RESILIENCE, COMMUNITY, AND PERCEPTIONS OF MARCELLUS SHALE
DEVELOPMENT IN THE PENNSYLVANIA WILDS

A Dissertation in
Rural Sociology and Human Dimensions of Natural Resources and the Environment

by

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Abstract

Unconventional natural gas development in deep shale formations forms a major, promising option for energy development. The Marcellus Shale in the northeastern United States is one of the most promising shale natural gas fields in the world with potential to provide energy resources for the nation and needed income for many rural communities. However, natural gas development in the Marcellus Shale region will have broad economic, social, and natural resource impacts – both good and bad.

The research goal of this dissertation was to understand key issues – real or perceived – related to Marcellus Shale development, to understand how these perceptions lead stakeholders to take action, and to understand how these actions emerge within local places. The twelve county Pennsylvania Wilds region served as the region for this study. Focus groups, discussion groups, key informant interviews, content and discourse analysis, and group observations were used to catalog, assess and analyze these issues.

Perceptions of Marcellus Shale development were found to be varied and nuanced, forming around social, environmental, and economic indicators. Perceptions were also shown to be influenced by prior experience with natural gas development, political philosophies, and proximity to Marcellus Shale development. Perceptions guide individuals in the selection of groups, organizations, and other individuals residents interact with and the information sources from which they seek guidance. Interactions emerging in response to Marcellus Shale development thus illuminate local practices of taking information and putting it to use within and across communities, counties, and regions.

Risk and risk perception was shown to be a major factor influencing interactions, adaptive capacity, and resilience within the region. Information transmission, especially miscommunication and misinformation, are key factors in perpetuating outrage in relation to Marcellus Shale development. Uneven development of resilience and adaptation was shown to form major barriers to the emergence of community fields and social well-being across the Pennsylvania Wilds region. Further, differences in resilience and Marcellus Shale impacts at various levels of the panarchy were shown to be barriers to effective community development and long-term planning. From this, implications for policy were discussed and avenues for future research noted.
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Dedication

To Silas – You have made this work all the more meaningful and important. In some small way, I hope this helps make the world a better place for you.
Epigraph

The community is an arena of both turbulence and cohesion; of order and disarray; of self-seeking and community-oriented interaction; and it manifests its dualities simultaneously. It should be studied for what it is and on its own grounds – not as an ideal type of an old form of social life, but as a dynamic and changing field of interacting forces.

– Ken Wilkinson, The Community in Rural America

"Would you tell me, please, which way I ought to go from here?"
"That depends a good deal on where you want to get to," said the Cat.
"I don't much care where --" said Alice.
"Then it doesn't much matter which way you go," said the Cat.
"--- so long as I get somewhere," Alice added as an explanation.
"Oh, you're sure to do that," said the Cat, "if only you walk long enough."

– Lewis Carroll, Alice’s Adventures in Wonderland
Chapter 1: Problem Statement

Natural gas development in deep shale formations forms a major, promising option for energy development. The Marcellus Shale in the northeastern United States is one of the most promising natural shale gas fields in the world with potential to provide energy resources for the nation and needed income for many rural communities.

There is little doubt natural gas development in the Marcellus Shale region will have broad economic, social, and natural resource impacts – both good and bad. For instance, development of the Barnett Shale in Texas reportedly brought nearly $10 billion to the economy in 2007 (The Perryman Group 2008). Similar contributions to Pennsylvania’s economy are anticipated. The Pennsylvania Department of Conservation and Natural Resources recently sold leases on approximately 106,000 acres of state forestland for nearly $288 million dollars (Governor’s Office 2010). Recent reports (Considine et al. 2009; Considine, Watson, and Blumsack 2010) predict gas company spending and natural gas production in the state will produce billions of dollars in value added economic impacts to the state.

It is likewise reasonable to predict Pennsylvania will experience negative social and ecological impacts similar to those tied to historic energy development there and more recent occurrences associated with natural gas, coal bed methane, and oil development in Texas and the Intermountain West. These include increased pollution, neighbor/neighbor conflicts, development and conservation organization conflicts, and wildlife population impacts (cf., Lavandera 2008; Jaffe 2008; Walker 2008; Walker et al. 2007; Doherty et al. 2007; Kaiser 2006; Holloran 2005; Francis 2007 Billings Gazette 2009a, 2009b). Indeed, it seems readily apparent many of these issues have already
occurred (Donlin 2009a, 2009b; Kasey 2008a, 2008b; Kane Republican 2008; PADEP 2008a, 2008b) and Pennsylvania may be entering into yet another boom cycle of natural resource development, with unknown impacts and opportunities yet to emerge.

This study finds purchase within this nexus of change and uncertainty. Natural resource development requires decision makers to make judgments on the short and long-term impacts associated with resource development. Such decisions are not made in a vacuum and are influenced by culture, history, prior experience, peer pressures, economics, risk perception, and other social and psychological factors (Berger and Luckman 1966; Berger 1969; McMullen and Eyles 1999; Renn et al. 2000). Often, decision makers reach out to others facing similar circumstances to gather information, gain support or political advantage, or to resist change. Within these contacts new relationships form, new identities are forged, and the potential to enact change or maintain the status quo develops.

This project explores the effects of Marcellus Shale development on local community well-being. A mixed methods research design is used to identify, refine, and contextualize issues facing communities and citizens in the Pennsylvania Wilds region. Resilience theory and adaptive cycles frame field theory, interactional capacity, and risk perception to better understand responses to Marcellus Shale development at local and regional scales. This study catalogs issues related to Marcellus Shale development as identified by regional stakeholders. It analyzes the role of information and communication in these perceptions, and demonstrates how residents chose informational sources and, in turn, how information influences interaction. The concepts of resilience and adaptation help show how community systems are trying to achieve equilibrium in
response to change and conflict. The study attempts to reframe the Marcellus Discussion by sorting issues by responsibility; doing this opens new and fruitful avenues to address issues at local and regional scales.

Four basic research questions guide this study. The first question assesses the issues stakeholders identify as being related to Marcellus Shale development within the Pennsylvania Wilds region. The second question considers the sources of information informants use to learn about Marcellus Shale development issues and its trustworthiness. The third looks at the social fields informants participate in related to Marcellus Shale natural gas development and how chosen participation relates to perception of issues and sources of information. The fourth question looks at barriers to social field development within and across the Pennsylvania Wilds region, whether these may prevent the development of regional community fields in relation to addressing issues related to Marcellus shale development.

The following chapters outline the research conducted in attempt to address these questions. Chapter Two is a literature review situating the study into the broader research on similar issues. Chapter Three addresses the theoretical framework used to analyze the data collected for this report. Chapter Four outlines the methods used to gather and analyze the data. Chapter Five presents a brief overview of the biophysical, sociocultural, and sociodemographic characteristics of the study area. Chapter Six presents the data collected for this paper. Finally, Chapter Seven features a discussion of the data gathered in this study, its implications, and suggestions for policy, practice, and further research.
Chapter 2: Literature Review

Risk, Risk Perception, Risk Communication, and Information Seeking

The major disasters of Buffalo Creek, Love Canal, Times Beach, Chernobyl, Three Mile Island, Bhopal, Hurricane Katrina, and most recently the BP oilrig explosion, fire, and spill in the Gulf of Mexico dominate the academic and popular literature on community responses to disastrous events. Within this literature, little agreement exists on why there are a myriad of responses generated to similar risks. Attempts to understand risk have generated numerous ways of looking at exposures and responses, including technical risk assessments (Starr 1969), epidemiological and toxicological risk assessments, Beck’s Risk Society (Beck 1992; 1999), the psychometric paradigm (Slovic 1992, 2000), cultural paradigms (Douglas and Wildavsky 1982; Rayner 1992), and the social amplification of risk framework (Kasperson 1992) (see also Renn 1992). Each of these perspectives looks at how individuals understand risk events in terms of a defined set of parameters (i.e., heuristics, technology, culture, and/or media). The goal of these models is to describe why people think the way they do and how risk responses can be controlled, mitigated, or incorporated into situational management.

Risk has a variety of definitions associated with it. Brooks (2003) listed ten distinct definitions of risk, many of which discuss the notions of loss, harm, or hazard in relation to human systems and natural hazards. Renn (1992, 56) on the other hand, defines as “the possibility that an undesirable state of reality (adverse effects) may occur as a result of natural events or human activities”. Differing definitions of risk are also found within economics, financial, ecological, medical, and management literatures.
Merriam Webster’s online dictionary also has several definitions for risk, the simplest of which is the “possibility of loss or injury”.

Three widely used frames for understanding how people perceive risk are the psychometric, cultural, and social amplification of risk models. The psychometric model emerged in response to Starr’s (1969) seminal assessment of acceptable risk and how people rate them in accordance to their actual, technological risks (Slovic 1992). From the psychometric perspective, human judgment defines the risk even when the hazard is well-known (Slovic, Fischoff, and Lichtenstein 2000b; Slovic 1987); whether a risk is considered acceptable or not is also a matter of priorities and values (Slovic 1987; Fischoff, Slovic, and Lichtenstein 2000).

Psychometric studies have identified several important issues. First, aversion to risk in terms of involuntary exposure may be explained more by the perception of possible catastrophe, control of the situation, and inequity than by it being voluntary or involuntary (Slovic, Fischoff, and Lichtenstein 2000b). Second, expert prediction of risk may be just as biased as laypersons, thus creating intractable situations of competing risk prediction and attenuation (Kraus, Malmfors, and Slovic 2000). Third, small incidents may increase the level of negative perception of risk, thereby forcing a higher level of risk mitigation (Slovic 1987; Kasperson et al. 2000). Last and relatedly, prior experience with a particular hazard is an effective predictor of how people will perceive and respond to risk and risk inducing activities or events (Ho et al. 2008; MacGregor, Slovic, and Malmfors 1999).

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The cultural model of risk and risk perception examines how culture influences the perception of risk within society (Rayner 1992). This approach starts from the standpoint that risks are perceived as a threat to a given social structure and cultural system (Douglas and Wildavsky 1982; Rayner 1992). Perceptions are mediated by the strength of institutions and interactions within a culture; thus, risk perception is the result of the culture’s influence on individuals.

Douglas (1970) describes the relationship between structure and interactions in a dichotomy called grid and group. Group represents the strength of the relationship between individuals in a particular social structure (Douglas 1970; Rayner 1992). Douglas and Wildavsky (1982) further define group as “the outside boundary that people have erected between themselves and the outside world” (138). Grid is defined as the “social distinctions and delegations of authority that [groups or organizations] use to limit how people behave to one another” (Douglas and Wildavsky 1982, 138).

In social structures characterized by low group, interactions between individuals vary widely allowing for a more open social structure and competition between individuals due to self-preservation. Where group structures are high, interactions are typically limited by the boundaries of the group, maintaining a collective sense of support and reliance on each other. Low grid indicates an inclusive, egalitarian organization (Rayner 1992). By contrast, high grid organizations are exclusive, meaning that membership is restricted to certain individuals, is hierarchical, and membership in the group is bound to maintain and support existing boundaries of exclusiveness.

Grid and group help explain interactions within social structures but do not offer insight into how different levels of power and influence affect social interactions. To
describe these relationships, Douglas and Wildavsky (1982) turn to another set of descriptors—center and boundary. Center describes center of power, the social entity maintaining the group and grid for a certain society. Boundary describes those who are opposed to or non-supportive of the center.

The center is where decisions on what is risky or not take place. It also determines penalties for failing to adhere to group and grid standards. The boundary consists of those who fail to conform to the mandates outlined by the group and grid of power holders at the center. Those in the boundary challenge the mandates, edicts, and power exerted by the center to control and maintain control over the individuals within a culture.

The third major body of risk research is called the Social Amplification of Risk (SAR; Kaspersen 1992; Kaspersen et al. 2000). SAR is an integrative perspective of risk that combines aspects of other risk theories. This body of work starts with “the thesis that events pertaining to hazards interact with psychological, social, institutional, and cultural processes in ways that can heighten or attenuate perceptions of risk and shape risk behavior” (Kaspersen 1992, 158). The social amplification process starts from an event. The characteristics of an event and the things people perceive related to the event determine what information begins to emerge. These characteristics are transmitted to people through various means such as symbols, signals (such as social cues), and imagery, especially through media outlets and personal communication. This information is then interpreted and responded to by individuals, groups, and institutions. The generated response spreads these interpretations and reactions outward in an amplifying effect, creating impacts beyond those originally affected. The resulting impact, or fallout,
is typically looked at as the resulting impact to a particular industry, company, or responsible party.

SAR attempts to integrate across the psychometric perspective and its typical focus on individual reactions, and the cultural perspective, which focuses on integration and power within cultural systems, to create a perspective that recognizes the interplay between different theories of risk, especially the psychometric models of risk (Kasperson et al. 2000; Kasperson 1992). Important within this theory is the flow of information and the resultant behavioral responses. The control of risk (or what is seen as risk) and the resulting impacts becomes an act related to controlling information and political power (Kasperson 1992; Nelkin 1985).

Another integrating perspective is provided by Peter Sandman. Combining aspects of psychometric and cultural risk, Sandman’s method of risk management has less to do with the cognitive aspects of risk than it does with communicating with people who are being affected by a particular hazard or risk (Covello and Sandman 2001; Sandman 2010). Sandman (2010), defines risk as:

\[ \text{Risk} = \text{Hazard} + \text{Outrage} \]

In his formulation, hazard is the actual harm a particular process or situation provides. Outrage, on the other hand, is the combined cultural, psychological, and physical issues related to the particular process or situation. Thus, to manage a particular risk correctly, one needs to account for the level of hazard as well as the outrage. Differing levels of hazard and outrage require different levels of response and management. Placed in a 2x2 matrix, his risk perception and management model looks as follows:
When both hazard and outrage are low, communication and management are relatively simple: normal conversation typically suffices. When outrage is low but hazard is high, advocacy for precautionary measures to counteract the hazards is his recommended management style. When hazard is low but outrage is high, he suggests outrage management as a key process. In this case, the risk manager needs to assure people who are upset that the hazards they face are relatively less dangerous than they believe them to be. When both hazard and outrage are high, the process of communication and management turns toward helping upset people manage and navigate the serious and potentially harmful impacts of what they are experiencing. 

Emerging within the risk perception and risk communication literatures is a discussion of how people determine when enough information on a risk is enough. Several studies (Griffin, Dunwoody, and Neuwirth 1999; Neuwirth, Dunwoody, and Griffin 2000; Kahlor et al. 2003; Griffin, Neuwirth, Dunwoody, and Giese 2004) have explored the concept of information sufficiency in determining risks associated with hazards. Within this literature, they explore individual characteristics, affective responses and peer pressure, personal learning capacities, beliefs and norms, and differing levels of risk. They found that personal beliefs about risk, especially worry about the severity of risks, lead one to feel they do not have sufficient information to understand risk from a
certain hazard. This, in turn, drove one to find and learn more information about the risk from a particular hazard (Griffin, Neuwirth, Dunwoody, and Giese 2004).

In looking at protective behaviors individuals undertake in response to a risk, and in particular information seeking, Neuwirth, Dunwoody, and Griffin (2000) found a number of important relationships. In particular, information seeking was positively correlated to fear and negatively related to perceived risk. That is, fear drove people to look for information; the lower the perceived risk, the less information an individual sought out. They also noted bi- and multivariate relationships between perceived barriers, information seeking and response efficacy. The higher the perceived level of barriers, the higher the level of information seeking individuals did to understand risks and look for alternatives. Additionally, the higher the level of perceived barriers, the less participants felt that risk protection responses would be effective. The interaction of these three variables indicates that individuals might seek information on other sources of risk protection if the barriers to a preferred or offered protection were too great.

To this study, they coupled the role of the media in communicating risk and risk messages. They note that the information included in the media clip used in their study influenced both behavioral intentions (the intention to use a risk protection measure based on the level of risk information one has) and information seeking. From their study, they conclude:

News stories containing information about the severity of a hazard’s effects can be expected to promote further information seeking. Reports containing level of risk, severity of consequences, and the availability of effective responses should generate the greatest change in peoples’ intentions and actions (Neuwirth, Dunwoody, and Griffin 2000, 730).
Thus, it appears that the kind of information available, and indeed the perceived need for information (Kahlor et al. 2003), drives people to try to understand risk and process the information they have in front of them.

As Visschers, Meertens, Passchier, and deVries (2007) conclude, the comparison of risks is an important mechanism people use to classify, clarify, and in some respects, validate, risks. They explore how people use known risks to compare and contrast unknown risks. The association of unknown risks is used to do four things: to characterize the severity and consequences of a risk, to illustrate where similar risks are already tolerated, to point out the benefits which might be similar between the known and unknown risk, and to point out that the risks themselves might be resolved. Each of these point to ways that information might be gathered and utilized, and in some cases manipulated, to cognitively understand and react to risks.

With roots in psychology, risk research historically has focused on cognitions and not behavior (Slovic 1992). Thus, these perspectives show how people think and, in some cases, feel about risk and risk perception, but generally do not focus on how they react. What is important, however, is that risk perception research is not enough to understand how people react; we must know something about the social, cultural, and environmental contexts in which these decisions and perceptions are made to get a clearer picture on risk perception (Marris, Langford, Saunderson, and O’Riordan 1997). Indeed, most risk perception research has focused on the individual and not the collective. The focus on cognition and the lack of context in examining results have been criticisms of risk perception research in general (Wilkinson 2001; Otway 1992). Thus, to move from individual cognition of risk to action on those cognitions, we need to be able to observe
individual action and how it leads to interaction with others in defining and addressing risk.

**The Field Theoretic Perspective of Social Interaction**

One perspective useful for exploring interactions is the social field or field theoretic perspective. This perspective draws on field theory in physics to describe the make-up of the social. The importance of the approach is in understanding the interconnected nature of various forces at work both within and outside an individual or a group. The life-space and its various components become the focus of explanation and exploration within the social field.

Every actor has a social field, also known as life-space, particular to a moment in history (Lewin 2006). This life-space consists of the person and their psychological and physical environments within which and to which the person interacts. Fields overlap when two life-spaces come together; the depth and type of overlap depends on the consistency of the social field at the time of contact.

A field can be thought of and constructed as “[a] totality of coexisting facts, which are conceived of as mutually dependent” (Mey 1972). Behavior is determined by the field; ergo, behavior is determined by the totality of coexisting psychological conditions (facts) of the individual at a specific point. These components of the totality of facts of the life-space are interdependent and together formulate the individuals response; therefore they act as a dynamic whole, or as a “dynamic field” (Lewin 2006). For the individual, the life-space becomes the social field: the interdependence of the psychological facts at the time of the interaction and the environment ‘as it exists’ (Lewin 2006). This can logically be extended to the life-space of groups.
In both the individual and group instances, vectors (forces exerted by the field) can be either toward the field or away from the field. As in physics, the sum of the vectors determines the movement of the individual at a given point in time. For example, the forces moving a person from their work space to their leisure space might be attenuated by family space. Family duties might prevent interaction in another section of their field.

Overlapping of life-spaces can cause problems. For an individual, a situation where two fields overlap can lead to what Merton called role-conflict (cf., Mey 1972). A mental situation may overlap a physical situation causing the individual to become distracted or to lose interest in what she/he is doing. Moreover, when the life-spaces of two individuals come together, the forces of their vectors may lead to conflict (Lewin 2006). As in locomotion, attraction or repulsion between life-spaces determines the flow of interaction. Forces may lead to both life-spaces overlapping, moving away from each other, or moving in a lateral direction away from a conflict of force.

Regardless, to understand the role of the individual in the field, a full description of the field is necessary. This description must look at the causal factors of the field and their interrelatedness. Lewin felt to understand frustration, the psychologist should be “...as much concerned with the question of what frustration ‘is’ psychologically, as with the effect of frustration” (Lewin 2006, 194). Thus, the subjective experience and the objective experience must be included to understand a particular situation.

**Interactional Community Theory**

Field theory has been applied in many areas beyond its roots in psychology. One area of particular interest to this study is interactional community theory. This

Community has a wide variety of uses and connotations. In summarizing community and community development from the interactional perspective, Theodori identifies two different connotations in common usage of community in current literature: territory-free and territory-based (Theodori 2005, 662). Territory-free communities generally “describe types of social groupings or networks” such as “‘the business community’ , ‘the farm community’, and/or ‘the Hispanic community’”. The latter is based on “geographically localized settlements” or “territory-based communities”.

Hillery’s (1955) seminal piece reviewed a sampling of the extant literature of his time, searching for commonalities among definitions of community. Roughly 70 percent of his reviewed definitions cited an area, common ties, and social interactions as important features of community. In the rural United States of the 1700s, 1800s, and early 1900s, one’s interactions were typically centered on a specific locale where most life needs were met (Kaufman 1959). As the nation’s economy became more industrialized and centered around urban areas, places of residence and production were separated. The disconnection of production and residence extended linkages beyond the place where one resided, increasing the dynamics of the community concept (and its attendant definitions; Ibid). The expanded sphere of interactions and their increasing
importance in understanding community spurred the development of interactional community theory (Kaufman 1959, 1985; Wilkinson 1999).

Interactional community theory consists of four core phenomena: associations, actors, actions, and interest configurations (Kaufman 1985). Actors are “leaders and other persons participating in actions and associations” (Kaufman 1985, 55). Actions are “activities, projects, and programs that persons carry out as they solve local problems and participate in various associations” (Ibid, 55-56). Associations are structural components that focus actions. Interest configurations reflect the various institutions within a community that express its image. The number of these associations and interrelatedness of these organizations show the interactional level of the community (Kaufman 1985).

The interplay between all four of these components and the fields they create form the basis of the interactional community (Kaufman 1959, 1985; Wilkinson 1999, 1995; Theodori 2005; Flint, Luloff, and Theodori 2009). An interactional field is defined as an “organization of actions carried on by persons working through various associations or groups” (Kaufman 1959, 10-11). Social fields are a type of interactional field (Wilkinson 1999; Theodori 2005). Social fields are the “sequence of actions over time carried on by actors generally working through various associations” (Theodori 2005, 663, emphasis in original). Social fields can be thought of as groupings such as faith-based groupings, government agencies, environmental groups, economic development groups, etc. (Theodori 2005).

When social fields overlap, the community field can emerge (Wilkinson 1999; Theodori 2005). As Wilkinson states, “[a] community field is a process of interrelated actions through which residents express their common interest in the local society”
Social interaction, according to Wilkinson, “delineates a territory as the community locale; it provides the associations that comprise society; and it is the source of community identity” (Wilkinson 1999, 11). What separates a community field from social fields is “the generalization of locality-oriented actions across interest lines” (Theodori 2005, 665). Generalization connects various social fields together, providing a base for community development to occur by pooling interest, expertise, and resources (Theodori 2005) and community response and adaptation to threats (Flint and Luloff 2005, 2007). Thus, community emerges from the collective action of individuals, acting through agencies, that expresses the interest configuration of the generalized social fields.

Multi-community Collaboration and Regional Community Fields

The three-part definition of community (a locality where people meet their needs of life, a local society which is oriented toward well being in this particular locality, and locality oriented action toward the common good) points to a wide variety of potential spaces for the community field to emerge. As Wilkinson (1992, 1999) notes, the difficulty in finding the community field is that many of the defining factors of community can be difficult to find at a small spatial scale in rural areas.

In discussing multi-community collaboration, Wilkinson (1992) points to six different factors guiding the creation and emergence of community across a broader multi-community region. The first point is residents of these localities must be given the opportunity to work on problems within their areas, not simply be the recipients of efforts at development. Second, local residents must overcome local power barriers and quiescence, such as those imposed by growth machines (Molotch 1976), local elite, or outside industrial interests.
Third, local organizations must emerge that are inclusive and representative of issues being faced across multiple localities. Thus, rural areas must find a way to bridge across multiple communities within a region, not just focus on the issues and problems of one area. Fourth, the assets of the local population within the region must be utilized and mobilized to address problems. When local assets are underdeveloped or missing, the fifth condition is to gain information and assistance to help make decisions toward action. It is in action, the sixth condition, where community development (development of community) takes place. Regardless of whether the action is successful or not, the creation of networks, pooling of assets, and creation of organization within the locality – and the capacity it creates – is critical to current and future social, economic, and environmental well-being (Wilkinson 1999).

Flint, Luloff, and Theodori (2009) build upon Wilkinson’s notion of multicommunity collaboration to describe something known as the regional community field. The regional community field emerges when two or more community fields generalize across their localities in order to form a community field capable of addressing issues of common concern. The regional community field is restricted to the same set of conditions the community field is, namely it emerges through the action of associations and actors, the local population is represented and active in purposeful attempts to address problems across the field, and generalization occurs across multiple fields of interest.

2 As will be discussed in more detail later, development of community relates to be development of human capital and breaking down of barriers preventing self-actualization. Development in community, on the other hand, relates to the development of economic and infrastructural systems typical in community development work today.
An important aspect of the regional community field is the generalization of multiple community fields. Thus, local community fields must exist before the regional community field can emerge. Barriers to the emergence of local community fields also serve as barriers to regional community fields. Furthermore, the generalization of community fields across a region appears to reflect the ability of local residents to: (1) identify and address problems within their own areas; and (2) to identify that these problems exist within multiple communities across space and move toward addressing them collectively.

Well-Being and Community Fields

Well-being has been a source of widespread research and debate for sociologists, psychologists, and economists for many years (Dasgupta 2001; Wilkinson 1999; Campbell 1981). Well-being can be either a qualitative measure of how various forces interact with and impact one’s life (Wilkinson 1999) or a quantitative measure of material and non-material items that add up to determine one’s well being or ‘quality-of-life’ (Campbell 1981; Dasgupta 2001; Andrews and Withey 1976).

As it is a combination of many factors, well-being can be a useful tool to describe the cumulative impacts of various factors on an individual unit, whether it is a community, environment, or person (Wilkinson 1999). Well-being can be difficult to define because different people experience well-being in different ways, and the forces and experiences that combine to form well-being will be different from person to person and from culture to culture (Campbell 1981). At the individual level, well-being can be viewed as a measure of how various social and economic forces interact with and affect one’s life. At a macro level, it can be measured as a function of the interactions of local
social fields on a community’s well-being. Wilkinson (1999) suggests well-being contains three components: personal, ecological, and social. As they interact, the foundation of community well-being is established.

Personal well-being is affected by a wide variety of social, psychological, and personal experience factors and differs greatly from person to person (Wilkinson 1999; Campbell 1981; Dasgupta 2001; Dana 2000). Abraham Maslow defined personal well-being as five levels of need: physiological, safety, belongingness/love, esteem, and self-actualization (Maslow 1954). Allport separated human needs as either lower-order or higher-order. Lower-order needs are those essential to human life and sustenance – food, clothing, shelter, etc. Meeting and fulfilling lower-order needs allows one to move on to higher-order needs (Allport 1955). Self-actualization is the highest level of personal well-being, and occurs when a person reaches a level where personal attributes have been formed to their fullest (Maslow 1954). From an economic perspective, personal well-being has been defined as “…a variety of objects (health, happiness, associational life, various kinds of freedoms to be and to do)” whose interactions add up to form well-being or quality of life (Dasgupta 2001, p. 22). Campbell (1981) adds to this definition the notion of freedom and self-determination in pursuit of needs.

Ecological well-being reflects the health of the environment in and around the community and is central to both social and personal well-being because it is the source of the materials needed to fulfill lower-order needs (Wilkinson 1999). Ecological well-being often comes at the expense of personal and social well-being, as the latter two are often tied to economic well-being that drives many common quality of life definitions (Dasgupta 2001). However, economists and sociologists are beginning to understand the
intricate connection between the economy and the environment and the role the
environment plays in determining the social, value, and economic bases of the
community and the individuals in it (Dasgupta 2001; Ramsey 1996; Parkins, Stedman,
and Beckley 2003; Kusel 1996; Carroll et al. 2003).

Social well-being is the measure of the quality of a person’s interactions in a
community (Wilkinson 1999). This measure includes the support systems in place to
promote and sustain individual well-being, the opportunities available to take advantage
of them, and their impact on the community and person (Andrews and Withey 1976;
Wilkinson 1999; Campbell 1981). Wilkinson (1999) lists five important items that a
community needs to support social well-being: (1) distributive justice; (2) open
communication; (3) tolerance; (4) collective action; and (5) communion.

Distributive justice is the belief that all people are equal and that removal of
barriers and inequalities increase communication and interactions within a community.
Open communication refers to the efficiency, effectiveness, and integrity of
communications among people; any barriers in communication are barriers to social well-
being. Tolerance refers to the acceptance of the values and beliefs of others and is also an
integral component of personal well-being. Collective action refers to the degree to which
people in a community work together. Communion is the celebration of community and
the relationships that exist within it.

Likewise, social well-being can be thought of as a measure of the quality of ties
within a community. Granovetter (1973) explored the social ties between communities
and the people within them in his concepts of weak and strong ties. Weak ties are
informal, transient, and tend to occur between relative strangers. Strong ties are formed
among family members and friends and tend to be long term. Weak ties interact with
strong ties by elevating the strong ties into higher-level interactions, providing social
stability for the community (Granovetter 1973). Measuring the number and type of ties
within a community can show the overall pattern of personal and social well-being of the
residents of the community. Granovetter (1973) contends too many strong ties are
detrimental to a community. This point is well reflected in Ramsey’s study of two towns
in Maryland with strong ties. In Ramsey’s study, such ties guided community
development, sometimes negatively, for the better part of a century (Ramsey 1996; see
also Wilkinson 1999).

**Interactional Capacity and Barriers to Field Emergence**

A community’s ability to respond to any type of crisis ultimately lies in its
internal capacity to do so (Brennan, Flint, and Luloff 2008; Flint 2004; Flint and Luloff
2005, 2007; Wilkinson 1999). The ability of a community to work together in
overcoming a problem is called interactional capacity. Interactional capacity measures a
community’s response to a risk or hazard based on the level of interactional community
within an area. Community capacity to respond to a risk or hazard depends heavily on the
local perception of the event, the level of community interaction, the status of social and
economic issues within the community, and the power structures controlling these issues
(Flint and Luloff 2005). Communities with high interactional capacity (and higher levels
of interactional community) are more likely to effectively adapt to threats than those with
low interactional capacity (and low levels of community interaction).

There are a number of factors that determine whether a community exhibits high
or low interactional capacity. Part of the answer lies in a community’s culture (Brennan,
Flint, and Luloff 2008). As previously noted, interest configurations promote and maintain the ‘image’ of the community, which in large part emerges from the culture of an area. Localities exhibiting high levels of interaction among members of the locality provide the means to adapt to and address the issues facing it – a capacity called community agency (Wilkinson 1999; Luloff and Swanson 1995; Luloff and Bridger 2003; Brennan, Luloff, and Flint 2008). If the area has a culture that prevents effective interaction among residents, effectively preventing community agency, adaptive capacity fails to emerge.

In this respect, history also has a role in influencing interactional capacity. Historically, industrial influences have strong effects on community well-being (Landis 1938; Cottrell 1951; Gaventa 1980). In some instances, corporate control and influence can be positive and help communities develop. In an industrial area of Western and Northern Maine, Duncan (1999) found a social and political structure that reinvested in the community created positive social interactions, allowing people to move through the social system and providing support to those who were poor, needy, and beset by hard times.

