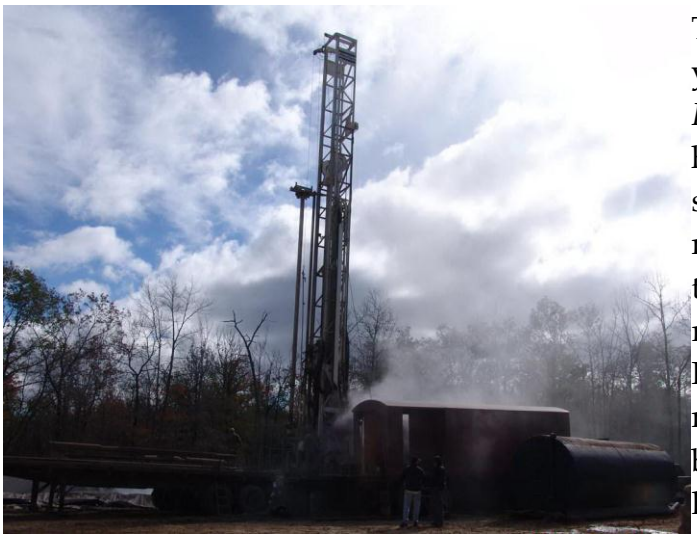
In This Issue...

The Hemlock

Volume 2, Issue 6 (March 2009)

"If the trout are lost, smash the state." --Thomas McGuane



This month marks the one-year anniversary of *The Hemlock*. Since last March we have published articles on such diverse topics as mushrooms, snowshoeing, the rails-to-trails system, recycling, the Susquehanna River, global warming, and mountain biking, as well as book reviews, directions for local hikes, nature photography and nature-inspired poetry. Our contributors have been students and faculty members in Biology, Communication Media, Geology, Philosophy, Art, English, and Management; and we've published articles from the secretarial and physical plant staffs, LHUP alumni, and members of the Lock Haven community. And all this has been accomplished without a cent of funding and without killing a single tree. Thanks to all of our contributors as well as to the 300-400 of you who are reading our issues each month. Please help us to continue this effort by contacting Bob Myers about articles that you'd like to contribute. Our previous issues can be accessed at "Past Issues of *The Hemlock*." Our "Hikes of the Month" can be found at Hemlock Hikes.

This issue is more narrowly focused than previous ones. In November, the Environmental Focus Group organized a panel discussion on the natural gas drilling in the Marcellus Shale, and many of us walked away from that session deeply concerned about the environmental impact of this drilling. Indeed, it doesn't seem to be an exaggeration to say that the development of the Marcellus Shale represents the biggest threat to the Pennsylvania outdoors that our generation will face. Accordingly, we've devoted this issue to the

"What Can You Do?"

"More Information on the Marcellus Shale"

"KCNet Contracts with Cartridge World" by John Way

Past Issues

controversies surrounding natural gas production in central Pennsylvania.

Prospects and Challenges of the Marcellus Shale

--Loretta Dickson and Md. Khalequzzaman (LHUP Geology Professors)

Tapping into the "super giant" gas field contained within the Marcellus Shale has the potential for significant economic benefit throughout the Commonwealth of Pennsylvania by creating new jobs, generating revenue, and contributing to our nation's energy independence. While global petroleum production and supply is already in decline and predicted to diminish further, production of unconventional natural gas using innovative drilling technology will add to our energy needs for decades to come. Unlike burning oil and coal that emit an entire host of toxic elements and noxious gases, including mercury, arsenic, sulfur dioxide, and nitrous oxide; methane is considered a clean energy source. Carbon dioxide and water are the only emission byproducts of burning methane.

The benefits of natural gas exploration are evident; however, we cannot ignore our past experience with unregulated coal mining that left Pennsylvania with environmental degradation that continues to impose serious financial and environmental burdens. Accordingly, the people of Pennsylvania have legitimate reasons to be concerned about another wave of resource extraction that also has the potential to negatively impact water resources and ecosystems. If the extraction of natural gas from the Marcellus Shale is not done within the framework of existing laws and regulations that safeguard the environment, we may create another negative environmental legacy for our future generations.

Drilling technology was key to making the Marcellus Shale a viable natural gas source. The natural gas is contained within pore spaces and fractures in the rock. These spaces are very small and poorly connected, so pumping to draw gas from pore spaces is inefficient. In 2003, Range Resources, headquartered in Fort Worth, Texas, applied horizontal drilling and hydofracing to the gas reserves in the Marcellus Shale in Washington County, Pennsylvania, and the success of this well led to a recalculation of the amount of gas recoverable from these formations.

Drilling to reach the Marcellus Shale requires a depth of approximately one mile, and then the drill bit is turned progressively through an arc until it can continue horizontally. Horizontal drilling in the shale is more effective than traditional drilling because the existing fractures are predominantly vertical, so drilling perpendicular to fracture orientation will maximize the number of fractures intersected. "Hydrofracing" produces a more extensive network of interconnected fractures by pumping in large volumes of pressurized water and sand, which increases the size of existing fractures and generates new fractures. Highly permeable sand is then injected into the fractures to hold them open, allowing the gas to flow easily through the open channels. Drilling costs are extremely high to reach significant depths, and horizontal drilling adds to the expense. Moreover, a range of three to nine million gallons of water per well is required for effective "hydrofracing."

Applying these new technologies to wells in the Marcellus Shale is anticipated to spark a "gas boom" in Pennsylvania. Industry experts estimate nearly 16,000 jobs may be created in the next two years while exploration is still underway. The long-term production of horizontally drilled and "hydrofraced" wells in the Marcellus Shale is unknown and presumed to decline over time. Nevertheless, this does not sway the determination of those drilling because the wells can easily be "hydrofraced" again to increase production.

