of agriculture. College of Agriculture tied for record number of intellectual property disclosures (70) and had a record number of patent applications (87) and license/option agreements (31) in FY 21-22.

Plant Sciences 2.0: Co-lead Plant Sciences 2.0 initiative. Co-author of proposal that secured a second investment ($40M) from Purdue for a second phase of plant sciences in April 2021. Significant components of the project include phenotyping and data sciences; digital forestry; center for food demand analysis and sustainability; and Ag-Celerator impact fund. Oversee $20M phenotyping greenhouse design and construction (beginning 2023), data scientist hires, and entrepreneurship. Recent external grants in support of digital forestry exceed $22M.

Rankings: The College of Agriculture ranks #8 globally and #4 in the US in the 2022 QS World Rankings for Agricultural and Forestry Colleges. Continuing to pursue strategies to improve key metrics considered in the rankings including citations and h-index.

Diversity, Equity, and Inclusion: A strong commitment to DEI has continued in this role building on successes in increasing diversity of graduate students as a faculty member and Head and increasing diversity of faculty while Head. Efforts include insuring faculty pools include diverse candidates, faculty recruiting, better alignment of ARGE diversity assistantships to recruit underrepresented students, inclusion of DEI professional development in college staff performance reviews, and DEI and belonging educational opportunities for ARGE staff.

USDA Research and Foreign Ag Service Civil Rights Reviews: Led successful USDA Foreign Agricultural Service (FAS) Civil Rights review of Purdue programs funded by USDA FAS in summer 2022. Led material preparation for USDA research focused review of Purdue programs (review spring 2023).

Advocate for Agriculture, Food, Life and Natural Resource Sciences Research: Work with state and federal government relations teams, Lewis-Burke Associates, director of agricultural services and regulations for the college, Experiment Station Section/APLU, and PCARET to build support for college interests with an emphasis on research.

Faculty Hiring and Development: Lead College of Agriculture hiring efforts (12-15 faculty per year) including review position descriptions, review diversity of pools, associate dean interviews of candidates, and negotiation of startups (approximately $8M/yr) working with department heads. Co-lead faculty development efforts including new faculty programs, second and third year faculty program, and development throughout careers.

Department 5 Year Reviews: Lead 5 year comprehensive reviews of academic departments. Work with heads to identify data to support reviews, develop review self-assessment report, identify review team, and build review team schedule; work with reviewers to finalize written reviews; and organize review response debrief with department leadership team and Dean/Associate Dean group.

Head of ABE

Dr. Engel served as Interim Head of ABE from August 2004-May 2005 and as Head from May 2005 to January 2019. The Purdue ABE department is a comprehensive program with undergraduate and graduate degrees in Agricultural Engineering, Biological Engineering, and Agricultural Systems Management. The department is within both the College of Agriculture and College of Engineering. Some of the most significant accomplishments as Head are briefly highlighted below. Both undergraduate and graduate programs were consistently ranked in the very top group of such programs nationally throughout Dr. Engel's tenure as Head.

Undergraduate Programs: The US News and World Report ranked the Purdue undergraduate programs as the #1 biological/agricultural engineering program from school year 2012 – released in calendar year 2011 - through 2019 and remains the top ranked program. This occurred as a result of strong faculty and staff support of students, growth of programs, breadth of programs, quality of students, and a focus on supporting student needs.

The undergraduate program grew under Dr. Engel's leadership from approximately 230 to more than 400 undergraduates between 2004 and 2019. Growth occurred in each degree area with the most significant growth occurring in the BS Biological Engineering area.

The engineering undergraduate programs underwent two successful ABET accreditation reviews (2007 and 2013). The BS Agricultural and Biological Engineering degree was split into a BS Agricultural Engineering and BS Biological Engineering in 2007 to enable programs to meet ABET criteria following introduction of an ABET biological criterion. The ASM program was reviewed and affirmed in 2008 and 2014 by the ASABE committee that reviews ASM programs.

