

## Natural Resource Impacts from Marcellus Gas Extraction: A Conservationist's Perspective

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There are a number of different energy sources on the market including coal, wind, gas, oil, solar, biomass, hydropower and nuclear. It is essential that the development of these energy sources in Pennsylvania safeguards the significant ecological places that make our state a very special place. Over the last several years, Pennsylvania has seen a dramatic increase in exploration and extraction of natural gas, especially in the Marcellus Shale formation. *Possible impacts from Marcellus gas extraction include fragmentation of forests and natural habitats, the spread of invasive species, high demands on water supplies, and contamination of groundwater and surface waters, including drinking water.*

According to the Penn State Cooperative Extension, when a gas well is built, four to six acres must be cleared and graded, or given a flat surface, to accommodate vast amounts of machinery, vehicles, and many workers. When a well is built in a forest, there is a loss of that habitat for plants and animals. New roads are sometimes built to bring materials and supplies to the well site and pipelines are created to carry the natural gas to its destination. A network of roads and pipelines created in otherwise natural environment, such as a forest, cuts away at the amount and quality of habitats for plants and animals. Roads and pipelines often act as corridors for invasive species and create opportunities for them to be transported on equipment or trucks. Although re-vegetating or stabilizing land cleared after road or well construction is generally a good practice, if not done correctly, it could introduce non-native or invasive species that reduce the success of desired, native species at the cleared site and in adjacent habitats.

The great demand for freshwater resources during drilling activities may affect our aquatic ecosystems. Between 2 and 9 million gallons of water are needed to drill each well and large numbers of wells are currently under construction, or planned (Penn State Cooperative Extension). As of June 2010, about 1,312 wells have been drilled in Pennsylvania (PA DEP, 2010). Although projections vary and are difficult to make, if one

Water Use in Pennsylvania	Million Gallons Per Day
Commercial and Industrial*	170
Domestic*	74
Agriculture*	57
Marcellus Shale**	20
Mining*	14
*1995 statewide use estimate, U.S. Department of Interior	
**2010 Industry estimate	

assumes based on industry estimates that 2,500 wells per year could be drilled once the industry is at full capacity, then that could require 10 billion gallons of water per year or about 27.4 million gallons per day

(MGD). Even if all of the waste “frac” water from other wells were used to drill these sites, *a minimum of 20 million gallons per day would be used* (Presentation by Range Resources, April 2010). If wells are hydrofractured more than once during the wells’ production time period, the water needs also could be much greater than estimated.

While the amount of water estimated for natural gas drilling needs does not appear overwhelming compared to other consumptive uses (see table above), *the location of water withdrawals can have a large impact on water resources*. Because many gas wells occur in remote locations with only small, ecologically sensitive streams that could not sustain large water withdrawals, there is concern about the availability of water sources, from which its take would not be harmful. Particularly, during summer low flow periods or during droughts, removing water from already stressed waterways could be harmful to biota.

**50% of the mussel species found in the Susquehanna River watershed are threatened or imperiled.**

Too much water withdrawal would be detrimental to aquatic organisms, such as fish, mussels, insects, crayfish, frogs, turtles, aquatic birds and others.

- A large draw down of a water body could dry up some habitats, strand some organisms, reduce water quality, and heat up the water in the summer beyond the tolerance of some aquatic life.
- Because pollutants become more concentrated when water levels are low, changes in water quality due to increased water withdrawals could be problematic.
- The habitats essential for feeding, breeding and rearing young of many organisms could be reduced or could disappear in extremely low water.
- A reduction in stream flows that clean and maintain habitats could result in poor quality environments for aquatic animals or plants.

Studies by the Western Pennsylvania Conservancy and others have found rich resources of freshwater mussels in the Susquehanna River watershed, which lies in the Marcellus Shale geologic formation. Fourteen species are recorded from the watershed, inhabiting small streams to large rivers or ponds and lakes. Seven species are



**Brook Floater, *Alasmidonta varicosa***

considered to be imperiled, critically imperiled or threatened in the Susquehanna River watershed. Low water conditions would add to their current threats. A rare mussel, such as the brook floater (*Alasmidonta varicosa*) that typically inhabits small streams would be at risk from habitat loss due to low water conditions. Because as adults, freshwater mussels rarely move more than a few meters, they lack the ability to escape to better environment and may die during times of low water.

Wastes from the drilling process must be contained or treated properly to ensure protection of human health and to prevent contamination of streams and groundwater. About one-third of the drilling fluids or “frac” water flows back to the surface. This “frac” water contains a combination of water, brine, clay or sand, and smaller amounts of various chemical additives. Industry representatives say that the additives account for less than 1% of the frac mixture. The waste “frac” water may also contain salt, metals, radioactive materials, oil, and surfactants among other chemicals (Penn State Cooperative Extension 2010). These contaminants, even at low concentrations, are the reason that “frac” water or waste “frac” water could pollute groundwater, lakes and rivers if it is not properly disposed. A spill or illegal dumping of “frac” water could severely pollute a waterway, killing fish and other aquatic life. Thus, the “frac” water must be either hauled away for treatment and disposal, or recycled for drilling other wells — a practice some drilling companies are adopting.

Drilling companies have begun to reuse “frac” water to cut down on the waste water disposal and the need for water supplies. However, the real demand for freshwater for drilling may not be realized for the next few years when many of the planned wells are in development. It will be up to government agencies and river basin commissions to regulate water withdrawals.

As more wells are constructed, regulators, drilling companies, private land owners, scientists and environmentalists are learning more about the most environmentally sound ways to drill for natural gas in the Marcellus Shale formation as well as other formations like the Barnett Shale. Proper regulation, enforcement of regulations and consideration for placement of wells, especially in environmentally sensitive areas, will help to ensure the protection of natural resources.

**Sources:**

Penn State Cooperative Extension, <http://naturalgas.extension.psu.edu/>, accessed May 20, 2010.

Pennsylvania Department of Environmental Protection, [http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new\\_forms/marcellus/Reports/Frac%20list%206-30-2010.pdf](http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/Reports/Frac%20list%206-30-2010.pdf) and <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/2010PermitDrilledmaps.htm>, accessed July 7, 2010.

Presentation by Range Resources staff to staff of Conservation organizations at offices of Range Resources, April 29, 2010.

U.S. Geological Survey, U.S. Department of the Interior, <http://pa.water.usgs.gov/reports/fs174-99.pdf>.