On the other hand, constellation of interests, cooperative domination between companies and government, and the threat of external sanctions led to poverty and low standards of living in company towns in Appalachia (Gaventa 1980; West 1994; Duncan 1999). Industrial developers often acted in imperialistic manners, colonizing the places where resources were available, degrading the existing culture, appropriating the place to fit the culture of the dominant social class, and then instilling a social structure and political system that was friendly to the company’s interests. The lack of social
development coupled with the application of imperial-type power lead to a system that, as Gaventa notes: “...maintains non-challenge of the powerless even after the powerful have fallen” (Gaventa 1980, 82).

Human capital in communities is also a major influence on both interactional community and interactional capacity (Bridger and Luloff 1999). A lack of human capital is generally recognized as a deterrent to community and economic development. In order for any development to be long term and meaningful for a community, the capacity of its residents must be developed. Wilkinson (1999) calls this development in the community. Beyond developing the people of an area, a number of barriers must be overcome before economic development, or development of, the community can take place (Wilkinson 1999, 1995; Bridger and Luloff 1999, 2001). Some of these barriers in part are related to location and economic issues, while others are related to the power structures existing in the local region. In essence, companies and industries that control jobs and resources in an area also control the key features that make human capital and economic diversification possible (Couch and Kroll-Smith 1985).

**Risk Perception as a Barrier to Interactional Capacity**

Decisions made at both the individual and community levels affect preparedness for the emergence of events (Flint and Luloff 2005; Kumagai et al. 2004; McCaffrey 2004). Several researchers have documented how social networks, peer pressure, leadership capacity, human capital, agency commitment, and communication have affected risk perceptions (Kruger et al. 2003; Nelson et al. 2005; Steelman and Kunkle 2004). Sociohistoric effects on post disaster and pre-event perceptions (Carroll et al.
In much of the risk research literature, natural and technological (human-induced) events are treated separately (Flint and Luloff 2005; Couch and Kroll-Smith 1985; Aronoff and Gunter 1992). Natural disasters are seen as being separate from technological events for several reasons. The first is control (cf., Flint and Luloff 2005). Natural events are seen as unpredictable, happening at any place at any time without warning, while technological events are, in some respects, controllable by human agency. Events in technological systems are believed to be controllable by experts from government and industry, leading to a sense of security that an event cannot occur without a massive system failure or recreancy (failure to perform one’s duties) on the part of a human actor (Freudenburg 1993).

This leads to another reason why technological and natural events tend to be separated – the doctrine of human domination of nature. Technology is seen by many as the ultimate tool to overcome the adverse effects of nature and this, as theory suggests, will allow us to continue developing resources and live in a perpetually improving world (Wulfhorst and Krannich 1999). To those who abide by this perspective, nature is constructed in a dual role as both resource and threat to continued human viability.

The bifurcation between nature and humanity is thought to lead to differences in responses to an event (Couch and Kroll-Smith 1985). Some feel natural events induce a therapeutic response while others feel technological events create corrosive responses. Therapeutic responses to events occur when a broad grouping of people who have been affected by an natural event come together as a ‘community’ to support each other and
attend to putting their lives back together (Flint and Luloff 2005; Aronoff and Gunter 1992; Edelstein and Wandersman 1988; Couch and Kroll-Smith 1985). From an interactional perspective, the actors in the community (who may or may not be victims of the event) come together in associations with the intent of performing actions that will lead to the betterment (healing, rebuilding) of the community.

Corrosive responses or chronic technical disasters on the other hand, have the opposite effect (Couch and Kroll-Smith 1985; Flint and Luloff 2005). In such communities, there is widespread disagreement on what the problem is, who is to blame, the correct course of action, and why it is important to do anything (Edelstein and Wandersman 1988). This, in effect, leads to conflict among actors and associations and reduces morale in a community (Wulfhorst and Krannich 1999) increasing stigmatization, and reducing the overall economic and social well-being of the community (Wulfhorst and Krannich 1999; Flynn, Peters, Mertz, and Slovic 1998; Aronoff and Gunter 1992).

Edelstein and Wandersman (1988) suggest that in any community, a continuum exists along which a community will respond. At one end of the continuum lies the concept of dissonance (corrosive response) and at the other lies consensus (therapeutic response). Where the community lies along the continuum corresponds to the event being encountered, the social make-up of the community, and local perception of the crisis (Flint and Luloff 2005).

The stage or phase of development that a project, disaster, or other change-inducing event is in should also have some level of effect on community activity and response. Several researchers, notably Gilmore (1976) and Freudenburg (1981),
identified four stages of response residents of boomtowns progress through during the life of energy development projects in the 1970s. They found communities were initially enthusiastic about projects, focusing on the positives and ignoring or dismissing negative impacts. As development begins and the intensity of change increases, the negative effects start to emerge and are recognized, forcing factions to arise in response to perception of these impacts. As change continues to occur, panic emerges as local residents struggle to adapt to challenges facing their quality of life, particularly changes to identity, infrastructure impacts, local governance issues, and the local environment as a whole. The final step is one of planning and mitigation, where local residents implement strategies and techniques to address issues and begin to accept the new reality they are living in.

Chapter Summary

This chapter has reviewed the literature regarding interactional fields, interactional capacity, risk, and risk perception in interactions carried out across multiple levels of analysis. It is within this nexus of community, capacity, and risk that Marcellus Shale development can be located. Development of the Marcellus is likely to test the boundaries of local places and the people living within them. From increased population to increased environmental change, the forces at work within the development of the shale have created reactions that have cascaded in a myriad of ways. The future effects of these responses are unknown at this point. However, based on the information outlined above, we have tools available to understand where and how they might emerge, as well as how they can be captured and utilized for the good of the greater population. The
following chapter brings together the key themes outlined in the literature review under the auspices of resilience. It highlights how they might be assimilated to better understand the emergence of community in response to Marcellus Shale development.
Chapter 3: Theoretical Framework

Researchers increasingly understand the intricate connection between the economy and environment and the role the latter plays in determining the social, cultural, and economic bases of the community and the individuals within it (Dasgupta, 2001; Ramsey, 1996; Parkins et al., 2003; Kusel, 1996; Carroll et al., 2003). When well-being is threatened, whether through an act of ‘man’ or ‘nature’, a response is generated within a community that can either strengthen or weaken the ties, associations, and interest configurations within a community; ultimately, this response impacts the community’s social fabric.

The development of the Marcellus Shale is causing widespread changes in the lives of Pennsylvanians. Understanding how these changes are occurring and how we can be better suited to adapt to the broader changes emerging in the world around us are part of what both the risk and interactional field theories accomplish. The well documented theories of risk and risk perception and the field theoretic perspective provides important clues for understanding response: risk and risk perceptions tell us why people react the way they do and field theory tells where they react through interactions with others to address a problem. Interactional capacity builds a bridge between the two by telling us how previous responses to risk create capacity to deal with future risks.

However, impacts, change, and adaptation occur in different areas at different times with differing speeds. Therefore, social fields and risk perceptions will emerge at different times and for different reasons at various speeds across different areas in response to the same event. It is especially important to understand the barriers to these responses and how they interact with each other to promote or prevent the development
of interactional capacity. What is needed is a process defining stages or steps that systems go through in responding to change and why these differ over time and space. The concepts of resilience and adaptive cycles provide a useful lens for understanding where places such as local towns, counties, and the state are in the process of change and adaptation and how these changes can be better managed to minimize conflict within communities of the state.

**Resilience and Adaptive Cycles**

Resilience is defined as “... the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks - and therefore the same identity” (Resilience Alliance 2010). The adaptive cycle, which is the process around which systems change and re-organize, can be conceptualized as in Figure 3.1.

Following the arrows starting in the upper right, the four phases of adaptation are:

- **K (Kappa) phase**: Conservation – slow change; close knit groups and organizations – rigid structures and functions; few people control most of the resources
- **Ω (Omega) phase**: Release – period of rapid change; capital released into the system
- **α (Alpha) phase**: Reorganization/Renewal – system boundaries break down; possibilities for innovation and system change possible because of capital release
- **ρ (Rho) phase**: Growth/Exploitation – capital available to many individuals; system boundaries renew themselves around new capital distribution and collective identity
Figure 3.1: The Adaptive Cycle

The stability of a system is measured by the connectedness of its parts and the ability of the parts to access the energy stored in the system (Holling and Gunderson 2002; Walker and Salt 2006). Connectedness is measured by how closely parts of the system are integrated with each other. Old growth forests would be an example of a highly connected ecosystem where various parts have developed over time to maintain the energy balance of the forest. A nation in a state of civil war would be a system with low connectedness, with members of the system fighting each other for control of the resources of an area.

Potential is the availability of energy to the parts of the system (Holling and Gunderson 2002). In a stable, resilient system energy is cycled rather than lost to the system. In non-resilient systems, energy is lost. In the forest example, nutrients cycled out of the soil by trees are recycled back into the system through specialists, such as decomposers, which emerge to transform waste products (dead trees and other organic matter) back into nutrients for new and continued growth. In non-resilient systems such as a country in civil war, energy is lost through the loss of human lives, the destruction of infrastructure, and a loss of trust between the factions fighting the war.

Rho and Kappa phases signify periods of relative stability (Walker and Salt 2006). These two phases tend to be the longest lived and represent the ordering of the components of a system. Only a few individuals within the system own or have access to these resources. A period of release follows when a major change is introduced. This is when the resources stored in a particular system are rapidly released and made accessible for others (Holling and Gunderson 2002; Berkes and Folke 2002; Walker and Salt 2006). During this time, system boundaries start to break down and the role/function these
systems played come into question. The point at which the system starts to break down and achieve a different state is called the threshold (Walker and Salt 2006).

When release occurs and a system moves over its threshold, a period of reorganization or renewal follows; this is when the system attempts to find equilibrium within its new set of parameters (Walker and Salt 2006; Holling and Gunderson 2002). System boundaries begin to reemerge in a different form and start the process of utilizing extant resources to reestablish equilibrium. This is the Rho phase, a period of growth and exploitation when resources are recaptured and reordered (Berkes and Folke 2002; Walker and Salt 2006). Systems begin to form solidly around these new resource distributions. As these systems become established, conservation reemerges in an attempt to preserve stability.

The adaptive cycle is a non-linear process. It is possible to go from one phase to another, except perhaps from release to conservation (Walker and Salt 2006). For instance, in the process of reorganization and renewal, the system might experience another release and enter into a new Alpha phase. Likewise, a system in its growth/exploitation phase might enter a period of release, starting the process of reorganization and renewal. A system in the conservation phase might enter a period of reorganization/renewal without a release of resources into the system. During the renewal phase, a system might be completely reorganized, starting a new dynamic that exits the dynamic cycle of the old system (Holling and Gunderson 2002). Janssen (2002) called this process institutional change.

The adaptive cycle is also scalar and is influenced by the adaptive cycles of the systems in which it is embedded. The term panarchy represents the nested nature of
adaptive cycles (Holling, Gunderson, and Peterson 2002; Walker and Salt 2006). Thus, a smaller system might be at a different point in its cycle than a higher system and might influence the cycle of another (Holling, Gunderson, and Peterson 2002; Gunderson, Holling, and Peterson 2002; Holling, Carpenter, Brock, and Gunderson 2002). Within the panarchy, two important terms emerge related to interactions among scales: revolt and remember (Walker and Salt 2006). These terms represent the relationship between the conservation phase of the larger system and the Omega (revolt) and Alpha (remember) phases of a smaller system (Holling, Gunderson, and Peterson 2002).

In revolt, movement is from smaller systems to larger ones. If the larger system is in its conservation phase and its resilience is low, a release may be triggered by a collapse of a lower system. As larger systems tend to be slower to adapt to change than smaller ones, a change (or multiple changes) in faster systems can cause collapse in larger ones. These disturbances might spread out to other systems, causing a cascade of release to occur across all systems. The term remember represents the opposite occurrence. If the larger system is stable and resilient, it can provide a model from which the smaller system can reorganize/renew itself. In effect, the ‘memory’ of the larger system causes stability in lower ones.

Ultimately, the stability of a system, regardless of where it is located in the panarchy, relies on flexibility and adaptability. Rigid, inflexible structures tend to make systems less able to adapt to change. As noted in the definition of resilience, a small change can push the system past its threshold creating a major release (Holling, Gunderson, and Peterson 2002; Holling, Carpenter, Brock, and Gunderson 2002; Walker and Salt 2006). As rigidity decreases and flexibility increases – that is, as a system
becomes resilient – the impacts of change are attenuated by internal functions and structures. Larger disturbances can be absorbed by the system; if releases occur, they quickly move through the reorganization phase and back into the conservation phase.

**Adaptation, Community Development, and Community Well-being**

Traditional community development (Wilkinson’s *development in*) efforts often center on efficiency and optimization of capital (Walker and Salt 2006; Gunderson and Holling 2002). These mantras become established within actions, meanings, and symbols and become increasingly more difficult to change. Moreover, as resources become increasingly tied to such meanings, symbols, and actions, they too become increasingly harder to mobilize and utilize. Thus, when change occurs, systems tend to fall apart because they have become rigid and inflexible and cannot adapt readily.

The role of resilience and the four phases of the adaptive cycle are important for understanding the role of actors in the creation of community and the emergence of community well being and preventing the collapse of local systems. Community development, from the interactional field perspective, is about the process through which people come together to address change. The community field, defined as a locality, a local society, and a shared sense of purpose and identity which towards action in dealing with day-to-day activities, is more about the process than the goal or end product (Wilkinson 1995). Through interacting with each other, individual capacities are built and shared identities are forged. In turn, these help to develop the ability to adapt to change and move the system, in this case a community, through its adaptive cycle.

Different actors come to the forefront during the adaptive cycle. During the conservation phase, K-Strategists emerge as the dominant leaders (Walker and Salt
K-Strategists are efficient in the use and application of resources within a community. They tend to prefer specialization and tend to utilize interests and resources over a wide area. Because of these proclivities, they tend to emerge as leaders who wish to maintain the status quo and prevent change from occurring, or at least the types of change that would potentially leave them out of the process. Bureaucrats and bureaucratic systems are often set up around the promulgation of these new delineated systems (Janssen 2002; Weber 1997[1930]). During this process, policy is implemented to protect the system’s equilibrium and maintain the distribution of capital within the system’s boundaries.

K-strategists also have roles in relation to environmental impacts or to impacts to quality of life in an area. They work to maintain their own special places or landscapes and resist attempts to utilize or develop them for uses other than what they desire. They attempt to create or emplace regulations or policies protecting what they consider to be an ideal system. Thus, they use their capital to maintain the equilibrium of an existing system and defend it from disturbances challenging its existence.

The release phase is the process that changes the relationships, stability, and inertia of the conservation phase. Releases range from economic and social decline to things such as the chronic technical disasters or recreancy noted earlier. The higher the level of resilience, the more it takes to send the system past its threshold and into release. Moreover, the more firmly entrenched the system is in terms of the conservation phase, the less disturbance it takes to disrupt the system. For example, communities with economies exclusively based on natural resource extraction are examples of systems with small thresholds. If and when the resource becomes depleted or some market force makes
the resource worthless, the industry and its related jobs and support structure disappear. The change (loss of resource) causes a disturbance in the community (loss of jobs and income) which in turn causes it to cross a threshold from which it may never return.

Important to the release phase are the perceptions that members of the system have of it. These perceptions lead people to action. Therefore, during the release phase, activists are the major role players (Gunderson, Hollings, and Light 1995; Janssen 2002). These activists utilize the disturbance to the system to move the system toward a redefinition of itself. In terms of bureaucratic systems, activists are those who challenge the status quo enforced by bureaucracies. If they are uneasy or disagree with the particular emphasis or focus of an agency, they will challenge the agency, and thus the conservation of the system, toward their perception of reality. If the activism is high enough, policy failure is highlighted, which then weakens the conservation phase of the system and sends it toward renewal.

The renewal phase is represented by the members of the system trying to redefine their boundaries, recapture and repurpose capital, and create a new vision and reason for the system. Decision makers, especially entrepreneurs and risk takers, emerge as the leaders in this phase and try to reestablish order through recapturing capital and redefining the parts of the system (Walker and Salt 2006; Gunderson, Hollings, and Light 1995). During the renewal phase, proposed alternatives guide decision making towards the implementation of a new, stable system (Gunderson, Hollings, and Peterson 2002).

In many respects, the environment corrosive or therapeutic responses emerge from could be thought of as the community’s ability to move from the release phase to the renewal phase. The options available to a community during a crisis and the actors
and institutions in position to choose among these options influence the interactional capacity of the community. Thus, in reestablishing equilibrium, two paths may occur: those supporting and in line with the initial system state (therapeutic response) and those counter to or against the initial system state (corrosive response). The path that emerges out of the alternatives available during the renewal phase determines which groups take part in the phase of rapid growth; it also frames the foundation for the next set of activists.

The rapid growth phase emerges from within the reorganized meanings, symbols, and actions of the new system. Entrepreneurs and developers, or ρ-strategists, are key in this phase, taking advantage of new opportunities and exploiting resources that emerge around the renewed system. The phase of rapid growth, over time, can lead to the next phase of conservation as resources become locked and the system slowly starts to become inflexible again. As Janssen (2002) and Gunderson, Hollings, and Light (1995) note, bureaucracies then reemerge to crystallize, maintain, and protect the use of capital as defined by the new system equilibrium, a process well outlined in the work of Max Weber (1997[1930]).

In some respects, Gilmore (1976) and Freudenberg’s (1981) works can be seen as part of the adaptive cycle. The initial excitement phase can be seen as part of a rapid progression from release (a new energy project) to renewal, growth and conservation. The uncertainty phase can be seen as the start of the next release phase, where the changes and impacts are not what was believed to be in the conservation phase, and thus the status quo is challenged and policies are questioned. Factioning that results in the uncertainty and panic phases could be seen as the emergence of the community from the
release into the renewal phase, where new identities are formed, capital is redistributed, policies are delineated and implemented, and growth starts to emerge. The final planning and mitigation stage can, thus, be seen as the movement out of the renewal phase into the next wave of growth leading to conservation based on a new equilibrium of the community. At any point during this process, however, the system can yet again destabilize, sending it into the next cycle of excitement, uncertainty, panic, and planning/mitigation.

**Community Resilience and Well-Being**

If we take community field emergence as a process which occurs in response to perceived risk, and that these processes emerge in different ways across space and time, the connection of risk, field, and resilience theories can help us understand the emergence of community well-being. The five components of social well-being, which are instrumental in the process of individual well-being, are key indicators of the stability and resilience of a community. If a community is open, tolerant, and adaptive, then disturbances to the community are addressed through existing communication channels, networks, and structures. Interactive capacity provides a mechanism through which well-being is expressed and through which a community renews itself in response to hazards and enters a new period of growth and conservation. Alternatively, if a community is closed and rigid, disturbances will cause greater disruption as the barriers preventing an open, tolerant, and adaptive system prevent meaningful interaction between and among individuals in dealing with these disturbances.

Placing the various components of the theories discussed in this chapter together and focusing it on community emergence, a model emerges as depicted in Figure 3.2.
Connectedness for this model is a measure of the integration that the person has with others within the local community. In this instance, high connectedness would be demonstrated by a strong sense of place, volunteerism in local groups and associations, and a sense of pride about where they live. Low connectedness would be measured by the opposite: disaffection with their locality, a lack of volunteerism, and a lack of associations and groups representing the character of the community.

The vertical axis is representative of the potential of an area. This axis represents the resources available to the locality, whether financial, human, political, or otherwise. Potential, in this case, deviates somewhat from the original model. The model predicts that as the locality moves from a release to a reorganization, the potential of the system to create a new, dynamic community increases. As the renewal moves into a period of growth, these potentials continue to increase as new and creative resources are created. It is likely that some aspects of potential, such as technology, might experience the creative destruction that is noted in the original model. However, in terms of human creativity, an open and resilient system will continue to build on itself to achieve a new phase of stability.

When a release occurs (as a result of a hazard or policy failure) that pushes a system across its threshold, the components of the system attempt to realign themselves. This phase of renewal includes the creation of a plan of action for moving the community out of its current disarray into a potential equilibrium. During the renewal phase the requisites of community well-being – distributive justice, open communication, tolerance, collective action, and communion – form a lens through which the problems of the community are assessed and addressed. This in turn forms the basis of interactional
Figure 3.2: The Adaptive Cycle and Community Well-Being
capacity for the community to adjust its way through the next two phases of the adaptive cycle.

In some instances, community well-being may become blocked as a result of internal or external barriers. In these instances, closed and rigid communities might emerge which, as discussed previously, prevent adaptation to new system variables. In this instance, the community may be in an unstable feedback loop, continuously going through cycles of adaptation which do nothing to bring the system out of its current state of disarray. In other instances, a policy plan might emerge which capitalizes on the requisites associated with community well-being. In these cases, following Wilkinson’s (1999) logic, open and adaptable communities may emerge which can absorb change and conflict without losing their state status and moving into a new system regime. Policy alternatives in these instances would reflect community well-being requirements, leading to policy implementation which maintains the open nature of the community and its capacity to deal with new issues. In these instances, it may be possible for community fields to emerge. As a non-linear process, a system of the first type might be able to jump back to the beginning of the growth phase, allowing it to apply the knowledge of failed policies to reemerge along the path of inclusivity and flexibility. In this case, community fields may emerge in response to the conservation of the closed system.

In all cases, the nesting of the cycle within cycles of larger systems – the panarchy – should not be forgotten. This relationship is represented by the linked cycles in the middle of Figure 3.2. At any step of the process, systemic processes from higher levels – such as state, county, or local municipal policy – may emerge which creates a ripple effect and may dislodge the adaptive cycle of a lower system, causing another release or
sending the system backward to a previous step. Likewise, the relationship may come from the bottom up, as is the case when community crises (i.e., an increase in violent crimes) cause major shifts in social and economic policy at upper levels of government (the concept of revolt).

Of particular importance to panarchy is the speed at which change occurs. Lower levels of the panarchy tend to move faster than upper levels (Holling, Gunderson, and Peterson 2002). For instance, local government tends to move faster to address a problem than county government; county government tends to be faster to adapt than state government; state faster than national, and so on (Walker and Salt 2006; Holling, Gunderson, and Peterson 2002; Westley et al. 2002; Gunderson, Holling, Pritchard, and Peterson 2002). This is based, in part, on the bureaucracies inherent at each level and their goal of maintaining the conservation of a system (Janssen 2002). This is also due to the number of components making up each successive level of the panarchy (Westley 2002). Higher, slower levels of the panarchy tend to resist change and release because there are more resources available to deal with change. Lower, faster levels of the panarchy tend to be more susceptible to release because there are less resources to deal with threshold crossing events. The relationships of nestedness (Beckley 1998) and speed across the panarchy is thus crucial to understanding the dynamic and unforeseen consequences of decision making without proper and complete information in relation to community development.

**Resilience in Response to Marcellus Shale Development: A Conceptual Model**

Based on the preceding discussion, a model emerges allowing the assessment of whether perceptions of Marcellus Shale development in the Pennsylvania Wilds are
leading toward resiliency or if actions and activities are leading the region toward closed, non-resilient cycles. More importantly, the model facilitates an assessment of whether processes leading to the development of community through social and community fields is emerging. Hypothesized to be key to these processes and the requisites of community well-being are information, communication, cooperation, and trust. Each of these terms embody concepts crucial to the development of tolerance, open communication, collective action, distributive justice, and communion.

The conceptual model in Figure 3.3 illustrates how resilience in relation to Marcellus Shale development can be thought of as relying of the concepts of information, communication, cooperation, and trust. Open and flexible systems allow open access to information and the ability to use it. It provides clear, open channels of communication that allow for honest communication of needs, perspectives, issues and questions. Open systems allow for cross-boundary cooperation and utilization of resources. Additionally, open systems value diversity and varied interests and work with all stakeholders in addressing community issues. They celebrate this diversity instead of shrinking from it. In terms of resilience, these open systems allow community well-being to occur, are conducive environments for community fields to emerge at the local and regional levels, provide an increased threshold of disturbance, and provide the mechanisms for the development of the interactional capacity needed for communities to move through the adaptive cycle when a threshold event occurs. Open systems tend to display consensus in terms of risk response and are better able to react and adapt to threats.

In the opposite case, closed and rigid systems control or provide barriers to the characteristics that form resilient communities. Information is controlled and
Figure 3.3: Conceptual Model of Resilience in Response to Perception of Marcellus Shale Development
misinformation abounds. Factions emerge within communities and form the loci for communication and actions, which when exclusive, cuts out the ability of other voices to be heard. In closed systems, competition for resources creates boundaries preventing interaction and cooperation. In some cases, boundary maintenance activities cause groups to attempt to undermine each other. In closed systems, a lack of trust between factions and the inability to cooperate leads to inability to deal with issues wholly and constructively. The results of closed systems are reduced community well-being, decreased interactional capacity, boundaries preventing the emergence of community fields, decreased thresholds in the system, and an increased likelihood of the system falling apart during the adaptive cycle and losing its ability to provide meaning and utility for its residents (in terms of community). Thus, closed systems tend toward dissonance in risk response and are less likely to adapt and absorb change.

The role of perception is critical in understanding the movement of communities toward open or closed systems. Perceptions of individuals lead to action and dictate those whom they interact with and the information they chose to believe as correct. In the Pennsylvania Wilds in particular, risk perception related to Marcellus Shale development is likely to grow in importance as a driver for both perception and interaction. However, as noted in the literature, risk is influenced by culture, personal philosophies, and prior experience with similar issues. Culture provides the lenses through which people perceive the world around them and therefore risks associated with development. Personal philosophies are closely related to culture, but, from an individual perspective, help to illustrate the cultural perspective one has and how, in turn, this leads to action in response to risk. Thus, sociocultural and sociodemographic characteristics are important factors in
understanding the role of perception in leading to individual and collective action in
response to risk – an individual adaptive cycle potentially leading to a social or
community field.

More importantly, the cultural, philosophical, and experiential factors influencing
perceptions, when coupled with an understanding of current activities and the risks
associated with these activities, provide a context through which we can understand
where communities might reside within the adaptive cycle and what their current level of
resilience might be. For instance, polarizing and divergent viewpoints within a
community might be indicative of several things. First, a community might be emerging
from a release phase and moving through a renewal phase where groups are vying to
establish a new system order. Second, polarization may emerge as one group attempts to
maintain a state of conservation within a system (risk response) while another attempts to
move the system into a new release phase through activism and policy challenging.
Third, the growth of a system may be seen as increasingly risky by a larger number of
people and, as a result, the system might be sent directly into a new release phase. The
key, in any case, is to understand whether such viewpoints are being communicated in a
cooperative mode or whether various groups and people refuse to interact directly when
addressing issues related to Marcellus Shale. This, in turn, allows us to understand
whether or not resilience is emerging or can emerge within the context of the local
community.

As resilience emerges, the propensity for community field emergence will also
increase. If local interactional fields emerge within these areas, and, through openness,
communication, tolerance, and cooperation, begin to work together, community fields
may emerge. As community fields come together to interact toward the greater good of
the region, a regional community field could emerge (cf., Flint et al. 2010). If, as
Wilkinson and others posit, the community field is the expression of well-being for a
particular place, the regional community field is the expression of well-being for a
region. More importantly, the creation of the community field opens the door for the
creation of interactional capacity, which, in turn, can help a locality move through a new
adaptive cycle.

Following the panarchical relationship between systems, a social field could be
thought of as a small, fast moving field embedded in a community field. The community
field could be thought of a medium sized, medium paced moving field embedded in a
regional field, which could be thought of as a larger, slower paced field located within a
state or other political boundary. Remembrance, from the panarchical sense, would
emerge from the community field in local social fields through the formation of networks
of interaction, breaking down of barriers, and establishment of skills and knowledge in
stakeholders. The sense of identity leading to the creation of the community field would
lead to a pattern of remembrance for the social system. The same might be said for the
steadying influence of the regional community field drawn from its individual
community field components.

Revolt, on the other hand, would come from the bottom up and would prevent or
restrict the emergence of the community fields and regional community field or provide
some level of barrier to be overcome in the community field emergence. Competition or
discord resulting in multiple, divergent social fields would fragment the local identity and
lead to reduced interactional capacity and potentially initiating a new release event for the
locality. Thus, it is necessary to understand the pattern of influence on local social fields and how they may or may not emerge into community fields.

Research Questions

The theoretical framework outlined in this chapter highlights key issues related to community resilience, namely perception, local community response, and community field emergence at both the local and regional scale. Within the conceptual model of community resilience, the goal of this research is to understand key issues – real or perceived – regarding Marcellus Shale development, to understand how these perceptions lead stakeholders toward action, how those actions emerge in the community, and how these actions then emerge across regional scales. In doing this, barriers to and opportunities for community well-being and resilience will be highlighted and potential avenues for further research and policy outlined. The following questions frame this research:

RQ1: What are the issues key decision-making stakeholders identify related to Marcellus Shale development within the Pennsylvania Wilds region?

This research question looks at the salient issues people perceive occurring in relation to natural gas development in the Wilds. With the identification of the major issues, it becomes possible to trace actions, activities, meanings, and vehicles. In turn, it becomes possible to understand risks people perceive as being related to Marcellus Shale development and how these in turn push people toward action in addressing them. By treating Marcellus Shale development as a release within the adaptive cycle, we can see how interaction and field emergence helps frame community response to risk. It will also allow the investigation of relationships within the panarchy through highlighting issues
which are local in nature, those that are regional or statewide in nature, and those that are connected across levels of analysis.

**RQ2: What are the sources of information informants use to learn about Marcellus Shale development issues?**

This question investigates stakeholder perceptions in relation to information sources, perceived believability and professionalism (in other words, trust), and how these influence interactions within their place of residence and the region. It is anticipated there will be differing perspectives on impacts and problems. These differences might be related to different meanings and vehicles based on prior experiences with natural resource development. These differences might also be related to differing perceptions of the relevancy or believability of information and materials available to understand issues they are facing. Such differences might be related to whether people are ρ- or K-strategists, activists, decision makers, or bureaucrats. The sources of information residents use to understand and frame their understanding of shale development – and thus their risk responses - should have a direct effect on their involvement and interaction with policy planning, policy alternative formulation, and policy implementation.

**RQ3: What social fields do informants participate in related to Marcellus Shale natural gas development? How do perceptions and chosen information sources influence their participation in social fields?**

This question begins with the assumption individual stakeholders use different sets of meanings and information to understand and find solutions to problems and use this information in selecting other individuals or groups. The research question addresses how actors act, *ergo*, the response mechanisms people use in addressing what they
perceive as key problems and risks. What social interactions do stakeholders use? Do they work individually, do they seek out existing groups to work with, or do they form new groups? What types of issues are groups working on in relation to Marcellus Shale development? The interactions within these questions point to places where community fields may occur. Also through interactional capacity, resident interactions can be related back to the resilience of a community in moving through phases of the adaptive cycle. For instance, the interaction a stakeholder takes part in might make them a K-strategist, a ρ-strategist, or may place them squarely in the conservation phase of a particular system state. This question sets the stage for understanding the interrelations among phases of the adaptive cycle, among levels of the panarchy, the potential for regional community field emergence, and whether risk responses move toward consensus or dissonance.

RQ4: What barriers to social field development exist within and across the Pennsylvania Wilds region? Can regional community fields develop or be fostered to address emergent Marcellus Shale issues within the Pennsylvania Wilds?

