**Striking a Balance: Forests and Natural Gas Drilling**

A Guide to Conserving Forests While Drilling for Natural Gas in the Delaware River Basin

Tag Words: Forest, conservation, natural, gas, methane, fracking, fluid, drilling, Pennsylvania, Delaware, river, basin, commission, regulations

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**Summary (KS)**

Natural gas drilling has been around for many years and wells are being drilled where ever gas reserves are found. Currently the Delaware River Basin which includes New York, New Jersey, Delaware and Pennsylvania is being drilled for natural gas and the drilling is destroying the environment. The process of natural gas extraction includes, clearing the drill site, fracking and transporting the fuel and contaminated water out to various plants. All of these steps damage the environment severely and the drilling needs to be more heavily regulated. The clearing of the site destroys the forest and takes away the homes of animals in the area as well as leaving the ground exposed to soil erosion and other negative consequences. The fracking contaminates ground water and poisons the wildlife and the vegetation in the surrounding area, and the transportation of the gas and contaminated water creates constant truck traffic and destruction of roads that they travel on. Currently there are regulations which mostly focus on controlling the contamination of ground water and not on any of the other negative consequences of gas drilling. For our community service project we developed a set of regulations which focused on regulating the deforestation of the drill site through making sure the forest is protected as much as possible during drilling and restored to its original state once drilling is complete. Our goal was to protect the forest and through protecting the forest the animals and environment would be able to be better protected from the harm of drilling. We submit the proposed regulations to the Delaware River Basin Commission which was accepting comments through April 15, 2011 which they will review for possible use in the new regulations of gas drilling in the Delaware River Basin. The website we submit the regulations to was [http://www.state.nj.us/drbc/](http://www.state.nj.us/drbc/) the website also contains information about current regulations and gas drilling available for anyone who is interested.

**Video Link**

Proposed Regulations for Gas Drilling: [http://www.youtube.com/watch?v=sRxfjdcaGzE](http://www.youtube.com/watch?v=sRxfjdcaGzE)
The Issue: Gas Drilling

History of Natural Gas Drilling in Pennsylvania (AL)
Gas drilling in the northeast region of America started in the early 1800’s when gas was seen bubbling through the bed of Canadaway Creek in Fredonia, New York. A well was dug and the gas collected, and a light was eventually lit. By the mid 1800’s, the well had been dug deeper and the gas found lit the town for another thirty to thirty five years. Drilling along the shoreline of Lake Erie reached all the way from New York, along Pennsylvania to Ohio and by the beginning of the twentieth century, most of the Pennsylvanian residents who lived close to the Erie shoreline had wells dug in their backyards. In the 1930’s the Marcellus Shale was hit by oil and gas companies and the gas that erupted would halt the drilling for a few days, however after said time the gas dissipated rather quickly. This led to the consensus that the Marcellus Shale simply did not have enough gas to drill wells into. As the 1970’s rolled around, the energy crisis that was presented spurred the exploration of natural gases. The U.S. Department of Energy thus created the EGSP, short for the Eastern Gas Shale Project. The project was in charge of finding organic-rich shales that could present the possibility of natural gas reserves. The two main purposes being “to determine the extent, thickness, structural complexity, and stratigraphic equivalence of all Devonian organic-rich shales throughout the basins; and to develop and implement new drilling, stimulation, and recovery technologies to increase production potential (PA Geology, 1)”. Shallower shales were seen as very important and deeper shales, such as the Marcellus Formation, were less attractive to surveyors. As the early 1980’s came by, gas prices hit a low and interest in natural gases faded. In this modern age, the interest has been reawakened due to three key points. The first being the rising gas prices, the second being advancements in technology, and the third coming from the success of the drilling of black shales in other parts of the country (i.e. Texas).

While the Marcellus Formation had been known about for decades (a little before the mid 1800’s), the natural gas that dwelled within has only just been recently tapped into. In 2003, a company named Range Resources-Appalachia, LLC (RRC) showed up with the idea of drilling into the shale and by 2005, it became the pioneer of Marcellus Shale drilling by being the first company to produce Marcellus gas. To date, the company has “permitted more than 150 Marcellus wells in Washington County alone (1)”. In early 2008, a new estimate on the amount of natural gas in the Marcellus Shale surprised much of the educated world. The figure went from about 1.9 trillion cubic feet (not much considering the size of the shale) of untapped resources to 500 trillion cubic feet (3). The increase in permitted wells increased exponentially after this announcement. From 2007 to 2010, the wells have increased from 27 to 1386 respectively. The largest rise between the years has been from 2008 to 2009 with an increase of 624 wells; from 161 to 785 (2). The exponential rise is seen in figure 1.

Figure 1

1)  http://www.dcnr.state.pa.us/topogeo/pub/pageolmag/pdfs/v38n1.pdf
2)  http://geology.com/articles/marcellus-shale.shtml
3)  http://transloading.org/tag/james-hall/
The Delaware River Basin Commission (DRBC) (KS)
Fortunately, the future of the Delaware River Basin is in the hands of the Delaware River Basin Commission, rather than the separate states and counties. The Delaware River Basin Commission was formed in 1961 and it is a federal-interstate compact government agency formed by concurrent legislation enacted the United States and the four basin states (Pennsylvania, New York, New Jersey, and Delaware). The members of the DRBC include the basin state governors, the Division Engineer, and the U.S. Army Corps of Engineers, who serves as the federal representative. The commission has legal authority over both water quality and water quantity-related issues throughout the basin. With the new gas drilling at hand the DRBC identified three major areas of concern

1) Gas drilling projects in the Marcellus Shale or other formations may have a substantial effect on the water resources of the basin by reducing the flow in streams and/or aquifers used to supply the significant amounts of fresh water needed in the natural gas mining process.

