

Penn State Marcellus Center for Outreach and Research (MCOR)
Michael A. Arthur, Co-director
Thomas B. Murphy, Co-director
Center Renewal
Earth & Environmental Systems Institute
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Rationale:

Natural gas is a critical resource in a greener energy portfolio that reduces our carbon footprint and promotes energy independence. Advances in horizontal drilling and gas shale stimulation techniques have increased access to domestic and global shale gas reserves, but research is needed to develop more efficient and sustainable extraction methods that will reduce impacts on the natural environment. Research also is needed to help communities minimize the potential problems and use the economic opportunities and wealth generated as the basis for transitions to sustainable local economies.

The Marcellus Center for Outreach and Research (MCOR) is committed to expanding research capabilities on technical aspects of Marcellus development, providing science-based programming on the Marcellus and other unconventional gas shales, and protecting the Commonwealth's water resources, forests and transportation infrastructure. Serving state agencies, elected officials, communities, landowners, industry and environmental groups, MCOR brings together the University's extensive expertise in shale gas geology, water resources and treatment, socioeconomic analysis, workforce development, market forces on development and exploration, educational programming, and natural gas technology. MCOR aims to be the research, information and education leader for the Appalachian region by fostering, supporting and advancing research and research-based outreach on gas shale development. Additionally, the Center promotes collaborations and cooperatives initiatives among disciplines and stakeholders in order to address the opportunities and challenges in gas shale development.

Penn State has a significant and recognized national leadership role on issues related to Marcellus and other gas shale development. The University has leading scholars working on many of the most critical areas of research and on extending that information to stakeholder groups, federal and state legislators, the natural gas industry, and the public. However, much more research and education is needed to take advantage of the formation's energy reserves and to address potential adverse environmental and social impacts. Areas that could benefit from additional research include advancing technical capabilities of natural gas production to improve efficiencies; developing new production practices to reduce impacts to Pennsylvania's water and environmental resources; developing more environmentally friendly fracturing techniques; and building international expertise in water resources and treatment.

Additionally, while researchers across colleges and units within Penn State have developed expertise within Marcellus Shale, the lack of a coordinated effort to organize outreach and research activities has led to missed research opportunities and also created some confusion within the University and among stakeholder groups. MCOR seeks to coordinate research and

researchers' efforts to address these issues through identifying relevant research RFPs, sponsoring monthly Brown Bag seminars, and developing programs in conjunction with Penn State campuses. Through MCOR activities, Penn State is solidifying its reputation for innovative research and its role as a leader in outreach and educational programming associated with gas shale development.

The Marcellus Center's goals are three-fold:

- To coordinate University research and outreach on gas shales and their impacts, including environmental, economic and sociological aspects.
- To spark additional cross-campus collaborations on gas shales.
- To address the issues related to the extraction and development of the Marcellus Shale in particular but of unconventional gas resources in general.

More specifically, MCOR seeks to enhance existing science and research capacity and build new capacity in the following topics: Marcellus geology and appropriate technologies; manufacturing and supply of materials for hydrofracturing; legacy implications for the environment; local and regional impacts and quality of life; transportation, development and environment; and worker housing. More than five dozen Penn State researchers have expertise in these areas and are listed on the MCOR web site (www.marcellus.psu.edu). See Appendix 1 for a list.

Since its official announcement in August 2010, MCOR has been involved in activities as diverse as sponsoring a media day on Marcellus Shale to Pennsylvania newspaper and radio reporters and discussing Marcellus Shale development on Capitol Hill. MCOR co-directors have briefed state legislators, served as organizers of statewide conferences and workshops, and participated in dozens of public and non-public events on natural gas development. MCOR personnel also have organized a monthly Brown Bag seminar involving speakers from across campus. In addition, the Center has a leadership role in two upcoming workshops—the Marcellus Shale Multi-State Academic Research Conference (May 2011) and the Natural Gas Utilization Workshop (June 2011). MCOR also is participating with the Pennsylvania Office of Rural Health in identifying how Marcellus Shale development may be impacting healthcare services in rural Pennsylvania.