Continuous improvement in undergraduate programs and experiences occurred throughout Dr. Engel's leadership of the programs. The plans of study for each BS degree (Biological Engineering, Agricultural Engineering, and Agricultural Systems Management) were significantly modified based on stakeholder input as well as to meet required changes in credit requirements. Laboratory experiences to provide additional and enhanced opportunities for hands on experiences to complement course work were created. Strong support for student clubs and efforts such as international Genetically Engineered Machine (iGEM), ¼ scale tractor, and Purdue Utility Platform provided students opportunities to broaden their experiences and knowledge beyond the classroom. International experiences for undergraduate students increased through various initiatives. Undergraduate opportunities for research were supported and encouraged through SURF, DURI and other programs with participation exceeding 15 students per summer.

An undergraduate BS Agricultural Engineering 2+2 program was developed with China Agricultural University (CAU) with students completing their first two years at CAU before transferring to Purdue University for their last two years to complete a BS Agricultural Engineering degree. CAU is the top agriculture and Agricultural Engineering program in China. The inaugural cohort of 7 students began their studies at Purdue in 2015 with groups of approximately 10 students with junior standing arriving in subsequent years.

Graduate Programs: The US News and World Report ranked the Purdue graduate programs as the #1 biological/agricultural engineering program 10 of the 11 years preceding 2019. Graduate student enrollment in ABE grew significantly throughout Dr. Engel's tenure growing by more than 50% to approximately 115 students in the 2018-19 academic year. The quality of students was maintained or improved during this growth. The diversity of graduate students also increased with program growth as a result of focused efforts to recruit diverse students. To meet increased graduate population needs, the number of graduate level courses was increased to improve educational opportunities. The ABE Graduate Student Association (GSA) grew significantly in number of students involved and in professional development activity as well as providing social opportunities for graduate students. Their efforts greatly increased from 2011, including the initiation of a research symposium.

Research Programs: The research expenditures of ABE more than tripled under Engel's leadership. The breadth of research efforts increased as did diversity of funding sources. Funding sources included a range of federal agencies as well as significant industry support. Industry sponsors provided approximately 30% of departmental funding in support of programs.

Depth, breadth, and interdisciplinary nature of research efforts within ABE grew substantially with the increase in faculty numbers from 21 to 35. Historical strengths of the program were reinforced with growth occurring in new areas, especially within biological engineering. Growth was facilitated by collaborative efforts between the Colleges of Engineering and Agriculture. Growth in research was in part due to efforts to build interdisciplinary teams of faculty within and beyond the department, identification of funding opportunities, addressing obstacles, and working to reduce barriers to faculty productivity.

Extension: Worked closely with Extension faculty specialists to build and leverage their programs. ABE Extension programs are known for their national leadership. These programs were highly successful in leveraging external financial support to amplify efforts. Areas of strength include agricultural health and safety; agricultural air quality; water quality and water management; grain post harvest drying, processing and storage; and livestock waste management.

Faculty Development and Support: The number of faculty with tenure home in ABE increased significantly from 2004 to 2019 (from 21 to 35) due to partnering with Engineering. Faculty hires (24 between 2004-2019) reinforced strengths as well as allowed growth into new areas. Faculty were recognized with numerous prestigious awards and were successful in promotion and tenure. Dr. Engel served as a mentor for new faculty, as well as other ABE faculty, working closely with them in development of their programs including pursuit of extramural resources. Fifteen faculty with a tenure home in ABE and one with a joint appointment in ABE were promoted and received tenure as associate professors, and 12 faculty with tenure home in ABE and two with joint appointments in ABE were promoted to full professor. Three faculty became heads of programs, one an assistant dean, one an associate dean, two vice provost, and another director of a division within a federal agency (NASA). The gender and racial diversity (including underrepresented minorities) of faculty increased under Dr. Engel's leadership.

Foster a diverse and inclusive environment: Worked as a champion to build a diverse and inclusive environment within ABE. The ABE program was known throughout the university for its culture of inclusiveness and support for faculty, staff and students. Dr. Engel lived this commitment for more than 29 years, with at least one underrepresented minority graduate student or post doc on his research team almost continuously over this period. He was successful in recruiting diverse faculty and students into ABE programs, and increasing the proportions of underrepresented minorities in faculty and graduate students.

As highlighted, Dr. Engel has been committed throughout his career to building a diverse and inclusive environment. A strong relationship with North Carolina A&T was built and was an important factor in recruiting excellent, diverse students to ABE.

