

# 2011 Marcellus Summit Research Poster Session

Penn Stater Conference Center, University Park, PA

5:30-7:00PM

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[www.MarcellusSummit.org](http://www.MarcellusSummit.org)



**Real Issues, Balanced Perspectives**

November 16–18, 2011

The Penn Stater Conference Center Hotel  
State College, Pennsylvania

## **Potential impact of hydrofracking spills on groundwater quality.**

Wenjing Sang, Cathelijne R. Stoof, Steven Pacenka, Tammo S. Steenhuis. Department of Biological and Environmental Engineering, Cornell University

Presenter: Wenjing Sang ws258@cornell.edu

### **Abstract**

With the increase in unconventional shale gas extraction, concern over impacts of related spills increases. Small scale laboratory studies were carried out to assess the potential impact of such spills on soil and groundwater quality. The effect of flowback water and production brine on colloid transport in soils was investigated. Colloids are small particles that consist of clay particles, bacteria, etc. and bind metals and organic matter. When colloids move through the soil, with the pollutants they carry, groundwater can be contaminated. In our laboratory experiment, we used a bright field microscope to visualize colloid transport in sand. Colloid movement and retention was quantitatively assessed by measuring colloid concentrations at the bottom of the sand column. In these experiments, a large increase in colloid transport was observed with flowback water. Thirty three percent of the colloids were released from the sand column with flowback water while only 3% of colloids were flushed out when production brine or water was used. This should not be surprising since the chemicals added to fracturing fluid are intended to push fine particles farther into fissures created by the “fracking” process. Our experiments suggest that the risk of groundwater contamination by remobilization of colloids and their associated pollutants is greater for flowback water spills than for spills of production brine.

## **Landowner Coalitions in the Marcellus Shale.**

Eleanor Andrews. Geography Department. Pennsylvania State University

Presenter: Eleanor Andrews esa5044@psu.edu

### Abstract

This poster summarizes empirical research on a critical site of the politics of the development of the Marcellus Shale: local landowner coalitions. Across the region, landowners are pooling their acreage and forming coalitions to negotiate collective lease agreements with drilling companies, in part because of the (perception of) straightforward economic and environmental benefits, but also because through participation, they regain some control over a whole suite of economic, environmental, and political issues. Using a political ecology perspective, this research explores the formation and micropolitics of these coalitions in a highly varied and dynamic context and identifies how different forces have impacted these dynamics, and by extension, group negotiations and final lease agreements. Interviews with representatives of fifteen landowner groups reveal a wide range of histories, objectives, institutional structures, and outcomes for the groups. The resulting diversity of lease agreements (and non-agreements) is both shaped by, and shaping Pennsylvania's landscapes.

## **Impacts of Natural Gas Development in the Marcellus Shale: A Research Summary.**

Kathryn J. Brasier, Matthew R. Filteau, Jeffrey Jacquet, Tim W. Kelsey, Diane K. McLaughlin, Teri Ooms, Danielle C. Rhubarb, Rich Stedman, Sherry Tracewski, Fern K. Willits.

Department of Agricultural Economics and Rural Sociology, Pennsylvania State University

Presenter: Danielle C. Rhubarb [dcr185@psu.edu](mailto:dcr185@psu.edu)

### **Abstract**

Research conducted during 2009-2011 with six counties that were experiencing some of the highest levels of drilling in the Marcellus Shale will be summarized by documenting the early social and economic impacts of Marcellus Shale development and providing insight into the experiences of residents in the region. Specifically, the poster describes perceptions of the effects of development as they vary across the region, by level of development, and by other critical factors such as historical and geographic context, and experience with and trust in the social institutions involved in managing unconventional natural gas development. The results describe community leaders' perceptions of the following issues: population increases and diversification, increased income for property-holders who leased their land, increased economic activity, financial pressures on those not benefiting directly from development of the Marcellus Shale, significant changes to communities' social and physical infrastructure, concern over the potential divisions created or exacerbated in communities, community conflict over the social and the environmental consequences of development. A fundamental issue that comes across in the interviews is the desire to balance needed economic growth with managing changes to communities; these are changes that have the potential to fundamentally alter their conceptions of the place in which they live and the features of the place that they value.