While the gas industry has long known about the organic carbon-rich, black shale of the 385 million-year-old Marcellus Formation, its exploration and development has created a boom in natural gas extraction that has been reshaping Pennsylvania's rural communities. Penn State Cooperative Extension educators together with MCOR personnel have responded with extensive outreach programs that have reached more than 80,000 people in 2010 alone, according to University estimates. Thousands more have tuned into TV, radio broadcasts and webinars. However, just as drilling has escalated, so has demand for information on all aspects of Marcellus Shale development from economic implications to water resource management and policy challenges. MCOR continues to provide that information.

Organizational structure

MCOR co-directors are Michael Arthur, professor of geosciences, and Thomas Murphy, extension associate and member of the Marcellus Education Team. This co-leadership reflects the Marcellus Center's equal commitment to both outreach and research responsibilities. Dave Yoxtheimer, P.G., EMS Extension Associate, is an outreach liaison between the University, natural gas industry, environmental organizations, local government and the public to advise stakeholders on key environmental issues.

MCOR has an internal steering committee that provides advice and guidance to the Center Co-Directors and assists in evaluating the research and outreach missions of the Center. This committee offers input on Center activities from across the University and, by drawing on their external collaborations, from outside the University. Steering committee members are:

Susan Brantley, director, Penn State Earth and Environmental Systems Institute (EESI)
Alan Taylor, associate director, Penn State Earth and Environmental Systems Institute
Tom Richard, director, Penn State Institutes of Energy and the Environment (PSIEE)
Susan McHale, director, Penn State Social Science Research Institute (SSRI)
Margaret Brittingham-Brant, College of Agricultural Sciences
Rob Brooks, College of Earth and Mineral Sciences
Zuleima Karpyn, College of Earth and Mineral Sciences
Tim Kelsey, College of Agricultural Sciences
Jon Laughner, Penn State Cooperative Extension
Ross Pifer, Penn State Dickinson School of Law
Demian Saffer, College of Earth and Mineral Sciences

Plans also are underway for an External Advisory Committee (EAC). This is a select group of representatives from the various stakeholder groups affected by development of the Marcellus Shale. EAC members will represent local government, business development organizations, citizens, environmental groups, state agencies, human services agencies, water resources industry, water treatment/processing industry, energy companies, workforce development organizations, and transportation. The EAC is expected to:

- Advise MCOR on educational programming, future industry trends, critical research priorities, and opportunities for collaborations.
- Identify strategic initiatives for MCOR to expand, enhance, and prioritize its outreach and research programs.
- Work with MCOR to heighten visibility of Center activities.
- Annually review MCOR's Strategic Plan.

Funding

The Marcellus Center for Outreach and Research is supported by the colleges of [Agricultural Sciences](#) and [Earth and Mineral Sciences](#), [Penn State Outreach](#) and by the [Penn State Institutes of Energy and the Environment \(PSIEE\)](#).

In spring 2010, MCOR administered a seed grant program sponsored by the Social Science Research Institute (SSRI) and Penn State Institutes of Energy and the Environment (PSIEE). This seed grant opportunity drew a large pool of innovative proposals from researchers across colleges with a broad range of topics. Six interdisciplinary teams were selected for seed grants ranging from \$15,000 to \$50,000. The six were:

- Assessing Landscape Change due to Marcellus Shale Drilling Operations and Devising Landscape Remediation Strategies to Minimize Site Impacts; PIs: Margaret Brittingham (Forest Resources) and Patrick Drohan (Crop and Soil Sciences)
- Environmental and Psychosocial Risk Regulators of Stress in Time and Context; PIs: Brian Orland (Arts and Architecture) and Martin Sliwinski (Health and Human Development)
- Implications of Marcellus Shale Development for the Well-Being of Resident Parents and Children: Community, Natural Environment, and Family Pathways; PI: Diane McLaughlin (Rural Sociology)
- The Impact of Marcellus Gas Development on the Rural Transportation Infrastructure; PI: Barry Scheetz (Civil Engineering)
- Fiscal and Community Impacts from Marcellus Shale Gas Development in Susquehanna and Washington Counties; PI: Michael Jacobson (Forest Resources)
- Assessing School Responses to Changing Workforce and Community Conditions in Pennsylvania in the Context of Marcellus Shale Development; PI: Kai Schafft (Education)