Led reporting efforts to supporting agencies and partners: Worked closely with faculty and staff to complete various reporting efforts to agencies and partners. Departmental level information and reports were prepared for both the Colleges of Agriculture and Engineering routinely. Communications with alumni and partners through newsletters and other updates were critical in preparing for and supporting the ABE building construction and renovation effort.

Space and Facilities: The growth in undergraduate and graduate students and faculty resulted in significant additional space requirements to meet research and teaching needs. To meet these needs, various solutions were identified including leasing space, acquiring space in Purdue Discovery Park, acquiring temporary space with collaborative programs in other buildings, and construction of the ADM Agricultural Innovation Center (approximately 28,000 square feet of space). Dr. Engel worked closely with the development team to raise $2M for construction of the ADM building.

Under Engel's leadership, a significant construction and renovation project for the ABE building ($80M) was initiated. Approximately 40,000 square feet of space was renovated and 125,000 of new space added, opening in December 2020. Dr. Engel worked closely with faculty in ABE and a consultant in 2014 to create an early conceptual space plan; College of Agriculture leadership to position the ABE building project as a university and state priority (2015-2017); development team to raise $10.5M in support of the building; and faculty, staff, architects and university planners (2017-2018) to design the building. The renovated and new space allowed all faculty and programs but those in the Maha fluid power lab to move to the new and renovated facilities.

Development: Strong partnerships created with alumni and corporations were instrumental in increasing scholarships, growing research support, and providing facilities within ABE. For example, a strong partnership with ADM led to sustained scholarship support and internships for undergraduate students. Further, when faced with a space and facility challenge, ADM provided $1.5 million in support for the new ADM facility to support student laboratories, capstone projects, and other efforts.

ABE Budget: The ABE budget exceeded $14 million in his final fiscal year as head including support from the university as well as support of grant funded activities. The budget was balanced and a starting deficit from 2004 repaid under Dr. Engel's leadership.

Additional noteworthy efforts in establishing programs beyond those in ABE are briefly highlighted in the subsections that follow.

Earth Observation Systems Graduate Program
Dr. Engel was a founding member of the joint graduate Earth Observation Systems program with the University of Leuven in Belgium (1998-2009). Students from Purdue and University of Leuven spent the fall semester at Purdue in a common set of courses (including one of Engel's courses), the spring semester at Leuven in a common set of courses and then completed their research at either Purdue or Leuven. Dr. Engel served as the Purdue director of the program.

Purdue Discovery Park Center for Environment (now part of Institute for a Sustainable Future)
Dr. Engel was the founding director of the Center for the Environment. The Center helps facilitate research and outreach efforts of faculty, students and staff with environmental interests. The Center facilitates large-scale, interdisciplinary research. His efforts as founding director were focused on startup of the center and building interdisciplinary teams.

Center for Advanced Applications of GIS (CAAGIS)
CAAGIS was established approximately 25 years ago by Dr. Engel. CAAGIS grew out of Dr. Engel's education, research and outreach efforts associated with GIS. CAAGIS served the GIS application needs of faculty, students, staff and the public.

Division of Environmental and Ecological Engineering
Dr. Engel was a founding member of the Purdue Division of Environmental and Ecological Engineering (DEEE) within the College of Engineering. DEEE has developed an environmental engineering minor, an interdisciplinary graduate program, and an environmental and ecological engineering BS degree. The first graduates of this program with a BS Environmental and Ecological Engineering occurred in 2013.

EXCELLENCE IN RESEARCH

Statement of Research Contribution

Dr. Engel is a leading global expert on development and application of hydrologic/water quality models and environmental decision support systems (DSS). These models and DSS are applicable on scales from plots, to fields, to watersheds and large basins. The models address agricultural, rural, urban and mixed land use watersheds and a range of constituents including nutrients, pesticides, and soil erosion.

He has contributed significantly to the science used in multiple hydrologic/water quality models including Soil and Water Assessment Tool (SWAT), Long-Term Hydrologic Impact Assessment (L-THIA) model, Agricultural NonPoint Source (AGNPS) model, Water Erosion Prediction Project (WEPP) model, and Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. In particular, SWAT and L-THIA are widely used globally by government agencies, non-government organizations, the private sector, and researchers.

