Section VI

Expanding Natural Gas and Oil Exploration/Production

Livia DeMarchis, Yale University

BACKGROUND

Oil and gas are a vital source of energy in the United States, providing about 60% of our energy (EIA, 2008). The benefits provided by oil and gas use, however, are offset by significant environmental concerns, including many that impact land conservation.

General information

Natural gas

Recent years have seen a significant increase in natural gas exploration in the United States. In what has become known as the “shale sweepstakes” in industry circles, developers have been engaged in “a fevered rush to purchase drilling rights to natural gas that lies deep in deposits of shale rock,” (Palmeri, 2008). In addition to the profits that can be made, drilling for gas has been promoted as a way to improve American energy independence and impact on climate change. Burning gas releases 23% percent less greenhouse gases that contribute to global warming than does burning oil, and the resource is found in our backyards (Lustgarten, Where Things Stand, 2008).

The recent rush of interest in U.S. natural gas has resulted largely from the development of modern tools to extract the resource. Horizontal drilling and hydraulic fracturing are some of the major new innovations. Horizontal drilling allows those searching for gas deposits to drill in multiple directions at the same time at a cost not much higher than the cost of one well (Palmeri, 2008). Holes are drilled horizontally for up to several thousand feet in one direction (NY Department of Environmental Conservation, 2009). After drilling in several directions, crews pump water at high pressure into the ground, fracturing the rock and releasing liquid natural gas (Palmeri, 2008). Along with the water, a “propping material” such as sand
is also pumped into the wells and assists in holding the fractures open to allow more
gas to flow into the well (NY Department of Environmental Conservation, 2009).

Figure 1  Major U.S. basins and shale plays

![Map of United States Shale Gas Plays](image)

Source: EIA (November, 2008)

The natural gas boom originated in Fort Worth, TX, home of the Barnett Shale
field, which is thought to be the largest new onshore field of natural gas in the U.S.
Since 2003, production at the Barnett Shale field has quadrupled to over 1 trillion
cubic feet per year. Development of this field has apparently changed the city of Fort
Worth, as rigs have appeared on any open land and brokers representing oil
companies knock door to door asking homeowners for leases to drill on suburban
land. Compensation for such leases can range from $500 an acre signing bonus plus
a 12% continuous royalty to $25,000 an acre signing bonus and a 25% royalty
(Palmeri, 2008).

In addition to Texas, shale fields have been discovered and are being developed in
a number of areas from North Dakota to Arkansas. The Marcellus Shale, stretching
across West Virginia, Pennsylvania, and the southern half of New York has generated
much interest among oil companies of late. In April 2008, XTO Energy bought
drilling rights to 142,000 acres on the Marcellus Shale for $600 million, thought to be
a record price for the area (Palmeri, 2008). Different shale formations contain
different estimated amounts of gas. The entire extent of the Marcellus Shale is
estimated to contain 168 trillion to 516 trillion cubic feet of natural gas; however, experts still do not know how much gas will be commercially recoverable (NY Department of Environmental Conservation, 2009).

**Figure 2 Dry natural gas proved reserves by area**

![Map of Dry Natural Gas Proved Reserves by Area](image)

*Source: EIA (February, 2009)*

**Last minute court order blocks oil and gas lease on public land**

In January 2009, a federal judge granted a temporary restraining order that had been sought by environmental groups to block oil and gas exploration on federal land in Utah. The Bureau of Land Management had auctioned off leases on the land in December 2008 (Barringer, 2009). These leases allowed exploration on tens of thousands of acres on or near the boundaries of Arches National Park, Dinosaur National Monument and Canyonlands National Park, yet the Park Service had been given insufficient opportunity to comment on the leasing proposal (Barringer, 2008).