Although methods of horizontal drilling and "hydrofracing" prove successful in high yield extraction, there are serious concerns about possible environmental impacts. Drilling operations involve heavy traffic of trucks and machinery that impact road infrastructure and disturb the land by construction of drilling pads and pipelines. Watershed ecosystems sensitive to construction and traffic are negatively impacted by increased sedimentation in streams from gravel roads and wildlife habitats are segmented by the drilling operations.

The vast amount of water required for "hydrofracing" operations is of particular concern. Some drilling operations are near the headwaters of streams with low volume, but exceptional water quality. Organizations such as Trout Unlimited have documented the unauthorized withdrawal by drilling companies of water from low-volume streams, which endangers fish and their food sources. The inconsistency of water withdrawal standards between the

various river basins or watersheds in Pennsylvania adds to this problem.

The enormous volumes of water pumped into deep wells dissolve salts, metals, and radioactive substances that are contained within the Marcellus Shale. These dissolved materials ultimately return to the surface, and if not handled properly, have the potential to contaminate both surface water and private groundwater supplies. The used water is estimated to contain up to 229,500 milligrams of total dissolved solids per liter (mg/L), as compared to permissible limits of 500 mg/L in drinking water.

Wastewater from drilling and "hydrofracing" is supposed to be temporarily stored in open-air, lined treatment ponds, and then trucked away for proper disposal. However, a recent visit to a local drilling operation indicated a different procedure. The drilling crew described how the wastewater is tested for pH, and then dumped from the lined pond onto the ground. This raises concern about the lack of adequate training of drilling crews on environmentally sound treatment and disposal methods. Further concerns focus on the capacity to treat the vast volumes of contaminated wastewater from drilling. Currently there are only two waste-treatment facilities in the state of Pennsylvania that are equipped to treat wastewater from gas drilling.

While the economic benefit from natural gas drilling in the Marcellus Shale may be great, and utilizing methane as an important clean energy source is desirable, the potential for environmental damage is significant if drilling is not conducted according to current laws and standards. The environmental impacts of unregulated coal mining in Pennsylvania until the 1970s persist even today. Over 285,000 acres of land are considered "abandoned mine lands", and more than 3,000 river miles are contaminated by acid mine drainage (AMD) that is a direct result of coal mining. The AMD is the most common cause of water-related environmental degradation in Pennsylvania, which will cost over $16 billion dollars to clean up. After spending millions of dollars over the last few decades, AMD still remains a major impediment to fulfilling the objectives of the Pennsylvania Wilds initiatives and a major economic burden for the commonwealth. The environmental legacy of the coal mining should make us cautious about the extraction of natural gas from

the Marcellus Shale in Pennsylvania and elsewhere.

40 years of Natural Gas Production and Storage on State Forest Land
--Butch Davey (Retired Sproul State Forest District Forester)

In 1955 the Pennsylvania Legislature enacted legislation which authorized leasing of oil and gas rights on State Forest land. As a District Forester, I've seen first-hand the consequences of this drilling on our public lands, and I'm deeply concerned about the drilling in the Marcellus Shale.

In the 1950s the Leidy field produced natural gas on both private land and state forest land. On state forest land the leasing and production was managed from the Central Office in Harrisburg. The local forest districts had no input on well location, road construction, or pipeline construction. The District Forester was notified of gas well development after the fact. Foresters were dispatched to the well sites to mark the trees which had already been cut and piled like jackstraws. The access roads to well sites invariably were too steep and not drained properly. Once drilling of a gas well started there was no mechanism or authority for the District Forester to halt drilling activities because of adverse weather conditions. As a result, many state forest roads were torn apart by heavy hauling during rain periods and during spring thaw. In 1955 the legislators created the Oil and Gas Fund for conservation to expand public forests and parks and lessen the impact of oil and gas development.

In the late 1960s a massive fish kill occurred from a well being drilled in the Susquehannock State Forest, upstream from Cross Fork. The breastwork of the sludge pit containing drilling fluids failed, and the contents of the pit flowed down the mountainside to the creek and killed thousands of fish and destroyed the macroinvertebrates that were food for the fish.

The natural gas storage facility at Tamarack uses abandoned wells for storage of natural gas. Many of the storage wells are located in Sproul State Forest and the Susquehannock State Forest, and they are connected by major interstate transmission pipelines and smaller in-field pipelines. The facilities are plainly visible from the air as a fragmentation of a large block of forest.

In the early 1970s there was a major natural gas well fire on Rager Mountain in Cambria County, near the Gallitzin State Forest. The fireball burned for several weeks before it was extinguished (another major fire occurred in Clinton County in September 2008). In the 1970s many Americans became more aware of the environmental problems facing the nation. Protests led to legislation, and in 1973 the Department of Environmental Resources was created, and soil erosion and sedimentation laws and regulations were established. Pollution of exceptional value streams in northwestern Pennsylvania from improper oil and gas exploration led to the birth of the Bureau of Oil and Gas within the Department of Environmental Resources. Regulations required permits that included the location of the well, a soil erosion and sedimentation plan, and permits for stream crossings.

In the 1980s, the Sproul State Forest was the scene of another extensive natural gas play. In July 1982 a shallow gas well was drilled by Eastern States Exploration Company on state forest land near the Marsh Creek Trail in Centre County. The well was very successful and started the Council Run Field. Muddy ruts and a churned-up well site enabled the Sproul staff to convince the central office that district oversight was desperately needed. There were many confrontations with Eastern States concerning the company's field operations and the roughshod treatment of the precious public forest environment. Nearly all of the gas wells drilled by Eastern States were drilled with private investor money, and wells of marginal production went on line to keep investors interested. There was no substantial bond requirement for plugging unproductive wells, so many of them were just abandoned. Eventually, Eastern States added staff which understood the problems and cooperated with Sproul staff to improve field operations. Other gas companies also drilled wells, and each of these companies went through the same environmental learning process.