Dr. Engel has also contributed to the widespread application of the hydrologic/water quality models above through development of model interfaces, interfaces to GIS to provide spatial data

and display model results, and data processing flows to automate use. He has also developed approaches to improve the utility of hydrologic/water quality models including modeling application protocols, management practice representation within models, tools to automate model calibration, and optimization approaches to select and place management practices.

Dr. Engel has also used hydrologic/water quality models to explore numerous questions of importance in water quality and environmental management. These include: (1) What are the impacts of land use change and urbanization on runoff and water quality?; (2) How much will it cost to mitigate future land use and climate change impacts on hydrology and water quality?; and (3) What are the long-term impacts of management practices on water quality?

His efforts in modeling the vulnerability of ground water to potential pollutants resulted in a series of ground water vulnerability maps that are used within Indiana's ground water protection State Management Plan.

Dr. Engel led development of the web GIS technology that forms the basis of a national sensitive crops registry to protect these crops from pesticide spray drift (www.fieldwatch.com). FieldWatch, a nonprofit launched in 2010, currently operates in 24 states and 1 province. The technology is credited with greatly reducing unintended drift damage to sensitive crops and corresponding complaints. Dr. Engel serves on the FieldWatch Board of Directors.

Publications (Google Scholar *h* index=61; citations = 16,155 as of December 22, 2022)

a. Refereed Journal Papers

1. Engel, B.A., W.D. Lembke, S.K. Sipp, and W.D. Goetsch. 1989. Irrigation crop coefficients for Illinois corn. Trans. ASAE. 32(4):1275-1280.
2. Engel, B.A., D.B. Beasley, and J.R. Barrett. 1990. Integrating multiple knowledge sources. Trans ASAE. 33(4):1371-1376.
3. Rewerts, C., B. Engel, J. Rogers, and D. Jones. 1990. An end user interface for CLIPS. AI Applications in Natural Resources. 4(2): 57-65.
4. Engel, B.A., D.B. Beasley, and J.R. Barrett. 1990. Integrating expert systems with conventional problem solving techniques using blackboards. Computers and Electronics in Agriculture. 4(4):287-302.
5. Motz, D., K. Haghighi, and B. Engel. 1990. A blackboard architecture for multiple knowledge source integration in a design environment. AI Applications in Natural Resources. 4(2): 101-109.
6. Engel, B.A., C. Baffaut, J.R. Barrett, J.B. Rogers, D.D. Jones. 1990. Knowledge transformation. Applied Artificial Intelligence. 4:67-80.
7. Wright, J.R., S. Benabdallah, and B.A. Engel. 1990. A normalized user interface for complex simulation models. AI Applications in Natural Resources. 4(2):11-16.
8. Amin Sichani, S. and B.A. Engel. 1990. Prediction of runoff and sediment from agricultural watersheds by a mathematical model: Watershed simulation. Iran Agricultural Research 9(1):1-16.
9. Amin Sichani, S., B.A. Engel, and E.J. Monke. 1990. Prediction of runoff and sediment from agricultural watersheds by a mathematical model: Sediment-bound and soluble phosphorus loadings. Iran Agricultural Research 9(2):75-100.