One expectation from the seed grants was that the teams would leverage their efforts toward subsequent proposal submission to external funding agencies such as NSF, NIH and private foundations. This occurred with the Brittingham-Drohan seed grant as the Heinz Endowments awarded them a \$412,000, three-year, grant to identify and mitigate the effects of Marcellus Shale natural gas exploration and development on the forest ecosystem.

MCOR does not seek any operating funds from the Earth and Environmental Systems Institute.

Funding Opportunities

MCOR has pursued additional funding for a \$2.5-million proposal to NSF's Informal Science Education program (PI: Michael Arthur).

Center Needs

MCOR requests continued use of the third floor office suite (Room 320) in the EES Building. The current office arrangement will be maintained (320A: Michael Arthur; 320B: Tom Murphy; 320C: Dave Yoxtheimer). Minimal finance support is requested for processing rental car, mileage reimbursements and conference registrations.

Appendix 1: Participant List, Marcellus Center for Outreach and Research

Areas of faculty expertise

1. Energy & Energy Independence

- Methods of extraction
 - Terry Engelder, EMS
 - Michael Arthur, EMS
 - Rudy Slingerland, EMS
 - Luis Ayala, EMS
 - David Yoxtheimer, EMS
 - Zuleima Karpyn, EMS
 - John Wang, EMS
 - Robert Watson, EMS
 - Derek Elsworth, EMS
- Location and Quantity (seismic and modeling methodology)
 - Terry Engelder, EMS
 - Michael Arthur, EMS
 - Rudy Slingerland, EMS
 - Jonathan Mathews, EMS
- Energy Markets
 - Seth Blumsack, EMS
 - Anastasia Shcherbakova, EMS
 - Andrew Kleit, EMS
- Pipeline siting
 - Luis Ayala, EMS
 - David Messersmith, EMS
 - Michael Adewumi, EMS
- Risk Analysis
 - Seth Blumsack, EMS
 - Klaus Keller, EMS
 - Jim Shortle, Agricultural Sciences
 - Anastasia Shcherbakova, EMS

2. Natural gas technologies

- Alternative Hydrofracturing Methods and Materials
 - John Hellmann, EMS
 - Terry Engelder, EMS
 - Michael Arthur, EMS
 - Barry Scheetz, Engineering

3. Water Resources

- Water Quantity, Water Quality
 - Bryan Swistock, Agricultural Sciences
 - David Yoxtheimer, EMS
 - Charles Abdalla, Agricultural Sciences
 - James Clark, Cooperative Extension
 - Joann Kowalski, Cooperative Extension
 - Rob Brooks, EMS
 - Beth Boyer, Agricultural Sciences
 - Thorsten Wagener, Engineering
 - Brian Dempsey, Engineering
 - Doug Miller, EMS
 - Art Rose, EMS (emeritus)
- Water Disposal and Processing
 - David Yoxtheimer, EMS
 - Brian Dempsey, Engineering
 - David Messersmith, Cooperative Extension
 - Tom Murphy, Cooperative Extension
 - Bryan Swistock, Agricultural Sciences
 - Art Rose, EMS (emeritus)
 - Charlie Abdalla, Agricultural Sciences
- Drinking Water Supplies
 - Bryan Swistock, Agricultural Sciences
 - Charles Abdalla, Agricultural Sciences
 - Brian Dempsey, Engineering

