

# The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains

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## Introduction

Both the number of oil and gas wells drilled annually<sup>2</sup> (U.S. Department of Interior [U.S.D.I.], Bureau of Land Management 2009) and the number of producing natural gas wells<sup>3</sup> (U.S. Department of Energy 2009) in the Rocky Mountain region<sup>4</sup> more than doubled from 1998 to 2008. The proportion of U.S. natural gas production from the region increased from 16% in 1997 to 23% in 2007 (U. S. Department of Energy 2009) and the number of drilling rigs operating in the region grew from 131 in 2002 to 318 in 2009.<sup>5</sup> This increase in natural gas drilling in the region has created boomtown conditions in several rural communities.

While energy development can benefit rural communities, boomtowns in the Rockies experienced an influx of non-local workers, a rise in crime and emergency service calls, increased demand for public services, more wear and tear on local infrastructure, and upward pressure on local wages and housing costs. Natural gas prices had dropped dramatically by 2009, the drilling boom had subsided, and the bust phase may have begun (Figure 1). The recent energy boom-bust begs the question—how can communities learn from recent history to better take advantage of future energy development for both short-term and long-term benefits?

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<sup>2</sup> On public lands and on split-estate lands (where the surface is privately owned, but the resources beneath are publically owned).

<sup>3</sup> On all lands, public, private and split-estate.

<sup>4</sup> Colorado, Montana, New Mexico, Utah and Wyoming.

<sup>5</sup> Baker-Hughes Rig Counts <http://investor.shareholder.com/bhi>.

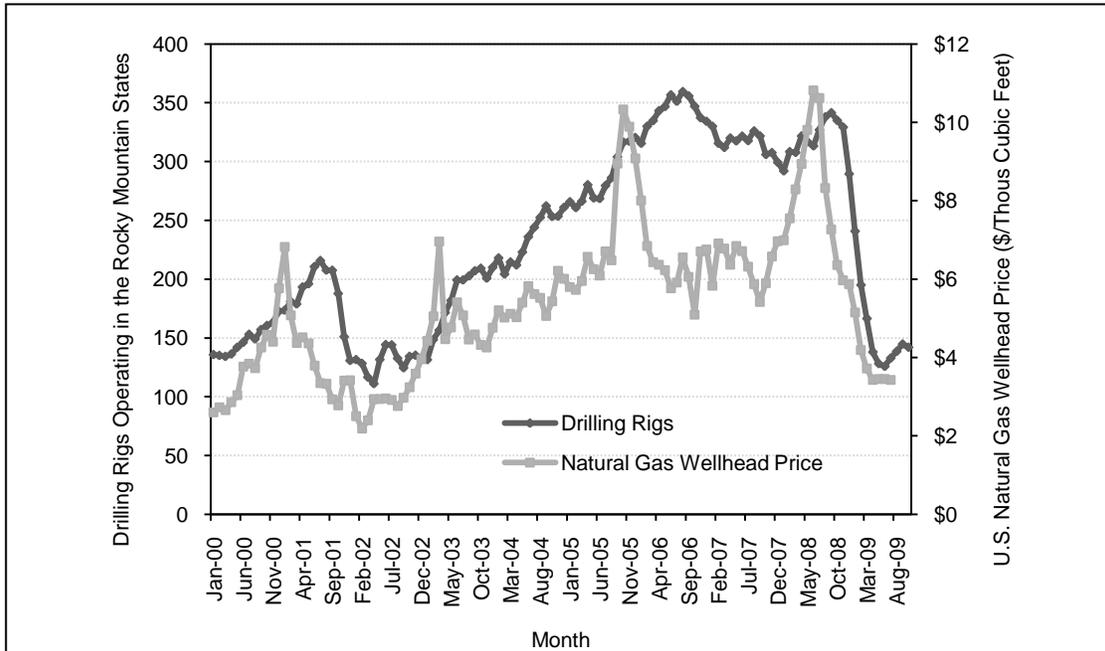


Figure 1. Monthly Drilling Rig Count for the Rocky Mountain Region and U.S. Natural Gas Wellhead Prices

Note: throughout the period shown the total rig count for the U.S. ranged from 750 to 2000.

Sources: rig counts: Baker-Hughes Rig Counts (<http://investor.shareholder.com/bhi/>); natural gas prices: U.S. Department of Energy, Energy Information Administration (<http://www.eia.doe.gov/>).

This question is explored with a short literature review, followed by recent case studies of Western boomtowns, and ending with a recommendation as per the pace and scale of development to reduce the economic costs while deriving the benefits of energy development.

**Background**

Past research indicates that an emphasis on resource extraction (logging, oil and gas, mining) often results in economically unstable communities (Fortmann et al. 1989; Freudenburg 1992; Freudenburg and Gramling 1994). Gulliford (1989) recounts the economic hardship and social turmoil of the oil shale boom-bust cycle in Colorado twenty-five years ago. Smith (1986) suggests the oil and gas industry is more prone to boom-bust cycles than mining. This finding is echoed by Slack and Jensen (2004) who find chronic underemployment to be more of an issue with oil and gas than with mining. Brabant and Gramling (1997) note the problem of persistent poverty in extractive industry-dominated economies. However, Flint and Luloff (2005) suggest that resource-dependent communities possess adequate social capital (described by Putnam (1995) as a society’s connections and shared values) and community structure to protect themselves from the inherent risks associated with natural resource industries.