Application of meanings during interactions with others, once tied to differential utilization of informational resources, shows how selective interaction with others may prevent or support the emergence of social fields within a community or region. This, in turn, may derail the adaptive cycle sending the system back into another cycle or result in a closed, rigid system. Research question four assesses whether barriers prevent people from interacting with each other in the creation of social fields. The strength of the interactions is likely to be influenced by several factors in addition to those already discussed, including proximity to drilling, proximity to other resource development, risk perception, and relationships with other levels of government. The question assesses
whether stakeholders participating in local social fields recognize the role of their associations within the larger panarchy. This, in turn, allows us to look at how local fields might emerge into regional associations, spurring the emergence of regional community fields. Likewise, the relationship between risk perception and consensus/dissonance can be more fully explored in relation to differences in perception, communication, and cooperation across a region.

**Chapter Summary**

This chapter reviewed the key theories and concepts underlying this research. The concept of resilience within communities is enhanced by field theory to allow it to emerge from individual perceptions and actions to community level response. Risk provides a mechanism through which actions and interactions are generated through the perceived impact and importance of changes induced by development, in this case Marcellus Shale natural gas development. The research questions and the theory underlying these questions highlight the need to approach the subject of Marcellus Shale development from a perspective which integrates sociocultural, biophysical, and sociodemographic perspectives. With the place of the study in the literature established and the theory supporting this project outlined, the next chapter reviews the methods used to collect, analyze, and report the information gathered to answer the research questions.
Chapter 4: Methods

Research was conducted using a mixed-methods approach (Cresswell and Plano-Clark 2007; Creswell 2007). Primary data was gathered using a variation of discussion groups, focus groups, and key informant interviews. Facilitated discussion circles were used to collect information on local stakeholder perceptions and responses related to Marcellus Shale development. The information from these groups was then collated and analyzed to determine key themes and issues in terms of the study’s conceptual model. Focus groups were used to clarify data, providing both a starting point for the discussion circles and a closing point for the information gathered in this study. Key informant interviews were used to supplement and enhance data collected in the discussion circles. These interviews began before and during the discussion circle process but concluded prior to the time of the last discussion circle and focus group. In addition, group observations allowed me to gather information from 16 meetings where I observed over 200 residents of the region.

Multiple forms of secondary data were used as well: (1) the collection and analysis of over 1,700 newspaper articles; (2) an analysis of propaganda, newsletters, and websites of groups and agencies across the state and region; and (3) gathering and analyzing Census data on population, housing, and economics. Secondary data provided historical and contemporary contexts for the primary data and was used to triangulate resident’s perceptions to actual, on the ground occurrences throughout the region.

Participant Summary

Overall, 165 participants took part in this research project. One-hundred twenty-eight people attended facilitated discussion circles and an additional 25 took part in focus
groups (see Table 4.1). Fifteen participants took part in key informant interviews (see Table 4.2). Three people took part in both key informant interviews and discussion circles. Participants represented different perspectives and life experiences – from environmentalists to industry representatives, workers to concerned residents of drilling areas. The initial focus group consisted of members of the Pennsylvania Wilds Planning Team Oil and Gas committee and the Pennsylvania Wilds Planning Team. This group included planners from several counties, the Outreach Specialist for the Planning Team, and DCNR personnel.

Local community stakeholders were the focus of the facilitated discussion circles. Stakeholders were residents of the local region who were selected to participate in the discussion circle process based on their interest and knowledge of the topic. Participants were asked to participate on the basis of recommendations of contacts, through review of local newspapers, newsletters, or other media, and/or through contacts made at meetings or conferences. Meeting places were selected based on location within regional hub communities so participants would be able to conveniently travel to the meeting. Twenty-five people were invited to each of the meetings; however, not all invitees were able to make it to the discussion when held. An attempt was made to select participants representing a variety of viewpoints, including those with pro, con, and neutral perspectives on Marcellus Development. Contact was made with the individual and they were invited to participate. These participants were asked to provide the name(s) of other contacts or, in some cases, volunteered to track down additional individuals for the discussion circles. Participants of the circles represented diverse interests throughout,
Table 4.1: Focus Group and Discussion Circle Matrix

<table>
<thead>
<tr>
<th>Session</th>
<th>Location</th>
<th>Participants</th>
<th>Participant Characteristics</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ridgeway</td>
<td>10</td>
<td>PWPT Oil and Gas Committee, Outreach Specialist, Chair</td>
<td>Focus Group</td>
</tr>
<tr>
<td>2</td>
<td>Clarion</td>
<td>20</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>3</td>
<td>DuBois</td>
<td>19</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>4</td>
<td>Warren</td>
<td>18</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>5</td>
<td>Bradford</td>
<td>24</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>6</td>
<td>Jersey Shore</td>
<td>25</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>7</td>
<td>Coudersport</td>
<td>22</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>8</td>
<td>Clearfield</td>
<td>15</td>
<td>Concerned stakeholders, state agencies</td>
<td>Focus Group</td>
</tr>
</tbody>
</table>

Table 4.2: Key Informant List and Characteristics

<table>
<thead>
<tr>
<th>County</th>
<th>Position</th>
<th>Age</th>
<th>Years in region</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>Local non-profit director</td>
<td>40s</td>
<td>40+</td>
<td>Yes</td>
</tr>
<tr>
<td>Clarion</td>
<td>Local business developer</td>
<td>40s</td>
<td>20+</td>
<td>No</td>
</tr>
<tr>
<td>Clearfield</td>
<td>Local business developer</td>
<td>30s</td>
<td>20+</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Local municipal official</td>
<td>60s</td>
<td>50+</td>
<td>Yes</td>
</tr>
<tr>
<td>Clinton</td>
<td>Local municipal official</td>
<td>50s</td>
<td>50+</td>
<td>Yes</td>
</tr>
<tr>
<td>Elk</td>
<td>Local resident stakeholder</td>
<td>40s</td>
<td>40s</td>
<td>No</td>
</tr>
<tr>
<td>Forest</td>
<td>Local resident stakeholder</td>
<td>60s</td>
<td>60+</td>
<td>No</td>
</tr>
<tr>
<td>Jefferson</td>
<td>Local business developer</td>
<td>30s</td>
<td>10+</td>
<td>No</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Retiree</td>
<td>70s</td>
<td>70+</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Local resident stakeholder</td>
<td>50s</td>
<td>30+</td>
<td>Yes</td>
</tr>
<tr>
<td>McKean</td>
<td>Local municipal official</td>
<td>60s</td>
<td>30+</td>
<td>No</td>
</tr>
<tr>
<td>Potter</td>
<td>Local business developer</td>
<td>60s</td>
<td>60+</td>
<td>Yes</td>
</tr>
<tr>
<td>Tioga</td>
<td>Local resident stakeholder</td>
<td>50s</td>
<td>50+</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Local resident stakeholder</td>
<td>30s</td>
<td>10+</td>
<td>Yes</td>
</tr>
<tr>
<td>Warren</td>
<td>Local resident stakeholder</td>
<td>60s</td>
<td>60+</td>
<td>No</td>
</tr>
</tbody>
</table>
ranging from industry representatives, business developers and entrepreneurs, local officials, non-profit members, retirees, homemakers, and college students.

The second focus group had 15 members. Fifteen participants is a higher number than typically engaged within focus groups. However, this number was arrived at to facilitate each county having a representative as well each of the three major state agencies involved in the region – the Pennsylvania Department of Environmental Protection, Department of Conservation and Natural Resources, and Department of Community and Economic Development - to have a representation. Again, differing perspectives were recruited through selective invitation. This process ensured the avoidance of groups already included in earlier information gathering sessions.

Selection of key informants was based on recommendation of key contacts within counties, recommendations made by discussion circle participants, or in two cases, were selected based on data uncovered during review and analysis of secondary data sources in order to fill gaps in information. For the purpose of this study, key informants were residents of the area selected for further, more in-depth interviews due to their unique perspectives, positions, or experiences and as such were believed to be able to provide more in-depth, unique information the stakeholder participants. Informants represented diverse stakeholder perspectives, and included local municipal officials, business and economic developers, and local residents interested in Marcellus Shale development. As noted in Table 3.2, most informants were older residents and lived in this region for a long time, many spending a majority of their lives here.

Key informants also had a wide variety of experience with Marcellus Shale development. Some had an active role in the industry or were trying to recruit the
industry to their area. Others have been active in environmental or community based activist groups. Some had little direct experience with Marcellus Shale but had prior experience with gas development in the Commonwealth. Others had no first-hand experience with shale development whatsoever but were actively trying to understand what was happening in their backyard and other areas of the state.

**Primary Data Gathering and Analysis**

**Facilitated Discussion Circles**

Facilitated discussion groups and focus groups (Barbour 2007; Morgan 1997; Elmendorf and Luloff 2001) are an important way to conduct qualitative research. A variant of these, facilitated discussion circles (Chadwick 2002) were conducted during the data gathering process for this research (see description of the process in Appendix A). These sessions brought local stakeholders together to discuss issues of interest in several areas within the *Pennsylvania Wilds* region. Six groups were held in the region (see Table 1). Participants were asked to complete an informed consent form before participating (see Appendix B).

The groups were conducted using a modified version of the Chadwick Consensus Circle process (Chadwick 2002). A circle of chairs was set up in the meeting space facing the center. The only gap in the circle was the easel and a space for the facilitator. After introductions, the group started with an introductory overview by the meeting facilitator and the establishment of ground rules for the conduct of the meeting. Then the first set of questions were asked in the opening circle, tasking participants to explain who they were, who they worked for/represented/occupation, and a reason why they were attending the discussion group. In the second round of questions, the following questions were asked:
When you think of the Marcellus Shale, what issues or opportunities come to mind?

When you try to figure out what is happening with or address issues related to Marcellus Shale development, what sources of information do you use?

Relatedly, when you try to figure out what is happening with or address issues related to Marcellus Shale development, whom do you talk to or work with?

What do you see as the largest barriers to communication and cooperation in your community?

The group would then proceed around the circle with each participant listing a thought or concept. In keeping with Chadwick’s (2002) consensus circle process, discussion of points was kept to a minimum during the listing. Each person’s point was recorded on the easel-mounted chart. After the first circle, participants were asked if they had additional thoughts, at which point the circle would begin again. Upon completion of the second round, the floor was opened to general discussion, clarification, and/or additional points. If none, the facilitator then posed the second question; this method was used until all four core questions were asked. After the last question was answered, the facilitator, guided by his use of the adaptive learning process (Chadwick 2002), closed the meeting by having participants reflect on what they learned from participation in the discussion circle.

At most sessions, and with the agreement of all participants, the activity was tape-recorded. In two instances, participants did not want to have tape recordings made of the
session. As a result, notes were taken by a volunteer along with the chart responses gathered in the session. After the group sessions, information on flip charts was entered into Microsoft Word where the discussion was grouped into key themes and other information groups through review of the recordings from the groups.

**Focus Groups**

Two focus groups were conducted for this research. The first focus group consisted of ten members of the Pennsylvania Wilds Planning Team and was conducted before the facilitated discussion circles began. This group was conducted to provide focus for the early information gathered and initial theoretical foundation of the project. This initial focus group also worked through a trial of the discussion circle process, helping to perfect the questions to be used.

The second focus group consisted of fifteen individuals and was utilized to report the findings from the discussion circles and key informant interviews (see next section) back to the local stakeholders. As noted earlier, participants were selected to be representative of various interest groups throughout the region. The second focus group was presented the major findings drawn from discussion circles, key informant interviews, and initial focus group. Through facilitated discussion, the group was given the opportunity to think about, discuss, and elaborate upon the findings presented to them. This enabled a validity assessment of themes identified during the synthesis and analysis of the discussion circle information and key informant interviews. The focus group process helped to contextualize the study’s findings to local issues, highlighting key gaps and adding additional information to the overall body of research.
Key Informant Interviews

Key informant interviews of local key stakeholders (Kvale 2007; Elmendorf and Luloff 2001; Carter and Beaulieu 1992) were conducted. Fifteen key informant interviews were held (see Table 2); at least one stakeholder was interviewed in each county – two interviews were conducted in three counties reflecting the size of county and emerging issues. Informant interviews were used to clarify and explore further information uncovered in the discussion circle process. Key informant interviews also helped to uncover and identify new and emerging topics of local interest. Key informants were asked to provide the names of additional people from their locality, creating a snowball sample of potential discussion group participants and other key informants. The interview instrument can be found in Appendix C. The informed consent form is included as Appendix D.

Group Observations

Group observations (Angrosino 2007) were also conducted of local task forces, local citizen groups, political breakfasts, lunches, meetings, and other public forums where Marcellus Shale was the primary source of information from August, 2009 to May, 2010. Sixteen different group observations were conducted; more than 200 people were observed in this process. During these meetings, notes would be taken about discussion points, and key quotes, actors, and the overall demeanor of the meeting were recorded. These observations were used to identify key informants in some counties; in others, the observations were used to triangulate key informant and discussion group discussions.
Secondary Data and Analysis

Secondary data were collected through a variety of means for content analysis (Rapley 2007; Creswell 2007). During group observations, when materials were distributed, copies were obtained for content analysis and to determine potential areas for further investigation and/or for use as questions for the key informant interviews. Local newspapers within the region were also reviewed for Marcellus Shale-related articles of relevance to this research. Blogs, online newsfeeds, and other forms of interactive media were reviewed for similar information. Listserves maintained by local groups and private individuals (such as a township supervisor from Clearfield County) were used to gather information.

Additionally, some secondary data were provided directly by county and regional groups and agencies and key informants. This data was reviewed for key concepts and issues and integrated into the other secondary data content analyses. Data from the US Census and other state and federal agencies were used to contextualize conditions within each of the counties within the study region. This data was gathered and loaded into Microsoft Excel files for each major topic. Some of these were then transferred to a GIS to create maps and graphics for illustrative purposes.

GIS data was downloaded from websites, primarily the Pennsylvania Spatial Data Access website (http://www.pasda.psu.edu) for analysis. Data was analyzed using ArcGIS 9.3. A boundary shapefile of the twelve county region was created as a base layer by which maps were created through clipping other layers. The resulting information was used to create the maps and images displayed throughout this study.
Verification and Reliability Assessment

Verification and reliability are key issues in any research project (Creswell 2007; Kirk and Miller 1986; Flick 2007). This study employed several types of verification and reliability assessment to address these problems.

The first method used in this project was persistent observation and engagement in the area being studied. The author of this research has been actively involved in the region in various capacities for over six years. The research within this report has been ongoing for two years, which has given him time to gather, understand, and expand upon data gathered from multiple sources. This has also helped the author wade through ‘fads’ in information and rumors to find issues and concerns based on factual occurrences. In addition, the researcher lives in the study area and has ongoing, first-hand experience in the issues discussed here.

Triangulation was a key tool used to verify information within this report. While the concepts and concerns expressed during the focus groups and interviews were those of the participants, a thorough review of local newspapers, newsletters, blogs, and other postings allowed the identified issues to be placed into perspective through corroboration. Census and other secondary data were used to ground perspectives. By employing these methods, an overall check and balance system emerged which allowed me to delve directly into core issues, rather than following whims and rumors.

This research also utilized member checks as a part of the review process. The focus group phase began with the participation of the Pennsylvania Wilds Planning Team Oil and Gas Committee as a trial run, allowing them to see the background research and theory being used, and to provide comments on the research, data, and process prior to
engaging in the research process. Also, the Oil and Gas Committee reviewed and discussed the lists generated from primary and secondary sources, and asked questions and made comments which sharpened the focus of this research.

In some respects, the member checks also served as a synchronic reliability check. Engaging local residents in the analysis and discussion of data, provided much needed insight into whether or not the data synchronized with their observations. While they were not dealing with the same data set as the researcher (for confidentiality and human subject reasons), they could assess the data and draw upon similar observations to indicate if the gathered data was consistent within the same period.

**Reflections on Researcher Objectivity**

Another form of qualitative verification is reflecting on one’s biases and areas of potential error within data gathering (Creswell 2007; Kirk and Miller 1986; Flick 2007). This process was especially important to this study because I have been actively involved in several Tioga County organizations as well as the Pennsylvania Wilds, each of which has been focusing on issues surrounding development of the Marcellus Shale development.

Overall, I am conflicted by development of the Marcellus Shale. As a community and economic developer, I understand the sheer importance of the jobs, income, and infrastructure being developed for the people of this economically poor and depressed region. As a landowner, I stand to gain from Marcellus Shale development through the leasing of my gas rights for development. As a rural sociologist, I am frustrated by the conflict and inner turmoil tearing communities, groups, and agencies apart as short-term greed and a lack of real information overcomes long-term, levelheaded discussions. I am
concerned the same problems and issues of natural resource dependency are emerging in the Pennsylvania Wilds as they did in southern Appalachia and the Intermountain West. As a resident of the region, I am concerned about the tremendous impacts of shale development on mine and other’s quality of life as we slowly watch the things that made the county attractive slowly disappear or be forever altered.

As much as possible, I made a conscious attempt to stay away from people and groups I have direct contact with during the information gathering process in order to avoid influencing the results of my work. I initially started with researching issues in Tioga County. However, I steered away from the county when I realized my own volunteer work was interfering with my results. On the other hand, I used issues encountered in Tioga County to triangulate against issues observed elsewhere in the region. Thus, while I did not actively pursue research in Tioga after my initial efforts which helped ground my study, relevant issues and concepts were still included from the area.

Another issue I encountered was tied to the number of presentations and discussions I was invited to attend and give over the course of my research. I presented at 22 different meetings and conferences and attended an additional 45 others during the two-year course of this research. My information often returned to me in ways I did not expect, highlighting the nature of information gathering and process in the “Marcellus Age” and how quickly feedback loops emerge. This helped me understand the dearth of information available to the public and how eager people were to understand what was happening around them.
This lack of information and the resulting rumor mongering made achieving saturation relatively simple. The same level of concepts and issues emerged throughout the region. As a result, it became more of a matter of looking at how people framed issues and where their perspectives emerged from rather than looking at new and exciting ways to split concepts into smaller and smaller pieces. This is where the key informant interviews were most useful, in that they helped point out the subtle social and economic issues inherent in local communities rather than expanding on issues or concerns noted throughout the literature and news media.

I attempted to complete this work in a transdisciplinary manner, with local stakeholders acting as co-researchers and overseers in the process of discovery. My initial goal was to work with members of the Pennsylvania Wilds Planning Team to conduct interviews of key government personnel. However, after observing the events happening around me, I quickly realized the key to understanding my research questions lied not in elected and appointed officials, but in the landowners and residents of the counties in the region (through whom information is transmitted and relayed). However, I continued to rely on the Pennsylvania Wilds Planning Team Oil and Gas Committee to serve as advisors, peer reviewers, and, in some respects, assistants in this process. My interactions with this group helped me to understand the social and political constraints local governments routinely addressed around issues related to Marcellus Shale.

The techniques described in this section outline how I have attempted to deal with my internal conflicts. Those I work with closely seem to be comfortable with my objectivity as a researcher and my ability to manage potential conflicts. I have attempted to maintain objectivity throughout this process by relying on triangulation of issues, using
local residents as co-researchers and reviewers in the data gathering process, and through separation of my research from my volunteer activities, at least in terms of data gathering.

**Chapter Summary**

This chapter outlined the methods used to gather data for this research project. A mixed methods approach was utilized, providing insight into the conceptual model through discussion circles, focus groups, key informant interviews, group observations, and content analysis. The variety of primary data collected using these methods facilitated the exploration of perceptions and reactions in response to Marcellus Shale development, providing understanding of the mechanisms underlying resilience and interactional field emergence. The secondary data helped to frame the primary data, providing the context through which an understanding of current activities could occur. Verification and reliability checks were also outlined. The mixed methods approach allowed the strengths of one technique to overcome the weaknesses of another. Through the involvement of local stakeholders as part of the research team, triangulation and verification of information gathered through this study was completed on a continual basis.

With the literature reviewed, the conceptual model delineated, and the methods outlined, the information gathered in this study can now be explored and discussed. The following chapter begins this process, reviewing some of the main sociodemographic and biophysical considerations of the study area, as well as providing an in depth introduction to Marcellus Shale gas development.
Chapter 5: Background

Marcellus Shale - Unconventional Natural Gas Development

The Marcellus Shale is an organic rich shale ranging from 75 to over 800 feet thick (Harper 1999) underlying nearly three quarters of the state (see Figure 5.1). The Devonian Series (the Marcellus forms part of the Middle Devonian), underlies nearly all of the state and ranges from 2,000 feet thick near Lake Erie to over 12,000 feet thick in Southeastern Pennsylvania (Harper 1999; 2008). The Marcellus formation has varying amounts of natural gas within it, believed to be due to the variation in organic material found within the stratum (Harper 2008).

Gas production from the Devonian Series predates oil development (Harper 2008). Near Fredonia, NY, free gas bubbling in a stream drove local residents to sink a well to capture it; enough was captured to provide fuel to power gaslights. A deeper well was soon sunk which provided gas for over 30 years. Early gas wells predating Drake’s Titusville well are scattered across the Lake Erie plane from New York to Ohio, some of which remain in active gas production. As of 1999, Erie County was the leader of gas production from shallow, Devonian aged shales (Briggs and Tatlock 1999).

Gas drillers have long known about the existence of gas in the Devonian Formation, especially the Marcellus (Harper 1999; 2008; Baughman 2010). The gas reservoirs in the Onandaga and Oriskany Sandstone Formations, which have been the mainstay of gas development within the state for over 150 years (Harper 1999), are located underneath the Marcellus. Gas drillers would have to stop drilling wells passing through the Marcellus Formation to allow them to de-pressurize because of the gas released from the well (Harper 2008; Baughman 2010). These bursts of gas were
Figure 5.1: Marcellus Shale Formation Location and Depth Map, Pennsylvania
often dramatic (sending water from the well upwards of 40 feet into the air; Baughman 2010) but so short in duration that most wells were not economically feasible to tap into, thus, interest in developing the Marcellus was minimal.

Recent advances in technology coupled with higher natural gas demand and prices created renewed interest in Marcellus Shale development (Harper 2008). With successful testing and development of the Barnett Shale, a black shale from the Mississippian Series found in Texas, the stage was set to begin the development of the Marcellus Play. The first Marcellus well was drilled in 2003 in Washington County; after additional drilling and experimentation with fracturing, gas production began there in 2005.

It is the process of fracturing that differentiates Marcellus Shale drilling from other forms of gas development. In conventional wells, geological features, known as traps, are drilled to free gas. Some traps are structural in nature, meaning folding and fracturing of earth creates pockets where gas is captured and collected. Other traps are stratigraphic, meaning surrounding layers trap the oil or gas and prevent it from migrating upward. Typically, oil and gas are found in high porosity rocks such as sandstones or limestones. When these traps are found, wells are drilled into the formation capturing the released gas or oil and bringing it to the surface (see Figure 5.2).

The Marcellus is considered a source rock, that is, decay of organic matter within the formation is the source of gas for other formations (Harper 2008). Because there are no traps to be tapped into, a series of different techniques are used to release the gas. The first part of this is horizontal drilling. Horizontal drilling has been around since the 1920s. Only recently, however, has the geological mapping techniques and drilling technology
Figure 5.2: Schematic of Conventional Versus Shale Gas Well Drilling
advanced to the point where it is cost effective to drill horizontally (Harper 2008).
Horizontal drilling consists of drilling a vertical well down for most of the well, and then, at a predetermined depth, the bit of the drill is turned at a slight angle. It continues to follow this angle until the bit is sideways and drilling horizontally. Horizontal drilling allows the drill string to follow the horizontal lay of the formation, getting better surface contact with the well, connecting many of the different fractures and faults within the formation, and allowing for more efficient use of the second technology that makes Marcellus drilling possible, hydraulic fracturing.

The process of hydraulic fracturing, or fracing, is when pressurized water and other materials (including sand, acid, suspension gels, friction reducers, and surfactants) are used to further fracture the formation, creating larger pore spaces allowing gas to move more freely (Marcellus Shale Committee 2009; Harper 2008). As part of the injection and pressurization process, materials known as propents are included to hold open these newly created fractures, allowing gas to flow. Often, bactericides, corrosion inhibitors, oxygen scavengers, scale inhibitors, and other chemicals are added to the fracturing mixture to aid in the drilling process (Marcellus Shale Committee 2009).

Hydraulic fracturing is not a new process; it has been used in Pennsylvania since the 1960s (Harper 2008). Gas and oil companies have injected materials such as water or kerosene into wells in efforts to increase oil and gas recovery. Such stimulation, as it is commonly known, can enhance well recovery twenty times over; that is, a stimulated well will produce gas at a rate 20 times its unstimulated rate (Harper, Tatlock, and Wolfe 1999). Fracturing is also used to enhance the porosity of gas reservoir formations.
The difference between conventional gas plays and unconventional shale plays, such as the Marcellus, is due to porosity in the formation (Harper 2008). Fracturing jobs on sandstones and other porous stones can be done with lower pressure and less water, typically several thousand gallons. In the case of shale formations, the porosity of the stone may be high but the connectivity of the pore spaces may be lower. Thus, fracking in shales require more water and more pressure in order to create adequate channels for gas to flow through, generally three to eight million gallons of water per well but sometimes more. As a result, there is greater demand for water, most of which does not return to the surface as flowback.

Horizontal drilling has both advantages and disadvantages over conventional drilling. Its primary assets are tied to the drilling process – horizontal drilling allows multiple wells to be drilled per pad, resulting in access to a larger area from one location. In turn, this helps reduce surface disturbance because fewer pads are built. As a result, there is reduced surface disturbance from access roads and pipelines (see Figure 5.3). The downside to this is that horizontal drilling takes more time to complete due to the turning process, and, because of the hydraulic fracturing process, is more labor and equipment intensive. Thus, overall, well pads are larger in order to accommodate equipment, supplies, and water tanks.

Because horizontal drilling allows developers to capture gas from a larger area than conventional drilling, leasing of land holdings becomes a major necessity. A standard production unit in Pennsylvania’s Marcellus play is 640 acres. Companies can adjust the boundary of the unit to match leases, special conditions or boundaries, or in response to other circumstances. In order to establish enough units to create a network of
Figure 5.3: Drilling Pad with Multiple Wellheads Versus Conventional Drilling

Note: Not to scale; number of conventional wells per unconventional well is exaggerated for illustration, actual numbers will vary depending on leasing and site restrictions.
wells through which to minimize pipeline and roadway costs, large contiguous tracts of land need to be leased by a company. A flurry of leasing activity occurred in the state of Pennsylvania from 2008 to late 2009 as companies leased lands to create drilling units. Public land leasing in the state brought in bids of nearly $300 million dollars for 106,000 acres (Governor’s Office 2010, see also DCNR 2008). The amount of leasing that has taken place on private land is unknown, although it is speculated to be nearly $3.5 billion dollars in total payments to landowners (Considine, Watson, and Blumsack 2010).

**The Pennsylvania Wilds: A Brief Overview**

*The Pennsylvania Wilds* is a twelve county region in north central Pennsylvania (see Figure 5.4). The region is characterized by an abundance of rural landscapes consisting of forested lands, rugged terrain, clean and cold streams, agriculture, and rural towns and villages. At a little over 6 million acres, the twelve county region encompasses a third of Pennsylvania’s land acreage; its 525,000 residents account for four percent of the state’s population.

The Pennsylvania Wilds was designated as one of seven regions of a larger statewide tourism promotion program in the mid-2000s which was designed to promote particular assets of each unique area. In response to the PA Wilds initiative, representatives of the counties in the Pennsylvania Wilds began meeting regularly to discuss issues of regional concern. After several years of meetings, the PA Wilds Planning Team was formalized via a twelve county intergovernmental cooperative agreement to discuss and address planning issues across the region. The planning team itself consists of county planners from the region, planners from the Appalachian Regional Commission Local Development Districts (LDDs), state and federal agency
Figure 5.4: The Pennsylvania Wilds

The Pennsylvania Wilds Region

Warren
Forest
McKean
Sage
Lycoming
Clinton
Cameron
Laporte
Clearfield
staff, and concerned stakeholders. The team currently meets monthly to discuss key issues facing the region, ranging from emergency services to Marcellus Shale natural gas development. Over the short course of its existence, the planning team has undertaken several major projects, including: (1) the Pennsylvania Wilds Design Guide, a guide to place, culture, and environmentally sensitive development in the PA Wilds; and (2) the Pennsylvania Wilds Planning Study, a study looking at major planning and zoning issues across the broader region.

**Historical Episodes of Development and Decline**

The history of the Pennsylvania Wilds is exemplary of cycles of natural resource development based growth and decline. During the settlement of the state, the region was marked by massive stands of hemlock and white pine (Kagan 2008; Dillon 1991; Miller and Pencak 2002). As the population of the country slowly moved westward, these resources were tapped into to fuel the growth of a burgeoning nation. The forests of the region were clear-cut during the late 1800s and early 1900s (Kagan 2008; Dillon 1991; Williams 2008a; Van Auken 2005). This timber was shipped downstream via streams like Pine Creek, the Sinnemahoning River, Clarion River, and the West Branch of the Susquehanna River plus railroaded Philadelphia, Baltimore, and other growing port cities. Hemlock bark was used for tanning; two of the three largest tanneries in the world during that era were located in Tioga County at Hoytville (now Morris) and Westfield.

As a result of this large scale deforestation, a period of mass wasting of large areas of the state occurred. Rains caused huge landslides which in turn dammed and destabilized streams and other waterways (Van Auken 2008; McGeehan 2009). The detritus left from logging fueled tremendous forest fires, many of which burned so hot
that the soil, which was rich with humus from centuries of forested growth, burned away (Webber 2008; 2010). Indeed, deforestation was a major reason a large number of depression era Civilian Conservation Corps (CCC) camps were located in the region. CCC workers helped restore many acres of forests throughout the region by planting trees, stabilizing streams and building dams, and creating roads and lookouts for firefighting purposes and for people to enjoy the scenic beauty of the area.

The deforestation of the hemlock and white pine led to the establishment of Pennsylvania’s famed hardwood forests. This transition took several decades, starting with the end of the lumbering in the 1800s and continuing today. The reestablished hardwood forests served as a base for the rise and decline of timber and wood product industries in the region (McGeehan 2006, 2007, 2008, 2009; Rickard 2003; Van Auken 2005). Contestation over access to the forest resources in the Allegheny National Forest and the myriad of state forests in the region would also frame the rise and decline of wood product industries throughout the region (Macdonald 2005). However, the industry is still active in many local economies (McGeehan 2008; 2009; Williams 2008a). One can learn about the region’s rich and storied lumber heritage at the Lumber Heritage Museum near Galeton and at numerous heritage shows and rendezvous throughout the region.

The coal era emerged on the heels of timbering in the late 1800s (Williams 2008a, 2008b). Historically, coal development occurred unevenly throughout the region. For instance, in Tioga County, deep mines and surface drift mines were common in the late 1800s through the early 1900s. In other parts of the region, such as Clearfield County, coal mining remains active (Rickard 2002, 2003). Historically though, mining in the
region has left behind a legacy of hundreds of miles of impacted streams and thousands of acres of abandoned mine lands.

