Economic Implications of Marcellus Shale Natural Gas Development

Understanding Potential Impacts on Tourism, Agriculture and Housing
May 9, 2011

A graduate student project in the Department of City and Regional Planning at Cornell University guided by Professor Susan Christopherson

Team Members: Vera Bartolome Diaz, Tom Knipe, Christopher Smith, Greg Waldman, Ethan Warsh, David West, Austin Zwick
Marcellus Shale is One Play in a National Natural Gas Boom
Marcellus Hydro-Fracturing: What Does it Mean for Economic Development?

For further information on our work, see www.greenchoices.cornell.edu

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Introduction

Industry reports and most reporting have failed to discuss the Long Term Economic Development impacts of horizontal shale gas drilling.

Our study focuses on the long term wellbeing of the preexisting local population.

Economic impacts of shale drilling classified into the following categories:

• 1) Housing
• 2) Tourism and Agriculture

Team Member: Austin Zwick
Shale Play Comparison

Why look at multiple shale plays?

- Find consistency in benefits and costs
- Illuminate intraregional and interregional impacts
- Help local governments plan for gas drilling

Which Shale plays did we look at?

- Marcellus Shale in Pennsylvania
- Middle Bossier-Haynesville Shale on the Texas-Louisiana Border
- 4 different shale plays in Colorado
- Barnett Shale in Texas
- Fayetteville Shale in Arkansas
Methodology

Barnett Shale Play Counties: Drilling Intensity

Legend

Status
- Red: Core
- Orange: Extension
- Green: Periphery
- Blue: Adjacent

Map Created by David West 3/13/2011
Projection NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet
Data: Population Per/Sq. Mile at the block group level from Census 2000 data.
Regional Analysis

Not to scale
Expected Benefits

A few overnight millionaires will be made by signing land and mineral rights leases

Most will receive only a few thousand dollars for their leases

New jobs will be created in the natural gas industry

Wages in existing jobs will increase, especially trucking
Expected Costs

Price Inflation

Increased traffic congestion and accelerated road maintenance
  • An estimated 890 to 1,340 truck trips per well site

Higher public safety costs

Increased demand for health and education services

Increased demand on public administrative services
  • Planning and zoning, permitting, assessments, housing assistance

Increase in Pollution

New service requirements, such as emergency response capacity and environmental monitoring and remediation
The Boom-Bust Cycle

A period of strong growth in investment and population is then followed by a period of sharp contraction.

After natural gas in the “sweet spot” is depleted, then gas companies will move on to the next area leading to a local bust.

Most localities can handle up to 6 to 7 percent annual growth in population without significant disruptions occurring.

Incentives for gas companies to rapidly develop.

At 15 percent annual growth, institutional breakdowns in the labor market, housing market, and social services occur.
Hydrofracking in the Marcellus Shale

Gas Wells
“Sweet Spots”

Sources:
Pennsylvania: Neighbors of Easton Coalition
West Virginia: WV Marcellus Shale
General Findings

State and county lines do not matter; impacts are regional.

“Goldilocks Effect”: The most profound effects are in certain types of counties.

Large variability of effects on agriculture and tourism industries based on a number of factors.
Housing impacts

Team Members: David West, Vera Bartolome
Why study housing?

It is one of the main planning issues when new population arrive to localities.

Housing prices will vary according to two factors:

- Increasing population pushes prices upwards
- Externalities push prices down in effected areas

Costs & Benefits are unevenly distributed --> Creates relative winners and losers

Equity

- Low-Income populations and renters are most impacted
Housing Research Outline

Lens of Analysis

Rental Rates
- Where will new people locate?
- Effect on market/existing residents.

Home Values
- How will being near a well change property value?

Approaches

Existing Research
- Boomtown Model
- News Reports of Shortages
- Effects of Well on Home Value

New Data
- HUD Median Rent Estimates Across Shale Plays
- Qualitative information from interviews to key informants in NE PA
Polling question:

In what kind of county do you think there will be more rent increases according to their proximity to gas drilling?