Increased economic diversity can mitigate the inherent risks from resource dependency because when one industry experiences a downturn, a larger variety of industries will be more able to absorb the unemployed. Conversely, areas dominated by one industry often lack this capacity (Wagner and Deller 1998; Malizia and Ke 1993). Malizia and Ke (1993) find that

greater economic diversity predicts lower unemployment rates and greater employment stability, and that areas with high concentrations of employment in unstable industries have higher overall unemployment rates. Headwaters Economics (2008a) finds that most energy-focusing counties have slower economic growth than other counties in the West. Wagner (2000) notes that pursuit of a growing industry is an appropriate short-term strategy for economic growth, but is best coupled with policies designed to increase economic diversity to provide long-term stability. Neumann and Topel's (1991) findings are less conclusive, although they do note that unemployment is lower in markets with greater labor mobility among industries.

### **The Role of Pace and Scale in Boom-Bust Cycles**

Two inherent characteristics of booming times are the rapid pace and large scale of development. A "boom" is defined as "a rapid widespread expansion of economic activity" (Merriam-Webster 1990). "Pace" indicates the speed with which an area is developed – in many instances a large number of wells are drilled in a very short time. "Scale" indicates the geographic or spatial extent of development – the recent drilling boom has spread across a large geographic area. Pace and scale are often interrelated; in many cases, as the pace is slowed, the spatial extent of development will decline. Large scale booms extend drilling into marginal areas which tend to be abandoned when prices drop; areas with the largest rate of growth experience the largest rate of decline (Smith 1986).

Booms often exert upward pressure on wages, creating labor challenges for local governments and non-energy-related businesses (Headwaters Economics 2008c; BBC Research and Consulting 2008a, b). Social problems develop from a sudden influx of workers migrating into the area during "boom" times (Merrifield 1984; Davenport and Davenport 1980) including the sense of dissatisfaction arising from rapid change (Smith et. al 2001; Brown et al. 2005; Goldsmith 1992; Gulliford 1989; Merrifield 1984; Kittredge 1987; Kelly 1980). Drilling booms increase housing demand which raises prices, leading to increased poverty among those unable to take advantage of new jobs (Brabant and Gramling 1997). Local governments need to provide basic services for a rapidly growing population, along with increased per capita service demand, resulting in fiscal burdens for taxpayers (Merrifield 1984; Headwaters Economics 2008c; BBC Research and Consulting 2008a, b).

### **Recent Case Studies from the Rockies**

Headwaters Economics (2008b) finds that five percent of the counties in the West experienced a surge in energy development, particularly in northwest Colorado and southern Wyoming. These areas were subjects of detailed economic studies and serve as useful case studies.

#### **1. Colorado Case Studies:**

BBC Research and Consulting (2008a) examined four northwest Colorado counties (Mesa, Garfield, Rio Blanco and Moffat) experiencing fast-paced energy development. This region of Colorado suffered the consequences of boom-bust oil shale development in the late 1970s and early 1980s. When the industry abruptly stopped work on May 2, 1982 ("Black Sunday"), the region entered a brief economic downturn, but has since experienced growth due in part to a diversified economy.<sup>6</sup> In 2006, energy and natural resources accounted for 11.6% of basic jobs.

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<sup>6</sup> For example, the community of Battlement Mesa, built to house oil shale workers, evolved into a thriving retirement community.

Tourism jobs accounted for 16.7% of total personal income and non-labor income<sup>7</sup> accounted for 28.6%. The BBC study notes oil and gas workers are mostly temporary, non-local employees who occupy between fifteen and thirty percent of the area's motel rooms. The increase in energy industry employment is predicted to put upward pressure on wages, along with creating a lag in projected non-energy businesses growth.

The BBC study (2008a) also examines the fiscal effects of energy development on local governments. Costs associated with energy development, over and above those expected with normal economic and population growth, include additional wear and tear on roads and additional costs from expanding government services. The authors predict the region will face substantial budget shortfalls if energy development continues to escalate. Compounding the budget problem is the fact that most of the expenditures occur early in the boom, while revenues are received in later years.

A related study (BBC 2008b) focusing on Rifle, Colorado (in Garfield County) (the community most hurt by the 1982 bust in oil shale development) found that the fiscal costs of increased energy activity far outweighed revenues. Rifle has experienced considerable growth in recent years. Despite a historic reliance on resource extraction, the economy has benefited from diversification in the last quarter-century. The report found that the drilling boom has "crowded out" new businesses, creating the possibility that economic diversity may decline or cease to grow.