2) On-site drilling operations may potentially add, discharge or cause the release of pollutants into the ground water or surface water.

3) The recovered "frac water" must be treated and disposed of properly.

All decisions regarding the basin and gas drilling must go through the DRBC and be approved. The natural gas extraction project sponsors must apply for commission approval for which there are regulations.

Proponents vs. Opponents on the New DRBC Regulations (AL)
The first round of hearings by the Delaware River Basin Committee (DRBC), brought about by the DRBC’s new guidelines for natural gas drilling in New York and Pennsylvania, was seen on February 22nd 2010.

Drilling Supporters were heard to say:

Bradford County commissioner Doug McLinko spoke in support as the “leading official in the most drilled country in the Commonwealth, ‘We have about 1,500 wells permitted with just about 600 wells already drilled…We have water impoundments with fresh water ponds that are lined, they’re safe, we have water extractions on the rivers, on the Susquehanna and three creeks. Everything is really going well’” (5).

“Landowners in parts of northeast Pennsylvania regulated by the commission said they want to join the boom to create jobs, keep their family farms and produce a kind of domestically produced energy that burns relatively cleanly” (6).

Many supporters are calling for “less stringent rules” (6). One going all the way to say “‘these are not regulations. They are strangulations’” (5).

Drilling Opponents were heard to say:
“Environmental groups and their supporters criticize the regulations as too lax, and giving too much power to the gas-drilling industry to regulate itself. They say the DRBC should hold further hearings and wait years until there are further studies on the effects of drilling — which uses "fracking." — on air and water quality.” (6).

“But, said many anti-drilling speakers like Barryville’s Debra Conway, the DRBC’s goal shouldn’t be economic. It should be about protecting the water they say will be polluted by the 10,000-12,000 wells the DRBC says would be drilled in the river basin.”

“We have had difficulty imagining how gas extraction could coexist benignly with our river paradise,’ said Lumberland’s Peter Comstock (4).”

With many proponents of the regulations citing the restriction of landowners rights, Jim Walsh, a member of Food and Water Watch counters, “‘We are talking about our drinking water here, something people need to live…Don't forget that” (6).

The outcome of the meeting seems to give no support to the new guidelines that the DRBC have created. Anti-drilling members advocate for a moratorium of the drilling until proper scientific research had been concluded on the adverse effects of fracking, etc. On the other hand proponents of drilling want immediate cuts on the new regulations since the land that could be leased to gas companies are now severely limited. Proponents are rising against the infringement that they feel are being placed upon their rights to their own property.

4) http://oilshalegas.com/marcellusshale.html


6) http://online.wsj.com/article/APbb095e2d02524cc093bd66be22ec003d.html

Gas Drilling Regulations (SW)
Special Protection Waters (SPW) regulations encompass the vast majority of the area of the Marcellus Shale in the Delaware River Basin (Figure S, below). Therefore, any rules affecting the SPW also affect virtually the entire potential drilling area in northeast Pennsylvania and New York. According to the DRBC the SPW area has “exceptionally high scenic, recreational, ecological and/or water supply values.” The SPW regulations were declared in the early 1990s, before any drilling began in the area. All DRBC regulations involving gas drilling operations are directed at SPW areas.

FIGURE S. Map outlining Delaware river basin, SPW area, and Marcellus shale.

On May 19, 2009 the DRBC announced that all new non-exploratory gas wells must first be approved by the commission before being drilled. On May 5, 2010 the DRBC decided that it would finalize natural gas regulations before approving more wells. On June 14, 2010 the DRBC announced that exploratory wells would require approval by the commission before drilling
began. This closed a loophole which allowed companies to label a well as “exploratory” and thus circumvent the need for DRBC approval. Two new exploratory wells were allowed after this period due to technicalities and timing of submission for approval. But other than that no new wells have been drilled since June 14th. The De facto moratorium is in effect until new regulations can be agreed upon.

The new gas regulations have taken the form of the DRBC proposing an Article 7 for its Water Quality Regulations. As a proposal it is still only in draft form, but according to the draft the purpose of Article 7 is: “to protect the water resources of the Delaware River Basin during the construction and operation of natural gas development projects. To effectuate this purpose, this Section establishes standards, requirements, conditions and restrictions to prevent, reduce or mitigate depletion and degradation of surface and groundwater resources and to promote sound practices of watershed management including control of runoff and erosion.” The equivocacy of that statement could favor drilling-advocates as easily as drilling-opponents. Luckily, it goes into greater detail.

In a total of 83 pages the proposed article primarily outlines the administration of wells, water sources for drilling, disposal of fluid from wells, and placement of well pads. Some of the key points follow. All wells will continue to have to be approved by the DRBC. Well pads must be 500 feet away from any bodies of water; but, the distance from water-wells is determined by the home state. Drilling-wastewater must not alter the operation of the treatment plant it is taken to. It must meet the standards of the DRBC and EPA when it is discharged into the environment. The minimum quality of water being discharged varies depending on the area of the DRB it is released in. Also, with DRBC approval, the water may be injected underground as a form of final disposal.