**Oil**

The first oil field in the United States was discovered in Titusville, PA in 1859 (Palmeri, 2008). U.S. crude oil production peaked in 1970 with an average of 9.64 million barrels per day. By 2006, total U.S. production of crude oil, including offshore
production, had fallen to 5.102 million barrels per day (EIA Crude Oil, 2009). There is a real question about whether it is efficient to continue expenditure of resources on oil production in the United States. A 2005 paper on energy return on investment (EROI) discussed the fact that there has been an overall decline in the EROI for petroleum extraction in the U.S. This decline in EROI suggests that the energy costs of extraction have been raised by depletion of resources, and other indicators also suggest that the quality of the nation’s petroleum resources in general has declined (Cleveland, 2005). Overall, there is good evidence indicating that the cost of producing oil in the continental US will continue to increase (Cleveland, 2003).

Oil is produced by extraction from wells drilled in crude oil reservoirs. There are several methods of extracting oil. The “natural lift” production method relies on the natural pressure inside the reservoir to force oil to surface. This method can usually be used for a while after a well is first created, but the natural pressure eventually decreases and more active extraction methods are needed. When “natural lift” has died down, mechanical pumps (themselves powered by gas or electricity) must be used to artificially lift oil out of wells. Natural lift and pumping are known as “primary” extraction methods. Over time, the effectiveness of primary methods decreases and “secondary” production methods must be employed. One common secondary method of production is the “waterflood” method. Similar to the case of natural gas extraction, the “waterflood” method involves injection of water into an oil well. This injection creates increased pressure inside the reservoir and forces oil through the drilled openings in the surface. Once secondary production methods have decreased in effectiveness, tertiary or “enhanced” production methods are needed. Such methods include the injection of steam, carbon dioxide and other chemicals or gases into an oil reservoir (EIA Crude Oil, 2009).

Figure 3  Top crude oil-producing states

![Figure 3](image)

Source: EIA (2006)

One of the most contentious issues in recent onshore oil development history has been whether to explore and drill for oil in the Arctic National Wildlife Refuge
(ANWR) in Alaska. This has been a question since the 1970s. The US Geological Survey (USGS) has made a mean estimate that approximately 7.8 billion barrels of oil might be recoverable from the area. Experts suggest, however, that oil from ANWR would not reduce US dependence on oil to a significant extent (Cleveland and Kaufmann, 2003).

One way in which onshore oil exploration is developing is in the field of oil shale development. Oil shale deposits are found mainly in the western U.S. (Bartis et al., 2005). There is currently no organization actively developing oil shale resources at a commercial scale because the development of cost-effective technology is still underway. Oil is obtained from oil shale by heating the shale and capturing the liquid that is released in a process called retorting. Production of oil shale usually involves either mining and surface retorting or in-situ retorting. Mining and surface retorting involves either underground or surface mining, though underground mining is more commercially viable. In-situ retorting, which involves heating oil shale in place and extracting the liquid from the ground for refining, appears to be more cost effective (Bartis et al., 2005). The Green River Formation, which stretches into Colorado, Utah, and Wyoming, is the largest known oil shale deposits in the world. Experts estimate that the formation contains between 1.5 and 1.8 trillion barrels of oil, though only
between 500 billion and 1.1 trillion are estimated to be recoverable. Even at the low end of this recoverable estimate, such resources could satisfy the U.S. demand for petroleum for hundreds of years (Bartis et al., 2005). Again, it should be stressed that while the resources exist, current technology still does not make this a usable energy source at present.

"Extremely suspect" leasing on the Wyoming range

In April of 2008, the governor of Wyoming attacked an agreement regarding oil and natural gas exploration on the Wyoming Range. The agreement was proposed between the US Forest Service and Stanley Energy, a Denver-based energy company. The company’s drilling plan included the possibility of drilling up to 200 wells from eight, 50-acre well pads in the 44,720-acre Big Piney Ranger District of the Wyoming Range. The governor had serious reservations about the lease agreement, in part because of the rapid pace of exploration and in part because it gave the independent oil and gas producer inappropriate influence in the area. The arrangements also came under the shadow of impropriety because it was agreed that Stanley Energy would pay for a private consultant to complete the Supplemental Energy Impact Statement deciding whether the leases could be developed (Sullivan, 2008).

What are the impacts of oil and gas exploration on land conservation?