Rapid energy development in the Rifle area has resulted in a two-fold infrastructure funding problem. First, Colorado state law does not guarantee that oil and gas revenues will flow to impacted communities. Second, there is an estimated delay of three to eight years between peak expenditures and peak revenues.

A third Colorado study examined the role of energy in the state's economy, taxes on the fossil fuel extraction industry, and the impacts of the recent energy boom on other industries (Headwaters Economics 2008c). This report finds that energy development increases the need for public investments in infrastructure, and that current tax policies do not address the added costs. Headwaters (2008c) also finds that Colorado counties with more employment in mining experienced lower overall income growth.

Prior to the boom, Mesa and Garfield Counties were affordable alternatives for retirees and workers in nearby resort communities (Headwaters 2008c). The influx of workers during the drilling boom increased demand for housing in an already strained market, resulting in higher housing costs. Residents not tied to energy jobs are less able to afford the increased costs and may have to move. Labor demand in the energy sector also created upward pressure on wages in all sectors. During the boom the government sector (the largest employer) was challenged to increase wages, and school districts and hospitals had difficulty filling positions. The authors note that local motels are often filled by temporary energy workers. Labor shortages during the drilling boom delayed housing projects, adding to the housing supply shortfall and exacerbating the problem of housing affordability.

Finally, Headwaters (2008c) notes a shift in area demographics. Retirees who had been the "pioneers" after the post oil shale bust are now leaving the area, often due to changes brought

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<sup>7</sup> Non- labor income is not tied to a job. This include retirement payments, transfer payments and investment income.

about by the recent boom. High-paying energy jobs may be responsible for an observed decline in the number of high school graduates attending college. These changes increase concerns that the mix of industries will narrow once again to focus primarily on energy, threatening long-term economic diversity.

## 2. Wyoming Case Study:

Sublette County, Wyoming provides another example of boomtown impacts from rapid energy development, especially in the Jonah Field. The 1998 Environmental Impact Statement projected community impacts assuming that 400 wells would be drilled over 20 years (U.S.D.I., Bureau of Land Management 1998). However, 400 wells were drilled within the first three years of development, and a subsequent Infill Plan was approved allowing 3,100 additional wells to be drilled (U.S.D.I., Bureau of Land Management 2006).

Ecosystem Research Group (2007) concludes that the county economic base changed from agriculture to oil and gas extraction in the past decade; the county produced 44% of Wyoming's natural gas in 2006. Taylor and Foulke (2008) note declining employment diversity in Sublette County, most likely due to increased employment in natural gas drilling and construction (which is linked to drilling). Between 2000 and 2006, energy development was responsible for a 24 % increase in population (nearly four times the national rate), although in a narrow 20 to 34 age range (Taylor and Foulke 2008). Taylor and Foulke (2008) found that, compared with past booms, more workers commute from outside Sublette County and that enrollment growth in County schools did not correspond with employment growth, implying that the workforce associated with the recent natural gas boom is more transient than in past booms.

During the same time period, average home price increased at twice the state rate, making the county unaffordable for the average wage-earner (ERG 2007). Rental costs increased 90% to reach a level 60% higher than the rest of the state. A large wage gap exists between natural gas workers and those in other sectors, meaning the rental cost increase falls disproportionately on non-energy workers. While county revenues increased, the cost of providing public services also increased (Taylor and Foulke 2008; ERG 2007; Pinedale Anticline Working Group 2005).

Oil and gas work is often dangerous (Loomis et al. 2007). The National Institute for Occupational Safety and Health (2009) finds the rate of worker fatalities is positively correlated with the pace of drilling, attributing the increase to inexperienced workers. Emergency medical service calls also increase with drilling (ERG 2007; Pinedale Anticline Working Group 2005). Jacquet (2005) demonstrates a link between per capita emergency service calls and increased gas drilling in Sublette County. ERG (2007) also shows steadily increasing numbers of ambulance (EMS) runs in Sublette County between 2000 and 2006.

Rapid development has reduced employment diversity in Sublette County, Wyoming (Taylor and Foulke 2008) and Garfield County, Colorado (Table 1) where the proportion of total employment in mining has rapidly increased, implying some loss of employment diversity.

	2000	2001	2002	2003	2004	2005	2006
Sublette County, WY	8.2%	10.2%	10.7%	13.8%	14.6%	14.9%	17.6%
Garfield County, CO	1.0%	1.3%	1.6%	2.4%	3.1%	4.9%	6.2%

Source: Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce

News accounts document the social issues from the recent boom. In some cases residents are leaving due to reduced quality of life and property values.<sup>8</sup> There are accounts of damage to rural roads,<sup>9</sup> poaching of wildlife,<sup>10</sup> and other crime, especially drug use.<sup>11</sup> Jacquet (2005) found a correlation between incidents of serious felonies and arrests and increased gas drilling in Sublette County.