4. Wildlife, Forest Fragmentation

- Wildlife
 - Margaret Brittingham, Agricultural Sciences
 - Doug Miller, EMS
 - Rob Brooks, EMS
- Forest Fragmentation
 - Margaret Brittingham, Agricultural Sciences
 - Michael Jacobson, Agricultural Sciences
 - Scott Weikert, Cooperative Extension
 - Joe Bishop, EMS
 - Doug Miller, EMS
 - Alan Taylor, EMS
 - Rob Brooks, EMS
 - Erica Smithwick, EMS

5. Environmental Impacts

- Land Surface and Land Use Change
 - Joe Bishop, EMS
 - Margaret Brittingham, Agricultural Sciences
 - Rob Brooks, EMS
 - Pat Drohan, Agricultural Sciences
 - Alan Taylor, EMS
 - Jim Shortle, Agricultural Sciences
 - Doug Miller, EMS
 - Restoration
 - Rob Brooks, EMS
 - Pat Drohan, Agricultural Sciences
 - Alan Taylor, EMS
 - Air Quality
 - Beth Boyer, Agricultural Sciences
 - Naturally Occurring Radioactive Materials (NORM)
 - Michael Arthur, EMS
 - Art Rose, EMS (emeritus)
6. Business and Economics
- Business development
 - Tim Kelsey, Agricultural Sciences
 - Joann Kowalski, Cooperative Extension
 - Jon Laughner, Cooperative Extension
 - Tom Murphy, Cooperative Extension
 - Taxation
 - Tim Kelsey, Agricultural Sciences
 - Michael Jacobson, Agricultural Sciences
 - Rose Baker, Education
 - David Passmore, Education
 - Tourism
 - Tim Kelsey, Agricultural Sciences
 - Bruce Lord, Agricultural Sciences
 - Entrepreneurship
 - Benefits and Costs
 - Jim Shortle, Agricultural Sciences
 - Charles Abdalla, Agricultural Sciences
7. Workforce Development
- Education and Training
 - Tim Kelsey, Agricultural Sciences
 - Jim Ladlee, Cooperative Extension
 - Jeff Lorson, Penn College

- Kai Schafft, Education
 - Larry Michael, Penn College
 - Tom Murphy, Cooperative Extension
 - David Passmore, Education
 - Rose Baker, Education
8. Landowner Decision-Making
- Jon Laughner, Cooperative Extension
 - Michael Jacobson, Agricultural Sciences
 - David Messersmith, Cooperative Extension
 - Tom Murphy, Cooperative Extension
 - Ross Pifer, Penn State Dickinson Law
 - Gary Sheppard, Cooperative Extension
9. Social and Community Impacts
- Local Government and Land Use Planning
 - Kathy Brasier, Agricultural Sciences
 - Charles Abdalla, Agricultural Sciences
 - Neal Fogle, Cooperative Extension
 - Tim Kelsey, Agricultural Sciences
 - Joann Kowalski, Cooperative Extension
 - Brian Orland, School of Landscape Architecture
 - Jon Laughner, Cooperative Extension
 - Walt Whitmer, Cooperative Extension
 - Peter Wulfhorst, Cooperative Extension
 - Quality of Life
 - Ted Alter, Agricultural Sciences
 - Kathy Brasier, Agricultural Sciences
 - Leland Glenna, Agricultural Sciences
 - Stephan Goetz, Agricultural Sciences
 - Charles Abdalla, Agricultural Sciences
 - Fern Willits, Agricultural Sciences
 - Schools
 - Kai Schafft, Education
10. Transportation infrastructure
- Roads
 - Barry Scheetz, Engineering
 - Martin Pietrucha, Engineering
 - Steve Bloser, Engineering
 - Dave Creamer, Engineering
 - Tim Ziegler, Engineering
 - Rail
 - John Tyworth, Smeal
11. Legal and Ethical Dimensions
- Ross Pifer, Penn State Dickinson Law
 - Tom Murphy, Cooperative Extension
 - Neal Fogle, Cooperative Extension
 - Nancy Tuana, Liberal Arts

- Jonathan Marks, Liberal Arts
- Peter Wulforth, Cooperative Extension
- Charles Abdalla, Agricultural Sciences