Several public hearings have already been held so as to give affected individuals a chance to argue their opinions on the issues. The final date for submission of written comments will be March 16, 2011. Sometime after this date the DRBC will decide whether or not to enact the proposed article in its current form. There is still no predetermined timeline for the enactment of the article.

http://www.state.nj.us/drbc/notice_naturalgas-draftregs.htm
http://www.state.nj.us/drbc/naturalgas-draftregs.pdf (Article 7 Draft)
http://www.state.nj.us/drbc/maps/SPW-MarcellusShale.pdf (Figure)

The Process of Extracting Natural Gas:

Readying the Land for Gas Drilling (AL)
Before a site is ready, “gas and oil drilling will require cutting trees to construct access roads, drilling pads, and pipelines” (7). Deforestation during the development of the site “can affect how water flows through a property, potentially affecting the quantity and quality of water entering nearby water resources such as stream, ponds, and private wells” (7). Drilling pads are created and can range from one to five acres large. Drilling pads specifically for the Marcellus Shale will be larger since the shale is so deeper. After deforesting the area and leveling the site,
the pad will be lined to prevent waste fluids created by drilling from spreading out. The soil will be “severely compacted and may have reduced productivity in the future” (7). Roads will be paved to allow access to the sites which are generally deep in the forest. These roads may lead to erosion and contamination to soil resources and water quality. If there were preexisting roads, large trucks and heavy machinery contributed to the breakdown of pavement and cement. Damages are seen in figure 2. Along with the construction of roads, pipelines are also essential for moving equipment to the site and for maintaining it during the well’s productive life. “The construction necessary to extract natural gas from the Marcellus Shale…could affect the soil around drilling sites and pipeline right-of-ways, says a Cornell soil expert” (8). Soil impact is dangerous to the habitat since “healthy soil is necessary for filtering and storing water, protecting the land surface and for supporting plant growth” (8). “Fallow lands (non-agricultural land) [have been] found to have marked negative effects from pipeline construction” due to “stringent construction and reclamation requirements” (8). Also associated with pipeline construction is the potential for the pipes to explode as it carries volatile chemicals. “In addition, pipeline clearings must be kept clear of large vegetation…this is often done with herbicides, which have their own impact on the environment” (9). Most of the additions mentioned above involve vegetation and topsoil removal. “This would lead to a loss of wildlife habitat, reduction in plant diversity, potential for increased erosion, and potential for the introduction of invasive or noxious weeds

Figure 2: “Some individual trucks weighed as much as 80,000 to 100,000 lbs when fully loaded.” (10).

7)  http://pubs.cas.psu.edu/FreePublications/PDFs/ua450.pdf
8)  http://www.news.cornell.edu/stories/March10/SoilTestDrilling.html
9)  http://pennsylvania.sierraclub.org/lv/Archives/DrillingFacts.htm
10) http://www.marcellus-shale.us/road_damage.htm

Hydraulic fracturing (Fracking) (KS)
Hydraulic fracturing is the process of creating fractures in rock through using fluid and high pressure. This is the process that the companies use to extract the natural gas from the rock deep under the ground as well as stimulate wells and maintain them. “Hydraulic fracturing has been used for over 60 years in more than one million wells.”(1) The fractures made in the rock are extended by internal fluid pressure which opens the fracture and causes it to extend through the rock. The fluid that is used to accomplish this is called fracking fluid. This fluid can be composed of a wide variety of compounds ranging from water and sand to complex polymeric substances with a multitude of additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well being fractured. Some compounds that can be found in fracking fluid are summarized below.

<table>
<thead>
<tr>
<th>Additive Type</th>
<th>Purpose</th>
<th>Common Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diluted Acid (15%) (</td>
<td>Help dissolve minerals and</td>
<td>Swimming pool chemical and</td>
</tr>
<tr>
<td>Additive Name</td>
<td>Function</td>
<td>Applications</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hydrochloric acid or muriatic acid</td>
<td>initiate cracks in the rock cleaner</td>
<td></td>
</tr>
<tr>
<td>Biocide (Glutaraldehyde)</td>
<td>Eliminates bacteria in the water that produce corrosive byproducts</td>
<td>Disinfectant; sterilize medical and dental equipment</td>
</tr>
<tr>
<td>Breaker (Ammonium persulfate)</td>
<td>Allows a delayed breakdown of the gel polymer chains</td>
<td>Bleaching agent in detergent and hair cosmetics, manufacture of household plastics</td>
</tr>
<tr>
<td>Corrosion Inhibitor (N,n-dimethyl formamide)</td>
<td>Prevents the corrosion of the pipe</td>
<td>Used in pharmaceuticals, acrylic fibers, plastics</td>
</tr>
<tr>
<td>Crosslinker (Borate salts)</td>
<td>Maintains fluid viscosity as temperature increases</td>
<td>Laundry detergents, hand soaps, and cosmetics</td>
</tr>
<tr>
<td>Scale Inhibitor (Ethylene glycol)</td>
<td>Prevents scale deposits in the pipe</td>
<td>Automotive antifreeze, household cleansers, and deicing agent</td>
</tr>
<tr>
<td>Surfactant (Isopropanol)</td>
<td>Used to increase the viscosity of the fracture fluid</td>
<td>Glass cleaner, antiperspirant, and hair color</td>
</tr>
</tbody>
</table>

(Table from source 2)