### **Controlling the Pace and Scale of Oil and Gas Development**

Many of the problems associated with the recent drilling boom in the Rockies are either caused by or exacerbated by the large scale and rapid pace of development. Slowing the pace and scale of development can reduce these problems by reducing the number of wells drilled at one time. Assume, for example, that 2,500 producing wells are needed to extract the resources. Figure 2 shows the total number of wells that would be drilled each year and total producing wells operating annually under several pace-of-development scenarios. Slowing the pace and spreading drilling over years or even decades means there will be producing wells in the area for a longer time period, but the dramatic peak in the earlier years will be diminished. The most rapid pace of development occurs in a very brief period where the drilling would be intense – resulting in boomtown conditions.

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<sup>8</sup> "Silt couple selling 110-acre ranch," The Grand Junction Daily Sentinel, 26 February 2007.

<sup>9</sup> "Boom hits county roads," Casper Star-Tribune, 13 December 2006.

<sup>10</sup> "Poachers making a killing in West's oil, gas fields," USA Today, 15 February 2007.

<sup>11</sup> "Boomtown Blues," The New Yorker, 5 February 2007.

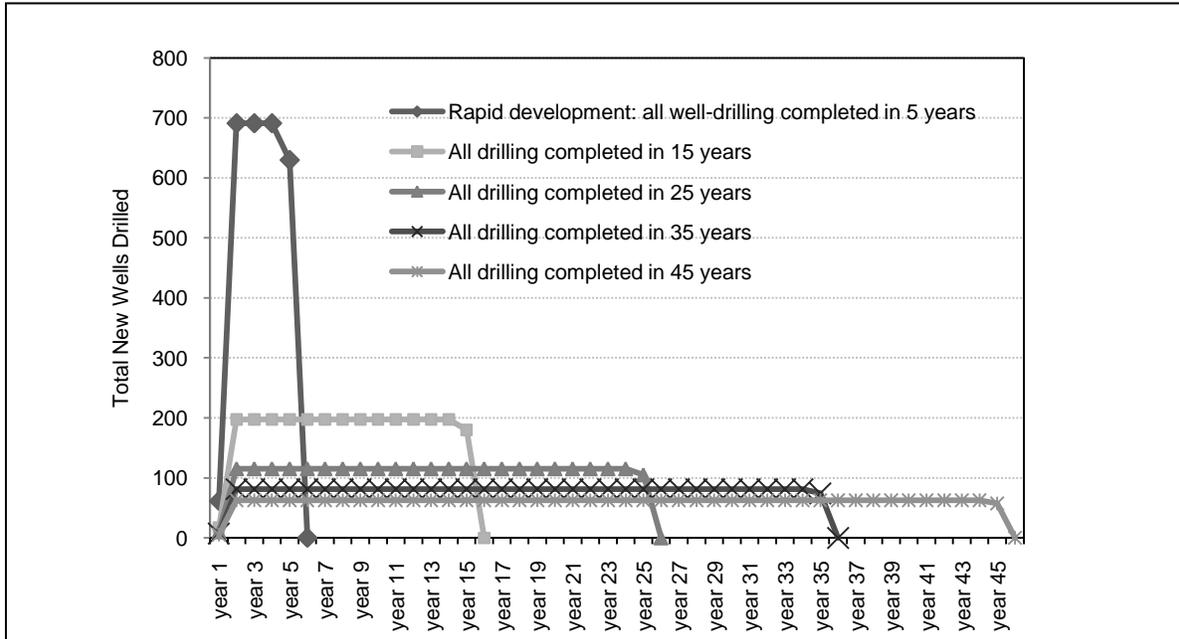


Figure 2a. Estimated Annual Well Drilling Under Five Pace-of-Development Scenarios