10. Stone, N.D. and B.A. Engel. 1990. Knowledge-based systems in agriculture and natural resources management. AI Magazine. 11(3):20-22.
11. Srinivasan, R., B.A. Engel, and G. Paudyal. 1991. Expert system for irrigation management (ESIM). Computers and Electronics in Agriculture. 36(3):297-314.
12. Engel, B.A., D.D. Jones, J.R. Wright, and S. Benabdallah. 1991. Selection of an expert system development tool. AI Applications in Natural Resources. 5(1):15-22.
13. Engel, B.A. and D.B. Beasley. 1991. DSS: A dam site selector expert system for education. ASCE Journal of Irrigation and Drainage Engineering. 117(5):774-783.
14. Zhuang, X., B.A. Engel, M. Baumgardner, and P. Swain. 1991. Improving classification of crop residues using digital land ownership data and Landsat TM imagery. Photogrammetric Engineering and Remote Sensing. 57(11):1487-1492.
15. Amin Sichani, S., B.A. Engel, E.J. Monke, J.D. Eigel, and E.J. Kladivko. 1991. Validating GLEAMS with pesticide field data on a Clermont soil. Trans ASAE 34(4):1732-1737.
16. Srinivasan, R. and B.A. Engel. 1991. Effect of slope prediction methods on slope and erosion estimates. Journal of Applied Engineering in Agriculture 7(6):779-783.
17. Engel, B.A., D.D. Jones, and T.L. Thompson. 1992. Advanced information systems: Integrating expert systems with traditional computer-based problem solving techniques. AI Applications in Natural Resources 6(2):5-12.
18. Edan, Y., B.A. Engel, and G.E. Miles. 1993. Intelligent control system simulation of an agricultural robot. Journal Paper No. 13043. Journal of Intelligent and Robotic Systems 8:267-284.
19. Mitchell, J.K., B.A. Engel, R. Srinivasan, R.L. Bingner, and S.S.Y. Wang. 1993. Validation of AGNPS for small mild topography watersheds using an integrated AGNPS/GIS. Advances in Hydro-Sciences and Engineering. pp. 503-510.
20. Brown, S.J. and B.A. Engel. 1993. A comparison of GIS assisted simulated hydrologic response with actual storm event data. Advances in Hydro-Sciences and Engineering. pp. 511-517.
21. Engel, B.A., R. Srinivasan, J. Arnold, C.C. Rewerts, and S.J. Brown. 1993. Nonpoint source (NPS) pollution modeling using models integrated with geographic information systems (GIS). Water Science and Technology 28(3-5):685-690.
22. Pritchard, T., J.G. Lee and B.A. Engel. 1993. Reducing agricultural sediment: An economic analysis of filter strips versus micro-targeting. Water Science and Technology 28(3-5):561-568.
23. Mitchell, J.K., B.A. Engel, R. Srinivasan, and S.S.Y. Wang. 1993. Validation of AGNPS for small watersheds using an integrated AGNPS/GIS system. Water Resources Bulletin 29(5):833-842.
24. Srinivasan, R., and B.A. Engel. 1994. A spatial decision support system for assessing agricultural nonpoint source pollution. Water Resources Research 30(3):441-452.
25. Srinivasan, R., B.A. Engel, J.R. Wright, J.G. Lee, and D.D. Jones. 1994. The impact of GIS-derived topographic attributes on the simulation of erosion using AGNPS. Applied Engineering in Agriculture 10(4):561-566.
26. Zhuang, X., B.A. Engel, D.F. Lozano-Garcia, R.N. Fernandez, and C.J. Johannsen. 1994. Optimization of training data required for neuro-classification. International Journal of Remote Sensing 15(16):3271-3277.
27. Hetzroni, A., G.E. Miles, B.A. Engel, P.A. Hammer, and R.X. Latin. 1994. Machine vision monitoring of plant health. Advanced Space Research 14(11):203-212.

28. Embleton, K., B.A. Engel, and D.D. Jones. 1994. Evaluation of a farmstead drinking water quality decision support system. Applied Engineering in Agriculture. 10(6):863-869.
29. Zhuang, X., B.A. Engel, X. Xiong, and C.J. Johannsen. 1995. Analysis of classification results of remotely sensed data and evaluation of classification algorithms. Photogrammetric Engineering and Remote Sensing. 61(4):427-433.
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31. Ozer, N., B.A. Engel, and J.E. Simon. 1995. Fusion classification techniques for fruit quality sorting. Trans. of ASAE 38(6):1927-1934.
32. Engel B., Randhir T., Lee J. 1995. A distributed parameter/GIS approach to reduce agricultural pollution. AM J AGR ECON 77: (5) 1358-1358.
33. McCauley, J.D. and B.A. Engel. 1995. Comparison of scene regenerations: SMAP, ECHO, and Maximum Likelihood. IEEE Trans. on Image Proc. 33(6):1313-1316.
34. Engel, B.A., K. Navulur, B. Cooper, and L. Hahn. 1996. Estimating groundwater vulnerability to nonpoint source pollution from nitrates and pesticides on a regional scale. IAHS Publication No. 235:521-526.
35. Muttiah, R.S., B.A. Engel, and D.D. Jones. 1996. Waste disposal site selection using GIS-based simulated annealing. Computers & Geoscience 22(9):1013-1017.
36. Preston J., Engel B., Lalor G.C. 1996. The application of geographic information systems to geochemical studies in Jamaica. ENVIRON GEOCHEM HLTH 18: (3) 99-104.
37. Engel B., Lalor G.C., Vutchkov M.K. 1996. Spatial pattern of arsenic and lead distributions in Jamaican soils. ENVIRON GEOCHEM HLTH 18: (3) 105-111.
38. Chang, Y., J.R. Wright, and B.A. Engel. Evidential reasoning for assessing environmental impact. Civil Engineering Systems (14):55-77.
39. Embleton, K., D. Jones and B. Engel. 1996. Comparative risk assessment primer. Environmental Software 11(4):203-207.
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b. Refereed Book Chapters