During this time, many thousands of acres of State Forest were fragmented into 40 acre woodlots by the well sites, pipelines, and access roads. The well site areas and pipelines were seeded to grasses and shrubs. But no follow-up maintenance is required, and over time these sites become barren. The access roads are gated for security of the well, but off-road vehicles can gain access and accelerate soil erosion and sedimentation. Forest fragmentation also invites

the establishment of invasive plant and animal species, which are adverse to sustainability of forest ecosystems.

Since 1982 four different gas companies have operated the leases within the Council Run Gas Field, which is not an unusual situation. A well starts out with excellent production, but then productivity falls off as the reserves are depleted. Companies are anxious to sell these leases, and often the next owner has fewer financial resources to operate the leases. These "po boy" operators cannot maintain operations and will sell to a company lower in the food chain until the wells are abandoned. Pennsylvania is doted with over a thousand of these "orphan wells" which are not plugged and become environmental hazards. This scenario is similar to the situation that followed the cutting of the original forests and the extraction of coal.

There is great excitement by many for the opportunity to make it big with the Marcellus Shale Gas exploration effort, but the pitfalls are many and could leave our children's children with a degraded place to live.

Extraction of natural gas from Marcellus Shale requires well sites at least four times the area of the shallow gas wells of the Council Run Field. As much as nine million gallons of water per well is needed to stimulate the flow of gas. To haul the water from rivers or major streams to the tops of the mountains, thousands of tankers will use township, private and state forest roads, which are not engineered for this continuous pounding. Many bridges on these routes have low weight limits creating a safety hazard. The fluids from "fracing" the wells must be treated at a sewage treatment plant before being discharged into waters of the Commonwealth, which will mean more sewage plant construction and added costs. With thousands of potential gas wells in nortcentral and northeastern Pennsylvania, much of the vast forest area will be fragmented permanently. The earth moving construction could cause massive soil erosion and sedimentation, and these areas will become breeding grounds for invasive species.

During the life of the Marcellus Gas play there will be numerous gas companies, lease farm outs, lease transfers, and a proliferation of "Po boy" operations resulting in orphan wells. Private landowners will essentially give up their surface rights since the mineral owner has the right to extract minerals including gas and oil. Some leases are so vague that once they are signed, anything goes. The Department of Environmental Protection Bureau of Oil and Gas is primarily a permitting agency and has an insufficient staff to enforce the regulations relating to environmental protection and protect the environment against these threats.

Reading the children's book *The Lorax* by Dr. Seuss to my grandchildren brings

home the lesson that we need to carefully conserve the natural resources of Pennsylvania on both private and public land. It is up to us to start living in a sustainable way so that future generations won't be saddled with mistakes we made because of a myopic view of natural resource limitations or outright greed. We must look at past oil and gas practices, learn from mistakes and provide protection for private landowners and public lands so that future generations will be able to enjoy living and working in Penn's Woods.

The Marcellus Shale in Central Pennsylvania: A Chronology

--Bob Myers (LHUP English Professor)

As Butch Davey's article indicates, natural gas drilling is nothing new to central Pennsylvania. But the intensive focus on the Marcellus Shale is a recent phenomenon. The first mention in the *Lock Haven Express* was a series of articles in April 2008 about a presentation on natural gas leasing by the Penn State Cooperative Extension (*LH Express* 4/28/08, *LH Express* 4/30/08 and *LH Express* 5/01/08).

In April the Pennsylvania Department of Conservation and Natural Resources announced that it would allow shallow drilling for natural gas on 74,023 acres of state forest lands. (DCNR Press Release 4/1/08). The DCNR began accepting bids for leases in July (*Tri-State News* 7/15/09), and in September, the results of this bidding were announced (DCNR "Oil & Gas Lease Bid Results"). Recently, Governor Ed Rendell has attempted to transfer $174 million of the lease money from the DCNR to the general budget (*Scranton Times* 12/10/09).

Early discussions of the Marcellus Shale focused on economic issues. In July the Keystone Central School Board voted unanimously to lobby for a gas well property tax. The school board pointed out that Pennsylvania is one of the only states that does not tax natural gas removal (*LH Express* 7/12/2008). State Representative Garth Everett indicated that he supported an impact fee on natural gas companies (*LH Express* 7/29/08).

In August, the Susquehanna River Basin Commission imposed tighter regulations on water use for natural gas drilling, requiring that all removals must be approved regardless of amount. (*LH Express* 8/19/08). However, in December the SRBC streamlined the procedure for review of requests for

consumptive water by the natural gas industry. SRBC Executive Director Paul Swartz noted, "The Commission acted quickly and decisively to address the unanticipated and pressing demand for water in 2008 from the natural gas industry. These regulatory amendments, along with other actions we had already taken, allow us to respond in an orderly fashion as we fulfill our dual mission to protect the basin's vital water resources and support economic development opportunities." (SRBC "What's New").

In the fall, several local universities became involved in the issue. The Pennsylvania College of Technology and the Penn State Cooperative Extension announced that they would open a Marcellus Shale Education and Training Center at Penn College (*LH Express* 8/23/08). In November Lock Haven University held a panel discussion on drilling in the Marcellus Shale (*Eagle Eye* 11/12/08), and a week later Misericordia University hosted a symposium on the Marcellus Shale for Republican Pennsylvania state senators. At that session Sen. Mary Jo White, who ran for the Senate because she was angry at the overregulation of the natural gas industry, expressed concern that the industry will leave Pennsylvania: "We have to find appropriate balances here, especially protecting water. On the other hand, imposing any cost does impact the ability of industry to operate here." (*iStockAnalyst* 11/19/08). In September a gas storage well in Leidy Township caught fire and burned for two weeks (*LH Express* 9/27/08).

By late fall, the focus for local officials had become regulation. In November, Dan Vilello of the state Department of Environmental Protection discussed natural gas drilling with the Clinton Country Economic Partnership. He noted the dramatic rise in well permits in Clinton County: 14 in 2006, 40 in 2007, and 35 so far in 2008. He said that the environmental regulations are necessary to protect Pennsylvania's water resources: "We have the streams to a point that we're now very proud of them and we want to keep them that way." Clinton County Commissioner Adam Coleman, who attended the Misericordia symposium, warned that the natural gas companies might be driven away by the excessive regulations: "If something doesn't change they're going to write off the money they spent on leases and go out of state." (*LH Express* 11/20/08).