## **Marcellus by Design: A studio on Rule-based Planning in Bradford County, PA.**

K. Altenbach, D. Barefoot, L. Gotschall, E. Gross, E. Hahn, K. Hess-Reichard, D. Himes, C. Karduck, A. Luddy, J. Matthews, A. Miller, N. Monroe, D. Rebok, S. Rumbaugh, L. Schreiner, C. Smith, K. Waksmunski, M. Weir, D. Yackuboskey, F. Young, B. Orland, C. Steinitz, and C. Cole. Department of Landscape Architecture, Pennsylvania State University

Presenter: C. A. Cole [cac13@psu.edu](mailto:cac13@psu.edu)

### Abstract

A considerable amount of data has been generated concerning the Marcellus Shale. While much of the previously available data has been focused on ecological or environmental concerns, very little has been used in efforts at planning, either short-term or long-term. To address this problem, the students of LArch 414-The Marcellus Shale Studio-spent fall semester 2011 developing background data into a format useful for rule-based planning, and then used that data to generate some scenarios for the future of Bradford County in the near and distant future. The project has resulted in a web site developed to allow for local residents to envision and understand the impacts (good and bad) that the Marcellus Shale brings. The web site develops scenarios from different perspectives, including farming, and residents of small towns and villages. We consider the view from the roads as well as the impacts on local forests. The intent of the studio,, and the web page, is to inform rather than advocate. This studio is the first in a recurring series of studios focused on issues related to the Marcellus Shale and the impacts that shale development has upon the residents and landscapes of Pennsylvania.

## **Educational and Community Stakeholders Perspectives Regarding Marcellus Shale Gas Development Impacts: Paradoxes of Prosperity and Uncertainty.**

Kai Schafft, Penn State Department of Education Policy Studies. Leland Glenna, Penn State Department of Agricultural Economics and Rural Sociology. Yetkin Borlu, Penn State Department of Agricultural Economics and Rural Sociology. Brandn Green, Penn State Department of Agricultural Economics and Rural Sociology

Presenter: Kai Schafft kas45@psu.edu

### Abstract

Social scientists refer to the often dramatic social and economic effects of rapid natural resource development as boomtown development. Although boomtown development can bring substantial economic benefit, at least in the short term, it also can pose serious challenges for local governments, schools and other community institutions as a result of population changes and new demands on social and material infrastructure. We conducted a survey of high school administrators across Pennsylvania's Marcellus region, followed by qualitative interviews with fifty school administrators and community stakeholders in Pennsylvania Northern Tier communities. We analyze school district administrators' perceptions of Marcellus gas development in the context of socio-economic status, rural-urban, and level of gas drilling activity. Respondents report significant local economic activity, but little economic benefit accruing back to schools. This is coupled with pronounced uncertainty regarding how to best manage a variety of challenges and opportunities in the context of rapidly changing community conditions.

## **The Hydraulic Fracturing (HF) Process: Real Concern or Misdirected Focus Concerning Threats to Drinking Water Supplies (DWS).**

Peter E. Penoyer. National Park Service. Fort Collins, Colorado.

Presenter: Peter E. Penoyer [pete\\_penoyer@nps.gov](mailto:pete_penoyer@nps.gov)

### Abstract

Massive development of several shale gas reservoirs including the Marcellus shale has established significant new unconventional resource reserves through multi-stage hydraulic fracturing coupled with horizontal drilling.