The process of fracking begins after the well has been dug and it has been deemed economically feasible to develop. Fracking begins with huge quantities of fracking fluid being pumped underground into the wells that had been dug earlier. The fluid is then put under intense pressure in order to put pressure on the rocks and cause them to fracture. In each fracking, 2-9 million gallons of water mixed with sand and chemicals which are forced through the well into the rock formation at high pressure to fracture, or crack, the shale, hence the name hydraulic fracturing. (3) After the fluid is pumped in roughly half the fracking fluid remains in the ground. “The rest of it (1,000,000 to 4,000,000 gallons) comes up out of the well and is considered industrial waste and must be disposed of. Each well may be fracked up to ten times during its productive life.” (3) An acid treatment (particularly in limestone) can also be used to increase and enlarge flow channels. The 30 to 60% of the fracking fluid that stays in the ground in the cracks in the rock may escape through the existing or new fractures and contaminate surface groundwater. This is one of the very serious problems that fracking can cause. The secret "proprietary" additives in the fracking fluid are highly poisonous and/or carcinogenic and the composition of the fracking fluid is typically not disclosed. This fluid getting into the ground water can cause problems for residents, humans and animals alike, as well as the environment as a whole. Once the ground water becomes contaminated it leads to a whole host of problems such as killing fish in rivers or lakes and any wildlife that drinks the contaminated water as well as the surrounding vegetation. The contaminated waste water that is recovered from the ground is often sent to sewage treatment plants to be treated. This seems as though it is a good thing and the sewage plants make take care of the negative by product and make the water clean again however this is
not true. In one study done by the EPA which was never made public, it was found that the waste water was sometimes hauled to sewage plants not designed to treat it and then discharged into rivers that supply drinking water. “Other documents and interviews show that many E.P.A. scientists are alarmed, warning that the drilling waste is a threat to drinking water in Pennsylvania. Their concern is based partly on a 2009 study, never made public, written by an E.P.A. consultant who concluded that some sewage treatment plants were incapable of removing certain drilling waste contaminants and were probably violating the law.” (4) There have been many instances in Pennsylvania where people have had their drinking water contaminated and animals are being negatively affected as well. As seen in the pictures below there are contaminated ponds, dead vegetation and dead animals all a result of the contamination that fracking causes.

Some of the animals in the Pennsylvania area which are being affected by this fracking due to loss of their habitat as well as poisoning their water are, raccoons, deer, opossum, fish, and even cattle to name a few. Seen in this video below are cattle on a farm in Texas that were drinking from a fracking waste water pit similar to what has happened to some farmers in PA. http://txsharon.blogspot.com/2010/07/cattle-quarantined-after-drinking.html and eye witness account from a resident of Caddo Parish described this as a result of the fracking in the area “120 CHICKENS DIED, A BABY CALF (1 WEEK OLD) DIED, AND 15 CATS, THE SAME DAY ALL THE COWS DIED, AND IT WAS 30+ COWS AND ALL OF THEM WERE PREGNANT. THE COWS THAT WERE CONTAMINATED, JUST BEFORE THEY DIED, STOOD BELLLOWING, HEAD AND STOMACH SWELLING AND FINALLY THEIR TONGUE SWELLED SO BIG IT CUT OFF THE AIR SUPPLY AND THEIR EYES EXPLODED IN THEIR SOCKETS, AND BLOOD RAN OUT OF EYES, NOSE, MOUTH, AND THEIR BACK END. THEIR STOMACHS WERE IMMEDIATELY HUGE, SO BIG IT WAS A WONDER THE STOMACHS DID NOT EXPLODE. THE CHEMICAL ATE THE INSIDES OF THEIR GUTS UP.”(5)

Fracking fluid contamination is clearly a serious danger to the residents of the areas undergoing natural gas drilling but not only is the fluid used for fracking dangerous but the process itself is also just as dangerous. Since the fracking process takes place hundreds of meters underground it is difficult to control. Fractures made in the rocks may allow the gas trapped inside to escape to the surface and this may cause harm to surrounding residents, animals and/or vegetation and creates a high risk of explosion. There have been reported cases in Pennsylvania of gas coming up through peoples water pipes and there have even been explosions. Fracking is extremely harmful to the environment, the animals and residents of the area. the deadly fluid poisons the ground water and kills the animals that drink from it and fish that live in the streams rivers and ponds of the area that become contaminated. Fracking kills the vegetation which takes away animals habitats and destroys any chance that they have to live it their natural habitat in Pennsylvania. As terrible as fracking is the damage that natural gas drilling has on the environment and the animals doesn't end here.

The Final Stages of Gas Extraction and the Long Term Impact (SW)
After the initial fracking of a well it may be fracked up to 18 more times in order to release more gas. A well may produce collectable gas for decades. Ostensibly, the well-head will either be removed, decommissioned, or abandoned after the well stops producing significant amounts of gas. At any point in its life the well presents a hazard to all surrounding life forms in a multitude of ways. Some of these effects are localized but some have potentially far-reaching consequences.

Natural gas is mostly composed of methane and ethane and the well and/or nearby storage tanks may leak at any time. Sufficient leaks could combust and obliterate the surrounding area and start a forest fire. A smaller leak may displace oxygen and kill all aerobic life in its range. Asphyxiation could potentially kill a patch of forest if the leak was sustained but not big enough to combust. Methane is also a much stronger greenhouse gas than CO2, even though it remains in the atmosphere for a shorter amount of time. This means it has a strong but short term effect on the levels of atmospheric gases which cause climate change. Nonetheless, long term exposure does not pose any known health risks.

Fracking fluid poses a much greater danger to all forms of life. It can get into the environment in several ways due to the way it is handled, used, and disposed of. Fracking fluid is usually brought on site in a concentrated form and is mixed with locally sourced water. If the fracking water is spilled en route the effects can be devastating. This occurred in Pennsylvania in October 2010. According to the Observer Reporter, “The driver of a tanker truck hauling liquid used in the Marcellus Shale hydraulic fracturing process was forced off a rural Chartiers Township road Wednesday morning and rolled down an embankment, spilling much of the 5,000 gallons in the tank.” The contents went up to a mile down a stream and minnows were found dead immediately. Unfortunately, it is impossible to know what effects the fluid wound up having on the environment as a whole.