Michael Allan Arthur

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Education

1971 BS, University of California, Riverside (Geology)
1974 MS, University of California, Riverside (Geology)
1979 PhD, Princeton University (Geology-Geochemistry)

Professional Experience

6/77 - 9/77 Geologist, WAE, U.S. Geological Survey, Branch of Oil and Gas
9/77 - 9/79 Staff Scientist and Post-Graduate Research Geologist, Deep Sea Drilling Project, Scripps Institution of Oceanography
9/79 - 9/81 Geologist, Branch of Oil and Gas Resources, USGS
9/81 - 9/83 Asst. Professor of Geology, University of South Carolina, Columbia, SC
9/83 - 6/89 Assoc. Professor of Oceanography, Graduate School of Oceanography, University of Rhode Island
6/89 - 12/90 Prof. of Oceanography, Graduate School of Oceanography, University of Rhode Island
1/91 - 6/97 Prof. and Head, Dept. of Geosciences, Pennsylvania State University
7/97 - present Professor of Geosciences, Pennsylvania State University

Honors and Awards

1980 American Association of Petroleum Geologists President's Award
1984 Fellow of the Geological Society of America
1996 Francis P. Shepard Medal in Marine Geology from the SEPM (Society for Sedimentary Geology)
2000 Wilson Award for Research, College of Earth and Mineral Sciences, Penn State
2003 Elected Fellow of the American Geophysical Union
2005 Wilson Award for Service, College of Earth and Mineral Sciences, Penn State
2007 L.L. Sloss Award, Geological Society of America, Sedimentary Geology Division
2007 Elected Fellow of the American Association for the Advancement of Science (AAAS)

Member and Professional Service (past 7 years)

American Geophysical Union
American Association for the Advancement of Science
Geological Society of America (Councilor, 2003-2006),
Sigma Xi Scientific Honor Society
Editor, *Paleoceanography* (AGU) 1999- 2002.
Marine Geology, Co-Editor in Chief (1994-2000) [Elsevier Pub. Co.]
Editorial Board (Geochemistry), McGraw-Hill Encyclopedia of Science, 2003-5
Chair, GSA Penrose Medal Committee (2003-5)
Member, AGU Paleoclimatology and Paleoclimatology Technical Committee (2000-2004)
Chair, GSA "Young Scientist Medal" Committee (2007-2010)
Member, Joint Oceanographic Institutions Board of Governors (2005-7)
Member, National Research Council Committee--Geological Record of Biosphere Dynamics (2002-2004)
Woods Hole Promotion and Tenure Evaluation Committee (external member) (2006)
Member, American Geophysical Union Fellows Committee (Ocean Sciences) (2004-2006)
Member, GSA L.L. Sloss Medal Committee (2009-10)

Department and University Service (past 7 years)

Member, Dept. of Geosciences Graduate Program Committee (2003-5), 2008-10
Member, Dept. of Geosciences Promotion and Tenure Review Committee 2001-2003, 2005-2006, 2008-10
Member, Penn State Marine Science Minor Program Committee 1995-present
Member, Maurice Udall Scholarship Committee (PSU), 1998-2006
Chair, Dept. of Geosciences Awards Committee 2000-2004, 2006-7
Member, Dept. of Geosciences Executive Committee 2004-2005

Member, BRIE IGERT, 2001-2006

Member, Astrobiology Research Center, 1998-2012

Penn State Representative to Ocean Leadership Consortium, 2008-present

Co-Director, Marcellus Initiative for Outreach and Research, 2010-present

Recent Publications (peer reviewed)