This poster illustrates that the real concern for impacts to potable aquifers (DWS) of a more widespread and long term nature will likely be stray gas (methane) migration from non-targeted gas bearing zones. Managing risk, detecting the occurrence of and preventing impacts from stray gas migration should be the focus rather than subsurface migration of hydraulic fracturing fluids for which limited pathways and little (if any) documentation exists. Methane is far more abundant, concentrated and mobile than the frack fluids introduced into the subsurface during the hydraulic fracturing “process” and poses an explosion hazard. Nearly all states (except New York in recently proposed regulation of High Volume Hydraulic Fracturing) and the BLM, permit well designs with substantial intermediate depth intervals of open, uncemented annuli outside casing strings. This leaves potentially open a several thousand foot cross-strata migration path to the surface casing seat for stray methane. Under deeply fractured bedrock conditions that may extend below required surface casing depths, a migration pathway to potable freshwater aquifers from a borehole over pressured (above hydrostatic) by gas could circumvent cemented surface casings of good integrity via this natural fracture system. This poster visually presents this migration mechanism and illustrates this risk for discussion purposes, so that its impact and frequency of occurrence under various geological conditions might be considered in the context of the expanding unconventional resource plays.

## **Educating the public about Marcellus Shale development in Northeastern Pennsylvania by an informational website.**

Erich Schramm, David Hines, Courtney Sperger, Dr. Ken Klemow. Institute for Energy and Environmental Research for Northeastern Pennsylvania

Presenter: Erich Schramm erich.schramm@wilkes.edu

### Abstract

Since the first Marcellus shale well was drilled in 2003 in western Pennsylvania, Marcellus Shale development has seen a rapid increase in the state. The Marcellus Shale infrastructure is complex, including site selection, site development, production, transport and restoration. Since there is a short history of natural gas development in Northeastern Pennsylvania, the public seeks facts and often turns to news sources such as environmental organizations or natural gas publications, which can base their information on personal beliefs or biases about the natural gas industry. Since January 2011, the Institute for Energy and Environmental Research for Northeastern Pennsylvania (IEER) website has provided unbiased information about the industry. It has grown to more than 250 pages, including a searchable library, news feed, and basic educational essays. Site use is tracked through Google Analytics© through which a comprehensive quarterly report is generated revealing that the IEER makes contact with its audience, indicated by widespread use of the site in the U.S. and internationally. The next step is to develop a report to track individual page use which will help to determine which page format works best, the alignment between current news and relevant page hits, and how to incorporate water quality data into the website. The IEER is dedicated to providing unbiased, scientific based information that citizens can use to make informed decisions.

## **Water-Quality Monitoring in the Marcellus Gas-Drilling Area in the Beech Creek Watershed**

Md. Khalequzzaman, Lock Haven University of PA; John Way, Lock Haven University of PA; Christopher Darwin, Lock Haven University of PA; Steve Cornia, Lock Haven University of PA; Matt Keele, Lock Haven University of PA; Lindsay Repman, Lock Haven University of PA; Kent Addis, Pennsylvania Senior Environmental Corps; Frank Bianco, Pennsylvania Senior Environmental Corps; Dan Delotto, Pennsylvania Senior Environmental Corps; Kathryn Farrigno, Pennsylvania Senior Environmental Corps; Ken Johnson, Pennsylvania Senior Environmental Corps; Stan Lembeck, Pennsylvania Senior Environmental Corps; Larry Lukens, Pennsylvania Senior Environmental Corps; Steve Lupis, Pennsylvania Senior Environmental Corps; Ann Donovan, Centre County Conservation District

Presenter: Md. Khalequzzaman mkhalequ@lhup.edu

### **Abstract**

Extracting natural gas from the Marcellus Formation requires large volumes of water and significant quantities of chemical additives to stimulate production from this tight, Middle Devonian shale unit. Accidents or the mismanagement of any fluids involved in the drilling, hydrofracing, and production processes have the potential to threaten surface and ground-water quality in those portions of the Susquehanna River basin impacted by exploitation of this resource.