Some ingredients in fracking fluid can become airborne while others are soluble in water. The threat of airborne fracking fluid is more likely to occur shortly after fracking takes place, and is more likely to have a limited range. The chemicals would need to come in contact with mucous membranes and would then get into the body. Many of the chemicals are detrimental to the GI tract, liver, skin, respiratory tract, circulatory system, reproductive tract, and brain. Some are also carcinogenic and mutagenic. The water soluble chemicals pose a much greater risk because they can get into aquifers which feed into wells and/or surface water. These chemicals cause a list of dangerous health effects which are similar to the airborne chemicals but are seen in higher
quantities. All forms of life require liquid water, therefore if the fracking chemicals get into the Delaware River it will have a massive impact on the ecology of the regional habitat and the people who drink its water. Initially, contamination could kill/sicken millions of people and animals. But, even more disconcerting is the problems which will only become apparent many years down the line. Chronic illnesses, cancer, mutations, and reproductive conditions could ruin the lives of many people and could decimate entire species. All the while, these problems could not be definitively linked to gas drilling.

Finally, the land around the well-head will remain cleared and barren for as long as gas is being collected. After production ceases it will take years for secondary succession to occur and cover the land. Therefore, the land around the well is unsuitable for habitation by most plants and animals for decades. If the land is contaminated or methane continues to seep from the ground it could prove unusable and even hazardous for many years to come. The area of the Marcellus shale is vast and the land is divided into small parcels which are mostly owned by average citizens. Therefore the number of contaminated sites could prove to be absolutely incomprehensible.

http://www.gaslandthemovie.com/whats-fracking
http://www.riverreporter.com/issues/08-12-04/fracking.pdf
http://www.observer-reporter.com/or/localnews/10-21-2010-fracking-truck-rolls
http://www.endocrinedisruption.com/chemicals.introduction.php

The Service Project: Regulation for Gas Drilling (KS)

For our community service project the below proposed regulation for gas drilling are to be submitted to the Delaware River Basin Commission for review. They may potentially use some of these regulations in the future to help regulate gas drilling in the Delaware River Basin.

Proposed Regulations for Gas Drilling in the Delaware River Basin (KS & SW)
Regulating Deforestation and Damage to the Forests.
“A forest is a dynamic system, continually changing in response to disturbances. Some disturbances help maintain native species and historic conditions. Others threaten them. Thus, there are limits to which a forest can recover from disturbances, especially exotic ones.” Currently there is little to no regulation on the damage allowed to the forests that natural gas drilling causes. Nearly all of the regulations put in place are designed to limit and control the use of water, contamination of ground water and the discharge of contaminated water from the site. The forests of the Delaware river basin serve as the home for most of the animals living in the area. The forest provides shelter, food and life for all the animals and without a healthy forest for them they cannot survive. The damage allowed to these forests must be strictly regulated to avoid permanently destroying them.

Forests are infinitely useful to the human population as well. They can be used for timber products, watershed protection, camping, hunting, fishing and other types of recreation. They also aid the global population by absorbing CO2, a major greenhouse gas. By protecting the health of our forests we vicariously protect our own health.
No two wells may be drilled within a 50 mile radius of any other well. (KS)

Limiting the number of wells in a given area will limit the amount of forest that will be affected by the drilling. Drilling pads can range from 2-5 acres large so having the wells be 50 miles apart will help local environments stay clear of pollution, flooding, deforestation and soil impaction due to the clearing of the trees. If wells are made close to one another large amounts of forest will have to be cleared. “Forests are great protectors and purifiers of our water supply. They, among other things, slow the runoff of rainfall, thus controlling erosion and stream and lake sedimentation; filter pesticide and nutrient runoff; and shade waterways thereby cooling water temperatures.” Without enough forest cover many things in the surrounding area will be negatively affected by things such as soil erosion, pesticide contamination, and rising water temperatures.

The DRBC will keep detailed account of all wells active or closed to date. The company looking to drill must survey the area and notify the DRBC of any well within a 50 mile radius of their potential drill site. If it is found that there was a drill site within the 50 miles radius that the company did not notify the DRBC about and the DRBC didn't recognize and drilling begins the company (well sponsor) will be charged a fine of $250,000 and the well will be closed immediately.

http://www.clarkswcd.org/Woodland/HealthyForest.htm

Only X number of trees may be removed per acre for any drilling or drilling related activity including creating roads, making room for drilling equipment, etc. (KS)

Limiting the number of trees being affected by the drill site is imperative to maintaining a healthy environment but it is equally important to regulate the number of trees and forest being affected by the need for roads, trucks, making room to store equipment, fracking fluid, etc. the removal of trees also leaves exposed soil which can lead to soil erosion. “Soil erosion can negatively impact the environment, since exposed soil creates dust in a community through wind erosion. Rain can also cause exposed soil to enter local waterways. This directly impacts aquatic ecosystems by smothering fish eggs and clouding water.

The DRBC shall be responsible for sending out a biologist to determine the maximum amount of trees that can be removed before causing significant damage to the forest health. Only the minimum amount of trees which allow the drilling to be done shall be removed. This number shall not exceed the number of trees determined by the biologist. The cost of sending out the biologist(s) shall be the responsibility of the well sponsor.

http://www.nationalforestassociation.org/documents/How%20to%20maintain%20your%20Forest%20Care%20plan.pdf

The company or individual who drills on the site must put up a security deposit (to be determined by the DRBC) to ensure that any environmental damage to the site can be remediated, regardless of the financial health of the company at that time. (KS)

This regulation will ensure that any negative consequence endured by the environment or the surrounding inhabitants will be remediated to the best of the companies ability. This will also
protect against if a company happens to go bankrupt and not have the money to clean up the damage it has done. The security deposit will be used towards any environmental damage if the company does not have enough money or if they have not restored the forest to the satisfaction of the biologist(s) who studied and evaluated the drill site for health prior to it being drilled.

The company who is drilling the well shall give to the DRBC a security deposit which the DRBC will determine based on the size of the well, the proximity of the well to any bodies of water, the proximity to any roads and residential houses. The security deposit will be placed in a separate account and will be returned once drilling is complete and the site is restored to the satisfaction of the biologist(s) who documented it initially.