Exploration and production of oil and gas have led to negative impacts on surface and ground water, soil, and ecosystems in all 36 states where these activities occur (Kharaka et al., 2005). Impacts to land surfaces can result from site clearing, construction of access roads, and construction of pipelines (Kharaka et al., 2005). Many of these impacts are aesthetic – heavy oil and gas exploration and production has the potential to turn a countryside into an industrial zone “crisscrossed with drill pads, pipelines, and access roads,” (France, 2008); but other impacts threaten environmental health more directly.

Natural gas

Gas exploration and production poses both aesthetic and environmental threats to land conservation. In terms of aesthetic impacts, a recent New York Magazine article about gas exploration in the Catskills summed it up nicely: “The installations are significant-size industrial parks. Including access roads and parking areas, a drill pad takes up several acres, with three or more physical structures the size of shipping containers and an Erector Set-style tower standing perhaps 40 feet tall. Trees are removed, entire slopes are leveled. The facilities wheeze and off-gas, and frequently throw off huge flames. Next to them are large pits holding millions of gallons of contaminated water” (France, 2008). Hand in hand with many of these negative aesthetic impacts come problems of habitat disturbance for species living in or near well sites.
Gas exploration has the potential to cause water quality problems and the process itself consumes huge quantities of water. Gas exploration using hydraulic fracturing requires large amounts of water to fracture the rock. Each well in the Marcellus Shale, for example, may use over a million gallons of water (NY Department of Environmental Conservation, 2009). In addition to the large amounts of water being used, the water is also treated with a number of chemical and other additives including: a “friction reducer”, a biocide that prevents bacterial growth in the well piping, a gel to carry sand or any other “propping material” into the rock fracture, and several other agents that prevent pipe corrosion and ensure the propping material remains in the fractures. The water or other fluid used in gas wells must be handled, transported and disposed of carefully after use (NY Department of Environmental Conservation, 2009). In 2004, the EPA released a study concluding that the injection of hydraulic fracturing fluids “poses little or no threat” to underground sources of drinking water and did not justify further research at that time (EPA, 2004). However, debate has surrounded the conclusion of this study. For one thing, the chemical makeups of additives are still being studied in some cases (NY Department of Environmental Conservation, 2009), and some sources claim that some of the chemicals cause skin, eye, gastrointestinal, respiratory, nervous system, and immune system harm (The Endocrine Disruption Exchange, 2009). Furthermore, there have been a series of “contamination incidents” in areas close to natural gas fields, leading to continued questions about the risks of chemicals used in hydraulic fracturing. In 2008, reports by the investigative journal ProPublica found contamination in drinking water supplies in at least 1,000 cases around the country.
where intensive drilling had taken place (Lustgarten, 2008). To try to prevent harm, precautions have been taken to protect municipal water. For example, a full environmental assessment of proposed oil or gas wells within 2,000 feet of a municipal water well is required in the state of New York. Strict well construction guidelines must also be followed to prevent pollution of private water wells (NY Department of Environmental Conservation, 2009). In some states where drilling has been most intense, officials have been redrafting legislation regulating the gas industry (Lustgarten, 2008).

Beyond the exploration process, gas production causes land conservation concerns as well with continued visual and noise impacts. While much of the infrastructure is removed after exploration is complete and production begins, a production site is still quite industrial. Each wellhead for production is connected to the next nearest wellheads via a pipeline, which can be noisy. Furthermore, giant pistons, fueled by diesel-fired compressors, pump nonstop to maintain the flow of gas downstream, creating vibrations that, in some cases, can be felt almost 2,000 feet away (France, 2008).

**Figure 6** Major U.S. natural gas transportation corridors

Source: Energy Information Administration, Office of Oil and Gas, Natural Gas Division, Gas Tran Gas Transportation Information System.

The EIA has determined that the informational map displays here do not raise security concerns, based on the application of the Federal Geographic Data Committee's Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns.