Gas and oil development emerged during the same time period and followed similar patterns of uneven development (Williams 2008a; 2008b; Brandon 2002; Costik 2006). In some areas of the region – Tioga, Lycoming, Clinton, and Potter Counties especially – oil and gas development emerged early and was soon tapped out (Dillon 1991). In other portions of the region, gas and oil development is still going strong (Williams 2008a). Recently there has been renewed interest in gas development in the eastern portion of the Pennsylvania Wilds as new ground penetrating radar and seismic imaging technologies have allowed industries to identify traps and other areas where gas has collected. Exploratory wells throughout the area showed the rich potential of the region for natural gas, which in part has contributed to the enthusiasm to develop the Marcellus Shale.

A corollary to natural resource development throughout the region lies in the region’s railroad system (Meckley 2006; Van Auken and Hunsinger 2003; McGeehan 2009; Brandon 2002). A massive system of railroads was developed over time to assist in getting developed resources from their harvesting areas to market. At one point, most valleys and plateau tops had a rail line associated with it, the remnants of which can be seen in old railroad grades following alongside streams throughout the region. The advent of the automobile and the upgrading of many roads throughout the nation caused the railroad industry to decline and disappear across the country, including Pennsylvania. With the disappearance of the rails many thousands of jobs were lost. The lasting byproduct of these losses is many of the region’s rail towns are mere shadows of their
former selves. Several active rail yards exist in the region, and the development of Marcellus Shale has helped to increase interest in rail line expansion and yard upgrades throughout the area.

The decline in rail use resulted in the creation of many miles of rail trails as communities attempted to turn these losses into economic gains (Rails-to-Trails Conservancy 2006). The switch toward amenity development based upon the region’s forests, streams, and land resources emerged as the next phase of economic development. Mimicking amenity development in the Western United States, many communities in the region turned toward tourism, second homes, and other lifestyle based development as a foundation for local economies.

While some counties turned toward amenity development, others focused on industrial development and information technologies to drive their local economies. When Adelphia Communications chose to site their corporate offices in Coudersport, Potter County, in the late 1990s and early 2000s, there was great excitement because of the growth taking place from new buildings, houses, and jobs. After the subsequent collapse of the company, the town was left with job losses and an empty, unutilized infrastructure. Since then, another telecommunications company, Level 3 Communications, acquired some of Adelphia’s assets and moved an office into the area, helping fill the gap left by Adelphia.

A more recent example of the ebb and flow of industrial development within the region is the region’s powdered metal industry (McGeehan 2006; 2007; WJACTV 2010a). Numerous powdered metal plants, which take powdered metals and compress them into parts of various shapes and sizes, arose throughout the region in response to
regional development efforts to offset costs associated with material transport and facility location. The industry became a victim of the downturned economy and automotive industry collapse, when many manufacturers turned away from metal parts toward cheaper parts made of plastic and resins as cost cutting measures. Many of the companies laid off workers, went dormant, or out of business. A few managed to survive through adaptation to other market demands, such as the parts needed to develop the Marcellus Shale. It seems the future of the industry in the region is still up in the air and will be heavily dependent on adaptation to volatile markets and industry needs.

**Current Land Use and Land Cover**

Figures 5.5, 5.6, and 5.7 illustrate the land use and land cover of the Eastern, Northwestern, and Southwestern portions of the Pennsylvania Wilds region. As readily seen, forested lands dominate land use and land cover across the Pennsylvania Wilds region. Land use and land cover raster data indicate 82% of the Pennsylvania Wilds landscape is forested or covered by trees (see Table 5.1). Agriculture and open space forms the next largest, albeit distant, land use at 12.7% of the total Wilds area. Water, lakes, and wetland areas make up another 1.7% of the total area, a slightly larger area than what is classified as residential (1.6%). Overall, this data clearly indicates why the Wilds is known for its natural, undeveloped landscape.

Table 5.2 shows the distribution of public land management types throughout the Marcellus Shale and the PA Wilds region (nearly all of which is in the Marcellus play). As can be seen, the region contains most of the state’s national forests and over half of the state’s public forests. It also contains over 70% of the state’s wilderness and wild
Figure 5.5: Land Use, Eastern Pennsylvania Wilds Region
Table 5.1: Land Cover Data, 2005, Raster Cell Counts

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<tr>
<th>Land Use/Land Cover Type</th>
<th>Pennsylvania Raster Cell Count</th>
<th>PA Wilds Raster Cell Count</th>
<th>LU/LC % of PA Wilds Total</th>
<th>PA Wilds % of State Total</th>
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<tr>
<td>Commercial/Industrial</td>
<td>2,821,546</td>
<td>159,123</td>
<td>0.5</td>
<td>5.6</td>
</tr>
<tr>
<td>Roads</td>
<td>2,457,772</td>
<td>273,342</td>
<td>0.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Disturbed Lands, Mining, Barren Lands</td>
<td>1,872,717</td>
<td>258,148</td>
<td>0.9</td>
<td>13.8</td>
</tr>
<tr>
<td>Total Land Area By Raster Cell</td>
<td>130,492,939</td>
<td>29,735,443</td>
<td>100.0</td>
<td>22.8</td>
</tr>
</tbody>
</table>

Note: Land use is based on the dominant land use for the cell. Raster cell counts were calculated by summing to total number of cells within Pennsylvania and the Pennsylvania Wilds boundaries. Rough acreage could be calculated by taking the percentage of each land use and multiplying it by the total acreage in Pennsylvania and the Pennsylvania Wilds region.
areas, and a quarter of its gamelands. Not surprisingly, a large percentage of the conservation stewardship lands are also found in the Pennsylvania Wilds (see Figure 5.8).

The forested nature of the Pennsylvania Wilds region makes it an important area in terms of high quality streams, rivers, and water sources. An analysis of the Chapter 93\(^3\) water use designations for the region contains nearly half of the state’s exceptional value streams, 35% of the state’s high quality streams, and nearly 30% of the state’s coldwater fisheries. Further analysis by stream classification and use (see also Table 5.2) shows the region contains nearly 60% of the state’s Wilderness Trout Streams, over 40 percent of the state’s Class A Wild Trout Streams, nearly 40% of its Natural Reproduction Trout Streams, and nearly a quarter of the state’s approved trout waters and trout stocked streams. In essence, this quarter of the state’s land acreage represents a disproportionate amount of the state’s critically important water resources.

Finally, analyzing the percentage of land area owned publically within each county illustrates the fact that nearly a third of the region is owned publically (Table 5.3). Some counties, such as Clarion, Jefferson, and Clearfield, have a small public land base. Other counties, such as Cameron, Clinton, Elk, Forest, and Potter have nearly half of their land areas encumbered by public lands, especially State and National Forests. Missing from this analysis but equally important are the acres of lands owned by people residing outside of the area. As Weigle (2007) illustrated for Lycoming and Tioga Counties, this classification of landowners can represent a significant percentage of landownership (nearly a quarter of the total land mass in both counties), which has important implications for taxes and resource management.

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\(^3\) Chapter 93 is the Pennsylvania State Code dealing with Water Quality Standards. Chapter 93 defines and identifies water uses for every stream and water body in the state, codifies anti-degradation rules, and notes the specific chemical and biological water quality criteria each water use must meet.
Figure 5.8: Conservation Stewardship Lands
Pennsylvania Wilds

Legend
- Pennsylvania Wilds Boundary
- PA Conservation Stewardship Land Management Type
  - PA State Forest
  - PA State Game Lands
  - PA State Park
  - US Forest Service
  - US Fish and Wildlife Service
  - National Park Service
  - Conservancy Lands
  - Locally Managed Lands

Data Source: Bishop 1998
Table 5.2: Land and Water Management Types, Pennsylvania, Pennsylvania Wilds, and the Marcellus Region

<table>
<thead>
<tr>
<th>Management Type</th>
<th>Value</th>
<th>Unit</th>
<th>% of Total</th>
<th>Management Type</th>
<th>Value</th>
<th>Unit</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Forest Service</td>
<td>484,773 Acres</td>
<td>Natural Reproduction</td>
<td>Trout Streams 9,825 Miles</td>
<td>484,763 Acres</td>
<td>1,000.0</td>
<td>In Marcellus Play 7,789 Miles</td>
<td>79.3</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>484,754 Acres</td>
<td>100.0</td>
<td>In PA Wilds 3,606 Miles</td>
<td>36.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Park Service</td>
<td>138,995 Acres</td>
<td>Approved Trout Waters</td>
<td>Trout Streams 8,328 Miles</td>
<td>63,750 Acres</td>
<td>45.9</td>
<td>In Marcellus Play 6,333 Miles</td>
<td>76.0</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>21,786 Acres</td>
<td>15.7</td>
<td>In PA Wilds 2,062 Miles</td>
<td>24.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Fish and Wildlife Service</td>
<td>9,235 Acres</td>
<td>Class A Wild Trout</td>
<td>Trout Streams 1,522 Miles</td>
<td>8,118 Acres</td>
<td>87.9</td>
<td>In Marcellus Play 1,104 Miles</td>
<td>72.6</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>0 Acres</td>
<td>0.0</td>
<td>In PA Wilds 643 Miles</td>
<td>42.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA State Forests</td>
<td>2,056,392 Acres</td>
<td>Wilderness Trout</td>
<td>Trout Streams 491 Miles</td>
<td>1,526,509 Acres</td>
<td>87.9</td>
<td>In Marcellus Play 1,104 Miles</td>
<td>72.6</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>1,178,605 Acres</td>
<td>57.3</td>
<td>In PA Wilds 281 Miles</td>
<td>57.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Game Lands</td>
<td>1,381,741 Acres</td>
<td>Trout Stocked Streams</td>
<td>Trout Streams 6,264 Miles</td>
<td>1,166,221 Acres</td>
<td>84.4</td>
<td>In Marcellus Play 4,758 Miles</td>
<td>76.0</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>338,324 Acres</td>
<td>24.5</td>
<td>In PA Wilds 1,500 Miles</td>
<td>23.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA State Parks</td>
<td>264,634 Acres</td>
<td>EV(Exceptional Value)</td>
<td>Trout Streams 3,347 Miles</td>
<td>214,665 Acres</td>
<td>81.1</td>
<td>In Marcellus Play 2,717 Miles</td>
<td>81.2</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>22,426 Acres</td>
<td>8.5</td>
<td>In PA Wilds 1,638 Miles</td>
<td>49.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilderness and Wild Areas</td>
<td>221,982 Acres</td>
<td>Wilderness Trout</td>
<td>Trout Streams 22,798 Miles</td>
<td>182,983 Acres</td>
<td>82.4</td>
<td>In Marcellus Play 18,380 Miles</td>
<td>80.6</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>156,777 Acres</td>
<td>70.6</td>
<td>In PA Wilds 7,883 Miles</td>
<td>34.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Management</td>
<td>69,486 Acres</td>
<td>HQ(High Quality)</td>
<td>Trout Streams 29,114 Miles</td>
<td>36,343 Acres</td>
<td>52.3</td>
<td>In Marcellus Play 24,613 Miles</td>
<td>84.5</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>2,732 Acres</td>
<td>3.9</td>
<td>In PA Wilds 8,377 Miles</td>
<td>28.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservancy Lands</td>
<td>25,348 Acres</td>
<td>TSF(Trout Stocking)</td>
<td>Trout Streams 9,151 Miles</td>
<td>15,959 Acres</td>
<td>63.0</td>
<td>In Marcellus Play 5,577 Miles</td>
<td>60.9</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>171 Acres</td>
<td>0.7</td>
<td>In PA Wilds 611 Miles</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAFBC Lakes</td>
<td>93,508 Acres</td>
<td>WWF(Warm Water Fishes)</td>
<td>Trout Streams 20,820 Miles</td>
<td>79,316 Acres</td>
<td>84.8</td>
<td>In Marcellus Play 14,609 Miles</td>
<td>70.2</td>
</tr>
<tr>
<td>In PA Wilds</td>
<td>13,865 Acres</td>
<td>14.8</td>
<td>In PA Wilds 1,352 Miles</td>
<td>6.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Water Trails</td>
<td>1,852 Miles</td>
<td>Trout Streams</td>
<td>Trout Streams 1,852 Miles</td>
<td>1,166 Miles</td>
<td>63.1</td>
<td>In PA Wilds 421 Miles</td>
<td>22.7</td>
</tr>
</tbody>
</table>

**Table 5.3: Conservation Stewardship Lands as a Percentage of County Acreage**

<table>
<thead>
<tr>
<th>County</th>
<th>Acres of Public Lands</th>
<th>Total County Acreage</th>
<th>Percent Owned Publicly</th>
<th>Public Lands as % of Total Acreage</th>
<th>Public Lands Rank</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>150,866</td>
<td>255,037</td>
<td>59.2</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Clarion</td>
<td>24,139</td>
<td>389,674</td>
<td>6.2</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Clearfield</td>
<td>137,483</td>
<td>738,485</td>
<td>18.6</td>
<td>10</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Clinton</td>
<td>316,190</td>
<td>574,812</td>
<td>55.0</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Elk</td>
<td>265,078</td>
<td>532,600</td>
<td>49.8</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>130,510</td>
<td>276,058</td>
<td>47.3</td>
<td>4</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Jefferson</td>
<td>44,204</td>
<td>420,342</td>
<td>10.5</td>
<td>11</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Lycoming</td>
<td>247,553</td>
<td>795,880</td>
<td>31.1</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>McKean</td>
<td>161,973</td>
<td>629,800</td>
<td>25.7</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Potter</td>
<td>285,117</td>
<td>692,137</td>
<td>41.2</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Tioga</td>
<td>179,759</td>
<td>727,901</td>
<td>24.7</td>
<td>9</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Warren</td>
<td>181,021</td>
<td>574,561</td>
<td>31.5</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,123,892</strong></td>
<td><strong>6,607,288</strong></td>
<td><strong>32.1</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note: Acreage for public lands calculated using Bishop 1998; county acreage determined by using county boundary data from PASDA and calculate geometry function in ArcGIS.
Oil and Gas Extraction

Oil and gas has been a staple of Northcentral Pennsylvania’s culture for over 200 years (Harper 2008; Harper, Tatlock, and Wolfe 1999). Since Drake’s first well near Titusville in 1859, the region has been developed for its oil and natural gas resources in shallow fields. The historical, non-Marcellus gas field in the state runs in a swath from Southwestern Pennsylvania to Northcentral Pennsylvania, following the structural traps, oil sands, and reservoirs created by the folding and uprising of the Alleghenies (Harper, Tatlock, and Wolfe 1999) (see Figure 5.9). The Pennsylvania Department of Environmental Protection estimates approximately 350,000 wells have been drilled in Pennsylvania for oil and gas resources since they were first tapped in 1859 (Associated Press 2010).

As of July 2006, there were approximately 112,000 active, inactive, or abandoned oil and gas wells within the Commonwealth (PADEP 2006). A graphical representation of the locational density of the wells is presented in Figure 5.10. As can be seen, counties in the western section of the Pennsylvania Wilds section have had significantly more development historically than counties in the eastern section. Broken into quintiles in terms of development, we see that the western half of the Wilds is in the upper two quintiles in terms of overall gas development while the eastern half of the region is in the mid to lower quintiles (Figure 5.11).

Based on this PADEP data set (PADEP 2006), there are approximately 49,000 wells in the Pennsylvania Wilds, or a little under 44% of the entire state total (Table 5.4). Over half of these wells are located in McKean and Warren County. The seven counties of McKean, Warren, Jefferson, Clarion, Clearfield, Forest, and Elk make up 94% of the
Figure 5.9: Oil and Gas Fields of Pennsylvania Circa 1996

Legend
- PA Wildlife Boundary
- Oil and Gas Fields, 1996

Note: Oil and gas field data include fields used for gas storage.
Source: http://www.pasda.psu.edu/data/compendium/basfields.zip
Figure 5.10: Density of Active, Inactive, and Abandoned Wells Through July 2006
Figure 5.11: Active, Inactive, and Abandoned Total Count Through July 2006
Table 5.4: Distribution of Active, Inactive, and Abandoned Wells by County, July 2006

Active, Abandoned, and Inactive Gas Wells and Facilities Through July 2006

<table>
<thead>
<tr>
<th>County</th>
<th>Active</th>
<th>Abandoned</th>
<th>Inactive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>85</td>
<td>8</td>
<td>57</td>
<td>150</td>
</tr>
<tr>
<td>Clarion</td>
<td>3,817</td>
<td>184</td>
<td>438</td>
<td>4,439</td>
</tr>
<tr>
<td>Clearfield</td>
<td>3,730</td>
<td>4</td>
<td>636</td>
<td>4,370</td>
</tr>
<tr>
<td>Clinton</td>
<td>513</td>
<td>29</td>
<td>134</td>
<td>676</td>
</tr>
<tr>
<td>Elk</td>
<td>2,193</td>
<td>73</td>
<td>748</td>
<td>3,014</td>
</tr>
<tr>
<td>Forest</td>
<td>3,328</td>
<td>209</td>
<td>315</td>
<td>3,852</td>
</tr>
<tr>
<td>Jefferson</td>
<td>4,283</td>
<td>133</td>
<td>540</td>
<td>4,956</td>
</tr>
<tr>
<td>Lycoming</td>
<td>260</td>
<td>6</td>
<td>20</td>
<td>286</td>
</tr>
<tr>
<td>McKean</td>
<td>9,146</td>
<td>2,087</td>
<td>3,198</td>
<td>14,431</td>
</tr>
<tr>
<td>Potter</td>
<td>840</td>
<td>152</td>
<td>205</td>
<td>1,197</td>
</tr>
<tr>
<td>Tioga</td>
<td>623</td>
<td>16</td>
<td>62</td>
<td>701</td>
</tr>
<tr>
<td>Warren</td>
<td>8,833</td>
<td>1,114</td>
<td>872</td>
<td>10,819</td>
</tr>
<tr>
<td>Region</td>
<td>37,651</td>
<td>4,015</td>
<td>7,225</td>
<td>48,891</td>
</tr>
</tbody>
</table>

Source:
http://www.pasda.psu.edu/data/dep/OilGasLocations2010_07.zip

Table 5.5: Marcellus Shale Permitted and Drilled Wells by County, 2008 through June 2010

Pennsylvania Wilds Marcellus Shale Gas Wells, Permitted and Drilled, by County

<table>
<thead>
<tr>
<th>County</th>
<th>Permitted</th>
<th>Drilled</th>
<th>Permitted</th>
<th>Drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
<td>2009</td>
<td>2010*</td>
<td>Total</td>
</tr>
<tr>
<td>Cameron</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Clarion</td>
<td>8</td>
<td>0</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>Clearfield</td>
<td>8</td>
<td>72</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Clinton</td>
<td>13</td>
<td>41</td>
<td>33</td>
<td>87</td>
</tr>
<tr>
<td>Elk</td>
<td>18</td>
<td>22</td>
<td>21</td>
<td>61</td>
</tr>
<tr>
<td>Forest</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Jefferson</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Lycoming</td>
<td>52</td>
<td>107</td>
<td>60</td>
<td>219</td>
</tr>
<tr>
<td>McKean</td>
<td>9</td>
<td>10</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>Potter</td>
<td>8</td>
<td>31</td>
<td>37</td>
<td>76</td>
</tr>
<tr>
<td>Tioga</td>
<td>31</td>
<td>300</td>
<td>215</td>
<td>546</td>
</tr>
<tr>
<td>Warren</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note:
* - 2010 data runs January 1 through June 30, 2010

Source:
http://www.dep.state.pa.us/dep/deputate/minres/oilgas/RIG10.htm, last accessed July 25, 2010

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entire Pennsylvania Wilds inventory of active wells and one third of the active wells in
the state. These seven counties, plus Potter, account for 96% of active, abandoned, or
inactive wells in the region.

The distribution of permitted and drilled wells associated with the Marcellus play
in Pennsylvania is listed in Table 5.5. In total, 3,880 wells have been permitted for
Marcellus drilling; 1,655 have been drilled. Both permitting and drilling have increased
significantly each year since 2008. Within the Pennsylvania Wilds, 493 out of 1,173
permitted Marcellus wells were drilled from 2008 through June 30, 2010. Maps
illustrating the distribution of permitted and drilled wells are provided in Figures 5.12
(permitted) and 5.13 (drilled).

Contrary to historical development patterns, the eastern section of the Wilds is
experiencing the highest level of Marcellus well development; the western section has
seen relatively little. For instance, Tioga County, which ranked near the bottom of the
Wilds counties in terms of total number of oil and gas wells drilled historically, is at the
top of the Marcellus Shale development pattern, with more than twice the number of
permitted and drilled wells than the next closest county, Lycoming (see Table 5.5).

Coal

Coal development in Pennsylvania has followed similar trends. The state’s coal
fields are divided into bituminous and anthracite fields. Pennsylvania’s bituminous coal
field covers a larger portion of southwestern Pennsylvania, and stretches eastward and
northward to include small pockets in the northern tier (Edmunds 1999). Coal’s chemical
and physical composition varies by beds across the state. Most of Pennsylvania’s
Figure 5.12: Location of Permitted Marcellus Shale Wells, Pennsylvania Wilds, through June 2010.
Figure 5.13: Location of Drilled Marcellus Shale Wells, Pennsylvania Wilds, through June 2010
bituminous coal goes towards electric power generation, metallurgical coke, industrial uses, foreign trade, and residential heating.

Pennsylvania’s anthracite coalfields lie in the eastern part of the state and feature partially metamorphosed coal that is harder, contains more carbon, burns at a higher temperature, and gives off fewer waste products during combustion than its bituminous counterpart (Eggleston, Kehn, and Wood 1999). Similar to bituminous coal, anthracite is cleaned and used for residential and commercial heating, as well as electric generation, coke, and cement. As noted earlier, the legacy of historical coal development includes miles of acid mine drainage impaired streams, acres of abandoned mine lands and slag piles, and scores of ghost towns dotting the landscape.

As can be seen in Figure 5.14, the Pennsylvania Wilds region includes a number of coalfields. Historical fields in place like Tioga County are nearly exhausted, with only minor development taking place. In other counties, such as Clearfield, Jefferson, and Clarion, coal mining continues to play a major, but declining, role in local economies (see later discussion, employment section). Comparing the oil/gas and coalfields of Pennsylvania, a striking overlap is evident (Figure 5.15). In the Pennsylvania Wilds region of the state, a significant overlap of oil/gas and coal within Clarion, Jefferson, and Clearfield Counties. The northern half of the region is mostly covered by gas fields. The overlap between the southern and northern halves of the region, combined with the differential development of the two resources, has lead to different issues related to leasing and to differing perspectives on development of gas and coal resources.
Figure 5.14: Coal Fields in the Pennsylvania, Circa 1996
Figure 5.15: Comparison of Oil, Gas, and Coal Fields in Pennsylvania, Circa 1996
The Twelve Counties: A Brief Sociodemographic Overview

Population

The population of the 12 counties in the Pennsylvania Wilds has been in a constant state of flux since the beginning of the 20th century. For most counties, as illustrated in Table 5.6, the overall trend has been steady decline with populations stagnating and/or slowly building back toward the highest levels experienced in the early 1900s. These trends are consistent with the loss of timber production in the early 1900s following the near total deforestation of the state. Other population declines are consistent with the closure of shallow oil and gas development in the western Pennsylvania Wilds and the collapse of coal development in the eastern Pennsylvania Wilds. The build-up of industrial development in the region in the 1960s, 1970s, and 1980s and its subsequent collapse in the 1990s is quite evident by the loss of population in the decade from 1990 through 2000.

Population within counties appears to be related to the percentage of public lands. Comparing Tables 5.3 and 5.6 illustrates that counties with higher percentages of public lands have smaller population bases. Two exceptions to this are Clinton County with nearly 38,000 residents and Elk County with over 35,000. These two counties are home to several of the region’s larger towns, DuBois, Clearfield, Ridgeway, and St, Marys, which are likely contributing to the larger population in these counties. Additionally, there is not a good trend between population loss and public lands in the region. Some counties with high population loss have low public land area (i.e. Jefferson County which lost over 13,000 residents from 1900 to 2000 but only has 10.5% public lands) while others with high public lands gained population (e.g. Clinton).
## Population of the Pennsylvania Wilds, 1900-2000, by County

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron County</td>
<td>7048</td>
<td>7,644</td>
<td>6,297</td>
<td>5,307</td>
<td>6,852</td>
<td>7,023</td>
<td>7,586</td>
<td>7,096</td>
<td>6,674</td>
<td>5,913</td>
<td>5,974</td>
<td>-1,074</td>
</tr>
<tr>
<td>Clarion County</td>
<td>34,283</td>
<td>36,638</td>
<td>36,170</td>
<td>34,531</td>
<td>38,410</td>
<td>38,344</td>
<td>37,408</td>
<td>38,414</td>
<td>43,362</td>
<td>41,699</td>
<td>41,765</td>
<td>7,482</td>
</tr>
<tr>
<td>Clearfield County</td>
<td>80,614</td>
<td>93,768</td>
<td>103,236</td>
<td>86,727</td>
<td>92,094</td>
<td>85,957</td>
<td>81,534</td>
<td>74,619</td>
<td>83,578</td>
<td>78,097</td>
<td>83,382</td>
<td>2,768</td>
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<tr>
<td>Clinton County</td>
<td>29,197</td>
<td>31,545</td>
<td>33,555</td>
<td>32,319</td>
<td>34,557</td>
<td>36,532</td>
<td>37,619</td>
<td>37,721</td>
<td>38,971</td>
<td>37,182</td>
<td>37,910</td>
<td>8,713</td>
</tr>
<tr>
<td>Elk County</td>
<td>32,903</td>
<td>35,871</td>
<td>34,981</td>
<td>33,431</td>
<td>34,443</td>
<td>34,503</td>
<td>37,328</td>
<td>37,770</td>
<td>38,338</td>
<td>34,878</td>
<td>35,112</td>
<td>2,209</td>
</tr>
<tr>
<td>Forest County</td>
<td>11,039</td>
<td>9,435</td>
<td>7,477</td>
<td>5,180</td>
<td>5,791</td>
<td>4,944</td>
<td>4,485</td>
<td>4,926</td>
<td>5,072</td>
<td>4,802</td>
<td>4,946</td>
<td>-6,093</td>
</tr>
<tr>
<td>Jefferson County</td>
<td>59,113</td>
<td>63,090</td>
<td>62,104</td>
<td>52,114</td>
<td>54,090</td>
<td>49,147</td>
<td>46,792</td>
<td>43,695</td>
<td>48,303</td>
<td>46,083</td>
<td>45,932</td>
<td>-13,181</td>
</tr>
<tr>
<td>Lycoming County</td>
<td>75,663</td>
<td>80,813</td>
<td>83,100</td>
<td>93,421</td>
<td>93,633</td>
<td>101,249</td>
<td>109,367</td>
<td>113,296</td>
<td>118,416</td>
<td>118,710</td>
<td>120,048</td>
<td>44,385</td>
</tr>
<tr>
<td>McKean County</td>
<td>51,343</td>
<td>47,868</td>
<td>48,934</td>
<td>55,167</td>
<td>56,673</td>
<td>56,607</td>
<td>54,517</td>
<td>51,915</td>
<td>50,635</td>
<td>47,131</td>
<td>45,936</td>
<td>-5,407</td>
</tr>
<tr>
<td>Potter County</td>
<td>30,621</td>
<td>29,729</td>
<td>21,089</td>
<td>17,489</td>
<td>18,201</td>
<td>16,810</td>
<td>16,483</td>
<td>16,395</td>
<td>17,726</td>
<td>16,717</td>
<td>18,080</td>
<td>-12,541</td>
</tr>
<tr>
<td>Tioga County</td>
<td>49,086</td>
<td>42,829</td>
<td>37,118</td>
<td>31,871</td>
<td>35,004</td>
<td>35,474</td>
<td>36,614</td>
<td>39,691</td>
<td>40,973</td>
<td>41,126</td>
<td>41,373</td>
<td>-7,713</td>
</tr>
<tr>
<td>Warren County</td>
<td>38,946</td>
<td>39,573</td>
<td>40,024</td>
<td>41,453</td>
<td>42,789</td>
<td>42,698</td>
<td>45,582</td>
<td>47,682</td>
<td>47,449</td>
<td>45,050</td>
<td>43,863</td>
<td>4,917</td>
</tr>
<tr>
<td>Region Total</td>
<td>499,856</td>
<td>518,803</td>
<td>514,085</td>
<td>489,010</td>
<td>512,537</td>
<td>509,288</td>
<td>515,315</td>
<td>513,220</td>
<td>539,497</td>
<td>517,388</td>
<td>524,321</td>
<td>24,465</td>
</tr>
</tbody>
</table>

Note: Population decreases from previous Census are indicated by italicized numbers.

Employment

Like population, employment has fluctuated repeatedly throughout the region over the past fifty years. Table 5.7 identifies the employed workforce for each county and the Pennsylvania Wilds region. With the exception of Cameron County, the number of residents in the workforce increased from the 1950s through 2000. The workforce experienced overall growth through the 1980s, where between 1980 and 1990 the workforce experienced a dramatic decline. Only in Tioga County did the workforce increase from 1980 to 1990; many of the other counties have still to recapture the number of employed persons experienced at the pinnacle of the 1970s and 1980s.

Examination of individual sectors of interest to the region – agriculture, forestry, and fishing; mining; construction; and manufacturing – in relation to other industries in the region indicated similar fluctuations and declines. The natural resource dependent nature of the region and the transition from these industries is presented in Table 5.8. The four extractive/manufacturing industries constituted the majority of industrial employment in the 1950s and 1960s. Then, beginning in the 1970s, these industries declined, bringing service, professional, transportation, and other industrial sectors to the fore.