1. **Arthur, M.A.** and B. B. Sageman, Sea Level Control on Source Rock Development: Perspectives from the Holocene Black Sea, the mid-Cretaceous western interior of North America, and the Late Devonian Appalachian Basin. In Harris, N., and Pradier, B., Eds., *The Deposition of Organic Carbon-rich Sediments: Models, Mechanisms and Consequences*, SEPM (Soc. Sedimentary Geol.) Special Publication 82, 35-59, 2004.
2. Ennyu, A. and **M. A. Arthur**. Early to Middle Miocene paleoceanography in the southern high latitudes off Tasmania. In *The Cenozoic Southern Ocean: Tectonics, Sedimentation and Climate Change Between Australia and Antarctica*, Nevile F. Exon, James P. Kennett, and Mitchel J. Malone, eds., *AGU Geophys. Monogr.*, v. 151. 215-234. 2005
3. Ennyu, A. and **M. A. Arthur**. Data Report: Oxygen and carbon stable isotope records of the Miocene calcareous microfossils from ODP Leg 189 Sites 1170 (South Tasman Rise) and 1172 (East Tasman Plateau). In *Proceedings of the Ocean Drilling Program: Scientific Results*, ODP Leg 189, Kennett, J.P., Exon, N., and Malone, M. et al. [189SR-112], 2004.
4. Hurtgen, M.T., **M.A. Arthur**, and A.R. Prave. The sulfur isotope composition of carbonate-associated sulfate in Mesoproterozoic to Neoproterozoic carbonates from Death Valley, California, in Amend, J.P., et al., eds., *Sulfur biogeochemistry—Past and present: Geological Society of America Special Paper 379*, p. 177–194, 2004.
5. Hurtgen, M. T., **M. A. Arthur** and G. Halverson. Neoproterozoic Sulfur isotopes, the evolution of microbial sulfur species and the burial efficiency of sulfide as sedimentary pyrite. *Geology*, 33, 41-44, 2005.
6. Cordes, E. E., **M. A. Arthur**, K. Shea, and R. Arvidson, C. R. Fisher. Modeling the mutualistic interactions between tubeworms and with microbial consortia. *PLoS Biology*, 3, e77, 1-10, 2005.
7. Kump, L.R., A. Pavlov, A. and **M. A. Arthur**. Massive release of sulfide to the surface ocean and atmosphere during intervals of ocean anoxia. *Geology*, 33, 397-400, 2005.
8. Frank, T. D., Thomas, D. J., Leckie, R. M., **Arthur, M. A.**, Bown, P. R., Jones, K., Lees, J. A., The Maastrichtian record from Shatsky Rise (northwest Pacific): A tropical perspective on global ecological and oceanographic changes. *Paleoceanography*, v. 20, No. 1, PA1008 10.1029/2004PA001052. 2005.
9. Hurtgen M.T., Halverson, G.P., **Arthur M.A.**, Hoffman P.F. Sulfur cycling in the aftermath of a Neoproterozoic (Marinoan) snowball glaciation: Evidence for a syn-glacial sulfidic deep ocean. *Earth and Planetary Science Letters*. 245, 551-570, 2006.
10. White, T.S. and **Arthur, M.A.** Organic carbon production and preservation in response to sea-level changes in the Turonian Carlile Formation, U.S. Western Interior Basin. *Palaeo*, 235, 223-234, 2006.
11. Sageman, B.B., Meyers, S., and **Arthur, M.A.** Orbital time scale and new C-isotope record for Cenomanian-Turonian boundary stratotype. *Geology*, 34, 125-128, 2006.
12. Riccardi, A.L., **Arthur, M. A.**, and Kump, L.R. Sulfur isotopic evidence for chemocline upward excursions during the end-Permian mass extinction. *Geochim. Cosmochim. Acta*, 70, 5740-5752, 2006.
13. Riccardi, A., Kump, L.R., **Arthur, M.A.**, and D'Hondt, S. Carbon isotopic evidence for chemocline upward excursions during the end-Permian event. *Palaeogeogr. Palaeoclim., Palaeoecol.*, doi:10.1016/j.palaeo.2006.11.010, 2007.
14. Junium, C. and **Arthur M.A.**, Nitrogen cycling during the Cretaceous, Cenomanian-Turonian, Anoxic Event. *Geochem., Geophys., Geosystems*, 8, 1-18, doi:10.1029/2006GC001328, 2007.
15. Dattagupta, S., **Arthur, M. A.** and Fisher, C.R. Modification of sediment geochemistry by the hydrocarbon seep tubeworm *Lamelibranchia luymesii*: A combined empirical and modeling approach. *Geochim. Cosmochim. Acta*, v. 72, p. 2298-2315, 2008.
16. Fuqua, L. M., Bralower, T.J., **Arthur, M.A.** and Patzkowsky, M.E. Evolution of Calcareous Nannoplankton and the Recovery of Marine Food Webs After the Cretaceous-Paleocene Mass Extinction. *Palaios*. v. 23; no. 4; p. 185-194; DOI: 10.2110/palo.2007.p07-004r. 2008
17. Junium, C.K., Mawson, D.H., **Arthur, M.A.**, Freeman, K. and Keely, B.J. Unexpected occurrence and significance of zinc alkyl porphyrins in Cenomanian-Turonian black shales of the Demerara Rise. *Organic Geochemistry*, v. 39, 1081-1087. 2008
18. Thomas, R.B.; Freeman, K.H.; **Arthur, M.A.**, Intramolecular carbon isotopic analysis of acetic acid by direct injection of aqueous solution. *Organic Geochemistry*, v. 40 p. 195-200, 2009.