Commissioner Coleman, a LHUP graduate and a member of the County Commissioners Association of PA task force on natural gas drilling (*LH Express* 8/22/09), emerged as a strong opponent of regulation. He

indicated that he would be lobbying to have state agencies loosen restrictions on natural gas drilling, arguing, "We need (DEP) to get out of the way." He pointed out that he favors saving the environment, but asked, "Is it worth keeping a stream 100 percent pristine to block $100 million worth of injection into the local economy?" Commissioner Tom Bossert echoed Coleman's concerns: "DEP needs to recognize they are holding central Pennsylvania and Clinton County residents in a choke-hold. We understand their purpose, but... they don't have to slow everything down to a snail's pace... We can do it with environmental concerns met." (*LH Express* 11/21/08). In December Commissioner Coleman again expressed frustration with the DEP's approval process: "Nobody's saying we should give the gas companies free reign on what goes on and not have any environmental standards for them, it's just getting these permits done in a timely manner." (*LH Express* 12/09/08). Commissioner Coleman also indicated that he would like to form a task force to address issues concerning natural gas drilling in Clinton County and that he would work with Keystone Central School District to establish training programs for the natural gas industry. (*LH Express* 12/31/08).

By January, the implications of drilling became more tangible, as Anadarko E&P filed a request with the Susquehanna River Basin Commission (SRBC) to withdraw 4 million gallons per day from the Susquehanna River Basin for natural gas drilling. (*LH Express* 1/06/09). Clinton and Centre County officials expressed concerns about the request (*LH Express* 1/06/09, *LH Express* 1/07/09), but Matt Carmichael, a public relations official from Anadarko was enthusiastic: "We are very excited about the potential of this area and its ability to produce much-needed, clean-burning natural gas for American consumers. In addition, we understand the importance of effective water management, and we are committed to working with the relevant regulatory agencies and adhering to the rules and regulations to balance our activities with protection of the environment, wildlife and public health." Anadarko has leased 300,000 acres in the Appalachian Basin, primarily in central Pennsylvania (*LH Express* 1/07/09) and is drilling in three locations in Clinton County: Hyner Mountain Road, Beech Creek Mountain Road, and Grugan Township. Commissioner Adam Coleman was delighted over the drilling: "I think it's very encouraging, especially because we've been sitting on the sidelines here for the past six or seven months seeing drilling in these other areas. I think it's pretty exciting it's finally starting to get here. I'm sure in the next few months we're going to see a lot more permits issued." (*LH Express* 1/07/09). The Clinton County Planning Commission was less enthused. When Anadarko revised its plans to draw water from the Susquehanna River as well as public water supply systems, for a peak consumption not exceeding 5 million gallons per day, board member David Glessner and Chairman Charles Sweeney expressed frustration over the lack of information and asked questions about the treatment of the used water. Commissioner Coleman

insisted, "DEP is watching things very closely, and they are really on top of this." (*LH Express* 1/21/09)

In response to the beginning of operations in Clinton County, the *Express* ran a series of articles in late January focusing on the implications of natural gas drilling. Penn State Cooperative Extension educator Thomas Murphy claimed that despite the drop in natural gas prices (from $14 to $4.50/cubic foot), drilling in the Marcellus Shale would continue. He pointed out that companies have invested $2 billion in Pennsylvania and want to recoup their investment. (*LH Express* 1/13/09). Tiadaghton District Forester Jeff Prowant boasted, "Our oil and gas programs are moving along at warp speed." He insisted that the amount of water required for the drilling was not a problem and that there should be few if any environmental concerns: "We've been drilling wells in Pennsylvania for 150 years." (*LH Express* 1/19/09). Mary Vuccola of the Department of Environmental Protection's Justice Board promised assistance to low-income people who might feel bullied by natural gas companies. (*LH Express* 1/23/09). Margaret Brittingham, a professor of wildlife resources at Penn State, warned that natural gas drilling threatens wildlife in Pennsylvania by creating forest fragmentation, introducing invasive plant species, and disturbing sensitive habitats. She will be conducting a free online seminar on this issue on March 18. (*LH Express* 1/26/09)

In February, the Pennsylvania Department of Environmental Protection announced that it will be opening a Bureau of Oil and Gas Management office in Williamsport. At a Lycoming College panel discussion on the Marcellus Shale, the DEP's Robert Yowell predicted that there would be 250 wells drilled in Lycoming County by the summer. Lycoming College will host another panel discussion on this topic on March 11, at 7 p.m. (*LH Express* 2/16/09). Recently, Governor Rendell announced that he was seeking a severance tax on natural gas extraction (*Delaware County Daily Times* 2/4/09).

A Landowner's Perspective: Leasing for Natural Gas Production

--Dr. Ralph Harnishfeger
(LHUP Biology Professor)

The recent interest in drilling into the geologic formation referred to as the Marcellus Shale has resulted in considerable public discussion of the advantages and disadvantages of such drilling. My wife and I are concerned about the environment, both as citizens of

the Commonwealth and as professional biologists. As landowners, we signed a lease agreement with Chesapeake Appalachia LLC in June 2007. Our land is part of a large acreage parcel owned by many different landowners who organized and used the services of a land company to complete documentation of land title and market an oil and gas drilling lease to many prospective companies. Chesapeake was the highest bidder willing to meet all provisions required in the lease. I have been asked to write about why a landowner would allow natural gas drilling if they were really concerned about protecting the environment. My comments will focus on that aspect rather than on significant economic issues such as income production, job creation, tax payments, and increased local commerce among others.