**Oil**

Crude oil development can have significant negative environmental impacts that affect land conservation. As with natural gas exploration and production, negative
aesthetic impacts and habitat destruction occur in site clearing and well construction. In some cases, such as in ANWAR, sensitive habitats are threatened by the introduction of industrial-scale exploration and production facilities. New technology has significantly decreased the “footprint” of drilling sites and the number of sites that are needed; however, negative impacts still occur in affected areas. When production is finished at an oil well, the well is plugged below ground, making it difficult to tell it was there (EIA Petroleum); however, oil wells are sometimes incorrectly sealed, which can present hazards in future (USGS, 2003).

Oil spills result in many of the worst environmental impacts attributable to oil production. Because they receive significant media attention, people generally think of oil spills or leaks from damaged ships as being the most negative spill events. However, while ship spills may cause the biggest immediate shock to wildlife since so large a quantity of oil is released at once, only a small percent of all oil spilled is from ship accidents. Much more oil leaks into watersheds when petroleum is in use, for example, when it seeps from leaky storage tanks or pipelines (EIA Petroleum).

Oil shale development, though not commercially viable yet, has the potential to impact land conservation as well. If the mining and surface retorting technique described above is used, then the landscape could be permanently scarred by mining operations and the disposal of spent shale. While in-situ retorting does not involve the permanent modification of land topography, it too could have significant negative impacts on land conservation, most significantly because of negative impacts to groundwater quality (Bartis et al., 2005).

**Projections for development**
Recent data on oil and gas production in the U.S. shows that both have risen slightly, though gas production has risen much more significantly and oil production is still much lower than it once was. According to the most recent DOE/EIA Annual Report, which was released in February 2009 and reports data from 2007, proved reserves of both natural gas and crude oil increased in 2007. Crude oil reserves increased in 2007
by 2 percent, with increases found onshore in the lower 48 states and in Alaska and slight declines in the Gulf of Mexico offshore reserve. Also in 2007, 1,691 million barrels of crude oil was produced, an increase in 2% from 2006’s estimated production. Production in 2007 marked the first time in four years that oil production rates increased (EIA, February 2009). Companies have continued to actively invest in U.S. domestic oil and gas production. In 2007, BP estimated that it planned to invest more than $45 billion over the following 10 years in oil and gas exploration and production in the Gulf of Mexico, Alaska, and the continental U.S. (Housley, 2007).

In the past four years, output from U.S. natural gas deposits has been on a steep rise after almost a decade of stagnant growth (Palmeri, 2008). In 2007, proved natural gas reserves increased to 26.6 trillion cubic feet (Tcf), making 2007 the ninth consecutive year in which proved U.S. natural gas reserves have risen (EIA, February 2009).

![Figure 7 U.S. dry natural gas proved reserves, 1997-2007](source: EIA (February, 2009))

Extended projections of natural gas production over the next twenty years forecast a continued increase in production. One EIA projection from 2008 estimates that shale gas production in 2029 will have more than doubled the amount produced in 2007.

Graphs of U.S. consumption of natural gas (Figure 9) show that use of the energy source is rising. Industrial users still consume the largest amount of natural gas, but use by electric power suppliers has risen most sharply in recent years. Future projections of natural gas use (Figure 10) show that industrial users and electric generators will likely continue to have the highest consumption of natural gas through most of the 2010s and 2020s.

Though U.S. crude oil production, in the lower 48 states especially, has decreased overall in the last several decades, EIA projections stretching to 2030 suggest that total U.S. production will increase somewhat again, due largely to increases in deepwater
offshore production (See Figures 11 & 12). That said, production is not expected to reach the same levels it once was at in the 1970s to early 1990s.

Figure 8  Shale gas annual production and energy information administration (EIA) forecast

Source: EIA (2009)

Figure 9  Natural gas (trillion cubic feet)

Overview, 1973-2007

Source: EIA Review (2009)
Figure 10  Natural gas consumption by sector, 1990-2030 (trillion cubic feet)

Source: EIA Outlook (2008)

Figure 11  Petroleum overview (million barrels per day)

Source: EIA Review (2009)
How is the land conservation community responding?