Before drilling, the condition of the site must be documented in detail including tests of water and soil to be sure no contamination has occurred and photographs to show the health of the Forest including documenting all animal and plant species that are found there. (KS)
This documentation will be imperative to being able to successfully restore the forest to its initial condition once drilling has ceased. It is essential that healthy forests are maintained and protected as they serve as the home, and shelter for many animals and plants as well as serve as protectors of soil erosion, pesticide contamination, excess nutrient runoff, and more. Trees are oxygen producers and provide cover from sun and keep the planet cool. Without healthy forests the planet will endure many negative consequences.

The DRBC will be responsible for sending a biologist(s) out to the potential drill site to document the health of the Forest as well as take photographs. The biologist(s) must also take a number of samples of soil and any water found near the potential drill site. The soil and water must be taken to a lab of the DRBCs choosing to be tested for its components as to be documented to compare to soil and water samples taken after drilling has commenced. All fees incurred through this process are the sole responsibility of the well sponsor.

Beginning from the start of the drilling process, the surrounding water and soil must be tested once every month (at the expense of the well-sponsor). Samples must be collected and tested by an independent laboratory and sent directly to the DRBC. The laboratory which is used may only be chosen by the DRBC. (SW)
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The surrounding forest must be inspected annually, by the EPA and the DRBC, at the expense of the well-sponsor, to ensure that the flora and fauna are healthy and have suffered no ill-effects due to drilling activities. The source of any problems must be corrected within 30 days and the site must be remediated and returned to its prior state within 6 months. (SW)

It is possible to miss contamination when you are only testing a limited sample size of soil and water. Also, airborne contaminants may be missed by testing because they are so transient, nonetheless, their effects may be long-lasting. Therefore, it is necessary to visually verify the health of the forest. In this way, any problems can be caught quickly and can then be fixed so their impact is undone and they do not reoccur.

As shown in the study by Adams et al., there can be many effects related to drilling (1). These include severe erosion due to well-pad construction, forest-clearing, and overuse of roads. In their observations, the dispersal of fracking fluid on the land resulted in the death of many trees in the immediate area with telltale signs, including early shedding of leaves and sloughing of bark. They go on to state that, “It is obvious that unexpected, unpredicted events will occur during such activities, and therefore land managers should consider a wide range of possible effects when analyzing impacts on natural resources.”

Once the well has surpassed its useful lifespan, the well must be filled, the well-head removed, and the site restored to its state prior to drilling. A minimum of the trees removed before drilling must be replanted (in proper proportions, according to species). (SW)

It’s absolutely key to keep the big picture in mind. All gas-wells are merely temporary. They are put in place and then are used to extract the methane which is stored underground. There is a finite supply of methane, and thus, the well has a very limited lifespan. That’s why we need to have an end-game in mind when we tap into this natural resource. By remembering the scope of the operation we can see that this will only be a blip in the life of the forest, if it is carried out properly.

Gas wells and/or fracking fluid retention ponds may not be placed within 0.5 miles of: waterwells, open water (lakes, rivers, streams, ponds, swamps, wetlands), or ground water which is within 0.5 feet of the surface. (SW)

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The proposed regulation does not take into account the retention ponds (drill pits) which hold used fracking water. These arguably pose the greatest danger of all because if they were to fail or overflow they would cause a large spill of toxic water to enter the waterway and leech into the surrounding soil. The impact from this could be catastrophic.

The 500 foot minimum setback is too small because it does not take into account the unique geology which occurs in every region of the DRB. Differing placement of rock formations and water tables mean that one gas-well may be completely safe while an identical one which is further away is a looming disaster. Due to the complexity of the geology and hydrology involved it would be prudent to set one standard which applies to the entire DRB. Due to the lack of a strong standard we have arrived at the 0.5 mile value. This was an appropriate value in a study by Sims, regarding distance of hazardous waste injection wells (2). This designation seems fitting based on what we have established regarding the danger of wells and fracking fluid.

It is utterly nonsensical to refer to the host state in regards to distance from water supply wells. Water must be kept very pure for human consumption and thus needs to have maximum protection. There are not varying standards for safe water, it is either safe for human use or it’s not.


**Regulations Submission Confirmation**

Thank You!
Natural Gas Development Regulations - DRAFT
Your comments were successfully submitted. April 13, 2011 09:15 PM Mountain Time

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Proposed Regulations for Gas Drilling in the Delaware River Basin Regulating Deforestation and Damage to the Forests. "A forest is a dynamic system, continually changing in response to disturbances. Some disturbances help maintain native species and historic conditions. Others threaten them. Thus, there are limits to which a forest can recover from disturbances, especially exotic ones." Currently there is little to no regulation on the damage allowed to the forests that natural gas drilling causes. Nearly all of the regulations put in place are designed to limit and control the use of water, contamination of ground water and the discharge of contaminated water from the site. The forests of the Delaware river basin serve as the home for most of the animals living in the area. The forest provides shelter, food and life for all the animals and without a healthy forest for them they cannot survive. The damage allowed to these forests must be strictly regulated to avoid permanently destroying them.

Forests are infinitely useful to the human population as well. They can be used for timber products, watershed protection, camping, hunting, fishing and other types of recreation. They also aid the global population by absorbing CO2, a major greenhouse gas. By protecting the health of our forests we vicariously protect our own health.

a) No two wells may be drilled within a 50 mile radius of any other well. Limiting the number of wells in a given area will limit the amount of forest that will be affected by the drilling. Drilling Pads can range from 2-5 acres large so having the wells be 50 miles apart will help local environments stay clear of pollution, flooding, deforestation and soil impaction due to the clearing of the trees. If wells are made close to one another large amounts of Forest will have to be cleared. "Forests are great protectors and purifiers of our water supply. They, among other things, slow the runoff of rainfall, thus controlling erosion and stream and lake sedimentation; filter pesticide and nutrient runoff; and shade waterways thereby cooling water temperatures." Without enough forest cover many things in the surrounding area will be negatively affected by things such as soil erosion, pesticide contamination, and rising water temperatures.