- **Core** (lots of wells)
- **Extension** (some wells)
- **Periphery** (few wells)
- **Adjacent** (no wells but adjacent to drilling counties)
% Rent increase, 2001-2010 in 2 br. units, by adjacency

- Core: 47%
- Extension: 43%
- Periphery: 60%
- Adjacent: 43%
% Rent increase, 2001-2010 in 2 br. units, by size of the largest city in the county

- 114 to 5000: 44.7%
- 5000 to 10000: 49.4%
- 10000 to 20000: 35.0%
- 20000 to 500000: 38.4%
- More than 50000: 27.4%
Colorado Drilling Intensity vs Rent Increase
Colorado Plays

* Clearest example of trends
Haynesville Play

- Populations distribution most similar to southern tier
Pennsylvania

- May be too early for data
- Many reports of pressure in core areas
Stories from County Planners in PA’s Northern Tier

- Displacement caused by increased rents
- Uncertainty in value of the land
- Decrease in subdivisions
- Some speculators have bought up vacant land
- Difficulty in getting mortgages
Stories from County Planners in PA’s Northern Tier

- County and regional plans lack regulatory authority
- Regulating compressor stations and water treatment facilities
- Most regulatory authority lies with State (DEP) and Federal Agencies (EPA & FERC)
- Most local governments do not have zoning
Land Values

Hypothesized Impact Curve with Value Loss Components

<table>
<thead>
<tr>
<th>Value Loss/Gain</th>
<th>Exploration Phase</th>
<th>Drilling Phase</th>
<th>Completion Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>+$100,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+$50,000</td>
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<td>$303,079(^1)</td>
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</tr>
<tr>
<td>($50,000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>($100,000)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Typical Residential Change in Value

Drill Site Properties Change in Value

- Perception of Risk
- Institutional Uncertainty
- Quality of Life Impacts

Source: Garfield County Land Values and Solutions Study. BBC Consultants (2006)

\(^1\) Typical property with a well — 40 acres, small home, 24 miles from Glenwood.

Data source: Colorado Division of Housing, 2010. First Quarter 2010 Colorado Multi-Family Housing Vacancy and Rental Survey.
Housing price trends in Grand Junction, Denver and Colorado, 2002-2010

Data source: Colorado Division of Housing, 2010. First Quarter 2010 Colorado Multi-Family Housing Vacancy and Rental Survey.
Building permits (per 100 residents) in Colorado and Wyoming counties, Colorado and Wyoming, 2002-2009.

Poll

Does your community have up to date zoning to direct development?

Yes

No
Findings, housing demand and rent price

Regional issue. County lines do not matter.

Goldilocks Effect

Impacts not directly spatially correlated with drilling: consider tax implications

County level analysis masks hyper local level effects
Recommedations

Form Regional Partnerships

- Clarify state level issues – Jurisdiction & Taxation

Generate Baseline Data and Organize and Track Critical Housing Metrics

- Availability
- Quality
- Affordability

Review or Institute Zoning
QUESTIONS?
Tourism and Agriculture: What’s the impact of natural gas drilling?

Team Members: Tom Knipe, Greg Waldman, Chris Smith, and Ethan Warsh
Tourism and Agriculture Presentation Outline

1. Conceptual assumption: promoting economic diversity
2. What other studies say about long term economic development implications
3. Research findings: agriculture
4. Research findings: tourism
Economic Diversity

WHAT: Economic diversity – the "unlikeness" between a region's economic sectors

HOW: To diversify a region's economy is to "select assets to minimize risk"

WHY: To mitigate the boom-bust of natural gas drilling

PLEASE ELABORATE: Risk comes from the boom-bust cycle of natural gas drilling and the instability of exogenous final demand
PURPOSE: To identify alternative economic scenarios to guide policy decisions with the goal of enhancing economic stability in the Southern Tier of New York State
Headwaters Economics, 2008

“Fossil Fuel Extraction as a County Economic Development Strategy”: Compared economic performance of Energy Focusing (EF) Counties with Non EF Counties in the West

- Less economic diversity
- More volatility in economic and population growth
- Lower ability to retain jobs during the “bust” period
- Less ability to attract outside investment
- Greater income gap between high and low-paying jobs

Tourism and Agriculture

Economically significant industries in the Southern Tier of NY

Both may be vulnerable to externalities of natural gas drilling
Vulnerability of tourism to natural gas drilling

Crowding out
- Hotels
- Truck traffic
- Labor supply

Degradation of landscape
- Scenery - visual impacts
- Air & noise pollution
- Water quality

Brand erosion
Vulnerability of agriculture to natural gas drilling

Crowding out
- Trucking and other crop transport
- Labor

Land leases
- Substituting drilling for ag activity on land?

Vineyards
- Linked to threat to tourism

Environmental Quality
- Water quality effect on Organic Standards compliance?
- Dangers to livestock?
What Drives Agriculture?