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c. Conference Proceedings

Professor Engel has authored or co-authored 96 papers for the proceedings of 67 national and international conferences.

d. Research Papers Distributed and Presented at National and International Meetings

Professor Engel has authored or co-authored more than 217 papers that have been presented and distributed at national and international meetings.

Graduate Students Advised

Professor Engel has served as major professor for 54 graduate students (27 MS and 27 PhD) and currently serves as major professor for 1 PhD student. He has served as mentor to 14 post docs and currently serves as mentor to 2 post docs. He has been successful in recruiting and mentoring diverse graduate students by every definition of diversity. His former students hold various positions including research engineers in federal laboratories, engineers in consulting firms, research scientists/engineers in industry, managers of watershed management districts and professors at universities. He has also significantly influenced the graduate education of many others having served on more than 128 graduate advisory committees. Professor Engel has served on graduate advisory committees for students from Agronomy, Forestry and Natural Resources, Agricultural Economics, Animal Science, Entomology, Horticulture, Civil Engineering, and Earth and Atmospheric Sciences among others. In addition, he has served as mentor to 39 visiting scholars, most of which are international PhD students.

Research Grants

Professor Engel and his co-investigators have obtained more than $28.4 million in support of his research efforts in the past 34 years through more than 155 grants. He has been especially successful in obtaining support from federal agencies including US EPA, USDA, NSF, DOE, USGS, Corps of Engineers, and NASA.

EXCELLENCE IN TEACHING

Dr. Engel's teaching contributions have been significant, both on- and off-campus. He has updated and revised existing courses, developed new courses, and taught special topics courses and workshops. Much of his impact has been in GIS science, expert systems, hydrologic/water quality modeling and teaching how to apply such knowledge to solving natural resources and environmental problems. Not only did he introduce state-of-the-art subject materials to undergraduate, graduate and adult students, he also developed new pedagogical techniques, e.g., interactive digital multi-media learning modules. While on sabbatical leave at the NASA Kennedy Space Center in 1994, he taught his ABE 565 (Agricultural Systems Engineering) class over the Internet. In 2000, 2001, and 2002 he taught ABE 526 (Watershed Systems Design)

through Web-based materials to students in Europe. He developed Web-based environmental modeling tools that have proven highly effective for educational uses in courses globally.

Dr. Engel has developed or assisted with the development of more than 75 computer-based multimedia programs for educational use primarily in the areas of environmental and soil and water resources protection (formerly at http://www.epa.gov/glnpo/seahome) that were used in more than 1.5 million sessions annually between 2002-2010. The hypermedia paradigm for these programs enabled them to be used by federal and state agencies, for college classes and for students in junior and senior high school. Many of the multimedia/hypermedia programs have been used to teach ASM 336, Environmental Systems Management, a new course developed by Dr. Engel. Approximately one-half the course lectures in this class were replaced by online modules developed by Dr. Engel. Testing of these multimedia programs by Dr. Engel has shown that they are as effective as lectures and that such programs maintain their effectiveness even when extensive use of such modules is made, such as in ASM 336.

Dr. Engel has taught several workshops on the development of multimedia applications and computer-assisted instruction including two one-week workshops in Indonesia and a one-week workshop in Puerto Rico. He served on the advisory board for a European effort to develop extensive distance education materials related to geographic information systems (GIS).