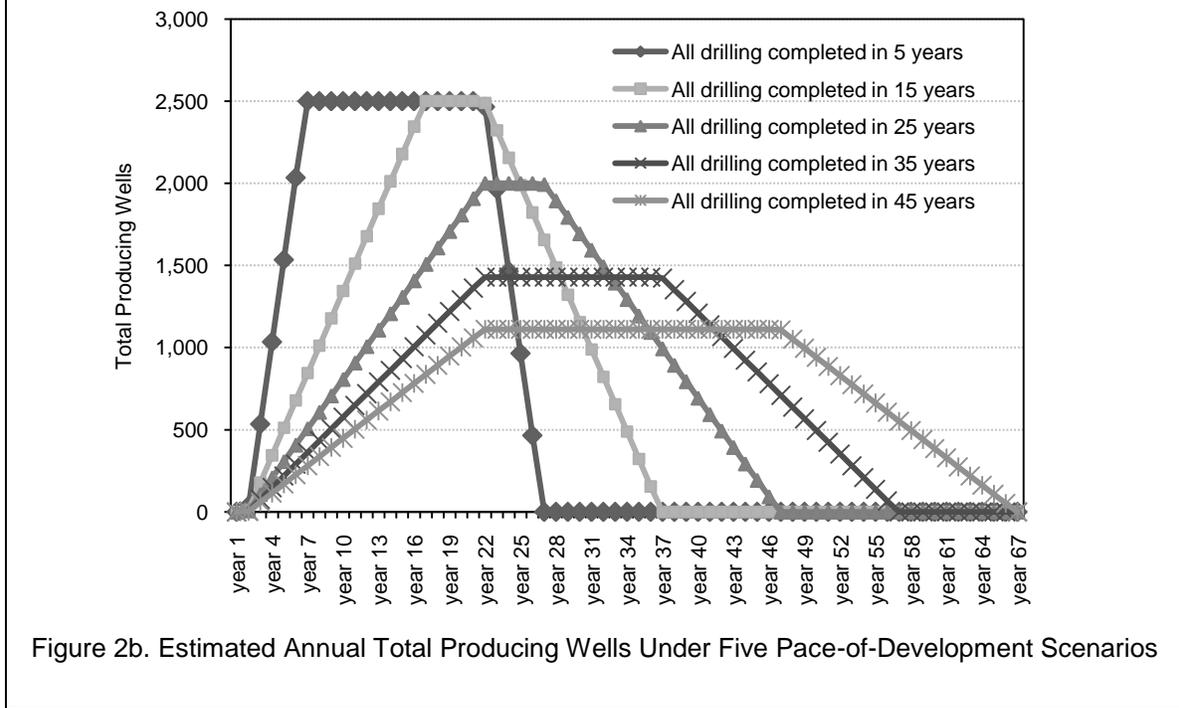
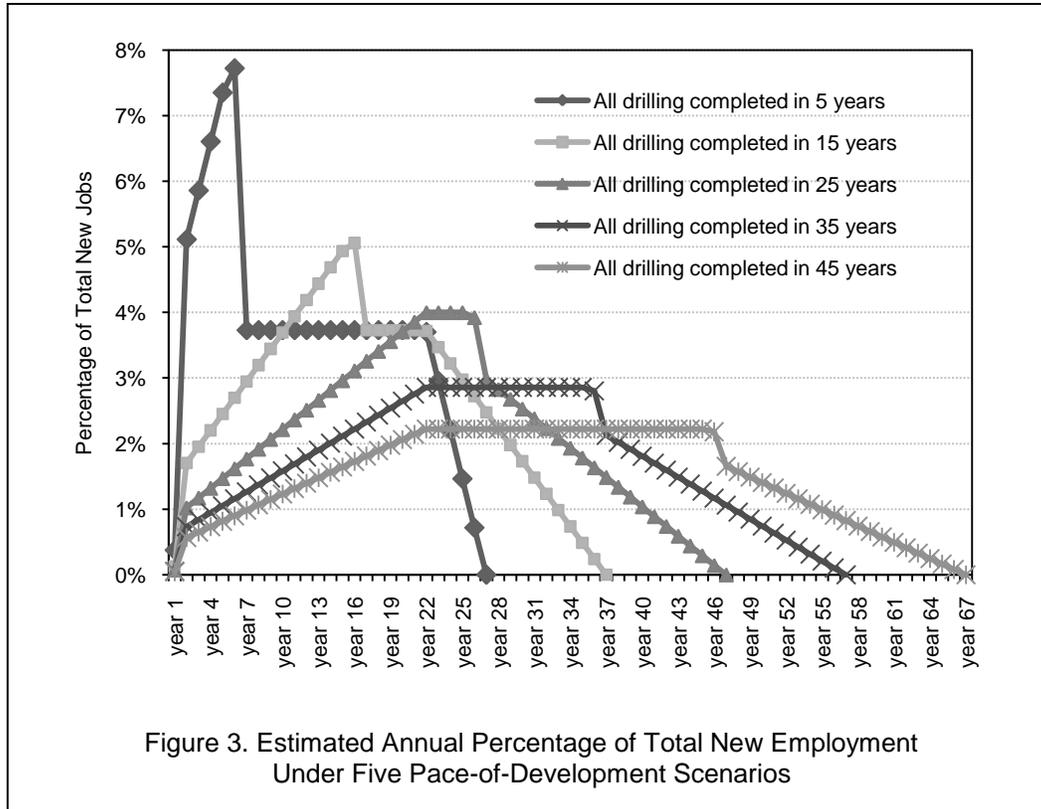


Figure 2b. Estimated Annual Total Producing Wells Under Five Pace-of-Development Scenarios

In-migrating energy workers are at the root of most of the socioeconomic problems. The drilling phase of natural gas development generally results in higher labor demand than the production phase. Slowing the pace and spreading drilling over a longer time will alter the patterns of industry employment (Figure 3). Using a ratio of 6 drilling jobs to 1 production job, the

employment effect of various pace-of-development scenarios is provided. The shorter the drilling period, the more pronounced the "peak" in employment.<sup>12</sup> It is this peak in labor demand that creates many of the boomtown impacts. Slowing the pace of development results in fewer energy-related jobs initially but employment continues over a longer period.



Slowing the pace and thereby reducing the scale of development will reduce the number of workers migrating into an area and mitigate the associated socioeconomic impacts.