While oil and gas exploration and production has definite environmental risks and aesthetic and habitat impacts, it may be possible for conservation and energy development to be compatible, but land trusts must proceed with caution (McGrory-Klyza, 2009). Thus far, the land trust community in some areas that have been impacted by gas and oil exploration has worked to draft model easement language to address gas and oil exploration and has taken steps to educate the public about the consequences of exploration and production. For example, the Pennsylvania Land Trust Association did a two-day conference on the consequences of drilling and to help people plan responses to the leasing process. In some cases, land trusts simply do not have the ability to draft easements that prohibit mineral extraction, and therefore they must try to compromise with oil and gas exploration and production (Nicole Faraguna in personal communication with Casey Pickett). In other cases, land trusts located in areas with heavy oil and gas resources know that they need to participate in a balancing act with landowners and developers to try to develop the resource with the least impact to the conservation values of a property.

It should be noted that in some cases, land trusts have actually been interested in offering their own fee-owned land for oil and gas exploration and production in order to generate additional revenue to support more conservation. Using horizontal drilling, exploration and extraction may be possible to accomplish from drill sites that are located beyond the boundaries of conserved land so that surface impacts to conserved land are negligible. One important negative consequence that could result if land trusts become involved in oil and gas exploration, however, is bad publicity. The Nature Conservancy, for example, received a huge amount of bad press in 2003 based on a series in the *Washington Post*, which portrayed the nonprofit as “acting like an oil company” for allowing drilling on a nature preserve for the Attwater’s prairie chicken (Stephens and Ottaway, 2003). As it happens, the prairie chicken reserve was
actually one of the most effective sanctuaries for protecting the endangered bird, yet the Nature Conservancy suffered a tarnished public image for trying to allow resource development and conservation to coexist (Barton “Buzz” Thompson Jr. in personal communication with Livia DeMarchis). Certainly, if oil and gas development is of interest and a land trust chooses to proceed on land they own or hold an easement on, they should do so with legal counsel and an expert resource professional on hand (McGrory-Klyza, 2009).

Recently, one Pennsylvania land trust gave a presentation in which they suggested model easement alternatives to address gas exploration and production in their area. The preferred language includes provisions that any documents drawn up to convey interests in gas be submitted to the easement holder for review and approval. Furthermore, preferred language would include a provision that only subsurface methods shall be used for exploration and extraction of oil or natural gas, and exploration and extraction shall not disturb the surface and shall not damage or endanger the conservation values of the property. One additional preferred provision is that roads and pipelines not be allowed to cross a conserved piece of property. Horizontal drilling, because it allows access to mineral resources on conserved property via drilling from an adjacent piece of property, should theoretically allow exploration and extraction without disturbing land within the boundary of property under a conservation easement.

Alternative suggested easement language, in addition to providing that any conveyance documents be submitted to an easement holder for review and approval, might require that specific development plans for oil and natural gas reserves be subject to review and approval by an easement holder. Such language might also include the following provisions: (i) development of any well or facility shall not violate the intent of the easement; (ii) clearing and removal of vegetation for wells and facilities shall not exceed 1 acre; and (iii) access roads shall not exceed 20 feet in width. Further provisions might be added to limit the number of wells, pipelines, and roads; to give the easement holder the right to review and approve road locations; to prohibit the taking of water from streams, ponds, or wells on the property; to require the lining of drill pits; to prohibit the discharge of water on the property; and to require roads and well sites to be “deconstructed” after use and revegetated.