Table 5.9 summarizes employment in four industrial sectors from 1960 to 2000: construction, manufacturing, mining, and agriculture, forestry, and fishing. Construction was a sector that continued to experience growth. While it fluctuated over time, the overall trend has been increased employment, with the lone exception of Cameron County, which experienced a decline.
Table 5.7: Workforce Statistics of the Pennsylvania Wilds, 1960-2000, by County

<table>
<thead>
<tr>
<th>County</th>
<th>Residents in Workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>2,660</td>
</tr>
<tr>
<td>Clarion</td>
<td>12,100</td>
</tr>
<tr>
<td>Clearfield</td>
<td>25,470</td>
</tr>
<tr>
<td>Clinton</td>
<td>13,277</td>
</tr>
<tr>
<td>Elk</td>
<td>12,495</td>
</tr>
<tr>
<td>Forest</td>
<td>1,466</td>
</tr>
<tr>
<td>Jefferson</td>
<td>15,287</td>
</tr>
<tr>
<td>Lycoming</td>
<td>40,593</td>
</tr>
<tr>
<td>McKean</td>
<td>19,924</td>
</tr>
<tr>
<td>Potter</td>
<td>5,621</td>
</tr>
<tr>
<td>Tioga</td>
<td>12,933</td>
</tr>
<tr>
<td>Warren</td>
<td>16,040</td>
</tr>
<tr>
<td>Region</td>
<td>177,866</td>
</tr>
</tbody>
</table>

### Table 5.8: Pennsylvania Wilds Industry Employment Transition, 1960 to 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extractive/Manufacturing</td>
<td>52.1</td>
<td>51.2</td>
<td>37.7</td>
<td>37.9</td>
<td>33.3</td>
</tr>
<tr>
<td>Other Industries</td>
<td>47.9</td>
<td>48.8</td>
<td>62.3</td>
<td>62.1</td>
<td>66.7</td>
</tr>
</tbody>
</table>


### Table 5.9: Employment in the Construction Industry by County, 1960 to 2000

<table>
<thead>
<tr>
<th>County</th>
<th>Agriculture, Forestry, and Fishing</th>
<th>Mining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>Clarion</td>
<td>1,108</td>
<td>760</td>
</tr>
<tr>
<td>Clearfield</td>
<td>594</td>
<td>543</td>
</tr>
<tr>
<td>Clinton</td>
<td>524</td>
<td>346</td>
</tr>
<tr>
<td>Elk</td>
<td>194</td>
<td>84</td>
</tr>
<tr>
<td>Forest</td>
<td>85</td>
<td>35</td>
</tr>
<tr>
<td>Jefferson</td>
<td>1,020</td>
<td>498</td>
</tr>
<tr>
<td>Lycoming</td>
<td>1,532</td>
<td>917</td>
</tr>
<tr>
<td>McKean</td>
<td>378</td>
<td>312</td>
</tr>
<tr>
<td>Potter</td>
<td>704</td>
<td>378</td>
</tr>
<tr>
<td>Tioga</td>
<td>2,037</td>
<td>1,249</td>
</tr>
<tr>
<td>Warren</td>
<td>696</td>
<td>503</td>
</tr>
<tr>
<td>Region</td>
<td>8,893</td>
<td>5,654</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County</th>
<th>Construction</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>168</td>
<td>133</td>
</tr>
<tr>
<td>Clarion</td>
<td>731</td>
<td>918</td>
</tr>
<tr>
<td>Clearfield</td>
<td>1,500</td>
<td>2,088</td>
</tr>
<tr>
<td>Clinton</td>
<td>600</td>
<td>837</td>
</tr>
<tr>
<td>Elk</td>
<td>512</td>
<td>473</td>
</tr>
<tr>
<td>Forest</td>
<td>82</td>
<td>118</td>
</tr>
<tr>
<td>Jefferson</td>
<td>902</td>
<td>1,167</td>
</tr>
<tr>
<td>Lycoming</td>
<td>1,778</td>
<td>2,536</td>
</tr>
<tr>
<td>McKean</td>
<td>778</td>
<td>852</td>
</tr>
<tr>
<td>Potter</td>
<td>379</td>
<td>328</td>
</tr>
<tr>
<td>Tioga</td>
<td>523</td>
<td>663</td>
</tr>
<tr>
<td>Warren</td>
<td>504</td>
<td>766</td>
</tr>
<tr>
<td>Region</td>
<td>8,457</td>
<td>10,879</td>
</tr>
</tbody>
</table>


103
As well, manufacturing continued to account for a large portion of industrial employment in the region. Overall, employment in the region declined from its high in 1970, with over 16,000 jobs lost. However, manufacturing employment gained ground in some counties while continuing to decline in others. Similarly, agriculture, forestry, and fishing experienced the same decline as manufacturing, with nearly a 33% loss of employment in this sector. Counties with higher percentages of public lands, especially State Forests, tended to maintain this sector better than those with moderate and low percentages of public lands, but by and large this industry saw decline in these decades. The most striking sector in terms of employment change was mining. This sector lost nearly 80% of its workforce from the 1950s to 2000. Even in counties with active coal mining – Clarion, Clearfield, Clinton, Jefferson, and McKean – the workforce employed has dropped considerably.

In the wake of the decline of manufacturing, mining, agriculture, and forestry has come an increase in employment in other industries – such as service provision, transportation, government, health care, and other sectors. Table 5.10 summarizes the growth of employment in these sectors from 1960 through 2000. Other than the contraction experienced in the 1980s, overall employment in these sectors has continued to increase, doubling in most counties from their 1960 levels. The well documented transition to service and information based sectors seems to also be taking place in this region, transforming both its workforce and the local economies.

Not surprisingly, the percentage of public lands in a county seems to bear some relationship on employment. For instance, counties with higher levels of public lands had a higher percentage of people working in agriculture and forestry, mining, construction,
Table 5.10: Employment in Other Industrial Sectors by County, 1960 to 2000

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>1,098</td>
<td>1,126</td>
<td>1,545</td>
<td>1,119</td>
<td>1,367</td>
</tr>
<tr>
<td>Clarion</td>
<td>5,648</td>
<td>6,887</td>
<td>11,842</td>
<td>11,242</td>
<td>13,051</td>
</tr>
<tr>
<td>Clearfield</td>
<td>13,071</td>
<td>13,163</td>
<td>22,580</td>
<td>20,260</td>
<td>25,441</td>
</tr>
<tr>
<td>Clinton</td>
<td>5,997</td>
<td>6,761</td>
<td>10,905</td>
<td>9,424</td>
<td>11,231</td>
</tr>
<tr>
<td>Elk</td>
<td>4,872</td>
<td>5,304</td>
<td>8,355</td>
<td>7,076</td>
<td>8,477</td>
</tr>
<tr>
<td>Forest</td>
<td>624</td>
<td>766</td>
<td>1,263</td>
<td>1,218</td>
<td>1,226</td>
</tr>
<tr>
<td>Jefferson</td>
<td>8,052</td>
<td>7,908</td>
<td>12,003</td>
<td>11,791</td>
<td>13,177</td>
</tr>
<tr>
<td>Lycoming</td>
<td>19,788</td>
<td>21,376</td>
<td>33,396</td>
<td>32,587</td>
<td>37,937</td>
</tr>
<tr>
<td>McKean</td>
<td>9,424</td>
<td>9,601</td>
<td>12,218</td>
<td>11,739</td>
<td>12,852</td>
</tr>
<tr>
<td>Potter</td>
<td>2,555</td>
<td>2,856</td>
<td>5,807</td>
<td>4,018</td>
<td>5,065</td>
</tr>
<tr>
<td>Tioga</td>
<td>5,505</td>
<td>6,831</td>
<td>11,100</td>
<td>10,694</td>
<td>11,991</td>
</tr>
<tr>
<td>Warren</td>
<td>8,585</td>
<td>9,259</td>
<td>13,599</td>
<td>12,881</td>
<td>13,508</td>
</tr>
<tr>
<td>Region</td>
<td>85,219</td>
<td>91,838</td>
<td>144,613</td>
<td>134,049</td>
<td>155,323</td>
</tr>
</tbody>
</table>

and manufacturing. Counties with lower percentages of public lands tended to have a higher concentration of “other” industrial sector employment. In general, other than in Cameron and Elk counties at one end and Clarion and Clearfield at the other, non-industrial employment tended to have 2:1 advantage over the industrial sectors.

**Income**

Income is a telling sociodemographic indicator for this region. On a per capita basis, income has been much lower throughout the Pennsylvania Wilds region than in the state as whole from 1969 to 1999 (see Table 5.11). The lower per capita incomes (PCI) are reflected in the median household incomes (MHI). When adjusted for inflation, it is clear PCI has slowly increased; on the other hand, MHI has remained relatively flat and in some counties declined over the 1969 to 1999 period.

On the surface, it would seem easy to draw the conclusion that public lands are a major impact. For instance, Forest County has both the lowest per capita income and median household income in the region. However, Cameron County, which has the highest level of public lands in the region, has both PCI and MHI values in the middle range of the region. It appears that population density is more of a driver of PCI and MHI than public lands. Counties with larger population centers such as Lycoming, Clinton, Elk, Clearfield, Warren, and McKean tended to have higher PCI and MHI, likely because of the diversity of employment opportunities available in these areas.

Poverty is also an indicator of importance within the region (Table 5.12). The percent of the region’s population living in poverty has fluctuated greatly from 1969 to 1999. Not surprisingly, levels of poverty follow changes in employment within the region. In 1979, the point at which per capita and median household incomes were the
Table 5.11: Per Capita and Median Household Income, 1969 to 1999, Adjusted to YR2000 Dollars

Per Capita Income and Median Household Income, 1969 to 1999, in Dollars

<table>
<thead>
<tr>
<th>County</th>
<th>Per Capita Income</th>
<th>Median Household Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>14,145</td>
<td>14,303</td>
</tr>
<tr>
<td>Clarion</td>
<td>10,825</td>
<td>14,289</td>
</tr>
<tr>
<td>Clearfield</td>
<td>10,656</td>
<td>14,284</td>
</tr>
<tr>
<td>Clinton</td>
<td>11,509</td>
<td>13,817</td>
</tr>
<tr>
<td>Elk</td>
<td>11,509</td>
<td>15,220</td>
</tr>
<tr>
<td>Forest</td>
<td>11,659</td>
<td>13,488</td>
</tr>
<tr>
<td>Jefferson</td>
<td>11,115</td>
<td>14,805</td>
</tr>
<tr>
<td>Lycoming</td>
<td>12,555</td>
<td>14,623</td>
</tr>
<tr>
<td>McKean</td>
<td>12,353</td>
<td>14,535</td>
</tr>
<tr>
<td>Potter</td>
<td>10,796</td>
<td>12,146</td>
</tr>
<tr>
<td>Tioga</td>
<td>10,787</td>
<td>12,829</td>
</tr>
<tr>
<td>Warren</td>
<td>13,052</td>
<td>15,554</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>14,380</td>
<td>16,768</td>
</tr>
</tbody>
</table>


Adjusted to 2000 dollars using Consumer Price Index inflation factor noted below; for the unadjusted value, divide the decade value by the appropriate number listed below.

<table>
<thead>
<tr>
<th>Inflation adjustment factors</th>
<th>1969</th>
<th>1979</th>
<th>1989</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.69</td>
<td>2.37</td>
<td>1.39</td>
<td>1.03</td>
</tr>
</tbody>
</table>
Table 5.12: Poverty Rates in the Pennsylvania Wilds, 1969 to 1999, by County

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>645</td>
<td>7,096</td>
<td>9.1</td>
<td>741</td>
<td>6,674</td>
<td>11.1</td>
<td>657</td>
<td>5,833</td>
<td>11.3</td>
<td>558</td>
<td>5,906</td>
<td>9.4</td>
</tr>
<tr>
<td>Clarion</td>
<td>5,602</td>
<td>38,414</td>
<td>15.4</td>
<td>5,160</td>
<td>43,362</td>
<td>11.9</td>
<td>6,985</td>
<td>38,637</td>
<td>18.1</td>
<td>6,059</td>
<td>39,288</td>
<td>15.4</td>
</tr>
<tr>
<td>Clearfield</td>
<td>12,321</td>
<td>74,619</td>
<td>16.6</td>
<td>8,692</td>
<td>83,578</td>
<td>10.4</td>
<td>10,714</td>
<td>76,890</td>
<td>13.9</td>
<td>10,028</td>
<td>80,123</td>
<td>12.5</td>
</tr>
<tr>
<td>Clinton</td>
<td>4,135</td>
<td>37,721</td>
<td>11.4</td>
<td>4,365</td>
<td>38,971</td>
<td>11.2</td>
<td>5,376</td>
<td>34,977</td>
<td>15.4</td>
<td>5,057</td>
<td>35,628</td>
<td>14.2</td>
</tr>
<tr>
<td>Elk</td>
<td>3,767</td>
<td>37,770</td>
<td>10.0</td>
<td>2,454</td>
<td>38,338</td>
<td>6.4</td>
<td>3,274</td>
<td>34,489</td>
<td>9.5</td>
<td>2,432</td>
<td>34,630</td>
<td>7.0</td>
</tr>
<tr>
<td>Forest</td>
<td>577</td>
<td>4,926</td>
<td>11.7</td>
<td>609</td>
<td>5,072</td>
<td>12.0</td>
<td>537</td>
<td>4,569</td>
<td>11.8</td>
<td>779</td>
<td>4,744</td>
<td>16.4</td>
</tr>
<tr>
<td>Jefferson</td>
<td>6,224</td>
<td>43,695</td>
<td>14.4</td>
<td>4,927</td>
<td>48,303</td>
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<td>5,312</td>
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<tr>
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<td>12,523</td>
<td>113,296</td>
<td>11.3</td>
<td>12,789</td>
<td>118,416</td>
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<td>13,180</td>
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<td>51,915</td>
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<td>50,635</td>
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<td>6,660</td>
<td>44,728</td>
<td>14.9</td>
<td>5,659</td>
<td>43,209</td>
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<td>2,825</td>
<td>16,395</td>
<td>17.4</td>
<td>2,730</td>
<td>17,726</td>
<td>15.4</td>
<td>2,435</td>
<td>16,339</td>
<td>14.9</td>
<td>2,264</td>
<td>17,781</td>
<td>12.7</td>
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<tr>
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<td>5,709</td>
<td>39,691</td>
<td>15.2</td>
<td>6,310</td>
<td>40,973</td>
<td>15.4</td>
<td>5,707</td>
<td>39,064</td>
<td>14.6</td>
<td>5,339</td>
<td>39,511</td>
<td>13.5</td>
</tr>
<tr>
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<td>3,941</td>
<td>47,682</td>
<td>8.8</td>
<td>4,033</td>
<td>47,449</td>
<td>8.5</td>
<td>4,208</td>
<td>43,659</td>
<td>9.6</td>
<td>4,224</td>
<td>42,762</td>
<td>9.9</td>
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<tr>
<td>Region</td>
<td>64,223</td>
<td>513,220</td>
<td>12.5</td>
<td>57,973</td>
<td>539,497</td>
<td>10.7</td>
<td>65,875</td>
<td>499,446</td>
<td>13.2</td>
<td>60,916</td>
<td>503,165</td>
<td>12.1</td>
</tr>
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</table>

highest, the percent of persons living in poverty was also the lowest. Following the contraction of the 1980s, the percent of persons below the poverty levels increased in counties losing jobs while the percent of persons below the poverty level decreased in counties where jobs increased. Not surprisingly, counties heavily dependent on mining, agriculture, manufacturing, and construction as a larger portion of their employment base had increasingly higher rates of poverty as those industries declined than those counties with a larger core city and more diversified economy. Also, counties with larger population centers, such as Lycoming and Elk, tended to have lower poverty rates than more rural counties.

**Housing**

The history of housing in this region also reflects the ebb and flow of its population and, to a lesser extent, employment. As Table 5.13 illustrates, total housing units in the region have, for the most part, continued to increase over the 1940 to 2000 period. There was a significant housing boom in the 1970s, a period of population growth for most of the region. In general, housing has outgrown the rate of population in the counties, perhaps pointing to the influence of seasonal and recreational homes in the region.

Table 5.13 also represents an analysis of vacant housing units of all types within the region from 1940 to 2000. Comparing this to the total housing unit data for the region, it is clear vacant housing units increasingly represent a growing portion of the housing market. In Forest County, three-quarters of the housing units were vacant in the 2000 Census of Housing. In two others, Cameron and Potter, vacant housing units made up nearly half of the housing units. Breaking vacant total housing units down further into
Table 5.13: Total, Vacant, and Seasonal Housing Units, 1940 to 2000

### Total Housing Units

<table>
<thead>
<tr>
<th></th>
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<td>1,882</td>
<td>2,530</td>
<td>2,704</td>
<td>3,491</td>
<td>4,430</td>
<td>4,399</td>
<td>4,592</td>
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<tr>
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<td>11,085</td>
<td>12,319</td>
<td>13,260</td>
<td>17,200</td>
<td>18,022</td>
<td>19,426</td>
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<tr>
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<td>24,762</td>
<td>26,111</td>
<td>26,496</td>
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<td>12,000</td>
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<td>16,478</td>
<td>18,166</td>
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<tr>
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<td>8,329</td>
<td>9,698</td>
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<td>13,708</td>
<td>16,347</td>
<td>17,249</td>
<td>18,115</td>
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<td>2,933</td>
<td>4,618</td>
<td>6,201</td>
<td>8,638</td>
<td>8,445</td>
<td>8,701</td>
</tr>
<tr>
<td>Jefferson</td>
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<td>14,810</td>
<td>15,939</td>
<td>16,291</td>
<td>20,661</td>
<td>21,242</td>
<td>22,104</td>
</tr>
<tr>
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<td>31,577</td>
<td>36,586</td>
<td>38,763</td>
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<td>49,580</td>
<td>52,464</td>
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<td>6,275</td>
<td>6,829</td>
<td>7,911</td>
<td>10,859</td>
<td>11,334</td>
<td>12,159</td>
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<td>11,535</td>
<td>13,357</td>
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<td>18,202</td>
<td>19,893</td>
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<td>23,058</td>
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### Vacant Housing Units

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<td>996</td>
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<td>4,118</td>
<td>3,991</td>
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<td>3,253</td>
<td>3,080</td>
<td>6,727</td>
<td>6,537</td>
<td>6,701</td>
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<td>3,401</td>
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<td>5,461</td>
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<td>3,620</td>
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<td>1,194</td>
<td>4,716</td>
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<td>1,840</td>
<td>5,177</td>
<td>4,992</td>
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### Seasonal Housing Units

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</tr>
</thead>
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<td>810</td>
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<td>5,643</td>
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<td>6,571</td>
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<tr>
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<td>989</td>
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<td>500</td>
<td>2,401</td>
<td>2,759</td>
<td>2,589</td>
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<tr>
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<td>726</td>
<td>407</td>
<td>1,324</td>
<td>2,219</td>
<td>2,345</td>
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<tr>
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<td>1,576</td>
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<tr>
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<td>724</td>
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<td>2,266</td>
<td>4,122</td>
<td>3,818</td>
<td>4,182</td>
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</table>

seasonal homes, we can see seasonal housing makes up the majority of vacant housing units. Looking at the percentage of seasonal housing units in comparison to total housing units (Table 5.14), we see that, overall, these types of homes represent an increasingly larger portion of the region’s housing stock. Other than in the population boom of the 1970s for the most part seasonal housing stock has increased as a proportion of total housing units. In all but two counties in the region, Lycoming and Clearfield, seasonal homes make up at least 10% of the housing stock.

Housing values have increased as well during this period. From 1940 to 2000, the median housing unit value has doubled, tripled, and in one county’s case (Potter) quadrupled (Table 5.15). This is in stark contrast to income, which has increased one quarter to one-half its 1940 rate in the case of per capita income or has increased less than one-quarter or decreased overall in respect to 1940 levels.

Comparing public lands, population, and employment to housing reveals several interesting insights. Counties with high levels of public lands have seen the highest level of housing unit growth in the region. They are also the counties with the highest level of seasonal and vacant housing units within the region. Housing value is in part related to public lands in the area. Potter County, the county with the fifth largest concentration of public lands, experienced the largest change in housing unit value from 1940 to 2000. Forest County, the county with the largest concentration of public lands, experienced the second largest increase in housing value. In terms of current value, public lands seem to also be a factor, with Elk, Clinton, and Potter having some of the highest value property in the region. However, two other counties near the top, Tioga and Lycoming, have high housing values with mid-range public land acreage, indicating other factors are at work.
### Seasonal Housing Units as a Percentage of Total Housing Units

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>0.1</td>
<td>16.2</td>
<td>9.9</td>
<td>5.3</td>
<td>37.8</td>
<td>40.5</td>
<td>42.6</td>
</tr>
<tr>
<td>Clarion</td>
<td>0.2</td>
<td>2.4</td>
<td>1.8</td>
<td>4.9</td>
<td>11.6</td>
<td>11.8</td>
<td>12.3</td>
</tr>
<tr>
<td>Clearfield</td>
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<td>1.6</td>
<td>3.4</td>
<td>2.3</td>
<td>5.0</td>
<td>7.1</td>
<td>7.6</td>
</tr>
<tr>
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<td>4.3</td>
<td>3.2</td>
<td>5.6</td>
<td>10.0</td>
<td>11.8</td>
<td>14.3</td>
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<tr>
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<td>11.7</td>
<td>17.7</td>
<td>15.8</td>
<td>17.1</td>
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<td>65.3</td>
<td>75.4</td>
<td>75.5</td>
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<tr>
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</tr>
<tr>
<td>Lycoming</td>
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<td>3.1</td>
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<td>1.3</td>
<td>5.1</td>
<td>5.6</td>
<td>4.9</td>
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<tr>
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<td>2.1</td>
<td>6.1</td>
<td>10.3</td>
<td>10.8</td>
</tr>
<tr>
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<td>12.4</td>
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<td>19.9</td>
<td>35.7</td>
<td>35.5</td>
<td>39.0</td>
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<tr>
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<td>2.4</td>
<td>4.1</td>
<td>5.4</td>
<td>11.0</td>
<td>12.4</td>
<td>15.5</td>
</tr>
<tr>
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<td>18.8</td>
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<td>18.1</td>
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</table>

Table 5.15: Median Housing Unit Value, 1940 to 2000, Adjusted for Inflation to YR2000 Dollars

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<td>45,732</td>
<td>73,777</td>
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<td>35,520</td>
<td>62,909</td>
<td>52,404</td>
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<td>49,728</td>
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<td>55,500</td>
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<td>36,084</td>
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<td>59,600</td>
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<td>39,516</td>
<td>58,507</td>
<td>56,100</td>
<td>59,600</td>
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<tr>
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<td>64,380</td>
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<td>46,176</td>
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<td>51,948</td>
<td>68,970</td>
<td>57,684</td>
<td>62,800</td>
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Note: 1980 Census sampling and reporting methodology differed from other Census years; decreases in value may be due to sampling methodology more than actual decreases in value. (US Census Bureau 2002)

Adjusted to YR2000 dollars using Consumer Price Index inflation factor noted below; for the unadjusted value, divide the decade value by the appropriate number listed below.

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<tbody>
<tr>
<td>1940</td>
<td>12.30</td>
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<tr>
<td>1950</td>
<td>7.15</td>
</tr>
<tr>
<td>1960</td>
<td>5.82</td>
</tr>
<tr>
<td>1970</td>
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<td>1980</td>
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<td>1990</td>
<td>1.32</td>
</tr>
<tr>
<td>2000</td>
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</table>
Setting the Context

The Pennsylvania Wilds region is a region of stark contrasts. Throughout the years, this region has ridden waves of growth and contraction. Losses of core industries, a stagnant and/or slowly growing population, slowly declining household incomes, and increasing property prices set the stage upon which the Pennsylvania Wilds program initially emerged in the mid-2000s.

In looking at the assembled data, several key issues emerge. The counties that experienced the greatest increase in both seasonal homes and median home values also tended to be those counties with the largest proportion of acreage encumbered by public lands. These counties also had some of the highest poverty rates and slowest growth in per capita and median household incomes while at the same time experiencing the highest increase in property values. Additionally, they have also seen the largest decline in extractive and manufacturing bases in the region.

The current level of development of oil, gas, and coal in the southern and western portion of the Pennsylvania Wilds has influenced housing, income, and environmental conditions within these areas. The legacy of these industries is still at the forefront of economic development processes. However, in the eastern portion of the Pennsylvania Wilds these legacies have largely been replaced by the development of timber resources from state forests and the amenity value these forests bring to the region. While oil, gas, and coal extraction are still active in pockets, the scale of these activities has pushed the legacy of experience out of the reach of current residents.

The natural resources of the region and their history of development set the stage for the emergence of ecotourism and other forms of amenity-based development which
form the core of the Pennsylvania Wilds program. Through ecotourism and tourism-based economic development, and through infrastructure upgrade, replacement, and creation, it was hoped the economy of the region would be improved and the ‘wild’ character of the area preserved. Thus, by utilizing the public lands of the region to promote tourism, a niche would be created through which the region’s residents could capitalize.

Whether the Pennsylvania Wilds program has been or is successful has yet to be seen (the 2010 Census should be telling). However, the conditions leading to the Pennsylvania Wilds initiative likely still exist, thus serving as the backdrop for the emergence of Marcellus Shale development in the region. Whether the cycles of boom/bust development occur or not, it is highly likely that the attitudes, values, and perspectives on gas development have been and will continue to be shaped by different relationships to the local environment and the resources within. The existence of differing perspectives related to legacies of resource extraction are likely to temper these responses, perhaps leading to differing opinions on how best to manage and balance the needs of both natural resource extraction and ecotourism in the Wilds.

**Chapter Summary**

The patterns outlined in this chapter illustrate a region bobbing around in a sea of growth and contraction. The history of the region is marked by the development of natural resources – including human resources – to build and grow outside markets. The Marcellus Shale, as the next phase of natural resource development, is poised to reestablish many of the historical patterns of natural resource development other phases
have created. This history of development has left its impact on the region and created many different perspectives on how resources should be developed. The next chapter explores how residents of the region perceive and react to Marcellus Shale development in light of these sociodemographic and biophysical factors.
Chapter 6: Findings

Review of Data Sources

Six facilitated discussion circles and two focus groups were held throughout the Pennsylvania Wilds region. Table 6.1 lists these sessions by location, number of participants, and general characteristics of participants. As noted in the Methods chapter (Chapter 3), saturation was quickly reached in terms of core issues, perceptions of issues, and positions people held in relation to questions asked.

In addition, fifteen key informant interviews were held throughout the region (as listed in Table 6.2) before, during, and after the facilitated discussion circles. Similar to the discussion groups, key informant issues and perceptions quickly reached saturation, with key positions, perceptions, and reactions emerging. Observations of local meetings occurred throughout the region. During these meetings, notes were taken on major discussion points, key quotes recorded, key actors involved, and the overall demeanor of the meeting identified. Observations were used to identify key informants in some counties; in others, the observations were used to triangulate key informant and discussion circle information and support the overall detail of this chapter.

Here, primary and secondary data have been combined. Information concomitant across each of the data sources provides its main substance. Direct quotes from facilitated discussion circles are cited by a pseudonym representing the town of the meeting and the speaker in order of appearance in the recording (if the person could be identified as a unique voice). Quotes from key informant interviews are referenced using the code assigned to each informant (see Table 6.2). Quotes and information from secondary information sources are referenced in the text using standard techniques. In instances
### Table 6.1: Focus Group and Discussion Circle List

<table>
<thead>
<tr>
<th>Session</th>
<th>Location</th>
<th>Number of Participants</th>
<th>Participant Characteristics</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ridgeway</td>
<td>10</td>
<td>PWPT Oil and Gas Committee, Outreach Specialist, Chair</td>
<td>Focus Group</td>
</tr>
<tr>
<td>2</td>
<td>Clarion</td>
<td>20</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>3</td>
<td>DuBois</td>
<td>19</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>4</td>
<td>Warren</td>
<td>18</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>5</td>
<td>Bradford</td>
<td>24</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>6</td>
<td>Jersey Shore</td>
<td>25</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>7</td>
<td>Coudersport</td>
<td>22</td>
<td>Concerned stakeholders</td>
<td>Discussion Circle</td>
</tr>
<tr>
<td>8</td>
<td>Clearfield</td>
<td>15</td>
<td>Concerned stakeholders, state agencies</td>
<td>Focus Group</td>
</tr>
</tbody>
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### Table 6.2: Key Informant List with Coding Pseudonyms

<table>
<thead>
<tr>
<th>County</th>
<th>Position</th>
<th>Age</th>
<th>Years in region</th>
<th>Experience</th>
<th>Pseudonym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameron</td>
<td>Local non-profit director</td>
<td>40s</td>
<td>40+</td>
<td>Yes</td>
<td>Cameron KI01</td>
</tr>
<tr>
<td>Clarion</td>
<td>Local business developer</td>
<td>40s</td>
<td>20+</td>
<td>No</td>
<td>Clarion KI01</td>
</tr>
<tr>
<td>Clearfield</td>
<td>Local business developer</td>
<td>30s</td>
<td>20+</td>
<td>Yes</td>
<td>Clearfield KI01</td>
</tr>
<tr>
<td></td>
<td>Local municipal official</td>
<td>60s</td>
<td>50+</td>
<td>Yes</td>
<td>Clearfield KI02</td>
</tr>
<tr>
<td>Clinton</td>
<td>Local municipal official</td>
<td>50s</td>
<td>50+</td>
<td>Yes</td>
<td>Clinton KI01</td>
</tr>
<tr>
<td>Elk</td>
<td>Local resident stakeholder</td>
<td>40s</td>
<td>40s</td>
<td>No</td>
<td>Elk KI01</td>
</tr>
<tr>
<td>Forest</td>
<td>Local resident stakeholder</td>
<td>60s</td>
<td>60+</td>
<td>No</td>
<td>Forest KI01</td>
</tr>
<tr>
<td>Jefferson</td>
<td>Local business developer</td>
<td>30s</td>
<td>10+</td>
<td>No</td>
<td>Jefferson KI01</td>
</tr>
<tr>
<td>Lycoming</td>
<td>Retiree</td>
<td>70s</td>
<td>70+</td>
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<tr>
<td></td>
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<td>30+</td>
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</tr>
<tr>
<td>McKean</td>
<td>Local municipal official</td>
<td>60s</td>
<td>30+</td>
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<td>McKean KI01</td>
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<tr>
<td>Potter</td>
<td>Local business developer</td>
<td>60s</td>
<td>60+</td>
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<tr>
<td>Tioga</td>
<td>Local resident stakeholder</td>
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<td>50+</td>
<td>Yes</td>
<td>Tioga KI01</td>
</tr>
<tr>
<td></td>
<td>Local resident stakeholder</td>
<td>30s</td>
<td>10+</td>
<td>Yes</td>
<td>Tioga KI02</td>
</tr>
<tr>
<td>Warren</td>
<td>Local resident stakeholder</td>
<td>60s</td>
<td>60+</td>
<td>No</td>
<td>Warren KI01</td>
</tr>
</tbody>
</table>
where information was found only in particular discussion groups, the groups where the information was given are listed. Finally, there were multiple quotes for many of these concepts. The best quote(s) describing the phenomena was used in completing this chapter; as a result, not all groups or informants are quoted in the text.

Framing the Discussion

As noted in Chapters 1 and 3, there are four basic research questions guiding this study. The first question assesses the issues stakeholders identify as being related to Marcellus Shale development within the Pennsylvania Wilds region. The identification of the issues as perceived by local residents allows the identification of actions, activities, meanings, and vehicles and how these emerge in community responses. Issue analysis also allows an understanding of risk perception and how these perceptions lead to action. Identifying issues also provides an understanding of linkages across levels of government and between communities, key issues for analysis of the panarchy communities reside in.

The second question considers the sources of information informants use to learn about Marcellus Shale development issues and its trustworthiness. This question explores stakeholder perceptions in relation to information sources, perceived believability and professionalism, and how these influence interactions within their place of residence and the region. Particularly, this question looks at how the perception of sources of information residents use to understand and frame their understanding of shale development affect their involvement and interaction with policy planning, policy alternative formulation, and policy implementation. It also allows the exploration of how risk perception and information gathering influences how individual react in response to Marcellus Shale development.
The third looks at the social fields informants participate in related to Marcellus Shale natural gas development and how this relates to perception of issues and sources of information. This research question addresses how actors act, *ergo*, the response mechanisms people use in addressing what they perceive as key problems. This question sets the stage for understanding how people form identities around Marcellus Shale gas development and its impacts and opportunities. The question also sheds light on the interrelations among phases of the adaptive cycle, among levels of the panarchy, the potential for regional community field emergence, and whether risk responses move toward consensus or dissonance within communities.

The fourth question looks at barriers to social field development within and across the Pennsylvania Wilds region, whether these may prevent the development of regional community fields in relation to addressing issues related to Marcellus shale development. Research question four assesses whether barriers prevent people from interacting with each other in the creation of social fields. The question assesses whether stakeholders participating in local social fields recognize the role of their associations within the larger panarchy. This, in turn, allows us to look at how local fields might emerge into regional associations, spurring the emergence of regional community fields. Likewise, the relationship between risk perception and consensus/dissonance can be more fully explored in relation to differences in perception, communication, and cooperation across a region.