There is little doubt that exploration and development of gas and oil reserves have some environmental impact. The advantage of offering land in the context of a large parcel with many individual landowners is that it provides enough leverage or incentive to a prospective energy development company to offer better environmental protections than a small landowner would likely be able to command on his or her own through direct negotiation.

Road construction impacts land use, increases impermeable surface, runoff rates and erosion potential. In our lease there is a provision for no outside roads, equipment or pipelines coming onto our land from adjacent lands which are not part of our pool of acreage. Any roads built for development of the pooled acreage must be mutually agreed upon. Such agreement must also occur for drill sites and pipeline corridors.

Once any land is agreed to for the uses above, there is additional language providing for payment for any crops removed or damaged, this includes vegetation and trees. The energy developer also assumes responsibility for liability resulting from personal or property damage occurring as a result of the energy development activity. Furthermore, we are protected by state and federal regulations that are relevant and apply to all energy development.

We believe that energy development can occur responsibly and in a manner consistent with good environmental stewardship. Farmland has been significantly altered by man from what existed prior to the arrival of Europeans on this continent and such change has dramatically improved food production and the resulting quality of life for many humans. This transition has increased habitat for some species and decreased habitat for others. It is unrealistic to expect a return to primeval forest and in the context of our highly altered environment we prefer well-managed and planned land use with the additional protections guaranteed through our lease.

Another Landowner's Perspective: Gas Well Exploration and Development

--by Jamie Walker (Distributed Systems Specialist, LHUP Computing & Instructional Technology Department)

A story that I have not seen told in the newspapers or television news reports concerns the effects of gas exploration from a private property owner's viewpoint. I have had personal experience of shallow gas well development on my family's property (the Elk Sands formation not the Marcellus Shale). My experiences have not been pleasant--aggravating and disheartening would be a more accurate way to describe them. I am concerned that many more landowners will share my viewpoint as the Marcellus Shale is developed.

We purchased the property in 1999 for recreational purposes: hunting, fishing, cross country skiing, and camping. The property sits in the headwaters of the Baker Run Watershed in Clinton County. Baker Run has a reproducing population of wild brook trout and the lower sections of the stream are stocked by the Pennsylvania Fish and Boat Commission. Route 120 is the only paved road in the watershed and it crosses the main stem approximately 100 yards upstream from its confluence with the West Branch of the Susquehanna River. The majority of the watershed is covered by the Sproul State Forest with some private property in the headwaters. We bought the "surface rights," which translates to the right to pay taxes and use the surface for recreation. The "timber rights" and "mineral rights" had been separated from the real estate and sold several decades ago. There were not any existing gas wells on the property, and when we asked the realtor about gas development, he replied, "They haven't drilled in 20 years and they probably won't drill in the future." As it turns out, this statement was a blatant lie or huge misconception because within five years, two wells were drilled on our property: one in 2004 and the next in 2005, by Texas Keystone Incorporated (TKI) of Pittsburgh. By not owning the mineral rights, we are entitled to absolutely zero royalties, but are fully entitled to all of the impacts of gas well development including loss of timber, destruction of access roads, increased sedimentation of our streams, deforestation, and habitat fragmentation. My favorite impacts are the 24-hour serenades of Caterpillar bulldozers and drilling rigs. The sounds carry great distances in the cool evening air. We also experience the regular disruption of

well tenders checking the wells.

Some of the impacts that occurred on our property during well development were large pieces of construction equipment blocking access to our camp, dozens of people without identification walking around our property, and littering by the construction crews. We've had the experience of watching equipment operators dredge an exceptional value wetland, and we've watched a wild trout stream become so polluted with sediment that it looked like chocolate Yoo-hoo. When we followed that stream upslope to an artesian spring that we used to drink from, we saw it bubble and boil and spew sediment for 72 hours.

Enforcement by the DEP's Department of Oil and Gas was rather lackadaisical. The wetland was at the base of a steep slope and part of a complex of wetlands that feed the headwaters of Tarkiln Branch of Baker Run. The DEP inspector from the Meadville office looked at the dredged wetland and said "that doesn't look too bad." I pointed out that TKI didn't have a permit to impact the wetland. He still insisted that the impact was minor and that no action was necessary even though a law had been broken (PA Code 25 § 105.17 and 18a). I followed up with a complaint to the Army Corps of Engineers, which resulted in a citation of TKI for violating the Federal Cleanwater Act section 404. TKI was forced to restore the wetland.

An additional water quality violation occurred when the second well was drilled. The drilling bit punctured the aquifer that fed an artesian spring. The sediment flowed from the aquifer to the spring and into the stream so that you could not see the bottom of the stream. There was not a direct fish kill that we observed, but the pollution did occur in the fall when brook trout spawn. The stream was polluted for 72 hours, and an unmeasured load of sediment was dumped into an exceptional value stream. I contacted the North Central DEP office, and they dispatched a staff person. The drilling operations were supposed to be suspended for a period of time so that concrete could be pumped down the borehole to seal it from the aquifer. The driller was fined $5000 dollars and allowed to continue. The fine of $5000 might seem significant, but the well will produce hundreds of thousands of dollars in profit. So the $5000 fine is really just a cost of doing business because the well was completed and is currently producing gas. In both of these incidents, the take home message is: if the violation would not have been reported by the property owner it would have been overlooked by the DEP gas inspector. DEP cannot possibly monitor all of the well sites it has issued permits for, so citizens should assist with the enforcement by reporting violations.

The purpose of the article is to give first-hand examples of the reality of gas

well drilling and bring attention to the hazards of gas exploration and development in central Pennsylvania. The events occurred in an exceptional value watershed, a gem in the crown of the PA Wilds. If the impacts are allowed to occur in the "best of the best" watersheds, what will happen in the rest of the West Branch of the Susquehanna River watershed? What will the PA Wilds look like in 50 years if drilling is not closely monitored? What will the PA Wilds look like if monies are not collected to restore abandoned wells and well sites at the beginning of the drilling boom when the wells are very profitable? We can compare the effects of timber extraction and coal extraction and then draw parallels. I think we will see impacted streams, severely fragmented forests, and thousands of abandoned well sites. This just doesn't seem like the way to protect and preserve a "wild" place.