19. Godwin, C.M.; **Arthur, M.A.**; Carrick, H.J Periphyton nutrient status in a temperate stream with mixed land-uses: implications for watershed nitrogen storage *Hydrobiologia*, v. 623, p. 141-152, 2009.
20. **Arthur, M.A.**, Carbonate rocks deconstructed. *Nature* 460, 698-699. 2009.

Also a series of site chapters and summaries in:

Bralower, T J, Premoli Silva, I, Malone, M J, Arthur, M A, Averyt, K, Bown, P R, and others in Shipboard Scientific Party, Proceedings of the Ocean Drilling Program, initial reports, extreme warmth in the Cretaceous and Paleogene; a depth transect on Shatsky Rise, Central Pacific; covering Leg 198 of the cruises of the drilling vessel JOIDES Resolution; Yokohama, Japan, to Honolulu, Hawaii; sites 1207-1214; 27 August-23 October 2001. Ocean Drilling Program, Leg 198, Shipboard Scientific Party, College Station, TX, United States (USA); *Proceedings of the Ocean Drilling Program, Part A: Initial Reports, vol.198*, 2002

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Professional Preparation

The Pennsylvania State University B.S. (Agronomy) 1980

Appointments

2010 Co-Director, Marcellus Center for Outreach and Research (MCOR), Pennsylvania State University
1985- present Extension Educator, Penn State Cooperative Extension
2005- present Leader, Penn State Marcellus Education Team (MET);
 Co-Chair, Penn State Natural Gas Working Group
2008-present Co-Leader, Marcellus Shale Education and Training Center (MSETC)

Publications

2010 Southwest Pennsylvania Marcellus Shale Workforce Needs Assessment (co-author)

Synergistic Activities

- More than 200 presentations (2006- 2010 on Marcellus Shale topics to stakeholders including landowners, business groups, local elected officials, state agencies, and professional groups with estimated attendance of around 50,000
- Legislative briefings (10) on Marcellus Shale development and impacts with Pennsylvania senators, representatives and respective staffs and Pennsylvania state senators, representatives and staffs
- More than 400 interviews (2008-2010) with media including Wall Street Journal, New York Times, Time Magazine, Philadelphia Inquirer, WDVE (Pittsburgh), WPSU (University Park), Sun Gazette (Williamsport, Pa.), Tribune Democrat (Johnstown, Pa.), Patriot News (Harrisburg, Pa.)
- Committee member for conferences including Marcellus Workforce Forum (2009, 2010); Marcellus Shale Workforce Expo (2010); PA Natural Gas Summit (2008-2010)
- Invited talks at conferences and workshops including Ohio Land Use Conference (2010); PBI Oil & Gas Colloquium (2010); Regional Marcellus Shale Symposium , NY (2010)