Inherent in all these questions are the concepts of community well-being: distributive justice, open communication, tolerance, collective action, and communion. Issues related to Marcellus Shale development provide insight into how people living in
the localities of the Pennsylvania Wilds region see these issues playing out where they reside. Sources of information and their trustworthiness identify how well channels of communication provide timely information and how these, in turn affect cooperation and trust in localities. Ultimately, these issues influence the processes that lead to the emergence of social and community fields at the local and regional level and to the creation of interactional capacity within these levels.

The following explores each of four research questions and details local resident’s perceptions of issues related to Marcellus Shale development. Each major section corresponds to a particular research question, with subcategories included under each section. The discussion concludes with a summary of the material as it relates to the major themes within the research questions.

**Issues of Concern**

A significant number of concerns emerged in reviewing newspaper and newsletter articles and attending public meetings and open forums throughout the region. Over 1,700 articles were reviewed during the course of this study to create a list of issues related to development of the Marcellus Shale. Papers reviewed included: USA Today, New York Times, New York Post, Bedford Gazette, Somerset Daily American, Wellsboro Gazette, Mansfield Gazette, Centre Daily Times, Penn State’s Daily Collegian, Williamsport Sun-Gazette, Towanda Daily Review, Saint Mary’s Daily Press, Ridgeway Record, Pittsburgh Post-Gazette, Pittsburgh Tribune-Review, The Patriot News (Harrisburg), Times News (Erie), Cameron County Endeavor News, Altoona Mirror, Elmira Sun-Gazette, and the Wall Street Journal among others. Internet newsfeeds were also reviewed, including but not limited to newsfeeds from ProPublica,
Facilitated discussion circles added clarity and depth to the initial list of concerns identified through review of newspaper/newsletter articles. New issues were added to the list; existing concerns were compared to what was discussed in the circles, and, when necessary, the list was updated to reflect this new information. The first and final discussion groups were used to provide boundaries to the lists by clarifying groupings of issues, reviewing the lists for gaps and missing issues, clarifying existing information, and adding new issues to the list if needed.

The following is an overview of key issues identified through this research. Not all issues were identified within each focus group, and indeed, some issues did not emerge at all in some discussion groups but were found only within news articles. The full, detailed list of concerns is presented in Appendix E. Topical categories were created using input from focus group participants. Overall, four categories emerged: (1) Government and Planning Concerns – issues related to governance and long-term planning at the local, county, and government levels; (2) Socioeconomic Concerns – issues and opportunities related to social and economic impacts associated with gas development; (3) Health and Safety Concerns – a range of health and human services, industry specific issues, and emergency provider impacts across the region; and (4) Environmental Concerns – issues related to the ecological impacts associated with natural gas development and the concerns some residents have that environmentalism might prevent gas development from occurring at all.
Socioeconomic Concerns

Jobs. Jobs were the most cited issue and opportunity noted by discussion circles, focus groups, KIs, and the media. Natural gas development, as noted previously, has the potential to create hundreds, if not thousands, of jobs throughout the region. As one local stakeholder stated:

It would be wonderful news for our county because our unemployment is so high ... to get new jobs for our area would definitely be a boost for our county, it would be a great opportunity (WJAC 2010b).

Focus group members in low development areas tended to focus on the number of jobs (Warren Circle; Clarion Circle; DuBois Circle; Bradford Circle). For many participants, jobs were enough to offset the negative impacts of natural gas development. Additionally, there was agreement jobs in the construction, trucking, and contracting sectors of the economy were the most likely to prosper and benefit from natural gas development.

In terms of job numbers, focus group members noted many residents of the area were switching jobs or going back to school to be retrained, especially in areas hit hard by joblessness during the current recession (Ridgway Circle; DuBois Circle; Clearfield Circle). They felt entry level jobs for gas development started at higher wages than wages paid to people who worked many years with the same company. Job creation in support industries was also important, in that the opportunity to expand local economies existed in food, supplies, and other logistics for the gas industry (Clearfield Circle; DuBois Circle; Bradford Circle). While there is realization jobs were likely temporary, the effort was to capture them and the income in the area. As one local stakeholder reported:

We understand they are temporary jobs, they’re going to be construction jobs and we’ll take advantage of whatever opportunities are available....
[w]e’ll do whatever we can to work with National Fuel to make sure we can provide as many of those local dollars into the economy as possible (WJAC 2010b).

KIs tended to focus more on the quality and tenure of gas industry jobs. Those in low development areas and those who supported industry-based economic development tended to follow the same thinking as those participating in the discussion circles in the same region. Many in higher development areas tended to worry about whether the jobs would remain in the area, whether they would be long-term, and ultimately, what would happen to their communities when these jobs went away. In other cases, some KIs wondered about the over-emphasis on job training and whether the region’s communities were setting themselves up for a bigger economic bust than others because of overspecialization. As one KI stated:

I’m really worried about the training and education thing. I mean, yeah, we need to train people to do these jobs, no doubt. However, are we putting all our eggs in one basket? I mean, look at what happened with logging, then manufacturing. These things come and go. If we aren’t careful, this whole generation will end up somewhere else and these parts will wither and go away (Warren KI01).

An apparent lack of jobs going to Pennsylvanians had some skeptical about industry projections. As one KI noted:

Where’s the Pennsylvanians? Anywhere I look all I see are plates from Texas, Oklahoma, Wyoming, and Montana anywhere but here. The only PA plates I see are from trucking companies outside of here. Really? Am I to believe them’s Pennsylvanian’s driving the trucks with flatlander tags? I don’t think so (Tioga KI01).

Also, people living in these areas tended to understand the physical demands of gas production. They wondered whether the vast majority of the workforce was willing and/or able to work within these contexts, especially in parts of the region where the median age of the workforce was in the 40s and 50s.
In areas of the PA Wilds region where development was low, had not fully developed, or where gas was already present, there was a great push to capture as much industry infrastructure and attention as possible. People living in these areas tended to see job creation as a function of being hubs for equipment, supplies, staff, training, and education. They saw the training and educational programs throughout the region as the door to job creation, with the remaining jobs spinning off from new start-ups to support the industry. As one KI stated:

We have a duty to perform, namely getting as many jobs as we can for our local economy. We have to be daring and direct and not worry about what our neighbors are doing. In many respects, we can’t worry about our neighbors at all – this is about the future of this county and the people in it, not about anything else. So, how do we get them to come here? Develop our industrial infrastructure, train our people, and make the environment as gas company friendly as possible, that’s how (Jefferson KI01).

Not all people in these areas were as supportive. A common issue was a disconnect between what industry and leaders see as a key benefit – more jobs and employment in outside areas. As a circle member noted:

While our leaders and congressmen tout the jobs and money we are to be getting in my county, I don’t see it. I’ve heard lots about industrial parks, industrial centers, and other industrial places that will supposedly support the industry. Are these industries really going to move into every community like leaders and industry representatives say? I don’t think so. More likely they will stay near major roads and population centers and drive to wherever they are working. That seems to be the most common sense thing. Anybody who tells us otherwise is trying to sell us something and that lowers their credibility in my opinion (DuBois Circle Participant 6).

Jobs and employment form the foundation for personal well-being. The influence of Marcellus Shale development on jobs and employment in the Pennsylvania Wilds region points to several key issues related to community adaptation and capacity at the
local and regional level. First, employment in the region is still relatively inflexible to economic shifts as evidenced by the variations in employment noted in Chapter 5 and discussed by residents of the region. Economic recessions, changing demand for goods and services, and changes in resource availability all play roles in creating threshold events through which communities must pass.

Furthermore, employment represents a distributive justice issue throughout the region. As noted by some discussants and informants, some places have a better opportunity at developing their resources toward Marcellus Shale development than others. Barriers to development, such as the apparent barrier of large acreage of public lands, place some localities at a relative economic disadvantage as compared to others. Therefore, some places will experience more of the benefits while others will experience less or might even experience more of the impacts, such as outmigration in search of jobs. Some places, as noted in the discussion, are happy to have jobs come into their area even if they are temporary or specialized.

Employment concerns in the region seem to be setting up the potential for conflict and competition among different areas of the Pennsylvania Wilds. Part of this is related to the history and legacies of natural resource development and public lands within the region. As noted in the preceding paragraph, some places will be better positioned to take advantage of this. However, the unevenness of development across these places is setting up apparent identities – those with gas development and those without – that is guiding economic development efforts throughout the region. A lack of communication between these areas is leading to replication of efforts, most notably training and entrepreneurship, which is serving to further distance communities.
Another critical area of potential conflict lies in the perception of whom jobs are going to. Perceptions of outsiders being employed in jobs being touted for locals does not sit well with many people. The apparent disconnect between local benefit and jobs is creating a trust issue toward the industry and the leaders of the region. This in turn appears to be leading away from collective action toward addressing these concerns toward factions of people concerned about one issue or another.

**Local Economies.** Similar to jobs, there were mixed perceptions among participants of what to expect or what was observed within the region. In general, focus group members and KIs from areas with higher levels of development tended to be more guarded about the state of local economies than those from low development areas. These changes were seen more as risks to the current state of economic development in the area and were seen as something that could cause more, bigger problems further down the road. Perspectives on local economies ranged from concerns related to wages paid to workers to concerns over whether the Pennsylvania Wilds tourism promotion would survive gas development intact. While there was much overlap between jobs and asset reuse, concerns over local economies tended to be more nuanced and interwoven with other concerns.

Jobs and wages were key considerations within local economies. Some KIs were concerned over the fact higher wages paid by the gas industry would create problems for local businesses. For instance, one KI described the relationship between jobs and wages that was expressed by many within the developed and developing regions:

The whole job and wage thing is funny. We want the gas industry jobs, which tend to pay more than jobs say at Wal-Mart or Trucklite. Fine. People go to work there, and, the way it seems to me, they get to sort through the applicants and get the best and most able bodied applicants.
Fine. What is everyone else left with? The not-so-good-as-the-rest group. Can they be trained? Maybe. Do they want to go through training? Dunno. But seems if they’re too lazy or don’t want to be trained, the next step is for companies to raise their wages to keep skilled folks. Not all companies in the county are in position to do this. What then? Do they continue to work with poor quality workers? Chances are they’ll hitch their wagons and head out of town to find greener pastures. Then what are we left with? I’m afraid we’re going to see more and more of this – and I’m afraid everyone will suffer the effects of this in terms of service, quality of service, and the ability of companies to adequately staff themselves. What’s the alternative? Haul in youngsters from other places. How do we do that? Higher wages?! It’s a bad cycle, a bad cycle, and everyone but the gas companies lose in the end. I just really hope we don’t end up losing the family businesses we have now (Tioga KI01).

Some participants were concerned about Marcellus Shale development chasing off other types of economic development, especially tourism. As the Pennsylvania Wilds program is predicated on a wilderness experience in the forests of the state, many were concerned about how the development of state and national forests for gas, coupled to the filling of hotels and restaurants by industry staff, would affect the long-term viability of tourism. Many noted the problems experienced in Lycoming, Tioga, and Bradford counties regarding the filling of local hotels and unavailability of hotel rooms during the early stages of development. As one KI noted:

We’ve had problems with hotels here and it’s a relatively new thing. It’s nearly impossible to find rooms here for most of the year. The Little League folks have had to make deals with the gas companies for them to have enough rooms to house all the players, families, and fans. Even then its touch and go. I know Tioga and Bradford counties are hurting as well. I’ve even heard that some hotels have been bought out up there and turned into housing for workers. I wonder how long tourism will last here if we continue to fill up the places people stay with people that develop gas? (Lycoming KI01).

Concern rested in the ability of local tourism and amenity development to maintain its attractiveness to tourists when seats and beds are hard to come by. Some participants noted local hotels have been getting around these early initial problems by removing
blocks of rooms for tourism season and by requiring gas industry renters to put multiple people in a room (Jersey Shore Circle).

According to participants, the need for worker rooms has not been ignored by local landlords and businesses (Jersey Shore Circle). New hotels and housing developments have been built or are being planned. In some areas, RV parks emerged to provide housing for gas industry workers. In areas with high levels of development, participants noted local landlords were cancelling leases midway or renegotiating leases as they expired to tap into the higher wages being paid by the gas industry. In some areas, such as Bradford and Tioga Counties, rental housing rates have doubled, tripled, and in some cases, quadrupled over the past two and a half years. The fall out, according to some KIs, has been an increase in social issues. They explained:

We’ve seen the apartment market dry up here. Rents have risen dramatically. Landlords have dropped out of housing programs providing rentals to low income, elderly, and disabled people. Some people have been kicked out from some arcane clause in a contract signed five years ago. Others are not having their contracts renewed. They then have to find housing, which is nearly impossible. The lucky ones have family they can live with. Others, the not so lucky ones, are left with two choices – use whatever money they have and move or go homeless. Unfortunately, I don’t think we have any programs out there to help people move. The homeless shelters are already full and the emergency rooms the agencies have to house people facing housing shortages are already full or are being rented to gas drillers. So, I think we’ll see the increase in homelessness lead to other issues like theft, squatting, drug and alcohol use, arson, and just about everything else under the sun. The truth of it is these people have nothing to gain from gas development but are really losing everything because of it (Tioga KI02).

Others in highly developed areas noted the increased business of local restaurants and how it was often difficult to find a table during the off-season (tourism), let alone when tourism was in full swing. An increase in restaurants and eating establishments was also noted, as one KI described:
If you go out to the intersection of 6 and 287 near the [Wellsboro] Junction, there’s a lunch cart popped up there. There at the Agway in Wellsboro is another. There’s two more along old 15 in Mansfield. They’re popping up all over the place, especially where there’s room to pull off the road. The food is pretty good, the prices are cheap, and they are there to serve the gas trucks and the locals that don’t mind a greasy spoon every once in a while. Seems they aren’t places tourists will stop and eat, but, is that a bad thing? Dunno, but I’m enjoying the new food choices even when places like my bars are getting filled to the gills with flats (Tioga KI01).

These issues and concerns were not as strongly voiced in areas where development has yet to occur. Indeed, just the opposite – these issues were discussed in a generic manner if at all. As one KI noted:

If you look around you will hear things about houses and hotels and restaurants being full and potential problems with these things. Personally, I don’t think it’s a problem of the industry, it’s a problem of the community. They need to build more of these so they won’t have a shortage. People need to get past the increased population, which will only be here a while, and think about the good. I think we’ll be in an ok position when our turn comes and I think our social systems will handle the problems just fine (Jefferson KI01).

It is clear the relationship between existing industries and existing residents is being altered by the influence of Marcellus Shale development. However, differing perspectives regarding the impacts beyond employment within localities are leading in various directions. Some residents of the region see these impacts as potentially detrimental to local cultures, while others see these changes as part of growth and not of much concern. Some dismiss impacts as being related to local incapacities rather than new and extreme forms of development. Others see these opportunities in a positive light such as an opportunity for diversity of food and entertainment. Divergent perspectives on these issues, however, indicates that establishing a common sense of identity or clear lines of communication might be difficult, and thus trust and cooperation in addressing issues may be a major concern within the region and its localities.
Infrastructure impacts. In developed areas, road impacts are a major issue of concern (Jersey Shore Circle; Clearfield Circle; Coudersport Circle). The degradation of local roads was noted as one of the major detractants of the gas industry. The sheer volume of traffic on roadways was another issue of concern. Both are interrelated and exacerbated tensions emerging around other issues. As one Clearfield KI noted:

The worst thing I’ve seen is the roads. The trucks can really do a number on them. The companies have been really good about fixing them up, and we’ve been looking at making arrangements to get them [roads] upgraded prior to them drilling. Folks have been concerned about the constant traffic, you know, 24/7, that runs up and down the roads. They’ve called and complained about jake brakes and other noise during the night. They don’t seem to care it’s only temporary, they just want it stopped. Can’t say I blame them (Clearfield KI02).

Similar to economic impacts, infrastructure impacts had varying importance throughout the region. Unlike economic concerns, however, there was general agreement on the potential impacts and outcomes of infrastructure impacts. Part of this appears to be due to the general undeveloped nature of the region and the road system that associated with it. Part of it is because there is tacit evidence of road impacts from coal and conventional gas extraction and thus it is not a far stretch to see where there would be impacts from gas development. Overall, it appears that infrastructure, especially roads, might be a place where communication and cooperation could be fostered and nurtured to help address other issues within the region.

Asset Reuse. Gas industry development was providing a critical boost to local economic redevelopment efforts through encouraging reuse and redevelopment of existing infrastructure. Such infrastructure reuse and revamping was being promoted by entrepreneurs and industry whom were mostly internal, and in the Jersey Shore and
Clearfield Circles external, to the area where development was occurring. In Tioga, Lycoming, and Clearfield Counties development has focused around key crossroads and interstate highways (Jersey Shore Circle; Clearfield Circle). Elsewhere, development has focused around abandoned, closed, or otherwise vacated industrial buildings (Cameron KI01). Overall, the redevelopment of blighted and abandoned buildings has created not only a source of jobs and revenue but a source of local pride (cf., Clearfield Circle; Jersey Shore Circle; Cameron KI01; Tioga KI02; Clearfield KI01; Clearfield KI02).

Asset reuse within the individual counties points to the availability of assets for building community capacity to deal with change. One threshold-passing event, the loss of employers within the region, can be turned to an advantage in terms of excess infrastructure and capital assets in the renewal and reorganization phase of Marcellus Shale development. This provides a niche for entrepreneurs – growth specialists or ρ-specialists – to take economic risks to redevelop these resources for industry use. As one participant noted:

We lost Sylvania a few years ago. Someone came along and bought the old plant building and is converting it for different gas business and other manufacturing companies. If it weren’t for gas, I don’t know if it would have happened. But, with gas there appears there might be a glimmer of hope for development around here. So, this guy picked up the pieces and is investing his own money in trying to turn the plant around (Bradford Circle Participant 5).

Environmental Concerns

The next largest group of concerns and issues noted by participants were those related to environmental impacts and opportunities. This group of topics had the greatest variety of concerns and the greatest range of participant responses involved with them. In some respects, these perceptions were influenced by prior experience with other natural resource development. In other respects, these perceptions were influenced by sources of
information one chose to believe or follow; this will be discussed in more detail later.

Overall, there was much agreement within similar perspectives but little agreement across perspectives, making environmental issues related to Marcellus Shale development the most complex and ‘wicked’ (Rittel and Webber 1973) of all topics.

**Water and fracturing.** Water resource impacts were the largest concern in relation to the environment. Water quality impacts are especially important, given the nature of the fracturing process and the chemicals and other additives needed in the well-drilling process. Many participants indicated concerns about the disposal of produced water. Others voiced worries about increased runoff and sedimentation caused by well pads, access roads, and in some areas, the dirt township roads which discharged stormwater directly into local waterways. Inherent in these conversations were risk and risk perception. Some risk perceptions were related to processes and procedures, other to the long-term and unknown impacts of the gas development on the environment. These perceptions filter down to how individuals react toward development and the steps they take to gather information.

Much discussion focused on the fracturing of wells, the long-term fate of injected waters and chemicals, the capturing, treatment, and disposal of produced water, and actual and suspected failures of the process. Many landowner participants were mistrustful of the gas companies they leased to because of the secrecy of the work being done and the inability to get anyone to explain anything to them. As one landowner stated:

I’m kinda torqued with the company drilling on my property. I asked the foreman the other day for some information on their schedule and what they were doing. He gave me some song and dance that he didn’t know and couldn’t say. (laughs) Really? I don’t know, at the very least they
could give me something so I could plan my own routine around them. Seems like common courtesy for neighbors in my book (Lycoming K102).

Many landowner participants adjacent to gas activity were concerned about the equipment, piping, water, and other materials being stored on site and the potential (and actual) releases occurring during development. Most, if not all participants, questioned the Department of Environmental Protection’s ability to protect both human health and the environment in the face of the explosive growth of the industry and political pressures to expand drilling. As one person noted:

You can do math, can’t you? Take all the permitted wells in the Marcellus, add them to all the wells in the shallow gas fields, and divide them by the total number of inspectors in DEP. I’m not a rocket scientist, but it doesn’t take one to know that them aren’t good numbers for gambling, let along trying to protect human health and the environment around us (Jersey Shore Circle Participant 2).

As was the case with socioeconomic impacts/opportunities, environmental perspectives differed by association with activity. Additionally, participants who were more informed regarding the process of fracturing were better able to express their concerns and reason through the pros and cons of them. Those who lived close to drilling activity were more concerned about water quality issues than those who lived in low activity areas due to association and previous experience. Further, those who worked in the industry or who were experienced with local resource development were less likely to be concerned with water quality. A salient example of this perspective is summarized by one KI:

I think the impact on water is totally overrated. I mean, we’ve been fracturing rock with liquids for 20 or 30 years or something like that. The chemicals they use are really the same stuff we have under our sink. Why should we get all bent up about stuff we already dump down our drains and into our streams and groundwater? Besides, coal mining is ten times
nastier than gas drilling ever was, so why not focus on them instead? (McKean KI01).

The composition of the drilling and fracturing fluids was a key concern noted by the focus groups, KIs, local groups, and especially the media. Companies are required to report the chemicals they used within their drilling mixtures, but the exact make-up of the chemicals is not public knowledge. Additionally, the impacts and influences of certain chemicals were well known while for others they were not. The people most concerned about water quality cited emerging research on endocrine disrupters on top of existing research on carcinogens and other human health hazards as the sources of their concerns. They were concerned not only about the known impacts from fracturing and drilling chemicals, but also the unknown impacts - the unknown risks - which was exacerbated by the industry’s secrecy on concentration and mixture going down the holes during development.

Others, especially those with experience in or closeness to the industry, had a different perspective on the fracturing process. They tended to rely on several factors touted by the gas industry literature. First, the chemicals being used were diluted to such a point that any exposure to them was de minimus at best. Second, the chemicals being used could be found under everyone’s sinks and workshops, thus any exposure to chemicals from fracturing was no different than working around one’s house. Finally, there have not been any proven cases of groundwater contamination from the fracturing process. The chemicals were being pumped one mile or more below the ground, thus,

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4 After the interviews, focus groups, and circles were completed, Range Resources released the concentrations of chemicals in their fracturing fluids. In early September, Chief Oil & Gas also announced their company would also voluntarily disclose their fracturing fluids beginning October 1, 2010. Thus, future discussions may change, focusing on what is in the fluid or why other companies are not following suit.
barring any major technical malfunction, the likelihood of the chemicals reaching the
surface again were slim to none; risk from exposure was next to nothing.\(^5\)

Risk perception of water impacts seems to be a key factor in relation to
acceptance of gas development among residents. A comparison of risks was emerging
along several lines. One was based around voluntary versus involuntary exposure; that is,
gas extraction in a nearby area created a potential, however slight, that an exposure event
might happen. The unknown characteristics of shale fracturing and fracturing fluids
overrode the characteristics of what was known. Residents also seemed to apply
emerging research, such as those related to bioaccumulation and endocrine disrupter, as a
measure against which risks from drilling were compared. Distrust of industry
propaganda and information caused these concerns to deepen, some of which seems to be
extending to others associated with gas development, such as state agencies.

On the other end of the spectrum, pro-industry residents tended to equate risks to
other risks. For example, one resident equated the risks associated with fracturing with
those related to household chemicals. This KI also noted the relationship between gas and
coal extraction, each of which have differing risks associated with them but are managed
quite differently in the state. The seeming incongruity of regulation between industries
was only mentioned in two cases, so it seems that this risk comparison is one that is
relatively unknown but potentially important.

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\(^5\) This issue was one of the largest sources of contention within discussion circles, public meetings and
within much of the printed media reviewed. Hundreds of letters to the editor outlined the various stances of
people in relation to fracturing and the composition of the fracturing fluids. In the case of observed public
meetings, in some instances debate on this topic would lead to a meeting unraveling and/or to vitriolic
discussion among participants. In the discussion circles, it was evident which side of the fence participants
sat. However, the ground rules established for the discussion circles helped overcome this contention. First
by focusing on the perception rather than the ‘correctness’ of any statement, participants were able to
acknowledge the existence of a position even if they didn’t agree with it. Second, if contentious debate
erupted, the ground rules, which were agreed to by all participants, allowed the facilitator to bring
distracting debate under control and allow further discussion of the material to ensue.
Also, other KIs and stakeholders were concerned with the involuntary risks that they were experiencing. For the landowner in the first example, a lack of communication between the gas company drilling on his property lead him to be concerned with the activities and possible outcomes of the activity taking place on his property. The initial risk seeking they took in signing a lease and offering their property for development is being moderated by the experiences they are having.

Other residents expressed concerns over the “fact that I didn’t volunteer for this, it was forced on me by my neighbors” (Jersey Shore Circle Participant 5). These residents express differing levels of frustration over the involuntary nature of many of the risks associated with gas development, a lack of control over impacts to their locality, and a fear of the unknown associated with the process of drilling. These feelings and concerns express a lack of distributive justice in areas where gas development is occurring. The adverseness to the risks associated with gas development, even amongst those who are benefitting from development, signals that communication and information barriers may be emerging preventing effective hazards communication and management.

In this manner, information communication seemed to be a key issue associated with environmental impact discussions. Even residents with very different perspectives on drilling issue found common ground for concern in terms of how information was communicated. As one KI noted:

Personally, I think the industry has lied by telling the truth. For instance, you see a lot of propaganda out there telling everyone how the industry uses less water than things like golf courses and nuclear power plants. One of the first MSC [Marcellus Shale Committee] flyers outlines the whole deal. While on a gallon to gallon basis it’s true, what they aren’t telling you is that all the water they use to frac wells is permanently removed from the water cycle. Thus they are lying through their teeth. But, to the
average unthinking country Republican like those around here who don’t think for themselves, it sounds like a fabulous thing (Forest KI01).

Comparatively, another KI said:

You know, information is critical to getting rid of a lot of this anti-development nonsense. Truthfully, I think the environmentalists are right in some respects. I mean, look at some of the information the Committee [Marcellus Shale Committee] and other “pro” (finger motion) industry groups put out. The whole water usage thing is baloney. Anyone who is familiar with the water cycle and Marcellus Shale development are going to realize the industry PR people are comparing apples and orangutans. Seriously! I mean, sure golf courses consume a lot of water, but it usually ends up going into the groundwater, evaporates, or is transpired. Same with nuclear plants, some goes back in the river, some is ejected out of the stacks as steam, and some is kept in the plant and disposed as radioactive waste. With Marcellus, it goes in the ground and stays in the ground, at least in human terms. It ain’t coming back. That’s a big difference. The industry PR folks need to realize people aren’t stupid, and that by being treated as stupid, they are made to distrust the industry. Take responsibility for the water, I think. Tell people we do use less water but the majority of the water we use ain’t coming back. Be realistic. I think we’d gain more in the long term than the way we’re heading now (McKean KI01).

Common in these responses are issues related to open communication and information exchange. In both expressions, the same information results in two very different outcomes: perceptions at both ends of the pro- and anti-industry scale. A lack of clear and concise information leads to two divergent opinions which express people’s perceptions of the risks associated with gas drilling. The outcome of this divergence, when compounded with similar miscommunication and misunderstandings, can provide powerful barriers preventing the emergence of cooperation and trust, especially as it relates to the tolerance of divergent opinion. The second quote expresses a form of tolerance, in that the informant, who is pro-industry, acknowledges that the opposite camp – the environmentalists – might have a valid argument in response to pro-industry activities. Their suggestion, of being more realistic about a situation, is a method of
providing information that might help to increase the effectiveness of communication, leading to enhanced trust between parties. Whether this leads to cooperation is likely dependent on the other issues compounding understanding amongst parties.

Water quantity was another issue of concern, but somewhat less of one than water quality. The regulation of water withdrawals within the Susquehanna River basin by the Susquehanna River Basin Commission was seen as both a good and bad thing, depending on where one stood. As was seen in the previous two statements, there is a broad interpretation of how water quantity use information was being disseminated.

For those concerned about water quantity issues and stream health, the regulation was welcomed (Jersey Shore Circle; Coudersport Circle). Compared to the withdrawal experience in the Ohio and Potomac River Basins, regulation by SRBC was preventing the over-withdrawal of water and inconsistent regulation seen from DEP regulation (Coudersport Circle). SRBC also added staff to inspect water withdrawal locations to ensure permits were in order. They were also undertaking a long-term scientific study to determine optimal withdrawals for much of the basin’s streams. As one KI summarized:

The SRBC seems to take these impacts seriously. They are carefully monitoring water throughout the watershed. They and East worked together to install a monitoring network, which I know East got a lot of industry flack for. They put people into the field to monitor everything and are empowering other groups and agencies to be proactively engaged in the process of understanding and monitoring the changes happening around us. Overall, they are doing a better job of helping people than DEP (Tioga KI02).

There were those who were less concerned about water quality and more concerned about overregulation and property rights. Those espousing this perspective took the stand that SRBC regulations were a major barrier to gas development and a taking of water rights from landowners and water providers who had access to water.
They felt both landowners and companies should be compensated for the water they could not access. As one circle participant noted:

We should all just stand up and get rid of the SRBC. I mean, they are nothing but trouble for everyone. Shouldn’t the market decide if a water company can sell their water to the highest bidder? I mean, they’d [water companies] be silly to sell all their water because they’d lose their customers or be sued. Who cares if streams dry up? They do all the time, that’s what droughts are. The water uses are only temporary and the streams will refill the next time it rains. We don’t need a bunch of liberal tree huggers telling people when they can or can’t use water (DuBois Circle Participant 3).

As noted previously, information and communication appear to be key issues related to water quantity and stream impacts. However, in the case of water quantity ideologies start to come into the forefront. Some residents believe the risks associated with the loss of local control (lost revenue, lost business opportunity) are outweighed by the surety of even-handed regulation. On the other hand, the risks associated with regulation were seen as detrimental to free-market utilization of water resources, and as such was a key deterrent to further or expanded regulation by the SRBC. These divergent opinions point to additional areas where barriers to trust and communication might be emerging, in this case, barriers caused by personal political philosophies about the proper place of regulation and oversight in the market.

**Aesthetics.** The impacts of natural gas development on environmental amenities were a growing concern in the Pennsylvania Wilds region. Drilling in the state forests drove a lot of this concern, especially as drilling pads encroached on wilderness areas and other areas of special concern. Lights and lighting from drilling rigs was a concern in the Wilds because of the Dark Sky Initiative, an astronomy/tourism promotion program (Coudersport Circle). Dark Skies promotes the lack of light in Potter County, especially
at Cherry Springs, and the fact this made for some of the best star viewing and astronomy outings anywhere in the Eastern United States and world. Lighting from drilling rigs – as well as cell-phone towers, radio antennas, and other forms of buildings – were disruptive to this, and many were concerned about its potential long-term consequences for tourism. Further, many were concerned about the impact from noise. The drilling process is loud and lasts constantly for the better part of a month at each well. Many go to the forests for the quiet and solitude provided by them. Drill rig noise coupled with the constant traffic associated with movement of trucks and equipment to and from the site, were antithetical to quiet and solitude. Some contended this was a minor deal and, because it was temporary, not cause for great concern. However, the long-term unease over this part of the process was driving much of the concern. This made for a difficult balance, as one KI noted:

You know, here in town we have a lot of truck traffic to begin with, but the additional trucks here have added a lot more noise than there ever was before. I mean, you can try to talk to someone downtown but the truck engines accelerating reverberate between the buildings to the point where you can’t hear yourself think. It’s worse in the state parks and on back country roads. I used to think Harley’s were annoying. Residual waste trucks are slowly creeping up my most annoying list! (Tioga KI02).