Early in 2010, representatives from Lock Haven University's Geology program, the Centre County Chapter of Pennsylvania Senior Environmental Corps, the Centre County Conservation District, and the Beech Creek Watershed Association forged a partnership to establish a baseline water-quality-monitoring program in the Beech Creek watershed (BCW) in Centre and Clinton counties, PA. Using GIS techniques to identify potentially impacted sub-watersheds within the BCW, the partners selected 12 sampling sites that lie upstream and downstream of gas-well drilling locations.

Along with assessing visual conditions of the streams and their watersheds, the volunteers collected field data including: temperature, pH, total dissolved solids, conductance, oxidation-reduction potential, dissolved oxygen, and flow rate. Laboratory testing yielded total suspended solids, barium, total iron, manganese, aluminum, calcium, magnesium, copper, arsenic, chloride, and sulfate data. This study ran from May 2010 to November 2010.

Preliminary results indicate no apparent adverse impact on water quality in sampled streams. Although this was a modest attempt to assess water quality throughout a portion of the basin, it is the intention of the partners to seek additional funding in order to continue this monitoring project and add more sample sites and parameters to this project.

## **Initial landscape changes associated with Marcellus Shale development.**

P. Drohan, M. Brittingham, and J. Bishop. Pennsylvania State University

Presenter: Joe Bishop jab190@psu.edu

### Abstract

Exploration and development of the Marcellus shale region is occurring at a rapid rate with number of permits and wells drilled increasing exponentially. We conducted a preliminary pre and post GIS analysis of disturbance associated with Marcellus well pads and present results that identify patterns of landscape fragmentation and habitat loss associated with Marcellus Shale development. Approximately 45% of wells are going into farmland and 54% into forest habitat. Twenty-three percent of wells are going into core forest habitat (areas >100m from a pre-existing edge or opening) which increases the extent of fragmentation. The well pad footprint averaged 3 ha (6.7 acres). On average, there are 2.3 wells per pad and 77% of the pads have 1 or 2 wells. Eighty-eight percent of the pads and 90% of the wells are on private land. Restoration efforts were noted on 16% of the sites and focused primarily on establishing grassy cover. Eighty four percent of the sites had no reclamation at this time. Our results suggest that if rates and patterns of development continue as they currently are, core forest habitat is at risk particularly on private land. As a consequence, public land will become increasingly important for large blocks of undeveloped habitat and the ecosystem services provided.

## **Shale Gas Innovation and Commercialization Center.**

Bill Hall. Ben Franklin Technology Partners

Presenter: Bill Hall billhall@rtto.psu.edu

### Abstract

The Ben Franklin Technology Partners CNP is uniquely qualified to foster communications between industry and research institutions. SGICC will implement a program similar to their well established Translational Research in Energy Support Program (TRESP). This program is designed to provide the seed capital to accelerate promising research and early stage small companies or private sector emerging concepts and technologies toward commercialization SGICC will also act to link researchers and technology with industry partners, investors, end-users, and government agencies to address real market issues and solve problems. A panel of industry experts, technologists, and business investors will review each opportunity to allocate resources, both financial and support. SGICC will also make its other resources-contacts, experts, research, market data, etc.-available to supported projects in order to ensure that each is properly tailored and directed to its own market opportunity. Creating this support network and infrastructure will help the Institute meet its goals of introducing technology to aid in the exploitation and development of Shale Gas resources.

### Goals

1. Identify and support research of new technologies that will facilitate efficient and environmentally safe extraction and transport of Natural Gas in Pennsylvania, focusing on Pennsylvania research universities and companies.
2. Identify new products and new markets for natural gas through industry collaboration and market research and encourage university researchers to seek innovative solutions to those problems.

## **Community and Social Implications of Marcellus Shale Development for Families with Children**

April L. Gunsallus, Diane K. McLaughlin, Kathy Brasier, Kelly D. Davis, Molly A. Martin.  
The Pennsylvania State University.