### **Discussion and Conclusions**

Certainly, communities can benefit from oil and gas development, but the total costs must also be counted, including social dissatisfaction from rapid demographic and lifestyle changes. Smith et al. (2001) and Brown et al. (2005) found that in time communities recover from this dissatisfaction; however, it is reasonable to believe that residents would prefer to avoid the period of discontent. Flint and Luloff (2005) note that social capital is important for community resilience; slowing the pace and reducing the scale of energy development may facilitate the ability of communities to sustain social capital.

Rapid paced, large scale energy development often results in added costs to local governments to meet the needs of an influx of workers which accrue well in advance of energy-related revenue (Merrifield 1984; BBC Research and Consulting 2008a, 2008b). Merrifield proposes

<sup>12</sup> We assume that the same total number of wells will be drilled regardless of the rate of development, and that therefore the same number of jobs will accrue.

several (often complicated) solutions; however, simply slowing the pace and reducing the scale of development may reduce or even eliminate the need for public investment.

Another reason to slow the pace and scale of development is to help protect a region's natural amenities (such as open space, scenic vistas, recreation opportunities, clean air and water) that many economists believe play an important role in promoting economic diversity (Rudzitis and Johansen 1989; Whitelaw and Neimi 1989; Johnson and Rasker 1993, 1995; Rasker 1994; Power 1995, 1996; Snepenger et al. 1995; Bennett and McBeth 1998; Duffy-Deno 1998; McGranahan 1999; Nelson 1999; Rudzitis 1999; Lorah 2000; Deller et al. 2001; Johnson 2001; Shumway and Otterstrom 2001; Lorah and Southwick 2003; Low 2004; Holmes and Hecox 2004; Rasker et al. 2004; Kwang-Koo et al. 2005). Oil and gas drilling has the potential to suppress amenity-driven growth (Morton et al. 2004; Headwaters Economics 2008c; BBC Research and Consulting 2008b) by altering the flow of goods and services produced by the pre development landscape.

Much of the oil and gas development is taking place on public lands administered by the U.S.D.I. Bureau of Land Management (BLM). The agency can help communities gain control over the pace and scale of this development by requiring phased leasing or phased development – incrementally opening an area for development, limiting the total area developed, or limiting the percent of the area developed at any one time will reduce both the pace and scale of development.

Controlling the pace and scale of natural resource development is not a new concept. American foresters dating back over 100 years to Gifford Pinchot who recommended controlling the pace and scale of logging in order to “regulate” the forest and sustain the level of timber harvest in perpetuity (Sample 2004). If 200 acres of forestlands are managed on a 100 year rotation, an average annual harvest of 2 acres would occur for that period. Phased energy development simply applies this long-standing “regulated” forest concept to oil and natural gas by controlling the pace and scale of drilling.

Further research is needed to assess the net fiscal impacts of slower energy development. Slowing the pace of energy development may not maximize profits or gross tax revenues, but slowing development can reduce fiscal costs, which serves to increase net revenues to communities and states. Slowing the pace of development can help land management agencies control monitoring and enforcement costs so that they do not exceed the available budgets.

Decreased fiscal costs, reduced environmental damages, enhanced economic diversity and increased stability for Western communities can be achieved by ensuring local economies a more stable long-term energy industry and avoiding the boom-bust cycles of rapid paced, large scale energy development.

## **References**

BBC Research and Consulting. 2008a. *Northwest Colorado Socioeconomic Analysis and Forecasts*. Prepared for Associated Governments of Northwest Colorado. 179 pp.

BBC Research and Consulting. 2008b. *City of Rifle: A Case Study of Community Renewal, Growth and Change in Northwest Colorado*. Prepared for the City of Rifle. 51 pp.