The impacts to the look and feel of the towns and countryside of the region point to several areas of potential conflict. First is the potential impact to the sense of place of an area, that is, the characteristics of the local place to which people associate feelings and attachments (Tuan 1977; Stedman 2002; 2006). These attachments form an aspect of place to which risks might become associated, especially risks that result from the impact to a place. If the viewscape of a particular place is damaged, such as the dark sky at Cherry Springs, tourists
and residents alike might have an unfavorable perspective to this loss, which in
many respects is an involuntary risk.

A second area of potential conflict resides between perspectives of
development: those who prefer the aesthetics of the current landscape versus
those who prefer the surety of income and job growth in relation to gas
development. The role of public lands in the region and discussions of traffic and
noise seem central to this concept. The pre-Marcellus landscape of the
Pennsylvania Wilds was one of the key selling points of the initiative. In many
respects, this aspect of the program represented a top-down application of
conservation onto the local landscape. Many residents are attracted to this sense
of place (if not the remembrance enforced on the area), which is a key factor in
inducing some of the risk-related responses in the area.

Those promoting the growth of Marcellus Shale development in the region
have essentially moved through the release phase and are in the process of trying
to reorganize local development efforts to open doors for growth and utilization of
natural gas. They tend to see the local landscape in a utilitarian manner, that is,
resources are there to be used and if we need to develop them why not here? As
one resident noted:

Rendell introduced the PA Wilds to the region five, six years ago.
Truthfully, I don’t know what good it is. It seems to be an extension of the
Philadelphia tree huggers into the region and it brings a lot of questionable
people into the region. I mean, the counties in this part of the state have
lost tons of jobs because of the closing of the Allegheny and
mismanagement of the state’s forests, not to mention us sending
[manufacturing] jobs overseas. The resources should be used, not to be
kept like museum pieces. I think your question relates back to this. Man of
these points are not really issues from my point of view, we’ve just lost
our balls to accept that some people will have to have their sweet little lives upset for a while (DuBois Circle Participant 3).

**Habitat Impacts.** Long-term changes to habitat were of concern to many participants (Group observations; Coudersport Circle; Jersey Shore Circle). Habitat fragmentation was the biggest concern, followed by introduction of non-native species into key habitats, influences on bird and animal patterns, and impacts to threatened and endangered species. Impacts to stream habitats from water withdrawals were another concern, especially in streams with high quality or exceptional value designations. Participants were concerned about the long-term health of the state’s ecosystems and the fact that little research was being done to catalog pre and post conditions.

There were mixed perceptions about habitat impacts on forestland. Some were concerned about the wholesale leasing of lands within the state forest for drilling (Jersey Shore Circle; Coudersport Circle; Clearfield Circle). Others pointed out that DCNR had very strict siting and leasing requirements and maintained oversight of their leases, thus, much of the concerns over impacts to resources of concern were unwarranted (Coudersport Circle). Still others were concerned that impacts would occur from private property, especially inholdings, which would spill over into the state forests (Jersey Shore Circle; Coudersport Circle). Coupled further to this was the fact the state did not own the mineral rights on a lot of state park and game land property, making these areas prime targets for development and impacts to public resources. As one participant summarizes:

I have mixed feeling about the whole state forest leasing issue.... It’s a tough call because you have to balance the needs of the residents of the state as a whole against the need of local residents and those who use these places. Politically, especially in this region, the latter is less important than the former, especially the Philadelphia and Pittsburgh blocks. Thus, you end up with outsiders controlling your quality of life in relation to one’s enjoyment of the state forests. The alternative, outsiders controlling your
quality of life through increased taxes, the alternative, isn’t as pretty either. It’s a no win situation regardless how you slice it. I’m glad I’m not a politician! (laughs) (Potter KI01).

Ownership of public resources and differences in opinion in how they should be managed are indicative of communication and information barriers leading to trust and cooperation issues. Some see the management of leasing as a distributive justice issue centered on balancing the needs of the state with the needs of local residents. Others see this as a risk to the sense of place they have assigned to the place (such as state forests) and the potential risks associated with exploration and production. Others see this as a natural extension of “the right use of state forests” (DuBois Circle Participant 3) in helping to provide income to state government in a time of need. These differing perspectives create barriers preventing meaningful communication, ultimately undermining discussions on how best to manage these publically owned resources.

**Government and Planning Concerns**

There was a mixture of sentiments related to local governments and development of Marcellus Shale. Overall, these perceptions helped highlight the fragmented nature of Pennsylvania’s governance structures and lack of governmental cooperation between and among units. In effect, these concerns highlighted barriers and issues related to the panarchy existing within the Pennsylvania Wilds. Of particular interest was the interconnection between gas development and local authority to regulate and zone gas related activities. Beyond this, perceptions of interest were far ranging and included concerns over: (1) planning for long-term impacts for local infrastructure; (2) the impacts of increasing demand for local governments in a time of decreased aid; (3) lack of
funding and technical support; and (4) a broad array of issues related to landownership
and the long-term stability of landholdings within the region.

Distrust between levels of local government was very high and independent of gas
development. Distrust between and among townships, between townships and county
government, between townships and county, and between township, county, and state
governments were constant comments heard in the various data gathering sessions.
Marcellus development has served to both exacerbate these disconnections in some areas
and increase them in others, making it even more difficult to effectively manage local
resources. As one resident summarizes:

We’ve had problems with local government cooperation for years. Our township
doesn’t talk to the neighbors. They hate the county because of some long-seated
disagreements over county bridges and roads. They hate the state because the
state asks them to do things they can’t afford to do or don’t understand how to do.
All in all, it makes me wonder how this state continues to survive with all the
disagreement happening between different governments (Jersey Shore Circle
Participant 7)

As noted in the previous statement, part of this distrust arises out of unfunded
mandates from higher levels of government. More programs and requirements have been
placed on local governments to perform certain functions. Despite the attempt to give
control to the closest level of government, many townships lacked the financial or
technical skills necessary to manage such programs. Others lack the interest in enforcing
things like zoning within their boundaries. Furthermore, many townships in the region
lacked the population base to make such programs worthwhile. The emergence of the
Marcellus play has strained local governments further, forcing them to deal with these
programs, deal with new and emerging mandates, and deal with the increased demands of
the gas industry on local infrastructure and services. As one KI elaborated on these issues:

The relationship between local municipalities and county government has always been tenuous at best. The county commissioners have done some things over the years which have upset the local officials which in turn have made trying to do things collaboratively across the county more difficult. Given that some townships are very small and have few people in them and little development going on in them, people there don’t see any need to do anything. It also seems that supervisors in one township don’t know the supervisors in other townships nearby, unless something happens that bring them together ... gas has changed things. The pressures of development are starting to emerge and people are taking notice. Many are starting to see that they have more strength together than apart – but, unless they see the problems or see how they can make money out of it, they typically don’t respond (DuBois Circle Participant 10).

Other forms of distrust emerge from state oversight exemptions for activities associated with natural gas development. Of particular concern was the removal of gas development review and oversight from local county conservation districts. Review of permits and associated materials was centralized in regional offices throughout the state, in effect streamlining the review process and removing some of the inconsistencies inherent in differences among county conservation districts. However, by doing this, the state removed one of the few areas where local communities could review and comment on gas development. This action exacerbated local angst over government oversight and relations. As one circle participant put it:

You know, our conservation district has always been very good about reviewing E&S plans and making fair, conscientious reviews and enforcement. Now, we have a faceless body in Williamsport. Nothing against the people working for DEP, they do what they have to do. But, now we’re dealing with people we’ve never talked to before rather than one of our own working in the real world (Jersey Shore Circle Participant 10).
Areas where the impacts were higher have been more proactive in understanding and developing competency in areas where they could control activities, such as in land developments associated with man camps and compressor stations. Recent court rulings helped clarify those activities that could or could not be regulated (i.e., Penneco v. County of Fayette decision, July 22, 2010\(^6\)). Many communities were slowly developing requirements for reporting and development within their boundaries (Kennedy 2010).

Implicit in these points are the notion that local areas are moving faster to address Marcellus Shale impacts than the state. Initially, local county conservation districts were managing and addressing Marcellus Shale impacts through review and comment on permit applications. As a sub-unit of county government, these agencies applied the regulations in a manner consistent with other land uses in the county. When the management of these reviews and requirements was seen as becoming a burden to the industry because of inconsistency among counties, the state stepped in and removed oversight to a higher level – the state. This form of remembrance resulted in a revolt which can be seen in many of the responses of pro-environment residents.

The recent court cases also point to a potential area where a perverse form of remembrance might be implemented. The court case mentioned above reinforced areas where local municipalities, whether county or local government, could influence natural gas development in their area. Pending legislation in the Pennsylvania legislature would place natural gas development as a use by right in all land use classification. Effectively, this would remove gas development from the local zoning and hearing process and place

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\(^6\) In the Penneco v. County of Fayette Case, the Commonwealth Court of Pennsylvania ruled that Fayette County was within its right to regulate the portions of gas development not directly related to drilling and which are dedicated to “...preserving the character of residential neighborhoods, as well as each zoning district, and encouraging beneficial and compatible land uses,” Pa. Commonwealth Court No. 18 CD 2010, pg. 18.
it at the whims of the state government as a land use issue in the Pennsylvania Municipalities Planning Code. Similar to permit review, the faster moving local municipalities, through zoning, created a revolt in the panarchy which resulted in the state attempting to enforce a form of conservation on the local level. Whether or not these changes will be made is yet to be seen. However, these incidents help to illustrate the relationship between levels of government within the panarchy.

Another concern related to government relations and community planning was the impact to local populations. In particular, concern was raised over the impacts of gas development on the migration rates of the county and to the agricultural community (Jersey Shore Circle; Coudersport Circle). Some noted newfound money in the area might begin an outpouring of migration away from these counties, where people could now afford to move to areas with better weather, amenities, etc. This was especially a concern because of the older nature of the region and the fact many residents were either of retirement age or of nearing retirement age.

If negative impacts, both socially and environmentally began to emerge, an increase in ‘brain drain’ in older generations could occur as they moved from the area. This could potentially lead to decreases in property values beyond gas impacts as more houses hit the market than what can be sustained. Further, the role of split estates (subsurface mineral rights severed from surface rights) was yet to be seen in terms of long-term real estate impacts.

Another concern revolved around agriculture and farming. As one local stakeholder put it: “Will millionaires milk cows?” (Jim Weaver, personal communication). For many generations, the farmers of the Northern Tier have been the
landed poor of the county; they owned many acres of land and worked very hard but had little financial security to show for it. The development of Marcellus Shale has the potential to make this group of residents the *nuveaux riche*. Thus, there is concern people will stop farming because they no longer had to put in long hours and be chained to a farm (Jersey Shore Circle; Coudersport Circle).

A lot of discussion emerged in some areas about this. Some claimed there would be little change because farmers were farmers and would never be anything different. Others claimed they would “farm until they run out of money,” indicating the shale was simply income to be reinvested, until it ran out, back into the farm. Still others felt there would be a change in farming from money and labor intensive forms of farming to less intensive forms, such as from dairy to beef. Regardless, in counties with significant agricultural bases, there was concern about what the future would bring.

As with natural resource impacts, local population impacts represented issues related to distributive justice. Everyone is affected by development and if the risks are not distributed evenly, those with the means to leave might do so or certain aspects of the perceived identity of an area might be replaced by something completely different. Population change has the potential to impact local and regional volunteer pools as well as local economies through leaks in local multiplier loops (especially if those with lease rights sever them and move to a different place).

Likewise, these impacts might create a rift in local identity, with those preferring the pre-Marcellus quality of life conflicting with those preferring the current quality of life involving Marcellus. These perspectives seemingly represent different stages of the adaptive cycle, with those preferring the pre-Marcellus state of the local area as a state of
conservation of a previous system while those preferring the current state of Marcellus Shale development might be in the renewal/reorganization or growth/exploitation phase of the same system in a new state.

**Health and Safety Concerns**

An emerging concern in regions where development was occurring was the impact on human health and safety for residents. Participants identified many issues related to health and safety, many of which emerged from the ‘urbanization’ of rural areas due to the rapid influx of gas well workers and families. Of particular importance were infectious diseases and their spread, impacts on health care availability, and impacts on emergency services in general.

Across the region, health care and safety were identified as areas of concern. The specificity of issues was higher in areas with development, while in areas where development was lower, health issues emerged as one of a wide range of other issues. Those in positions of authority or oversight tended to be more concerned about the overall stability of the system while those not involved in planning, managing, or influencing these issues tended to be more concerned about what these impacts meant for them in terms of waits, costs, and service availability.

In terms of infectious diseases and other vector-based health issues, participants identified two key areas: problems caused by drilling activities (i.e., pollution) and problems caused by interactions with gas well workers. The first area related mostly to issues with radioactive materials. There are two types of radioactivity associated with gas drilling: natural occurring radioactive materials (NORM), and technically enhanced NORM (TNORM). Concerns arose around pollution from drilling activities, including
fracturing, spills, and accidents and the resulting human exposure to such chemicals (Jersey Shore Circle; Coudersport Circle; DuBois Circle).

In the case of T/NORM, concerns arose from the fact that much of Pennsylvania was underlain by naturally radioactive bedrock. As these materials were brought to the surface, they brought with them radioactive nuclides which could cause harm to human health. As these materials were collected and brought together, the concentration of radionuclides increased, creating T/NORM. Radioactive materials emitting radiation above a certain level must be disposed of at a licensed disposal facility for radioactive waste. There were concerns these materials were not being handled or disposed of properly (some believed they were being deposited in regular landfills, rather than in radioactive waste repositories). There were also concerns that exposure to the trucks hauling these materials might lead to human health impacts among the general public.

As noted previously, there were concerns about exposure to chemicals in drilling fluids and fracturing water. A number of people cited the recent experiences with methane in wells near Dimock and with a free gas release (non-Marcellus) in Lycoming County. Others noted the recent explosion of wells in Clearfield County, near Pittsburgh, and in West Virginia. People were concerned about the secrecy behind the concentrations of chemicals in fracturing and drilling fluids, despite the industry divulging what chemicals they used in the fluids and more recently the composition of those materials within the fracturing solution7. Some were concerned about the disposal of fluids and whether the fracturing process would actually lead to the permanent disposal of fracturing fluids or

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7 As noted previously, voluntary disclosure of fracturing fluid formulations by two regional gas companies occurred after the primary data gathering for this study. In areas of the region where these companies are active, their actions may alleviate some of these concerns. However, this issue is still likely to continue to be important locally as most companies use different proprietary formulations.
whether these fluids would reemerge at the surface at some later date. One KI described the dilemma facing residents of the Marcellus Shale region:

I’m not really sure about the fracturing thing. It sounds safe, pumping it miles underground. But, is it really? Can anyone really say for certain it will stay down there? I’m guessing that within my lifetime it won’t, but who’s to say it will stay there for my children’s lifetime, or even my grandchildren’s? What happens if a truck rolls over near a school, or near a mall, or even if they drive through some town with a leak? Everyone’s exposed to this stuff then. I don’t feel comfortable with that. Maybe things are as harmless as they say and things aren’t as bad and won’t be bad if it leaks. But, I’m also aware that we still have a lot to learn about nature and the things we do to it to be sure that we aren’t doing something we shouldn’t be (Clinton KI01).

A third concern lies in airborne pollution caused by drilling and its support industries. In particular, airborne dust and diesel vehicle exhaust are two issues of concern, especially for those who suffered from asthma. The increased traffic within areas of high development contributed to more dust and dirt on main roads and in the air. As one person noted: “some paved roads are like driving on dirt roads because of all the dirt been laid on them by the trucks” (Jersey Shore Circle Participant 03), referring to the level of dust kicked up off the roads when traffic drives over them. This airborne dust can cause lung irritation in sensitive residents, increasing asthma attacks and other respiratory ailments (Jersey Shore Circle Participant 3). The increase in diesel exhaust was believed to have the same effect, increasing respiratory problems within sensitive populations.

These three concerns point out different levels of risk perceptions across the region. To some, exposure to radiation was a concern of utmost importance. Compared to normal background radiation, the unknown radioactiveness of drilling materials was cause for concern and care in management. Impacts from chemical exposure were seen as a similar problem, but, as explained earlier, exposure perceptions tend to be split by
beliefs in just how toxic or non-toxic materials are when compared to common, everyday household chemicals. Respiratory illnesses and other problems caused by dust and particulates is one risk and hazard that all acknowledge as an issue. It is hard to say that these are not a problem when many people have experienced an increase of dust on local roadways (Jersey Shore Circle; Coudersport Circle, Clearfield Circle)

A fourth group of concerns was tied to the increased population and the diseases higher population concentrations brought with them. Some were concerned about the potential for increased outbreaks of sexually transmitted diseases, contact diseases such as tuberculosis, or for diseases endemic to other parts of the country or world which were being brought into Pennsylvania by workers who have resided there. As one circle participant exclaimed:

Hell, we know what’s gonna happen here, let’s not beat around the bush. Just like when I was out west in the 70s. A bunch of young lads with a lot of free time and money on their hands and nothing better to do 'cept drink and drive and sex it up. It’s amazing how easy it is to find a gal when you need one. So, they’ll sex it up and booze it up and you’ll see an increase in both DUIs and sexual diseases. That is unless companies screw down the clamps and keep their workers locked up like I hear rumors about them doing places. We’ll see, but I’m guessin’ they won’t lock ‘em up too bad ’less they want unhappy roughnecks (Clarion Circle Participant 05).

As well, there was significant concern regarding the ability of local health care organizations to recognize or properly diagnose some exotic diseases, increasing the risk to local residents throughout the region (Jersey Shore Circle; Coudersport Circle). This in turn pointed to a larger problem: the ability of local health agencies to be able to provide adequate health care in the face of increased demand. The region has many medically underserved areas, and as such, health care was at a premium. The influx of people was believed to pose an increase in demand for services local agencies could not handle.
Some noted planning was currently happening to expand hospitals and clinics, however, there was concern these estimates might not be accurate long-term, increasing the potential risk to local residents from the lack of adequate healthcare.

Last, an area of concern was related to the ability of local communities to provide adequate emergency and police services. In particular, people were concerned about the ability of emergency responders to deal with gas site incidents, especially to major incidents such as well fires. Other participants noted the increased demand on police to attend to traffic violations, disorderly and drunken conduct, domestic violence, and other issues associated with increased populations. Finally, other participants noted their concern about local volunteer fire and ambulance companies, who might face a dwindling younger volunteer base as volunteers take up new jobs with the industry. As one KI elaborated:

.... We have to be really careful here. Our volunteer base is slowly decreased due to age. If we promote industry jobs to our youth, we run the potential to lose even more volunteers due to long shifts, long work weeks, and constant movement. It’s difficult to think or plan much beyond the fiscal year because we don’t know what is happening next. I’d like to think the projections are correct, but I’m also afraid that they might be and what it means for us (Clearfield KI02).

Similar to previously discussed issues, health and safety issues were foremost in the mind of participants living in areas with heavy drilling activities. The risks they perceived were related to provision of lower order needs, especially those related to health and safety. Their responses also point to concern over the distributive justice of these conditions. Respondents from counties with little or no drilling and those counties facing moderate drilling were more likely to consider such issues part of the planning phase for increased support of the gas industry. The risks from these impacts appeared to
be mitigated through proactive planning (or perceived proactive planning) for
development in these areas. The fact health issues were recognized across the board
indicated the potential significance of their impacts for local communities.

Sources of Information

While, over time, gas drilling has been commonplace throughout the
Pennsylvania Wilds, the most continuous development has taken place in the region’s
western counties. Many residents in the eastern portion of the Wilds region had little or
no legacy knowledge of gas drilling and no one interviewed or involved in any of the
groups in the region had knowledge of the style of horizontal drilling used for production
within the Marcellus. The rapid onset of Marcellus development in the Commonwealth
caught many residents off guard. As a result, many people were scrambling to find
information on Marcellus drilling and its associated impacts.

Where People go for Information

When residents were asked where they turned for information on Marcellus Shale
development, a wide variety of responses emerged. Information sources could be sorted
into three main areas: internet, personal, and print (see Table 6.3). The Internet proved to
be the most prevalent source of information on Marcellus Shale drilling in Pennsylvania.
This was not surprising given the speed at which the industry was expanding and new
information was emerging. Industry and corporate websites were the most noted internet
sites visited, followed by Penn State Cooperative Extension’s website, and then blogs and
news feeds.

Interpersonal communication formed the second largest group of interactions.
People relied on their friends and families most for information followed closely by
### Table 6.3: Sources of Information

<table>
<thead>
<tr>
<th>Sources of Information Used to Understand Marcellus Shale Development</th>
<th>Internet</th>
<th>Personal</th>
<th>Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry corporate websites</td>
<td>Friends (non-specific)</td>
<td>Daily newspapers</td>
<td></td>
</tr>
<tr>
<td>Industry associations (i.e. Marcellus Shale Coalition Website)</td>
<td>Relatives</td>
<td>Industry trade publications</td>
<td></td>
</tr>
<tr>
<td>News feeds/internet news search sites (e.g. Pro-Publica)</td>
<td>Neighbors</td>
<td>Newsletters (i.e. watershed group newsletters)</td>
<td></td>
</tr>
<tr>
<td>Industry trade websites</td>
<td>County agency staff</td>
<td>Weekly newspapers</td>
<td></td>
</tr>
<tr>
<td>Penn State Extension Website</td>
<td>State agency staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blogs (esp. environmental activist blogs)</td>
<td>Co-workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State websites (DCNR, DEP)</td>
<td>Friends (work for the industry)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Information in each category is sorted from the highest number responses to lowest
neighbors. County and state agency staff was also noted as key interpersonal contacts for information on Marcellus activities. In the eastern region of the play, where development had already occurred, friends who worked for the industry were a significant source of information on industry activities.

Print sources of information were noted as important, especially newspapers. Two types of newspapers could be found within the Wilds region: those printed daily in larger cities, and those printed weekly in the more rural counties. Daily papers were seen as the most important and informative of the print sources. Trade publications made a surprising entry, especially in the western portion of the region. Newsletters from environmental groups, county conservation districts, and other sources were noted as a source of information by some. Finally, weekly newspapers (such as the Wellsboro Gazette) were identified as a source of information, but were not considered to be timely enough to be a good source of current, up-to-date, information.

Channels of communication appear to be wide open but information was seen as incomplete but slowly becoming known. The availability of high-speed internet throughout much of the region is helping to make information available to people at an unprecedented rate. This is both good and bad in that it is generally accepted that there are good and bad sources of information on the internet. Those without internet access tended to have a harder time getting access to information and tended to rely on newspapers, friends, and family as sources of news and information.

People living in the region identified information sources in keeping with their personal philosophies regarding the shale. That is, those who were supportive of the shale turned toward industry and industry-friendly sources of information. Those who were
cautious or disapproving of the industry tended to favor neutral and environmentally focused sources of information. These choices indicate that trustworthiness of information may be more key than information availability.

**Trustworthiness of Information**

An interesting subtheme in terms of information lied in what information people felt was trustworthy. Largely, prior experience with gas drilling, environmental attitudes, and attitudes toward economic development had significant influence on sources of information (and in many respects, people) residents felt were trustworthy.

Those who lived in parts of the region where gas drilling has continuously occurred (Western PA Wilds) tended to favor industry related websites and news sources. Those who heavily favored natural gas development as a means of economic development also tended to favor industry based news sources rather than local papers or other sources of information. The general attitude was such news were accurate reflections of the development of the shale and as such formed a good basis for understanding the changes going on around them. As one circle participant stated:

> The industry sites are more reliable because they ain’t been spun by the environmentalists or the media. If you want to know what is happening, go to the people who do it, not those who seen it done (Clarion Circle Participant 05).

Similarly, others believed media was biased against the industry. As one regional resident wrote:

> What seems to be missing are local stories about the jobs created and the money being spent locally by this industry. I had a meeting today with a company and it was very insightful discussing the logistical components of this energy industry. Water acquisition and disposal, sand purchases and shipment, pipe needs, rail transportation, trucking schedules and the list goes on and on. The uninformed and ignorant as usual want to stop this industry, and yet they offer no science or factual information – just
fear and capitalism bashing ... (DuBois Area Resident, Personal Communication).

Those who focused on environmental impacts or who were more leery of gas development in general tended to focus on outside news sources for their information. Online news feeds like Pro-Publica were cited as key sources of information. As one participant noted:

I don’t feel I can trust the industry websites. They craft careful descriptions of the processes which paint a pretty picture but which don’t tell the entire story. It’s kind of a shell game: we distract your eyes here while we do something completely different over here.... independent news sources will at least give you a broader picture of what is happening, if you are careful to sort through what you read (Forest KI01).

There was common agreement there was not enough information available in general. One common complaint was that what was put out by organizations and agencies, such as Penn State Cooperative Extension, was outdated, too generalized to be of much use in dealing with specific issues, or were biased toward the industry. Others complained that websites, like the Pennsylvania Department of Environmental Protection, were too difficult to use or seemed to be actively hiding data. As one KI stated:

Have you ever tried to get onto DEP’s website? It is impossible…. You can search and click and never get to what you want. When you find it and bookmark it two weeks later the site has changed and you have to start over! It’s like they don’t want you to know what is going on! (McKean KI01).

Institutional credibility was another source of consternation among residents of the region. Some questioned the ability of institutions, such as Penn State and the University of Pittsburgh, to maintain credibility when gas industry interests were donating millions of dollars to research and academic programs. Others questioned the
ability of agencies, such as DEP, to provide accurate and timely information in the wake of the massive buildup of gas development in the state. Still others questioned the credibility of information given out by all the agencies and institutions when the information they had to work with was incomplete to begin with.

Overall, the level of information gathering people used to understand and adapt to gas development in their portion of the region seems to reflect the current status of their locality in terms of adaptive cycles. Those living in areas where development has started – areas which have moved from a release to a renewal phase – tended to cite information sources related to specific problems and issues, such as drilling fluid constituents. Those living in areas where development has not started or is slowly emerging, those areas which have not experienced a release, tended to cite information related to process and procedure rather than specific issues.

Further, judgments related to trustworthiness of information related to these searching behaviors are indicating the emergence of significant barriers in terms of communication, cooperation, and trust. As noted throughout this chapter, the same information can produce to vastly different opinions. These opinions are aided by the level of trust that people have in the source of the information, which in turn is related to the personal philosophies and cultures of the area where the person lives and previous experience with other types of gas development.

These differing opinions are creating divisions within places throughout the region and appear to be exacerbated within areas with current Marcellus development. Pro- and anti-industry positions seem to be more about differing opinions on what the problems are, the distribution of risks and rewards, timely and accurate information,
tolerance of change and outsiders, what types of action to take to address problems in local areas, and the ability to define a common identity from which to move forward. These divisions can be seen in how people within the region come together at the local level to address issues of common concern through participation in social fields.

**Social and Community Fields**

Participants were asked to discuss and identify the kinds of groups/organizations they participated in related to Marcellus Shale development. Early on in the interview and circle process, which was during the early-middle stages of current development, there was a limited response to this question. As the level of development of Marcellus Shale increased within counties and across the region, however, more groups were identified as being engaged in Marcellus related planning and discussion.

The fifteen key informants were selected in part because of their involvement with Marcellus Shale related associations, agencies and groups. The first focus group, which consisted of Pennsylvania Wilds Planning Team (PWPT) and PWPT Oil and Gas Committee members, were also members of an association whose mission is in part to address with Marcellus Shale development. Table 6.4 illustrates the breakdown of the facilitated discussion groups and second focus group in terms of participants, those invited because of their known involvement with organizations addressing Marcellus Shale topics, and those within each meeting group who self-identified with a group of some sort within the meeting.

Self-identification was determined by reviewing transcripts and recordings to identify statements connecting a participant with a group. Statements such “I belong...”, “A group I work for/with...”, “My friends and I started...”, and so on counted as groups
an individual was affiliated with. Statements such as “I went to a meeting...” or similar short term affiliations were not counted as self-identification in this total. Additionally, all other types of statements (“I heard about...”, “Someone told...”, etc.) were not counted as participation in these groups. Recording quality prevented assigning some participants within a specific classification. A lack of specific questions to this manner prevent concise quantification and comparison of groups within the industry and environmental group classifications.

Industry groups include those associated with task forces, trade, production, drilling, pipelines, metal working, welding, lobbying, and other groups promoting the gas industry and trade. Environmental groups include watershed organization, wildlife conservation organizations, anti-drilling groups, and others whose mission is to mitigate, minimize, or prevent impacts from the industry. Identification with an industry or environmental group was determined by the group name or description of the group the participant gave. In some cases, participants noted belonging to both types of groups. Of the 57 who identified with a group, four fell into this classification. Participants who identified with both sides of the issue tended to work for municipal, county, or state agencies or associations and thus had specific roles or interests in both group types. These co-affiliations typically were noted as being with wildlife conservation organizations such as Trout Unlimited, Ducks Unlimited, or Audubon.

As can be seen, nearly forty percent of participants in the study self-identified with a group of some nature dealing with Marcellus Shale issues. These affiliations tended to be slightly higher in areas where Marcellus Shale development is occurring and lower in areas where it is not. Participants identified more with industry groups in areas
Table 6.4: Self-Identification with Groups by Group Type

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Participants</th>
<th>Invited Because of Group Involvement</th>
<th>Involved in a Marcellus Related Association</th>
<th>Number Identifying with an Industry Group</th>
<th>Number Identifying with an Environmental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarion</td>
<td>20</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>DuBois</td>
<td>19</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Warren</td>
<td>18</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Bradford</td>
<td>24</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Jersey Shore</td>
<td>25</td>
<td>5</td>
<td>11</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Coudersport</td>
<td>22</td>
<td>4</td>
<td>10</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Clearfield</td>
<td>15</td>
<td>3</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Totals</td>
<td>143</td>
<td>22</td>
<td>57</td>
<td>31</td>
<td>30</td>
</tr>
</tbody>
</table>

Notes:
1. Includes three key informants.
2. Includes those invited to participate because of known group involvement.
3. Includes groups associated with task forces, trade, production, drilling, pipelines, metal working, welding, lobbying, and other groups promoting the gas industry and trade.
4. Includes watershed organization, wildlife conservation organizations, anti-drilling groups, and others whose mission is to mitigate, minimize, or prevent impacts from the industry.
5. Includes several people who also identified with industry groups.
with a prior legacy of gas development and more with environmental groups in areas with higher Marcellus Shale drilling. One participant in the Bradford circle discussed their organization in such a vague manner that it was difficult to tell which group they belonged to. Interestingly, locality-related non-profit groups and agencies were not mentioned amongst participants as groups to which they belong. They were mentioned as groups actively pursuing interests related to Marcellus Shale development, but none were mentioned by participants as being groups in which they were actively involved.