And Justice for All

--by Mary Vuccola (Member of the DEP's Environmental Justice Advisory Board and Lock Haven resident)

With the probability of gas well drilling facing many of our local community's residents, the issue looms of whether they are being fairly treated by gas companies and being informed of the entire impact on their land if they consent to drilling. Because there have been past environmental exploitations in our region, such as logging at the turn of the century and coal mining which continues to this day, these residents need an advocate to turn to with questions and concerns. The Environmental Justice Advisory Board (EJAB) was created to make sure that these residents, particularly those living in poor communities, do, indeed, have that advocate.

EJAB was formed in the spring of 1999 as a work group by the PA Department of Environmental Protection (DEP) in response to an increasing awareness of environmental justice concerns involving poor inner-city neighborhoods and rural regions. By 2001 a board comprised of 21 members representing all six of DEP's regions was formed. The board's mission has been to foster mutual respect between DEP and the communities. Members of EJAB believe that by building environmentally aware, healthy and knowledgeable communities, the group can work to stimulate sustainable and environmentally friendly development as well as implement policies, regulations and legislation that provide equal protection to disadvantaged communities throughout the Commonwealth.

It is imperative that Pennsylvania's residents become aware of this board in order to utilize its support when necessary. You have a forum for protecting the health of your communities. It is EJAB's goal to encourage and enhance public participation in these poor communities to improve the conditions of

their environmentally burdened neighborhoods and assure the fair treatment and meaningful involvement of all people in the process of environmental decision-making. To learn more, go to the EJAB page on DEP's website.

Tapping Our "Super-Giant" Gas Field: How Much Are We Willing to Pay to Play?

--by John H. Way (Retired LHUP Geology Professor and Rebecca Dunlap (West Branch Susquehanna Restoration Initiative Project Manager for Trout Unlimited)

In early 2008 the Middle Devonian Marcellus Shale rocketed into international, national, and local headlines, following estimates of natural gas reserves (published by Terry Englander of PSU and Gary Lash of SUNY Fredoniaf) exceeding 500 trillion cubic feet. Previously, the USGS calculated estimates totaling only 1.9 trillion cubic feet. As a result, the Appalachian Basin's natural gas play, "the Marcellus," became a hot discussion topic overnight among members of the oil and gas industry, lawyers and landmen (those who secure leases working for resource-extraction companies), property owners, geoscientists, ecologists, environmentalists, and concerned citizens.

As far as we here in northcentral PA are concerned, the Marcellus is in our backyard AND our front yard as well. Can we afford to wait before we begin to address the long list of possible implications that envelope this important gas play like a thick set of onion skins? Local academic and environmental scientists are among those well positioned to address the environmental implications with real data coupled with a strong sense of purpose. Indeed, just as data gathering and drawing conclusions based on those data are inherently part of doing good science, so active discussion and debate are healthy and should be pursued as a vital part of this resource-extraction endeavor as well.

Perhaps some perspective is required here so that we break free from the trap suggested by Georg Wilhelm Friedrich Hegel: "We learn from history that we do not learn from history." The history we need to remember is the "distress" that resource extraction can bring to the environment.

The vast collection of photographic records and oral and written reports demonstrate the physical conditions that followed the lumbering industry that changed our Pennsylvania landscape forever. When William Penn arrived in 1682, nearly 90% of his "Penns Woods" was thickly forested. However, by the early 1920s, that once seemingly endless 20-million-acre forest of white pine, Eastern hemlock, and mixed hardwoods was gone. Thousands upon thousands of devastated treeless acres remained as a legacy of this resource extraction effort. As lumbering ebbed, the commonwealth began yielding

another valuable resource to fill the economic void. This time, Pennsylvania was to benefit from its rich endowment of both hard and soft coal. Coal mining accelerated furiously and fed the rapidly growing number of furnaces that produced iron, steel, and manufactured goods. But at what cost? The legacy of Pennsylvania's second major extractive phase has been streams that are devoid of life because of acid mine drainage (AMD). How many generations will it take before these streams can support trout?

Given this long history of ignorance, corporate greed, blatant disregard for nature, and industries driven by the mantra that ends justifies means, a reality check appears in order. In response to the nation's current economic climate, environmental-related issues have taken a back-seat to domestic policy and unemployment. In fact, a January 2009 poll released by the nonpartisan Pew Research Center cites that only 41% of voters deemed protecting the environment a top priority – down 15 points from last years' 56%.

But amidst a gloomy outlook, there are indeed glimmers of hope. Trout Unlimited, a national, nonprofit organization dedicated to the protection, restoration, and conservation of North America's cold water fish and their watersheds recently published a study documenting the economic benefits associated with remediating local abandoned mine drainage pollution. The study reports that cleaning up the more than 1,200 miles of polluted waters and 42,000 acres of abandoned mine lands in the West Branch Susquehanna River watershed could potentially create approximately 6,000 green-collar jobs--well paid jobs that contribute directly to enhancing environmental quality--and an associated $800 million in economic benefits. The study also reports that streams free of abandoned mine drainage pollution would potentially generate $22.3 million in sport fishing revenue on an annual basis.

And what can be said of this third phase of resource extraction destined to permeate much of the commonwealth's land—widespread drilling for natural gas? We've all heard the talking points: end our reliance on foreign sources of petroleum; lower our energy costs; exploit our domestic supplies. But what will be the legacy of this third phase of natural-resource extraction—the Marcellus "gas rush?" What will we see throughout our slowly but steadily recovering "Wilds" when the wells peter out; when the big companies with deep pockets leave; when the land is covered with a maze of rutted dirt roads, pipeline corridors, and abandoned wellheads; and when leaky infrastructure, sediment-filled creeks, and briny ground water require billions of dollars of remedial efforts by our citizens? How easily can the region's fragile ecosystem recover from an accidental spill? How long before we can recover a two-mile stretch of high-quality stream, again? How long will it take for the abandoned roadbeds to be reforested? How long will it take to pay all the bills?