There are some important property rights issues that land trusts must be aware of with regard to the possibility of oil and gas exploration and development on their land. In some areas of the U.S., generally in the west, it is often the case that property owners only own surface rights to their land, and mineral rights have been “severed” and sold separately. In some cases, a surface owner may only own a portion of the mineral rights. If this is the situation, leasing, exploration, and production of mineral rights might be allowed to occur without the consent of surface owners because the prior decoupling of mineral rights from surface rights takes precedence. This can be a particular issue for land conservation if conservation easements and land put in trust does not include mineral rights. The laws on mineral rights vary from state to state and land trusts must be aware of them (McGrory-Klyza, 2009). Land trusts must do their due diligence and learn who owns mineral rights before proceeding with the
purchase of an easement or a piece of property for conservation (Kueter, 2002). If land trusts are considering allowing oil and gas development on conserved land that was donated or bargain-sold (either in fee simple or as an easement), then the tax code also becomes important. A land trust must be familiar with the tax code and Treasury regulations to determine whether and how to allow resource development on such land. If the tax code is not properly followed and the land trust is later audited, it can lose its tax-exempt status (McGrory-Klyza, 2009; Kueter, 2002).

**QUESTIONS FOR CONSIDERATION**

1) To what extent is oil and natural gas exploration and development compatible with land conservation?

2) Is it feasible for oil and gas exploration wells, access roads, and pipelines to exist on property subject to a conservation easement without violating the conservation intent of the property? Would language giving the easement holder the ability to place limits on exploration and production make a significant difference?

3) Do gas and oil wells and production pipelines present a situation in which mitigation credits might be used to offset the damage to certain pieces of land?

4) Should land trusts consider offering certain land for oil and gas exploration and extraction to increase their revenue stream?

5) In the West, how can a land trust’s ability to acquire mineral rights be increased?

6) How should land trusts respond to the following four situations of concern? (adapted from McGrory-Klyza 2009).
   a) a landowner already has an easement in place and may be in danger of violating it by making an agreement with an energy company.
   b) a land trust discovers land that it would like to conserve, but a lease already exists with an energy company.
   c) when negotiating an easement, a landowner wants to reserve the right to extract oil and gas.
   d) a land trust owns land in fee simple on which it would like to allow limited mineral exploration and extraction.

7) How would allowing oil and gas exploration and excavation impact the public perception of a land trust?

**ORGANIZATIONS AND INDIVIDUALS DOING INTERESTING WORK**

- Cutler Cleveland, Boston University
  (http://www.bu.edu/cees/people/faculty/cutler/)
• Terry Engelder, Pennsylvania State University (http://www.geosc.psu.edu/~engelder/)
• Matt McDonough, Grand Traverse Regional Land Conservancy (http://www.gtrlc.org/)
• Northcentral Pennsylvania Conservancy (http://www.npcweb.org/)
• West Virginia Surface Owners’ Rights Organization (http://www.wvsoro.org)

USEFUL READINGS/WORKS CITED


The Endocrine Disruption Exchange. (February 2009). “Products and Chemicals Used in Fracturing.”


Palmeri, Christopher. “Gas, Gas Everywhere; Billions are being pumped into new U.S. natural has exploration, leading to a jump in production, lower prices, and a lot of rich Texans.” Business Week Online, September 11, 2008. Available at: http://www.businessweek.com/bwdaily/dnflash/content/sep2008/db20080910_471923.htm

Pennsylvania State University. Cooperative Extension: Natural Gas Impacts. Available at: http://naturalgas.extension.psu.edu/


U.S. Environmental Protection Agency. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs. EPA 806-R-04-003 (June 2004).


KEY TAKEAWAYS FROM THE DISCUSSION

Moving from renewable energy to the pressure to expand extractions of US fossil fuels, this part of the discussion started with a review of key points from the background paper prepared by Casey Pickett at Yale (see above). It then moved to Andy Loza and the experience of the Pennsylvania Land Trust Association with expanded natural gas exploration and production in its region. The key points from the discussion included the following:

While off-shore oil production is expected to increase, on-shore oil production is likely to continue to decline. Off-shore drilling creates both risks to marine environments as well as new federal conservation funding opportunities (see below).

“We had no idea that natural gas production was a threat in Pennsylvania until new technology made it possible – do not rest easy.”