The DRBC will keep detailed account of all wells active or closed to date. The company looking to drill must survey the area and notify the DRBC of any well within a 50 mile radius of their potential drill site. If it is found that there was a drill site within the 50 miles radius that the company did not notify the DRBC about and the DRBC didn't recognize and drilling begins the company (well sponsor) will be charged a fine of $250,000 and the well will be closed immediately.

http://www.clarkswcd.org/Woodland/HealthyForest.htm

b) Only X number of trees may be removed per acre for any drilling or drilling related activity including creating roads, making room for drilling equipment, etc. Limiting the number of trees being affected by the drill site is imperative to maintaining a healthy environment but it is equally important to regulate the number of trees and forest being affected by the need for roads, trucks, making room to store equipment, fracking fluid, etc. the removal of trees also leaves exposed soil which can
lead to soil erosion. "Soil erosion can negatively impact the environment, since exposed soil creates dust in a community through wind erosion. Rain can also cause exposed soil to enter local waterways. This directly impacts aquatic ecosystems by smothering fish eggs and clouding water.

The DRBC shall be responsible for sending out a biologist to determine the maximum amount of trees that can be removed before causing significant damage to the forest health. Only the minimum amount of trees which allow the drilling to be done shall be removed. This number shall not exceed the number of trees determined by the biologist. The cost of sending out the biologist(s) shall be the responsibility of the well sponsor.

http://www.nationalforestassociation.org/documents/How%20to%20maintain%20your%20Forest%20Care%20plan.pdf

c) The company or individual who drills on the site must put up a security deposit (to be determined by the DRBC) to ensure that any environmental damage to the site can be remediated, regardless of the financial health of the company at that time. This regulation will ensure that any negative consequence endured by the environment or the surrounding inhabitants will be remediated to the best of the companies ability. This will also protect against if a company happens to go bankrupt and not have the money to clean up the damage it has done. The security deposit will be used towards any environmental damage if the company does not have enough money or if they have not restored the forest to the satisfaction of the biologist(s) who studied and evaluated the drill site for health prior to it being drilled.

The company who is drilling the well shall give to the DRBC a security deposit which the DRBC will determine based on the size of the well, the proximity of the well to any bodies of water, the proximity to any roads and residential houses. The security deposit will be placed in a separate account and will be returned once drilling is complete and the site is restored to the satisfaction of the biologist(s) who documented it initially.

d) Before drilling, the condition of the site must be documented in detail including tests of water and soil to be sure no contamination has occurred and photographs to show the health of the Forest including documenting all animal and plant species that are found there. This documentation will be imperative to being able to successfully restore the forest to its initial condition once drilling has ceased. It is essential that healthy forests are maintained and protected as they serve as the home, and shelter for many animals and plants as well as serve as protectors of soil erosion, pesticide contamination, excess nutrient runoff, and more. Trees are oxygen producers and provide cover from sun and keep the planet cool. Without healthy forests the planet will endure many negative consequences.

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It's absolutely key to keep the big picture in mind. All gas-wells are merely temporary. They are put in place and then are used to extract the methane which is stored underground. There is a finite supply of methane, and thus, the well has a very limited lifespan. That's why we need to have an end-game in mind when we tap into this natural resource. By remembering the scope of the operation we can see that this will
only be a blip in the life of the forest, if it is carried out properly.
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http://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs76.pdf
http://www.geog.unt.edu/~jminhe/Teaching/GIS-Inter/TermProjects/KellySims.pdf

Comment
ID: 473834-37829/7214
Natural gas drilling has been a topic of concern to many surrounding the Delaware River basin (DRB) which includes parts of New Jersey, New York, Pennsylvania, and Delaware. A new found natural gas reserve in the DRB has prompted companies to begin pushing for drilling of the land and extraction of this natural resource. These companies are only concerned with one thing, MONEY. The effect that this drilling has on the land is severe and long lasting. Not only does it destroy the land surrounding the drill site it destroys much of the land and waters for miles around it. The trucks used for hauling in equipment and hauling out gas destroy the local roads, the clearing of the drill site destroys the habitat of the animals, and the fracking pollutes the water and poisons the fish that live in it and animals that drink from it. Not only does it hurt the environment and the animals it hurts the people who live in the surrounding area. The drilling poisons their water, destroys their roads and state parks and creates an eyesore for them to look at as well as an inconvenience with the noise and truck traffic. These companies are paying individuals who own land on top of the gas reserve to lease their land in order to drill and extract the oil. The people being offered the money are being deceived by these companies who make the drilling seem like a rather simple and totally non harmful process. They are blinded by the money and do not realize that the drilling is not as temporary and harmless as they might think. The drilling process will affect the land for long after the drilling has stopped. The states that are all desperately in need of money these days would do anything to get a little extra income even if it means leasing state forests and parks to these companies for gas drilling. The state governments are not concerned with the effects this drilling will have on the land or what damaging affects the drilling will have on its inhabitants they only care about the money that is going into their pockets. This is unfair to everyone who lives in and around these areas. Who will have a say for all the animals being displaced and poisoned, who lose their homes and lives at the expense of these greedy gas companies. Who will stop them if our state and federal governments are only concerned with getting their money and not doing what’s right by the people and animals that live here? The gas companies have been able to get laws relaxed so they can push through and get drilling approved while not “violating” any laws or regulations in place. One example of this is the exemption of these gas companies from the clean water act which states “The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters” (http://www.epa.gov/regulations/laws/cwa.html). The fracking fluid used in the drilling process is filled with harmful chemicals and if it gets into the surface water and contaminates the ground water it will cause serious problems for many people and animals. Over 15 million people use the Delaware River Basin for their drinking water as well as water for agricultural and industrial use. Some who live around where drilling has begun have had already had their water poisoned, there has even been reports of gas that came straight out of their kitchen sink! There are clearly people living in these areas who are already experiencing the negative effects this drilling causes yet the government and companies keep pushing for more drilling claiming that it is not harmful to the land or its inhabitants. This is ridiculous, how could our government who is supposed to be there to protect us and serve us put us in such danger, how could they be so greedy and look the other way while these gas companies are destroying
the land and water we live on. Something needs to be done to stop the drilling and protect our forests and waters so they can be enjoyed not only by those who live there now but by those in the future.