Apologies to those who may feel we evangelize, preach, or harangue here; clearly that is not our intent. Can we do this right? Sure we can. We have the knowledge, the expertise, the technology, the historical perspective, and the conscience for it. But the question remains—WILL WE?

Hike of the Month: Natural Gas Production in the Sproul State Forest
--Bob Myers

This drive/hike takes you to a site in the Sproul State Forest where you can see first-hand what natural gas production looks like. Along the way, you'll be exposed to some central Pennsylvania literary history. The roads are passable in a regular car, especially when the last of the snow melts, but a four-wheel drive vehicle is better.

Begin at Walmart and turn right onto Rt. 150 South. In about 4 miles, you'll be entering the outskirts of Beech Creek, which is the site of Alison Bechdel's graphic novel, *Fun Home*. If you've never read it, *Fun Home* is the story of a young woman's struggle to come to terms with her father's death, the secrets uncovered in the wake of it, and her own identity. Most of it takes place in central Pennsylvania (including a scene in Stevenson Library), and some of the sites mentioned in the novel can be seen on this trip. At 4.4 miles, on the left, is the place where her father was struck by a truck and killed. At 6.4 miles, note the pink house on the left--this is the former funeral home that is alluded to in the title. If you turn left at the funeral home onto Maple Street and go .2 miles, the beige house on the left (169 Maple) is the Victorian house that her father restored. A bit further down Maple is the cemetery where her father is buried.

Return on Maple to Rt. 150 and turn left. After .2 miles, just before the bridge, turn right onto Water Street/the Monument-Orviston Road (Rt. 364). The stream to the left is Beech Creek, a sad example of the residual effects of coal mining, an earlier extractive industry in this area. Although it looks beautiful, the red rocks indicate that the stream is dead, killed by acid mine drainage (AMD). However, the Beech Creek Watershed Association is working hard to undo the damage.

After 2.3 miles, you'll come to an intersection: the Monument-Orviston Rd. curves to the left and crosses a bridge; Falls Rd. goes sharply to the right--go

more or less straight onto Martin's Grove Rd., which becomes the Beech Creek Mountain Road. After .5 miles you'll need to bear slightly right to stay on it. The road becomes a moderately rough gravel road as it climbs the mountain. At about 7 miles, you'll start seeing natural gas wells and their accompanying storage tanks. At 8.7 miles from Rt. 150, turn right onto the Eagleton Road. After you go 1.3 miles (10 miles from Rt. 150), turn right into the parking lot of the Eagleton Mine Camp Trail (EMCT, described in the October 2008 *Hemlock*). Park your car and notice the green storage tank next to the parking lot.

The hike is 2.8 miles and takes about an hour. From the parking lot, walk back to Eagleton Road and turn right, following the red blazes of the EMCT. After about a third of a mile, you will see a well site and a large compressor to the left, but you will hear the engine and smell the diesel fumes long before that. This is well #42, operated by NCL Natural Resources, of The Woodlands, Texas. DEP received the permit application for this well on March 14, 2008; the permit was issued 27 days later on April 10th. Drilling began on June 13. To me, this doesn't seem like a long time to wait, especially since this well is sitting on top of the Baker Run watershed. Well #42 is located on Tract 653, a one-mile by three-mile rectangle of state forest land that contains about 20 active wells (the Google Earth image above gives a sense of the web of access roads and well pads in this area).

Immediately after you pass the well site, the EMCT turns left and follows the gravel road to the east of the site. After a quarter of a mile, the trail turns right into the woods. A few hundred feet later, you'll see another well to the left (you'll still be able to hear the compressor from well #42). Continue to follow the blazed trail along Smokehouse Run. This is one of the prettier parts of the EMCT, and it's worth remembering that a hundred years ago this entire area would have been treeless, the result of clear-cut logging, the earliest of Pennsylvania's extractive industries. About a mile after you've left the compressor, you'll come to a intersection with a trail. Leave the EMCT, turn right and climb a small hill--after about a quarter mile, you'll reach the Eagleton Road (note the well to the left). Turn right and return to your car (you'll know you're close when you hear the compressor engine). This entire

hike has taken place in Sproul State Forest--land owned by the citizens of Pennsylvania.

You can either return the way you came, or follow the Eagleton Road 8.8 miles until it ends at Rt. 120. Turn right and follow Rt. 120 back to Lock Haven.

What Can You Do?
At this point, most of the land has already been leased by the gas companies. The only remaining issue is to what extent the drilling will be regulated. New York state also sits on top of the Marcellus Shale, and their state Department of Environmental Conservation has enacted a temporary freeze on new permits until they can revise their regulations to ensure protection of the water resources in the Catskills and the Adirondacks. Many people in New York are calling for a complete ban on drilling (*NY Times,* 12/18/08).

If these articles have convinced you that the drilling in the Marcellus Shale is indeed a major threat to the environment of central Pennsylvania, please contact the elected officials below and express your support for increased protection of our state's resources:

- Governor Edward G. Rendell's Email
- U.S. Senator Robert P. Casey, Jr.'s Contact Page
- U.S. Senator Arlen Specter's Contact Page
- U.S. Congressman Glenn Thompson's Contact Page
- State Representative Mike Hanna's Contact Page
- State Senator John N. Wozniak's Email
- If you are uncertain who you state legislators are, go to the Find Your Legislator Page
- Pennsylvania Department of Conservation and Natural Resources Contact Page
- Clinton County Commissioner Adam Coleman's Email
- Clinton County Commissioner Joel Long's Email
- Clinton County Commissioner Tom Bossert's Email

For More Information on the Marcellus Shale:

EARTHWORKS--Hydraulic Fracturing of Oil and Gas Wells: EARTHWORKS is a non-profit organization dedicated to protecting communities and the environment from the destructive impacts of mineral development, in the U.S. and worldwide. This site offers much useful information about the threats to water quality and the inadequate regulation of hydraulic fracturing. Especially useful is their free publication, *Oil & Gas at Your Door? A Landowner's Guide to Oil and Gas Development*.