- Bennett, K. and M.K. McBeth. 1998. Contemporary Western Rural USA Economic Composition: Potential Implications for Environmental Policy and Research. *Environmental Management* 22(3): 371-381.
- Brabant, S. and R. Gramling. 1997. Resource Extraction and Fluctuations in Poverty: A Case Study. *Society & Natural Resources* 10(1): 97-106.
- Brown, R.B., S.F. Dorius and R.S. Krannich. 2005. The Boom-Bust-Recovery Cycle: Dynamics of Change in Community Satisfaction and Social Integration in Delta, Utah. *Rural Sociology* 70(1): 28-49.
- Davenport, J. and J. A. Davenport (eds). 1980. *The Boom Town: Problems and Promises in the Energy Vortex*. Laramie WY: University of Wyoming, Department of Social Work.
- Deller, S.C., T. Tsai, D.W. Marcouiller, and D.B.K. English. 2001. The Role of Amenities and Quality of Life in Rural Economic Growth. *American Journal of Agricultural Economics* 83(2): 352-365.
- Duffy-Deno, K. T. 1998. The Effect of Federal Wilderness on County Growth in the Intermountain Western United States. *Journal of Regional Science* 38(1): 109-136.
- Ecosystem Research Group. 2007. *Sublette County Socioeconomic Impact Study. Draft Report*. Prepared for Sublette County Commissioners. Missoula, MT: Ecosystem Research Group.
- Flint, C. G. and A.E. Luloff. 2005. Natural Resource-Based Communities, Risk, and Disaster: An Intersection of Theories. *Society and Natural Resources* 18: 399-412.
- Fortmann, L.P., J. Kusel, and S.K. Fairfax. 1989. Community stability: The foresters' fig leaf. In *Community Stability in Forest-based Economies*, eds., D.C. Le Master and J.H. Beuter. Portland, OR: Timber Press.
- Freudenburg, W.R. 1992. Addictive Economies: Extractive Industries and Vulnerable Localities in a Changing World Economy. *Rural Sociology* 57: 305-332.
- Freudenburg, W.R. and R. Gramling. 1994. Natural Resources and Rural Poverty: A Closer Look. *Society and Natural Resources* 7: 5-22
- Goldsmith, O.S. 1992. Economic Instability in Petroleum-based Economies. Presented at OPEC/Alaska Conference on Energy Issues for the 1990s. Anchorage, AK, July 23-24, 1992.
- Gulliford, Andrew. 1989. *Boomtown Blues: Colorado Oil Shale 1885-1985*. Niwot, CO: University Press of Colorado.
- Headwaters Economics. 2008a. *Fossil Fuel Extraction as a County Economic Development Strategy*. ([www.headwaterseconomics.org/energy](http://www.headwaterseconomics.org/energy)), 26 pp.
- Headwaters Economics. 2008b. *Energy Development and the Changing Economy of the West*. ([www.headwaterseconomics.org/energy](http://www.headwaterseconomics.org/energy)) 20 pp.

- Headwaters Economics. 2008c. *Impacts of Energy Development in Colorado With a Case Study of Mesa and Garfield Counties*. ([www.headwaterseconomics.org/energy](http://www.headwaterseconomics.org/energy)), 94 pp.
- Holmes, F. P. and W. E. Hecox. 2004. Does Wilderness Impoverish Rural Regions? *International Journal of Wilderness* 10(3): 34-39.
- Jacquet, J. 2005. *Index Crimes, Arrests, and Incidents in Sublette County 1995-2004: Trends and Forecasts*. Report prepared for the Socioeconomic Analyst Advisory Committee, Sublette County, Wyoming (available at: <http://www.pinedaleonline.com/socioeconomic/> accessed March 8, 2007).
- Johnson, T.G. 2001. The Rural Economy in a New Century. *International Regional Science Review* 24(1): 21-37.
- Johnson, J. and R. Rasker. 1993. The Role of Amenities in Business Attraction and Retention. *Montana Policy Review* 3(2):11-19.
- Johnson, J., and R. Rasker. 1995. The Role of Economic and Quality of Life Values in Rural Business Location. *Journal of Rural Studies* 11(4):405-416.
- Kelly, J. 1980. Rocky Mountain High. *Time*, December 15: 28-41.
- Kittredge, W. 1987. Overthrust Dreams. In: *Owning It All* by W. Kittredge. Saint Paul, MN: Graywolf Press.
- Kwang-Koo, K., D.W. Marcouiller, and S.C. Deller. 2005. Natural Amenities and Rural Development: Understanding Spatial and Distributional Attributes. *Growth and Change* 36(2): 273-297.
- Loomis, J., J. Kerkvliet, and S. Weiler. 2007. Are High Wage Jobs Hazardous to Your Health? The Myth That Attracting Higher Paying Extractive Industry Jobs is a Desirable Community Economic Development Strategy. *Western Economics Forum* 16(2): 10-14.
- Lorah, P. 2000. Population Growth, Economic Security and Cultural Change in Wilderness Counties. In *Wilderness Science in a Time of Change Conference, Volume 2: Wilderness within the Context of Larger Systems*, eds. McCool, S.F., D.N. Cole, W.T. Borrie, and J. O'Loughlin. 1999 May 23-27. Missoula, MT. Proceedings RMRS-P-15-VOL 2., U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT.
- Lorah, P. and R. Southwick. 2003. Environmental Protection, Population Change, and Economic Development in the Rural Western United States. *Population and Environment* 24(3): 255-272.
- Low, S. 2004. Regional Asset Indicators: Entrepreneurship Breadth and Depth. *The Main Street Economist*, September, 2004. Center for the Study of Rural America, Federal Reserve Bank of Kansas City, Kansas City, MO.
- Malizia, E. E. and S. Ke. 1993. The Influence of Economic Diversity on Unemployment and Stability. *Journal of Regional Science* 33(2): 221-235.