Presenter: April L. Gunsallus alg978@psu.edu

### **Abstract**

The Marcellus Shale Family Project team examines the nature and extent of Marcellus Shale gas development for the well-being of families with children. Our research compares the experiences of families who live in places with high and low drilling activity. The first phase of this two phase study involves interviewing key informants from four Pennsylvania counties. Key informants were identified based on their expertise in one of six broad areas: community, natural environment, families and health, work and economic development and education. Participants answered open-ended questions about what makes the community a good place to raise a family, the levels of trust and interaction in the community, the importance of the natural environment to residents and whether/how these have or are expected to change with development of Marcellus Shale. The second phase involves interviewing and surveying parents in families with children (up to 80 families) using questions similar to those for the key informants, but also asking specifically about family relationships, children's health, activities, parent's friends and social support and direct experiences with Marcellus Shale leasing, drilling and income. The poster will provide preliminary results about the different ways in which Marcellus Shale development can affect family well-being and which families are most likely to be affected. One goal of this study is to provide information to local decision makers to use in responding to the needs and concerns of families impacted by Marcellus Shale development.

## **Marcellus Shale Wealth Management Education Program.**

Dave Messersmith, Tom Murphy, Carol Loveland, Cathy Bowen, Mike Jacobson, Mark Madden and Joann Kowalski. Penn State Cooperative Extension.

Presenter: Dave Messersmith dtm101@psu.edu

### **Abstract**

With natural gas leasing and exploration spreading throughout much of Pennsylvania, many landowners have received significant amounts of income from a natural gas lease bonus payment or gas royalties.

Starting in early 2008, a team of Penn State Extension Educators and Faculty developed a Wealth Management educational program specifically for landowners who were experiencing sudden wealth as a result of gas lease or royalty income. Topics included:

- How natural gas markets affect price.
- Land Pooling/Unitization.
- Estate planning issues.
- Personal Income Tax Implications.
- Choosing a Financial Planner.
- Basic Financial Planning and Investing.

During the 2009-2010 program year, eight face-to-face Wealth Management workshops were held throughout the Marcellus 'fairway' in Pennsylvania with a total of 1,350 participants. Evaluation results from these programs indicated that approximately 60% of participants planned to take at least one recommended action (i.e. pay down high interest debt, set aside funds to pay taxes, hire a financial planner, etc) as a result of attending the program.

In addition to face-to-face workshops, publications titled 'A Landowners Guide to Financial Management' and 'Tax Treatment of Natural Gas' were developed to help Marcellus landowners better understand financial management, investing, estate planning and personal income tax implications of receiving natural gas related income.

## **Performance & Cost Effectiveness of Add-On CNG Dual Fuel Conversion Kit for Fleet Operations of Heavy Duty Vehicles**

André Boehman, Joel Anstrom, Tim Cleary, Claire Maxey, Vickey Kalaskar, Dongil Kang and Vince Zello, Penn State University

Presenter: André Boehman boehman@ems.psu.edu

### **Abstract:**

This project explores the conversion of existing heavy-duty diesel trucks to dual fuel vehicles which utilize the low cost, domestically available natural gas resources being developed in Pennsylvania through low cost “add-on” systems. Current natural gas add-on systems, having their own control units that do not communicate with the engine control unit, supplement the power of the engine by providing a boost in horsepower rather than displacing some of the diesel with natural gas to maintain the same performance of the engine. Lab testing, and will be conducted to evaluate power and performance with diesel substitution using different engine control strategies. Researchers from the Larson Institute Hybrid and Hydrogen Vehicle Research Laboratory will assist Hawbaker with installation of a commercial CNG conversion system onto a test bed Mack tractor. Performance and tuning of the Diesel/CNG fuel system and supporting equipment will be validated on the test track and dynamometer of the Penn State Bus Research Center and on the road. The validated system will then be replicated for installation on several tri-axle dump trucks for further validation in simulated service on the road. Concurrently, an economic cost-benefit analysis will be performed to assess the net cost savings, if any, this system may have in a typical fleet vehicle operated by Glenn O. Hawbaker, Inc. If the engine testing and cost-benefit analysis provide favorable results, it is expected that GOH will convert several large triaxial trucks to dual fuel engines as a trial.