Courses Previously Taught
ABE 325 Soil and Water Conservation Engineering
ABE 484 and 486 Engineering Design
ABE 526 Watershed Systems Design
ABE 565 Agricultural Systems Engineering
ABE 591 GIS Applications
ABE 696 Graduate Seminar
ASM 215 Introduction to Surveying
ASM 216 Introduction to Surveying
ASM 335 Environmental Systems Management
ASM 494 and 495 Agricultural Systems Management Capstone
ASM 525 Soil and Water Management
EPICS Engineering Projects In Community Service

EXCELLENCE IN ENGAGEMENT AND SERVICE
Professor Engel makes numerous outreach presentations and has conducted numerous workshops related to the application of environmental education software and decision support systems (described briefly in the research section of this document). In recent years, he has averaged 3 outreach presentations on the application of web-based decision support tools including the L-THIA (Long-Term Hydrologic Impact Assessment) model, web-based watershed delineation, SEDSPEC, and NAPRA (National Agricultural Pesticide Risk Assessment). A significant base of users has been established for these tools.

University Service

Professor Engel has provided service to the university beyond that as Head of Agricultural and Biological Engineering and Senior Associate Dean for Agricultural Research and Graduate Education. For example, he has served as:

Forestry and Natural Resources Head Search Chair
Agricultural Economics Head Search Chair
150th Ideas Festival Sustainability Co-Chair
University COACHE Committee
College of Agriculture strategic planning committee
AgIT Director Search Committee Chair

Memberships in Professional Societies and Organizations

American Society of Agricultural and Biological Engineers (ASABE), 1987-present.
National Society of Professional Engineers (NSPE), 1987-present.
Soil and Water Conservation Society (SWCS), 1988-present.
American Society of Civil Engineers (ASCE), 1988-2005.
Sigma Xi (honor society, scientific research), 1986.
Phi Kappa Phi (national scholastic honor society), 1986.
Alpha Epsilon (honor society, agricultural engineering), 1987.
Gamma Sigma Delta (honor society, agriculture), 1986.
Alpha Mu (honor society, agricultural systems management), 2003.

Professional Service Activities

1. American Society of Agricultural Engineers (ASAE) KS-14: Knowledge Engineering Committee, 1987-90, 1992-present, Vice-Chair in 1989-90, Chair in 1990-91.
2. American Society of Agricultural Engineers KS-15: Simulation Committee, 1988-90.
3. American Society of Agricultural Engineers (ASAE) KS-16: Geographic Information Systems Committee, 1990-present, provided leadership in establishment of this new committee. Secretary 1992-93, Vice-Chair 1993-1994, chair 1995-1996.
4. American Society of Agricultural Engineers (ASAE) SW-215: Hydrologic Systems Committee, 1988-present.
5. American Society of Agricultural Engineers (ASAE) SW-225: Conservation Systems Committee, 1987-89.
6. S-211: Hydrologic/Water Quality Modeling of Sediment and Chemical Movement, Southern Region USDA Committee, 1988-91.
7. S-249: Hydrologic and Water Quality Modeling, Southern Region USDA Committee, 1992-1996, Co-wrote proposal to form committee.
8. S-273 Ecological and Water Quality Modeling, Southern Region USDA Committee, 1997-2002.
9. US EPA National Land Use Change Committee 1998-2000.
10. MUTATE GIS Distance Education Advisory Board, European Union, 1998-2002.
11. Global Livestock Collaborative Research and Support Projects Program Advisory Committee, 2000-2005.
12. US EPA Scientific Advisory Panel to the Food Quality Protection Act Implementation Team, 1999-present.

13. ASABE ED210 Agricultural and Biological Engineering Academic Heads, 2009-2010, Vice Chair, 2010-2011 Chair.
14. NCAC 016 North Central Agricultural and Biological Engineering Academic Programs Regional Committee. Chair 2011.
15. DOE Oak Ridge Biofuels Advisory Committee. 2008-2013.
16. BARD Technical Advisory Committee 2010-2013.
17. US EPA FIFRA Scientific Advisory Panel Member, 2011-present.
18. FieldWatch Board Member, 2012-present.
19. North Central Regional Association (NCRA), 2019-present; vice chair 2022-present.
20. Indiana Soybean Alliance Board, 2021-present.
21. Indiana Corn Marketing Council Board, 2021-present.
22. ESCOP Science and Technology Committee, chair 2021-present.
23. ESCOP Infrastructure Committee Member, 2022-present.
24. Indiana Crop Improvement Association Board and Executive Committee, 2022-present.