- McGranahan, D.A. 1999. *Natural Amenities Drive Rural Population Change*. U.S. Department of Agriculture, Economic Research Service, Food and Rural Economics Division. Agricultural Economics Report No. 781, 24pp.
- Merrifield, J. 1984. Impact Mitigation in Western Energy Boomtowns. *Growth and Change* 15(2):23-28.
- Morton, P., C. Weller, J. Thomson, M. Haeefele, and N. Culver. 2004. *Drilling in the Rocky Mountains: How much and at what cost?* In Proceedings of the 69<sup>th</sup> North American Wildlife and Natural Resources Conference, Spokane, WA. Wildlife Management Institute.
- National Institute for Occupational Safety and Health, Centers for Disease Control. 2009. NIOSH Program Portfolio, Oil and Gas Extraction, Inputs: Occupational Safety and Health Risks (<http://www.cdc.gov/niosh/programs/oilgas/risks.html> )
- Nelson, P.B. 1999. Quality of Life, Nontraditional Income, and Economic Growth: New Development Opportunities for the Rural West. *Rural Development Perspectives* 14(2): 32-37.
- Neumann, G.R. and R.H. Topel. 1991. Employment Risk, Diversification and Unemployment. *The Quarterly Journal of Economics* 106(4): 1341-1365.
- Pinedale Anticline Working Group. 2005. *BLM Pinedale Anticline Working Group PAWG Task Groups' Report*. 56 pp.
- Power, T.M. 1995. *Economic Well-Being and Environmental Protection in the Pacific Northwest: A Consensus Report by Pacific Northwest Economists*. Missoula MT: University of Montana.
- Power, T.M. 1996. *Lost Landscapes and Failed Economies*. Covelo, CA: Island Press.
- Putnam, R.D. 1995. Bowling Alone: America's Declining Social Capital. *Journal of Democracy* 6: 65-78.
- Rasker, R. 1994. A New Look at Old Vistas: the Economic Role of Environmental Quality in Western Public Lands. *University of Colorado Law Review* 52(2): 369-399.
- Rasker, R., B. Alexander, J. van den Noort and R. Carter. 2004. *Public Lands Conservation and Economic Well-Being*. Tucson, AZ: The Sonoran Institute. 160 pp.
- Rudzitis, G., and H.E. Johansen. 1989. *Amenities, Migration, and Nonmetropolitan Regional Development*. Report to National Science Foundation. Moscow ID: Department of Geography, University of Idaho.
- Rudzitis, G. 1999. Amenities Increasingly Draw People to the Rural West. *Rural Development Perspectives* 14(3): 9-13.
- Sample, V. A. 2004. *Sustainability in Forestry: Origins, Evolution and Prospects*. Discussion Paper 6-04, Washington DC: Pinchot Institute for Conservation. 43 pp.

- Shumway, J.M. and S.M. Otterstrom. 2001. Spatial Patterns of Migration and Income Change in the Mountain West: The Dominance of Service-based, Amenity-rich Counties. *Professional Geographer* 53(4): 492-501.
- Slack, T. and L. Jensen. 2004. Employment Adequacy in Extractive Industries: An Analysis of Underemployment, 1974-1998. *Society and Natural Resources* 17: 129-146.
- Smith, E.J. 1986. *Boom and Bust in Energy Extraction*. Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, DC. Staff Report No. AGES860423.
- Smith, M.D., R.S. Krannich and L.M. Hunter. 2001. Growth, Decline, Stability, and Disruption: A Longitudinal Analysis of Social Well-being in Four Western Rural Communities. *Rural Sociology* 66(3): 425-450.
- Snepenger, D.J., J.D. Johnson, and R. Rasker. 1995. Travel-Stimulated Entrepreneurial Migration. *Journal of Travel Research* 34(1): 40-44.
- Taylor, D.T. and T. Foulke. 2008. *Sublette County, Wyoming: A Socio-Economic Profile*. Bridger-Teton Region, County Profile Series. Laramie, WY: University of Wyoming, Department of Agricultural and Applied Economics. 40 pp.
- U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System. (<http://www.bea.doc.gov> accessed 3/31/09).
- U.S. Department of Energy, Energy Information Administration. 2009. Statistics on natural gas prices (<http://www.eis.doe.gov> accessed 10/20/09).
- U.S. Department of the Interior, Bureau of Land Management. 1998. Record of Decision: Jonah Field II Natural Gas Development Project, Environmental Impact Statement. Wyoming State Office, Rock Springs District Office.
- U.S. Department of the Interior, Bureau of Land Management. 2006. Final Environmental Impact Statement: Jonah Infill Drilling Project, Sublette County, Wyoming. BLM Document No: BLM/WY/PL-06/006-1310.
- U.S. Department of the Interior, Bureau of Land Management. 2009. Data from the Automated Fluid Minerals Management System.
- Wagner, J. E. 2000. Regional Economic Diversity: Action, Concept, or State of Confusion. *Journal of Region Analysis and Policy* 30(2):1-22.
- Wagner, J.E. 1998. Measuring the Effects of Economic Diversity on Growth and Stability. *Land Economics* 74(4): 541-56.
- Merriam-Webster's Collegiate Dictionary (9th ed.). (1990). Springfield, MA: Merriam- Webster.
- Whitelaw, E. and E.G. Niemi. 1989. Migration, Economic Growth, and the Quality of Life. In Proceedings of the Twenty-Third Annual Pacific Northwest Regional Economic Conference, Corvallis, OR, pp 36-38.