- Agricultural performance is affected by many biological, environmental, economic, and regulatory factors.
Does Gas Drilling Affect Agriculture?

Drilling *may* have consequences for farming and other agricultural activities.

Key questions: In what ways? Where? How much? How long?

Establishing firm relationships between drilling and ag performance requires modeling the entire system.

This analysis does not model agricultural systems.

This analysis looks for patterns in change across shale plays.
Stories from Farm Bureaus and County Planners in PA’s Northern Tier

Differential Lease Agreements

- 2005: $20-30/acre annually and 12% royalty
- 2009: $7,000/acre annually and 21% royalty

Potential implications for agricultural tax exemption

“Crowding out” caused by increased traffic and shortage of dairy truckers

Site locations of wells, pipelines, and roads sometimes interfere with farming operations

Water contamination affecting livestock and crops
Stories from Farm Bureaus and County Planners in PA’s Northern Tier

**Reinvestment**
- New equipment, new hires
- Passing farm down to children or entrusted farm hand
- Secondary revenue allows farmer to keep working
- New population generates more business

**Disinvestment**
- Scaling back farming due to secondary income
- Changing from dairy to less intensive production type
- Farm hands go to work for gas companies
- Income allows farmer to move away
What We Found: Inconsistency

Two Scenarios

Farm owners respond to early capital from drilling leases in one of two ways:

- **Reinvestment** — investing capital gains into expansion of farming operations
- **Disinvestment** — minimizing or ending farming operations

Both scenarios may occur simultaneously within a county, shale play, or county type.
Methods and Sources

**Economic Indicators**

- **What**: Patterns in how ag economic indicators changed across shale plays
- **Where**: Colorado and Louisiana counties, Grouped by county type
- **When**: 2002-2007
- **How**: Federal Agencies, USDA, BEA

- Farm Acreage
- Farm Employment
- Farm Income
- Farm Expenditures
Methods and Sources

Patterns consistent with growing agriculture operations were associated with Reinvestment:

- Increasing farm acreage
- Increasing farm employment
- Increasing farm income
- Increasing farm expenditures

Patterns consistent with declining agriculture operations were associated with Disinvestment:

- Decreasing farm acreage
- Decreasing farm employment
- Decreasing farm income
- Decreasing farm expenditures
Indicator: *Farm Acreage*

**Reinvestment**

**Increasing Farm Acreage**

![Bar chart showing increasing farm acreage by type of county (Core, Extension, Periphery, Adjacent).]

**Disinvestment**

**Decreasing Farm Acreage**

![Bar chart showing decreasing farm acreage by type of county (Core, Extension, Periphery, Adjacent).]

Data Source: USDA & BEA
Indicator: Farm Employment

Reinvestment

Increasing Farm Employment

Disinvestment

Decreasing Farm Employment

Data Source: USDA & BEA
Indicator: *Farm Income*

**Reinvestment**

![Bar chart showing increasing farm income by type of county](image)

**Disinvestment**

![Bar chart showing decreasing farm income by type of county](image)

Data Source: USDA & BEA
Indicator: Farm Expenditures

Reinvestment

Increasing Farm Expenditures

<table>
<thead>
<tr>
<th>Type of County</th>
<th>Number of Counties</th>
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<tbody>
<tr>
<td>Core</td>
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<td>Extension</td>
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<tr>
<td>Periphery</td>
<td>12</td>
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<td>Adjacent</td>
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Disinvestment

Decreasing Farm Expenditures

<table>
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<th>Type of County</th>
<th>Number of Counties</th>
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<tr>
<td>Core</td>
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<td>Extension</td>
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</tr>
<tr>
<td>Periphery</td>
<td>5</td>
</tr>
<tr>
<td>Adjacent</td>
<td>9</td>
</tr>
</tbody>
</table>

Data Source: USDA & BEA
Goals for Local Agriculture

- Keep Land in Production
  - Maximize productivity gains and minimize productivity losses
- Grow sales
- Retain Diversity of Farm Ownership
Jurisdictions should:

- Anticipate their farmers’ response
- Provide farmers with business counseling and planning assistance
- Develop practical programs and incentives for empowering farmers to implement their plans
- Support farming networks and exchanges to connect farm sellers with buyers who would keep the land in production
- Conduct “Buy Local” marketing to generate new sales for local farms from transient workers
- Encourage groups of farm laborers to take ownership stakes in farms
Tourism – Research Outline