Damascus Citizens for Sustainability: A grassroots organization that has been in the forefront of recognizing and protesting against the hazards of oil/gas drilling in the upper Delaware River valley. According to the site, "Overwhelming evidence and much science now exists that the type of gas drilling proposed for this region - made possible by total federal deregulation--is a danger to the public health, causes contaminated drinking water, carcinogens in the farmland and food chain, torn-up roads, air pollution, plummeting home values, and noise pollution."

Pennsylvania Department of Environmental Protection--Marcellus Shale: A collection of links to FAQs, maps, industry resources, and agency contacts. DEP "is responsible for reviewing and issuing drilling permits, inspecting drilling operations and responding to complaints about water quality problems. DEP inspectors conduct routine and unannounced inspections of drilling sites and wells statewide."

The Susquehanna River Basin Commission--Marcellus Projects: In addition to information on regulations, and presentations by the SRBC on Marcellus drilling, this site includes a list of approved requests by the gas companies for consumptive water use (in millions of gallons/day).

The Pennsylvania Department of Conservation and Natural Resources--Marcellus FAQs: An appallingly shallow site, given the importance of this issue. See also DCNR--Oil & Gas on State Forest Lands, which contains their position statements on why they have allowed drilling on state forest lands.

The Pennsylvania Chapter of the Sierra Club: The SC is a grassroots organization committed to promoting conservation. The SC's position on natural gas is as follows: "When compared to oil, natural gas may be cleaner and more accessible, but the extraction of natural gas causes many of the same problems as the extraction of any other fossil fuel. The Sierra Club supports natural gas that is extracted in an environmentally acceptable fashion, but in Pennsylvania, the extraction and delivery of natural gas produces a number of environmentally unacceptable side effects, many of which affect public lands and may simply prolong our expensive and destructive dependence on fossil fuels."

Trout Unlimited: TU's mission is "to conserve, protect and restore North America's coldwater fisheries and their watersheds." The Winter 2009 issue of *Trout* features the article "Fractured Landscape," by Morgan Lyle, which notes that "Trout Unlimited is working at the state and national level to help assure that valuable trout resources in the Northeast are protected from the Marcellus Shale Development."

Penn State Cooperative Extension--Natural Gas Impacts: An excellent site with much useful information for landowners, local government, businesses, and the general public.

Green Party of Pennsylvania Position Paper on the Marcellus Shale: The Green Party of Pennsylvania "believes that despite the apparent short-term economic benefits, Marcellus Shale gas drilling will have a net negative economic and environmental impact for Pennsylvania."

Energy Justice Network--Natural Gas Health and Environmental Hazards: "Natural gas is a fossil fuel that is often promoted as "cleaner" than coal, but which has its own serious environmental hazards."

Anadarko Petroleum Company: The company that has leased 300,000 acres in the Susquehanna River Basin, mostly in central Pennsylvania. Their mission "is to deliver a competitive and sustainable rate of return to shareholders by developing, acquiring and exploring for oil and gas resources vital to the world's health and welfare." The company also claims, "Anadarko's employees are committed to finding and producing the energy resources we all need, while balancing our responsibility to preserve our environment, protect public health and support our local communities."

KCnet Contracts with Cartridge World

--John Way (Retired LHUP Geology Professor)

Are you thinking greener these days? Green is not just for environmentalists anymore. Eco-friendly has come of age! Increasingly, as you are probably very well aware, advertisers apply greenwashing strategies to products they hawk. Politicians and economists are also picking up this ball and running it into virtually every sector of our "global" society. Theorists see green economics as applying a more sensible approach for meeting both human and environmental needs. However, we, as vigilant and often cynical consumers, recognize that companies "spinning" green product lines may be neither sensible nor economically sound.

One conundrum that clearly does have an easy and straight-forward answer is "Should I purchase new or refilled printer ink and toner cartridges?" A common lure of printer manufacturers is to sell their hardware at or below market value with the intention of accruing a continuous stream of profits from the required consumable ink or toner cartridges. According to the *Wall Street Journal* (1/26/06), Hewlett-Packard makes more than two-thirds of its profit selling printer cartridges. The article notes that about 1.3 billion ink cartridges are sold world-wide annually, and sales generated $30.1 billion in revenue for the company the previous year. As the price of printers drops,

some consumers even note that it is less expensive to buy new printers than replacement ink cartridges.

As an astute, price-conscious consumer, have you weighed the cost of using refilled ink cartridges instead of new ones? Well, this decision just became a little easier. KCnet, located at 18 East Main Street, Lock Haven, announced that beginning this month it is contracting with Cartridge World, the world's largest ink and toner refilling company. Now you can go downtown to KCnet and exchange your empty printer and toner cartridges for refilled ones supplied by Cartridge World in Williamsport. This service offers LHUP students, faculty, and staff a truly cost-effective option. It's about 50% cheaper than buying a new cartridge, it provides a 100% satisfaction money-back guarantee, and it helps the environment by keeping cartridges out of landfills.

Environmental Focus Group

Bob Myers (chair), Md. Khalequzzaman, Lenny Long, Jeff Walsh, Danielle Tolton, John Crossen, Sandra Barney, David White, Tom Ormond, and Ralph Harnishfeger. The committee is charged with promoting and supporting activities, experiences, and structures that encourage students, faculty, and staff to develop a stronger sense of place for Lock Haven University and central Pennsylvania. Such a sense of place involves a stewardship of natural resources (environmentalism), meaningful outdoor experiences, and appreciation for the heritage of the region.