The Grounds are Cracking and the Machines are Fracking.
By Angela Lin

About a decade ago, the word “fracking” might have brought up images of space travel, cylon warfare and the battle for mankind’s survival. These days however, that word only brings up images that hit closer to home. Both thoughts however do lead to similar outcomes. Nowadays when fracking is spoken of, it is used to describe the process in which heavy machinery create fractures in rocks way underground to extract the natural gases that lie below. These fractures are created using millions of gallons of fluid and an incredible amount of high pressure. Once the natural gas is released, these machines continue to frack up to eighteen more times to release any leftover gas.

Proponents for this destructive and aggressive procedure argue that the benefits outweigh the repercussions. They argue that the natural gas industries have arrived and brought with them a boom in the local economy, giving the area more affluence. They persist to claim that there has been no damage to local reservoirs and woodlands. They blindly rally against the people who have been personally damaged by the natural gas industry. How can the damages from fracking be ignored when the amount of chemicals in the fracking fluid include swimming pool chemical cleaner, bleaching agent in hair cosmetics, and automotive antifreeze? How can they ignore the claims that farm animals are dying at an exponential rate and that people are getting sick near fracking grounds?

Coinciding with fracking are a whole list of other destructive and habitat impacting processes. Before a site can be defined as ready, it has to have all forest cleared for the construction of access roads, drilling pads, and pipelines. This deforestation can impact local water flows and watersheds which consequently supply 80% of Pennsylvania’s drinking water (1). Drilling pads are created and these can range from one to five acres and specifically referring to the Marcellus Shale that runs through the northeast; the pads will be larger since the shale is so deep. With the implant of these pads, the impaction of soil will pose another threat to habitat and agricultural prosperity. The roads that will allow access to these drilling pads from the main road will lead to erosion and contamination to soil resources and water quality. All of these supplemental aspects for fracking lead to the possibility for a decline in human health and wildlife conservation. Just in the Marcellus shale, an exponential rise of 27 to 1386 wells drilled was seen from 2007 to 2010, with the largest increase of 624 wells seen between 2008 and 2009 (2).

With most of the public increasing its interest in natural gas as an alternative clean fuel, many do not know about the consequences that inhabit the drilling and fracking process. It seems appropriate that the word “fracking” links the seemingly heroic natural gas drilling process with a world where robots rebel to counter against humans who don’t deserve to inhabit the world. Regardless of who can be called a “toaster”, we will all be toast if we continue to crack and frack up the earth.

1. [http://pubs.cas.psu.edu/FreePubs/pdfs/ua450.pdf](http://pubs.cas.psu.edu/FreePubs/pdfs/ua450.pdf)
The Dangers of Natural Gas Drilling (Steven Wharrie)

Your drinking water is currently under siege. Energy companies are attempting to drill for natural gas in the Delaware River Basin (DRB), and they may poison your water in the process. The DRB is the water source for over 15 million people, many of them in New Jersey.

There is a very large deposit of shale under the DRB; this shale has a high concentration of natural gas (methane). But the gas cannot be extracted by conventional means. So, the gas companies needed a way to break up the tight shale rock underground to get at the gas inside; thus, they invented a method called hydraulic fracturing (AKA “fracking”). They use “fracking fluid” which is mixed with water and pumped underground to fracture the shale and release the gas. The gas is recovered from the well-head, but the majority of the fracking fluid tends to be left underground. The fluid then has the potential to leach into the water table.

Fracking fluid contains many chemicals which are harmful to human and animal health. Effects can include severe disease of specific organ systems and cancer. These effects may be seen immediately after exposure or may only become apparent much further down the line. The Endocrine Disruption Exchange (a non-profit) has published a full report on these chemicals and their health effects at: endocrinedisruption.com/chemicals.multistate.php. There sample was taken from the fracking fluid of one well, but the companies which use fracking fluid do not publicize the list of ingredients, so they could vary.

According to the EPA, the nine major companies which use fracking fluid are: BJ Services, Complete Production Services, Halliburton, Key Energy Services, Patterson-UTI, RPC, Inc., Schlumberger, Superior Well Services, and Weatherford.

There is currently a moratorium on drilling in the DRB, but The Delaware River Basin Commission (DRBC) has the power to maintain or end that moratorium. They have proposed an amendment to their regulations which would allow gas drilling to take place within the DRB. The board of the DRBC is comprised of the governors of New Jersey, New York, Pennsylvania, and Maryland along with one federal representative. There is currently a period of open comment on the proposed legislation to allow drilling. Please go to: http://parkplanning.nps.gov/projectHome.cfm?projectId=33467 and let them know what you think. Do not allow yourself to sit idly by while your life is at risk. You can also directly tell Governor Christie that you protest this contamination of your water supply by calling his office at 609-292-6000.

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