Original data analysis across three shale plays:

- By gas drilling intensity (Core, Extension, Periphery, Adjacent)
- By 2003 USDA Rural-urban Continuum Codes (aka Beale codes)

Results of conversations with planners and tourism professionals in Pennsylvania

Findings summary and policy recommendations
<table>
<thead>
<tr>
<th>Cluster/Sub-Cluster Name*</th>
<th>NAICS Code (2007)</th>
<th>NAICS Industry Name</th>
<th>% of Industry Employment and Payroll in Cluster</th>
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<tbody>
<tr>
<td>Accommodations Sub-Cluster</td>
<td>721110</td>
<td>Hotels (except Casino Hotels) and Motels</td>
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<tr>
<td>Accommodations Sub-Cluster</td>
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<td>Casino Hotels</td>
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<td>Accommodations Sub-Cluster</td>
<td>721191</td>
<td>Bed-and-Breakfast Inns</td>
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<td>Accommodations Sub-Cluster</td>
<td>721199</td>
<td>All Other Traveler Accommodation</td>
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<td>Accommodations Sub-Cluster</td>
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<td>RV (Recreational Vehicle) Parks and Campgrounds</td>
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<tr>
<td>Accommodations Sub-Cluster</td>
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<td>Recreational and Vacation Camps (except Campgrounds)</td>
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<td>Drive-In Motion Picture Theaters</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Theater Companies and Dinner Theaters</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Dance Companies</td>
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<td>Musical Groups and Artists</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Other Performing Arts Companies</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Sports Teams and Clubs</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Racetracks</td>
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<td>Other Spectator Sports</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Promoters of Performing Arts, Sports, and Similar Events with Facilities</td>
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<td>Promoters of Performing Arts, Sports, and Similar Events without Facilities</td>
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<td>Culture, Recreation and Amusements Sub-Cluster</td>
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<td>Agents and Managers for Artists, Athletes, Entertainers, and Other Performing Arts Individuals</td>
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<td>Zoos and Botanical Gardens</td>
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<td>Nature Parks and Other Similar Institutions</td>
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<td>Amusement and Theme Parks</td>
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<td>Amusement Arcades</td>
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<td>722111</td>
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<td>Cafeterias, Grill Buffets, and Buffets</td>
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<td>Food Service Contractors</td>
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<td>722320</td>
<td>Cafeterias</td>
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<td>485320</td>
<td>Limousine Service</td>
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Source: NYSDOL, Christian Harris
Pennsylvania: tourism jobs vs. overall jobs by drilling intensity

Median real TOURISM employment change 04-09, Pennsylvania counties

Median TOTAL employment change 04-09, Pennsylvania counties

Data Source: QECW
## 2003 USDA rural-urban continuum codes (Beale code)

<table>
<thead>
<tr>
<th>Beale Code</th>
<th>Coding Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>County in metro area with 1 million population or more</td>
</tr>
<tr>
<td>2</td>
<td>County in metro area of 250,000 to 1 million population</td>
</tr>
<tr>
<td>3</td>
<td>County in metro area of fewer than 250,000 population</td>
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<tr>
<td>4</td>
<td>Nonmetro county with urban population of 20,000 or more, adjacent to a metro area</td>
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<td>5</td>
<td>Nonmetro county with urban population of 20,000 or more, not adjacent to a metro area</td>
</tr>
<tr>
<td>6</td>
<td>Nonmetro county with urban population of 2,500-19,999, adjacent to a metro area</td>
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<td>7</td>
<td>Nonmetro county with urban population of 2,500-19,999, not adjacent to a metro area</td>
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<td>8</td>
<td>Nonmetro county completely rural or less than 2,500 urban population, adj. to metro area</td>
</tr>
<tr>
<td>9</td>
<td>Nonmetro county completely rural or less than 2,500 urban population, not adj. to metro area</td>
</tr>
</tbody>
</table>
What happened to tourism in counties similar to Upstate NY?

Eleven Counties in PA, LA, and CO most like New York State counties:

- 3% or more of their economy in tourism in 2004
- Rural-urban type ranging from 3 to 7 (on 1 – 9 scale)

Changes 2004–2009:

- Median/Average real employment in tourism: DROPPED 57/202 jobs
- Median/Average % change in tourism jobs: DROPPED 6% / 15%
- Median/Average % of total employment in economy in tourism: DROPPED 0.5/1.4%
Tourism jobs declined in counties similar to Upstate NY

TOURISM employment change 2004-2009 - gas counties with USDA rural-urban classification of 3-7, and 3% or more employment in tourism

Data Source: QECW
Changes in total employment are not correlated

TOTAL employment change 2004-2009 - gas counties with USDA rural-urban classification of 3-7, and 3% or more employment in tourism

Data Source: QECW
What about tourism in very rural counties?