–Andy Loza, Pennsylvania Land Trust Association

On-shore production of natural gas, however, is expected to increase substantially – including in new areas of the country, particularly the Northeast. New technologies, higher fuel prices, as well as concerns over climate change and energy security are driving its expansion. Natural gas is the cleanest of the fossil fuels, as well as the most efficient. Not surprisingly, approximately 85% of new US electricity generation is from natural gas. Natural gas is also: the major power source for distributed fuel cells;
more amenable to CO₂ capture than coal; and often paired with wind or solar facilities to address intermittency issues. Finally, new horizontal drilling technologies can dramatically reduce the land area needed for a well, allowing drillers to go up to two kilometers to any side.

**Water impacts are among the major concerns for the “fractured shale” technology being used in Pennsylvania.** Water is injected deep into the ground to bring gas out. Trucks are often used to bring the water to the well – posing problems for roads, abstraction points, and the dewatering of small, mountain streams. Once used, the waste water contains large quantities of sand, biocides, and polymers and often has a higher salinity than ocean water. The five to 10 acre drilling sites include large wastewater ponds for holding the water before the extensive treatment that is required – either off or on site. The US EPA has long-standing regulations that control underground injection wells designed to protect underground drinking water sources. While drillers need to post a bond to cover decommissioning costs, the large cuts in the budgets of state environmental enforcement agencies raise serious concerns.

**The leases used for wells often contain few protections for the surface land involved.** Soil restoration provisions can usually be negotiated, but still more should be done.

**Other new technologies – deep geothermal, carbon dioxide capture and storage – are coming that pose similar issues.** Deep geothermal involves pumping water far into the ground to heat it and then using the heated water/steam to produce electricity. Carbon dioxide capture and storage involves capturing the carbon from the combustion of fossil or current biomass fuels and injecting it deep underground in suitable formations to permanently isolate the CO₂ from the atmosphere. Both raise similar underground injection, surface footprint, and subsurface ownership issues. Both require more understanding by the land trust community. For example, a new literature is developing on who owns what rights (e.g. mineral rights, “pore space” rights, surface rights) as part of the discussion of carbon dioxide capture and storage.

**These subsurface activities raise a host of issues for conservation organizations:**

- Should they buy lands from which the mineral rights have been severed or are the risks too great? For example, one participant mentioned the difficulties created for their FSC certified forest when it was clear cut by the owner of the subsurface rights who decided to access the minerals on site.

- Should they accept donated easements on land from which subsurface rights have been severed? What restrictions on operations can/should they try to include on surface activities by the holder of the subsurface rights?

- Should they capture operating revenue from leasing a portion of their land for gas production under specified conditions or are the risks to their reputation too high?
New legal issues are also being raised under existing agreements. For example, how should older easements that are silent on subsurface issues be interpreted/enforced when issues arise? This can be a particularly acute issue given the huge disparities in economic power between land trusts and most energy developers. In some cases, participants reported being able to reach an agreement to amend and restate the easement with limits on surface activities, as well as upgrades to other parts of the document.

Severed estates are a new topic for many land trusts, but are growing in importance. For example, a current case in Wyoming involves a donated easement by the original owner, who then sold the land at the restricted value/lower price. After its sale, the availability of technology to use methane from coal beds led the new owner to petition to have the easement extinguished – which the county agreed to do. The owner then promptly subdivided the land for sale, leading to suits from a neighbor and the Attorney General challenging the extinguishment. In Kentucky, even more acute issues around ownership were reported by another participant – with most of the mineral rights severed and most of the land rights held by out-of-state interests.

The land trust community should collect lessons learned and provide guidance on subsurface rights. For example, guidance on lease provisions to protect surface habitats could be offered, possibly along with a list of lawyers familiar with subsurface rights and leasing issues. In addition, many lessons have been learned by conservation organizations in the West and South, from which those in newly impacted parts of the country might benefit. A survey of land trusts on their experiences with gas leases/subsurface rights could be quite valuable.

The community should also provide its views to Secretary Salazar on the use of funds from off-shore oil and gas leasing as a dedicated source of conservation finance. While the experience with such dedicated funds at the federal level has not been great, royalties are expected to rise and the Secretary has asked for input. The opportunity to help direct more of these funds to land conservation should not be missed.