TOURISM employment change 2004-2009 in RURAL gas counties (USDA Rural-Urban Code 8 & 9)

Data Source: QECW
Versus total employment change in rural counties

TOTAL employment change 2004-2009 in RURAL gas counties
(USDA Rural-Urban Code 8 & 9)

Data Source: QECW
What about tourism in urban counties?

TOURISM employment change 2004-2009 in URBAN gas counties (USDA Rural-Urban Code 1 & 2)

Data Source: QECW
Versus total employment in urban counties

TOTAL employment change 2004-2009 in URBAN gas counties (USDA Rural-Urban Code 1 & 2)

Data Source: QECW
What we have heard from visitors bureaus and county planners

Positive
- Hotels
  - Increased occupancy rates
- Construction of new hotels and additions
- Increased revenue from hotel tax
- Businesses
  - Increased sales from new population

Negative
- “Crowding out” – traffic and hotels
- Damaged landscape and “brand” erosion
- Decrease in hunting and park visitations
Summary of Findings Related to Potential Tourism Impacts

Trends in tourism employment by drilling intensity:

- Decline in extension counties
- Modest growth in core counties
- Growth in periphery counties

Trends in tourism employment by urban-rural type:

- Decline in very rural counties
- Average decline in modestly rural to modestly urban counties
- Average growth in urban counties

Mix of effects and impacts on tourism vary county to county

Long-term impacts are uncertain, but our analysis shows that the tourism industry in some types of counties may be at greater risk of declining than in others
Tourism-related recommendations

Establish threshold measures of cumulative impacts and enforce moratoriums or other checks on the pace and scale of development linked to thresholds\(^1\)

Ensure that local and regional governments have access to energy revenue to support long-term economic diversification and development\(^1\)

Change room tax policy to capture tax revenue from long-term occupancy of gas workers (30+ days)\(^2\)

Require mitigation of potential visual and noise impacts\(^2\)

Consider strategies to capture tourism revenue from gas workers\(^2\)

Include tourism assets in road use agreements \(^2\)

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1 - Headwaters Economics, 2011
2 – Andrew Rumbach conversation
In Summary

Our Research: Was concerned with local economic effects of Shale Gas drilling

Took a regional perspective to understand the range of possible economic outcomes

Classified vulnerable counties as either Core, Extension, Periphery or Adjacent

Investigated economic indicators that are relevant to NY State Counties
General Findings

The economic effects of drilling activities are difficult to separate from those of other micro and macro trends, but are nonetheless significant.
General Findings

AVERAGES DON’T TELL THE ENTIRE STORY:

- Effects vary amongst communities
- There will be winners and losers
General Findings

Effects are felt regionally:

- Communities with drilling and near drilling may experience changes.
- Certain effects are more pronounced in different types of communities.
Specific Findings

The effect of drilling on rent and land value is regional and does not correlate with the intensity of drilling. Specific factors, especially with regard to town/city size seem to be of particular importance.

Different types of agricultural production seems to be more vulnerable than others: Dairy may be more vulnerable than crop production.

Farmers act in one of two ways to drilling activity: Reinvestment or Disinvestment

Tourism employment trends point to declines in extension counties, very rural counties and moderately urban and rural counties. Growth is observed in core, periphery and more urban counties.
Further Research

**Housing:**
- Have there been successful government efforts to mitigate the effects of drilling and other extractive industries on rent and land values?

**Agriculture:**
- Which types of agricultural production are more vulnerable to drilling? Why?
- Is there a threshold amount of money that leads farmers to reinvest rather than disinvest?

**Tourism:**
- How do the effects differ between different elements of the tourism economy (e.g. lodging vs. outdoor recreation vs. different types of retail)?
- Have there been successful efforts to mitigate the effect of drilling on tourism?
Economic Implications of Marcellus Shale Natural Gas Development

Understanding Potential Impacts on Tourism, Agriculture and Housing

May 9, 2011

A graduate student project in the Department of City and Regional Planning at Cornell University guided by Professor Susan Christopherson

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