**Identified Social Fields**

The most readily identified groups in the region were county task forces, specifically, groups assembled by county leaders to look at and work on issues related to Marcellus Shale development (Jersey Shore Circle; Coudersport Circle; DuBois Circle). These groups served a variety of functions. However, the key goal of most of these groups was to maximize economic development within their county as it related to Marcellus Shale. Some task forces, such as Potter County’s, were open to the public for participation (Coudersport Circle; Potter KI01). Others, such as Lycoming County’s, were closed and operated under what appeared to be a cloud of secrecy (Jersey Shore Circle; Lycoming KI01; Lycoming KI02). Some counties, such as Tioga, did not have a task force which left room for other organizations to emerge to address these issues (Tioga KI01; Tioga KI02).

Watershed organizations and environmental groups were also key associations emerging from or adapting to Marcellus Shale development. Some existing groups were noted to be re-tooling themselves to deal with Marcellus Shale monitoring. Others, such as the Pine Creek Waterdogs, emerged in response to a lack of enforcement ability.
throughout the state (Tioga KI02). Trout Unlimited recently hired a coordinator for Pennsylvania to train local chapter members to be environmental watchdogs and to increase support for continued stewardship within the state. Other groups, such as those affiliated with hunting and fishing interests, noted trying to maintain neutrality while their group gathered information to assess the potential good and bad associated with Marcellus Shale development.

Participants also identified local non-profits geared toward economic development, health, service, and volunteerism as an avenue for participation (Jersey Shore Circle; Coudersport Circle). These groups were identified as addressing some portion of the impacts and opportunities not addressed by government, task forces, or environmental groups. Similar to some watershed and environmental organizations, these groups were identified as existing prior to development and were in the process of redeveloping their capacity to deal with the issues emerging within their areas.

Groups, task forces, and other associations will continue to emerge, change, and disappear as communities work to address the myriad issues associated with continued Marcellus Shale development. The sheer number of organizations working on or responding to Marcellus Shale issues has grown exponentially since this study started and many have continued to emerge since then.8 Overall, these local organizations were representative of the strength of interactions within the communities, important to defining the character of the communities, and influenced the type of adaptation they would make in relation to Marcellus development.

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8 When this study started in 2009, there were four energy-related county task forces. As of August 3, 2010, there were 14 (Mike McDavid, personal communication). There are nearly as many citizens groups in the region and many existing groups have taken on Marcellus as a part of their work.
Participation

As with information, the groups people participated in were highly related to their past experience with gas development, perspectives about development, and attitudes towards environmental issues. Regardless of location in the region, those with pro-industry and pro-economic development perspectives tended to participate in and identify with economic development oriented task forces and other groups whose aims were to maximize economic development or support the gas industry. Their perspectives tended to distrust environmental perspectives, discount issues of distributive justice and hazard, and focused more on the gains to be made through development of the shale. Many participant in this study noted actively seeking ways to capitalize on shale development, showing levels of entrepreneurialism and risk seeking in attempting to tap into the development occurring within the region.

Those with locality-oriented perspectives tended to favor environmental groups or groups whose goals were broader and focused on more than just economic development (Jersey Shore Circle; Coudersport Circle; Clearfield Circle). Participants with these perspectives identified more with distributive justice issues, albeit with recognition of the other side of the story and a tendency to favor communication, cooperation, and trust in their areas. Risks were seen as real but perhaps not insurmountable, and indeed, many participants in this category identified hazards in respect to some issues and opportunities and benefits related to Marcellus development in other areas.

Those with intense environmental perspectives tended to be active in groups whose aim was to stop drilling or to lobby government agencies for stricter standards and regulations for drilling in the state (Jersey Shore Circle; Coudersport Circle; Clearfield
Circle; Clarion Circle). These participants distrusted industry perspectives and tended to see risks inherent in environmental issues overriding local development issues. They also tended to be more inclined to support locality-focused initiative toward addressing issues related to distributive justice, tolerance, and communion.

**Identity**

Key to cooperation, trust, and communication across groups within an area and across levels of the panarchy is a shared identity. The most obvious connection for all participants would reside in the concept of the Pennsylvania Wilds. However, not including the first focus group, only three of the KIs and 30 discussion circle participants (4-5 per circle) even mentioned the Pennsylvania Wilds in their responses. When the Wilds were identified, it was in relation to the economic impacts that Marcellus Shale might bring to the region’s tourism infrastructure, not as a source of regional pride or identification. It appears that the Pennsylvania Wilds, while potentially successful as a top-down, economic development driven regional branding agent, is not as successful as a regional identity people would consider as their own.

Largely, participants identified with the communities they came from and the areas their groups worked in. For some participants, these areas were towns, some were watersheds, and others were counties. In several instances, participants identified with the region their particular association or group was set up to administer or address, whether environmental (Clearfield focus group; Coudersport Circle), industry (Warren, Clarion, and DuBois Circles) or neutral (Cameron KI01). These boundaries served as the focus of

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9 Key informants were asked directly about the Pennsylvania Wilds in the opening interview question; discussion circle participants were introduced to the Pennsylvania Wilds concept as the location for the study but were not asked directly about the region.
their responses, with issues, barriers, and opportunities focused around what they have seen and/or heard occurring within their home place.

For some participants, the level of the panarchy they were involved in and identified with influenced the problems they saw as existing. For instance, one participant, who worked for a regional association covering parts of several counties in the Wilds, tended to identify regional issues rather than local in their responses (Coudersport Circle). Others who were involved at the local municipal level tended to focus on issues at this level and seemed uninterested in larger county and regional issues emerging in response to Marcellus Shale development (Clearfield KI02; ClintonKI01; McKeanKI01). While identity helped them understand and comprehend the issues happening at their particular level, it kept them from thinking about problems and issues beyond what they normally deal with.

Identity emerged in another way as well, that related to risks and risk distributions. Those who self-identified as pro-industry and pro-environmental tended to identify with risks and hazards differently. Pro-industry residents seemed to be less risk adverse and tended to see hazards from drilling as a voluntary risk instead of an imposed risk (Clarion Circle; Warren Circle; DuBois Circle). This is in keeping with the common use of risk comparison to categorize risks from shale drilling and to minimize the hazards to community well-being identified by divergent opinions. This is also in keeping with their proclivity to seek out and self-select into groups and organizations which supported these perspectives and promoted the growth of the industry in the state.

On the other end of the spectrum, pro-environmental perspectives tended to identify with risks and hazards as imposed, involuntary hazards with unacceptable
consequences for local communities (Jersey Shore Circle; ElkKI01). They tended to use risk as a metaphor to discuss the unknown and the dread related to the process of development. They identified and self-selected into groups which address locality and environmental issues while at the same time disregarded the information expressed by pro-industry groups. In this case, the common identity resided in groups with similar viewpoints.

In the middle of these two groups were participants whose identities were keyed to their locality rather than to pro-industry or pro-environmental perspectives (Coudersport Circle; TiogaKI02). Their identity was more about the place they lived in and the impacts to quality of life and sense of place than about environmental protection or economic development. They used risk as a balancing agent, balancing the good and bad between the overall perspective of community that they saw in their place. While not as numerically great as the other two perspectives, they provided an important counterpoint to the two more extremes.

**Community and Regional Community Fields**

Self-identified participation in local social fields indicates that most of the groups focus on specific, locality-relevant issues. Participation in county-based groups tended to focus on county-based issues. Most environmental groups realized the extent of interconnectedness of the impacts they were seeing, but their lack of influence and resources prevented them from working beyond their pre-determined boundaries. Most economically focused groups, on the other hand, were geared toward gathering jobs and development for their county or place, and as such, were nearly defiant about the idea of working across county boundaries. Indeed, it seemed in some cases years of fighting
other groups for scarce resources created boundaries which the development of the Marcellus Shale seemed poised to strengthen.

Participants did not discuss much of the nature of intercommunication and cooperation across their groups. Discussion of regional cooperation was limited to preexisting agencies and non-profit groups and the work that they did. Watershed groups seemed to provide the broadest sense of regional identity and cooperation; however, participants did not discuss these groups to any degree. Some participants did mention that their group had contacted other groups in the surrounding region to see what kind of issues they have seen and heard about. Some noted getting information about meetings and presentations from other groups and organizations. Many responded favorably to shared responses about cooperation and discourse, especially those that helped to increase local capacity to address issues related to Marcellus shale development.

**Chapter Summary**

This section summarized the key findings of eighteen months of attendance and observation of meetings, experience with 6 facilitated discussion circles, 2 focus groups, and 15 key informant interviews (together accounting for 165 participants), and review of over 1,700 newspaper and internet news articles, blog entries, RSS feeds, and other forms of secondary information. The information discussed in this chapter addressed the four research questions outlined in Chapter 3. With biophysical, sociocultural, and sociodemographic trends established and information on the perspectives created by them

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10 RSS stands for Really Simple Syndication. RSS feeds are collections of news items, blog entries, or other small packages of information to which someone subscribes using services found in web browsers or in special stand along programs. RSS feeds update themselves automatically whenever new content is published.
outlined, the following chapter reflects on the implication of this information for resilience. It revisits this information through the lenses of risk, the adaptive cycle, and social fields. What emerges is a reframing of the issues related to Marcellus Shale development, pointing to the importance of resilience and how it can be applied to understanding broader social, environmental, and cultural impacts throughout the region.
Chapter 7: Discussion and Conclusion

This dissertation has reviewed the biophysical, sociocultural, and sociodemographic characteristics of the region of Pennsylvania known as the Pennsylvania Wilds and the response of its residents to the development of Marcellus Shale. Following my conceptual model of community resilience, the research goal of this dissertation was to understand key issues – real or perceived – about Marcellus Shale development, to understand how these perceptions led stakeholders to take action, how these actions emerged within local places, and whether and how these actions continued to emerge at the regional scale. Discourse analysis, group observation, group discussions, and key informant interviews were used to provide guidance for understanding these issues.

Revisiting Risk and Marcellus Shale Development

As shown in Chapter 6, much of the perceptions, discourse, and dialogue related to Marcellus Shale development revolved around issues related to risk – to human health, the environment, community development, economic gains, quality of life, and sense of place. The perspectives discussed by local residents provided a window into the things they valued, their cultures, and the places they lived. It also detailed whether, how, and why they took action.

Such perspectives are critical because they provided the foundation through which people approached risk (Kahneman and Tversky 2005). As noted previously, those who tended to choose a “sure” thing over a risky enterprise were said to be risk adverse. Put in the context of resilience and adaptive cycles, a risk adverse person might be a K-strategist firmly centered in the conservation phase of a system in which they are heavily invested.
On the other hand, people who chose to take the risk rather than rely on the “sure” thing were viewed as less risk adverse or risk seekers. Entrepreneurs are often seen to be risk takers through the investment of capital toward a goal which may or may not come to fruition. Voluntary risks, regardless of personal level of risk averseness/risk seeking, create substantively different reactions than those risks imposed on individuals by outside interests (Sandman 2010). In many respects, the Marcellus Shale development problems and issues noted in Chapter 6 emerged at the crossroads of involuntary/voluntary risk and risk aversion/risk seeking actions among individuals.

The majority of the issues in Appendix E related to some level of risk which, in turn, varied from issue to issue and person to person. Issues related to the development of gas wells (land disturbance, water issues, releases, spills, traffic, etc.) were voluntary for landowners who signed the lease to have the gas well but were involuntary for everyone else. As noted by Slovic and others, the perception of involuntariness of a risk is due more to a loss of control, a dread of potential harm, catastrophes, accidents, etc., and a distrust of people who make decisions guiding these processes.

Regardless of the driving force behind the perception of involuntariness, which was not tested in this research, the fact that many people experience a detriment without direct gain means these exposures are still voluntary. For example, local traffic was an involuntary risk noted by many participants. Everyone, regardless of whether they had a lease or enjoyed financial gain, had to deal with increased traffic, traffic jams, and traffic accidents. The same could be said of taxes, school enrollment, sewer and water system expansions, and other service expansions essential to address population increases. Such
involuntary risk affects certain populations much more than others, especially those with low and/or fixed incomes and retirees.

Some participants were able to take these involuntary risks and turn them into voluntary risks. For example, several participants noted being able to take local impacts and turn them into opportunities for personal business expansion or entrepreneurial activity. Thus, what was initially an impact to them turned out to be a gain in they were able to establish a niche in their locality to address a particular deficiency.

Upon analysis, most of the communication breakdowns occurring between gas industry representatives, local leaders, and the public were rooted in perceptions of voluntary versus involuntary risks and in some respects, differing levels of risk averseness. Engineers, geologists, biologists, economists, and others tied to gas development tended to speak in terms of absolute risks, or those risks truly attributable to a particular substance, activity, event, or procedure. Many regional industry supporters took the perspective that if something was to occur, science or government would be able to solve the problem; moreover, most felt the overall risks were minimal in relation to the gains. They saw the overall results of increased wealth and growth in the state as worth any potential risks to social and environmental systems that occurred, and tended to oppose or dismiss any information that pointed out the risks and concerns tied to well development and gas extraction. In essence, they were ρ-strategists for development of Marcellus Shale.

Those who opposed drilling, on the other hand, tended to see risks in terms of the effects on their quality of life, health, and environment. They framed their averseness based on these factors. They tended to dismiss epidemiological evidence as
underdeveloped and called for and supported more thorough studies of chemicals, processes, and procedures prior to implementation. Likewise, they tended to see reports supported by the industry as buy-offs of agency and institutional staff to promote the agenda of the industry. In this respect, the fact many of the risks were involuntary furthered their resolve to stand fast against development. These folks can be thought of as K-strategists who were trying to conserve a specific way of life from the imposition of involuntary risks on them.

Those leery of drilling but who wanted their communities to benefit from gas-related development tended to land somewhere in between. They tended to balance the risks related to development against the risks to human health, the environment, and the economy, and tried to strike a balance. While risk adverse about some aspects of gas development (such as its impacts on water quality), they could also be risk seekers in terms of trying to promote environmentally friendly drilling practices. These residents realized drilling was going to occur for quite a long time, and were attempting to move the dialogue toward a long-term, balanced approach to community development capable of benefitting many. Their pragmatic approach tended to balance the risk adverseness of gas development impacts with the risk seeking (and in some instances, risk taking) behavior needed to maintain a vibrant and health community.

**Resilience and Adaptive Cycles in the Wilds**

It is clear that the communities in the Pennsylvania Wilds are in various phases of the adaptive cycle. Some communities have experienced threshold exceeding events, such as the loss of Sylvania in Emporium and the loss of jobs in the timber and powdered metals industries, and are in currently still in the process of trying to adapt and adjust to
these impacts. Other communities have experienced relatively little change since the collapse of the timber and rail industries in the early 1900s, and continue to exist in a relatively stable state, albeit with less people.

Marcellus Shale has created another threshold-inducing event, resulting in a release which in some cases may be good and in others bad. For instance, in places where jobs have recently been lost, development of shale gas represents a possible avenue to rebuild lost populations and local economies. In others, the introduction of shale gas development has upset local qualities of life and is leading toward factioning of communities.

It is within this factioning that issues of community well-being, particularly distributive justice, open communication, tolerance, collective action, and communion, emerge. As seen in the circle participant and key informant discussions, these issues are creating interactions between residents, many of which are leading to the concerns listed in Appendix E. The distribution of risks, whether voluntary or involuntary, are not seen as being evenly or justly distributed. Open communication and tolerance issues are noted in how industry supporters and environmental groups describe interactions with each other. Collective action to address the Appendix D concerns seems unlikely as there is little agreement on whose problems they really are: the industries or the communities? Finally, with a lack of trust, cooperation, and communication between residents, there seems little room for communion within the localities described by the participants.

In some respects, the expressions of identity within this research are also indicative of the potential formation of irreconcilable factions within localities. The lack of identification of local organizations as dealing with Marcellus Shale issues was
surprising and in some respects, unexpected. Many of the issues noted by participants are related to very basic local needs – healthcare, emergency services, infrastructure, etc. – but participants did not make this connection for whatever reason. Whether these are being addressed externally to municipalities (i.e. by county or state governments) or whether these resources are so ubiquitous they do not come to the forefront is a question for future research.

The lack of identification with the Pennsylvania Wilds is also surprising. Even though KIs were asked this directly, they did not identify with this description. Likewise, group participants, though not prompted to, also did not identify with the Pennsylvania Wilds region. The initiative, however, was identified as an economic concern, and thus may be a way to provide a shared identity to the region and its residents as it continues to mature.

The relatively strong self-identification with industry and environmental groups is telling of the conflicts emerging within the Pennsylvania Wilds region. The factioning of local populations into groups appears to be creating diverging sets of perspectives on how best to address the issues emerging locally and regionally. These divergent opinions, which, from the data collected in this research, appear to be related to culture, prior experience with the gas industry and gas development, and personal ideologies and philosophies, appear to be creating vying policy positions.

As these positions grow and coalesce around perceptions of shale development, they have the potential to emerge as alternatives from which policy makers choose. Whether these divergent opinions can be brought together in an expression of interactive capacity, or whether they will prevent meaningful interaction from occurring appears to
be dependent on the level of trust, communication, cooperation, and information sharing these groups do in the renewal (planning) and growth/exploitation (policy alternative selection) phases of the adaptive cycle.

Regardless of the positions residents took, it was clear Marcellus Shale development represented a release across multiple levels of the panarchy. Its emergence as an economic, social, and ecological force created ripple effects at multiple levels of society, from impacts in local towns to legal and legislative maneuvering at the county, state, and national levels. Local zoning efforts in southwestern Pennsylvania, which created a number of Pennsylvania Supreme Court cases denoting local planning authorities and limits to the Pennsylvania Municipalities Planning Code, has sparked recent legislation to give natural gas development a use by right designation throughout the state (PCN 2010a; 2010b). This designation would make gas development an allowable land use within all land use classes. Therefore, a gas company could drill for gas in a zoned residential district without any local input or zoning hearings. In effect, a revolt at the local level (zoning requirements regarding drilling) caused an adaptation to occur at the state level (court cases and legislation). The proposed legislation, if passed, would act as a form of remembrance, the state level placing strict boundaries on what people may or may not do at the county or municipal level, in effect stabilizing zoning across the state while at the same time potentially creating revolts in other levels of the panarchy.

These potential areas of conflict emerging from panarchical interactions can be found in participant’s discussions. Varying levels of trust among levels of government are an indication of the strength of remembrance between levels. Some of the issues
noted in Appendix E are related to issues among family members, between friends, and between colleagues. Other issues are related to competition among localities and municipalities as they vie to gain access to jobs and revenue from gas development.

**Using Risk to Reframe the Conceptual Model within the Adaptive Cycle**

In some aspects, the risks associated with Marcellus Shale were pushing residents of the region to take one action or another, whether individually or through groups and associations; thusly, risk emerged as a critical factor in understanding resilience in local communities. As discussed in Chapter 2, Peter Sandman (2010) defines risk as the actual hazard and the outrage that emerged in response to the management of that hazard. This corresponds nicely to a phrase penned by Thomas and Thomas (1928, p.572), which has become known, perhaps incorrectly, the Thomas Theorem (Merton 1995): “if men define situations as real, they are real in their consequences”. The difference in perception between voluntary and involuntary risks is based in outrage – the hazard was essentially the same. If people perceived problems with Marcellus Shale development, then, these problems became real and manifested themselves in new and interesting ways. From these perceptions, and the outrage that emerged, we found purchase for actions based on varying levels of risk averseness in community development.

Placing such information within the study’s conceptual model, and the adaptive cycle model discussed in Chapter 3, a better understanding of interaction and resilience in terms of development, a Risk-Based Interactional Adaptive Cycle, emerged (see Figure 7.1). The core components of the adaptive cycle outlined in Figure 3.2 – thresholds,

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11 As Merton points out, the theorem is usually only attributed to William I. Thomas. However, the book it is quoted from, “The Child in America: Behavior Problems and Programs”, was actually co-authored by Thomas’s Wife, Dorothy Swain Thomas. Merton provides his perspective on why this occurs and continues to occur. At any rate, this “Mythic Fact” (Maines, Bridger, and Ulmer 1996) continues to be carried forth in many publications to this day.
Figure 7.1: Risk-based Interactional Adaptive Cycle
community well-being, adaptive capacity, and community fields—lied in their respective corners as components of the different adaptive phases. Now, I have added to the model risk and the factors that lead communities toward open or closed systems.

When change resulting in release\textsuperscript{12} occurs, the first gate passed through is whether the risk was voluntary or involuntary. Differences in risk exposure and/or perception, as detailed previously, create a branching of the path as residents combine into groups of similar interests. Those who took on risks voluntarily fell in one path of risk perception generation. Those involuntarily exposed to risks moved initially in one path toward risk perception. However, in some cases, people exposed to risk involuntarily chose to take advantage of this opportunity and engage in risk seeking behavior (such as entrepreneurialism). This risk seeking or taking activity placed them along a similar trajectory as those who sought the risk out in the first place.

After exposure to the risk (release causing event), perceptions of change and response emerged. These perceptions were framed by culture, experience, and philosophical standings, which could be similar to or different from others exposed to the same risk. It is during this planning stage that the antecedents for community well-being—distributive justice, open communication, tolerance, collective action, and communion—are defined and integrated (or not integrated) into the renewal plan for the community. The divergent risk perceptions noted in this research seem to be creating two different perspectives on how best to integrate community well-being into policy planning and policy alternatives. Issues of trust, cooperation, communication, and information sharing

\textsuperscript{12} It is important to note that the release may be in response to a risk-causing event or the perceived or actual risk itself, regardless of the event.
thus form the next gateway through which community well-being is to be negotiated into policy possibilities through the processes inherent in interactive capacity.

As framed by the conceptual model, the pathway emerging from the implementation of trust, communication, cooperation, and information sharing – and the resulting interactional capacity - ultimately determines whether the locality becomes an open or closed system. Interactive capacity was a central component of the system at this point, as it provided the community the ability to sort through, select from, and begin the process of implementing policies. If community well-being was strong and emerged within the interactive capacity of the community, the system should emerge with more resilience than where resilience was lower, reflecting extant barriers to interaction and well-being.

**System Exits and New Adaptive Cycles**

The adaptive cycle is non-linear and subject to perturbations which cause the system to exit the cycle. Systems exit cycles for two basic reasons – the complete collapse of the system or the establishment of a new system and new adaptive cycle. The most obvious place for divergence from the adaptive cycle is at the point of system release, or the threshold. If a threshold was passed by a significant event (i.e., a natural hazard such as a hurricane or a human-made event such as a nuclear plant meltdown), the system may be so impacted a new adaptive cycle begins, or, if the system dies, no adaptation will take place.

Exits also occurred at stages of renewal and growth. If, during the renewal phase, it was determined the system could no longer function as designed, a new adaptive cycle could emerge. Likewise, during the growth phase, new information or changes may occur.
capable of pushing the system into a new system state and, thus, a new adaptive cycle. Except in the most extreme cases, such as those resulting in ghost towns, a new adaptive cycle should emerge from any exit from an older system.

The adaptive cycle could also jump track and restart within the phases, as demonstrated in Figure 7.1. For instance, a release inducing risk could be such that a series of shocks hits a system, causing it to be stuck in a feedback loop that causes further releases to occur. If, during the renewal phase, dissonance was too high to stimulate the finding of common ground, the system could be thrust back into a release phase. In addition, if during the growth phase a system cannot choose from policy alternatives or if planning and organizing missed a major sector of the locality’s population, a new phase of planning and renewal might occur. In essence, the passing of the proposed legislation regarding local municipal planning could cause many communities to jump phases in their planning and zoning adaptations to shale development.

**Resilience and Community Development**

Resilience in response to one event may not lead to resilience in response to another. A strong community identity built through the development of community fields and interactional capacity for one issue might have little bearing on the outcome of another. What resilience does do, through the connection of people to each other and through the potential to pool resources together, is increase the size of the threshold-inducing event needed to cause a release much larger than it would have previously.

Resilience also does not necessarily mean that the outcome of the development of interactive capacity or a community field is necessarily good for the residents of a particular locality. Indeed, from many perspectives it might not be. However, it is the
process that is of concern for community well-being, interactive capacity, and community field emergence, not the end product. If the process brings people together, gives them a common identity for which they take action, and puts in place networks and resource from which they can draw from in future instances, community development has occurred (Wilkinson 1995).

Considering the nature of the panarchies – the relationship between adaptive cycles across different levels – within a community and within which the community exists, it was easy to see that the adaptive cycle was constantly occurring, changing, and adapting in response to changes at higher and lower levels. The phases of adaptation a community is operating within may be shifted due to outside pressures (such as through policy or legislation). Truly open and flexible communities were capable take advantage of such ongoing adaptations within the panarchy, and utilized them to promote social, environmental, and economic well-being. These systems recognize the duality that actors are sometimes placed in and enables them to manage those conflicts. Closed and rigid systems, on the other hand, resisted the changes and adaptations resilience required; such systems chose to take a stand on a particular conservation phase within which the community developed.

In reality, all communities are found somewhere in between – they are closed in some respects and open in others. They are all in some stage of adaptation. These are important to consider because, as this research has demonstrated, risk and perceptions of development can lead people to be more risk adverse in some instances and more risk seeking in others. This, in turn, leads to interactions out of which associations emerge,
which in turn, can determine the fate of the emergence of the community field at local and regional levels.

**Role of Specialists in the Risk-Based Interactive Adaptive Cycle**

The role of actors is important in certain phases of the risk-based interactive adaptive cycle. As noted in the literature and in the conceptual model, individuals and groups can play different roles in different phases of development. Two types of specialists emerge: $\rho$-strategists and K-strategist. $\rho$-strategists emerge during the rapid growth and exploitation phases and take the released potential of the systems (in the community case, capital) and apply them toward establishing a new order in the system. K-strategists, on the other hand, work to maintain the stability of the conservation phase. This can be through policy implementation (bureaucrats) or through establishment of local associations.

In many respects, the differences between voluntary and involuntary risk tracks of risk response are related to the type of specialist one is in the adaptive cycle. Participants who are less risk adverse and welcome the changes brought on by gas development are seeking ways to take the changes initiated by the Marcellus induced release and turn them into opportunity for growth. In this respect, these actors are taking $\rho$-strategists positions within the adaptive cycle and are attempting to move the system from release into a new level of conservation. Those in the more risk adverse category who see the change and exposure as unacceptable seem to identify the pre-Marcellus phase as a time of stability. In many respects, they are attempting to bring the system back to the old stability of the system prior to Marcellus development.
However, the roles change depending on the topic. Those who are pro-Marcellus take positions K-strategists of the old system when resisting changes to bureaucratic systems and introduction of new regulations to address new issues not covered by current policy. Those who are more environmentally prone take positions of ρ-strategists when advocating for policy to address new issues not covered in the old system. In some respects, those who are pro-development but caution about its implementation are ρ-strategists in one case and K-strategists in the other.

These contextual dualities point to multiple adaptive cycles occurring within a locality at the same time. Different actors might have different perspectives on community well-being at different phases of the adaptive cycle, which might force them to make an “exit” from their own personal adaptive cycle. They might seek out others with similar perspectives – creating and forming new associations which then interact in addressing these contextual dualities and relationships. In some respects, this was apparent in the self-identification of some participants in relation to both environmental and industry interests. These fluctuations in personal adaptive cycles are an important aspect of panarchy and panarchical relationships and are important when looking at risk and risk-based perception of Marcellus Shale development.

The Interaction of Perspective, Information, and Participation: The Vanna White Effect

As was seen in Chapter 6, perceptions of Marcellus Shale development have a significant impact on the information residents choose to believe and utilize in making decisions in their communities. As demonstrated, those with pro-industry or pro-growth attitudes tended to focus on information and participated in groups supporting natural gas
development in the state. They tended to discount or even rail against perspectives held by those with beliefs counter to their own. This also happened in the opposite direction, with anti-industry and environmental interests discounting the information of their antagonists. Those who favored cautious development or who wanted development with responsible stewardship, essentially those in the middle, pooled information from both groups in an attempt to understand what was occurring in their area.

In all three instances, it appeared each of the groups operated with what Chadwick (2002) termed the “Vanna White Effect”. The Vanna White Effect, metaphorically speaking, occurred when we are given the beginning and ending letter of a word. Each of us then becomes Vanna White, filling in missing information between the first and last letters in an attempt to figure out what the word is. While there are many possible combinations of letters which could be placed within the puzzle, there is only one correct combination.

In terms of Marcellus Shale development and information, there was a finite amount of information available to people from both ends of the spectrum (pro- vs. anti-industry), leaving gigantic information gaps between. People filled these gaps with information, misinformation, hearsay, gossip, rumors, and common knowledge. In this process, they created the Vanna White Effect – numerous possible outcomes, problems, issues, concerns, and benefits, etc. – many of which may or may not ever become true.

One major and unfortunate consequence of the Vanna White Effect was that much of the conflict and distrust discussed by residents was based on essentially half-truths. It appeared the story contained some but not all of the appropriate letters. Risk seekers and risk avoiders, ρ-strategists and K-strategists, each operated within a vacuum based on
their particular worldview. Faced with boundaries created by partial, biased, or missing information, system resilience was undermined and, at the very least, faced significant barriers. How can we move past the *Vanna White Effect*, the lack of communication, cooperation, information sharing, and trust between groups, and the potential for conflict which will reduce adaptive capacity and redefine the arguments surrounding Marcellus Shale development?

**Redefining the Marcellus Argument**

As with the *Vanna White Effect*, a good place to start is to examine the letters given to us and then begin to place more letters in the puzzle. Reframing the arguments surrounding Marcellus Shale development required a more objective examination of the issues noted in Appendix E. Doing this would gain us access to more letter combinations from which to work. One way to do begin this process is to ask if the issues listed in Appendix E would be different if a major industrial project, such as a landfill, a cluster of industrial development, or wind farms, were proposed to be put in place. If an item on the list was something only occurring with development of Marcellus Shale (or gas in general), it would be placed in one category. If an issue occurred regardless of the type of development it was related to, it would go in another category. If an issue happened in any industrial development but was extremely influenced by Marcellus Shale development, it would go in a third category. Sorting this way created a very different puzzle. Using this approach, the items in the larger list could be categorized as follows:

1. Issues directly related to Marcellus Shale development; or
2. Issues related to local planning, zoning, governance, and assets; or
3. Issues that are an interaction of Marcellus Shale development and Local Governance.

When the issues were reframed in such a manner, some surprising things emerged (see Appendix F). First, when the grand scope of issues was considered, very few were directly attributable to Marcellus Shale development, per se. Any industrial process carried with it a variety of risks, and Marcellus Shale development was no different. Water quality and quantity, land disturbance for pipelines, NORM/TNORM, and drilling waste disposal were all hallmarks of gas development. However, many of the issues people blamed on gas development – particularly social, community, and environmental impacts – fell into a different category because they emerged in response to many major industrial projects.

Community-only issues were the second largest group of impacts. Many of these issues fell into issues of governance, scale, and capacity. Planning for large scale land use changes, addressing critical infrastructure impacts and use changes, and controlling the rate, timing, and location of change related to expanded populations were all directly controllable by communities and governments. Marcellus Shale development had increased the intensity and timing of these issues, and in many respects, forced communities to plan for and deal with issues they never imagined.

The largest list, issues positioned in the nexus between Marcellus development and local governance, were tricky because on the surface they seemed simple. For instance, increased demand for housing and housing units and the resultant escalation in rental rates and real estate prices seemed solely caused by the gas industry, the population growth it brought, and forces of the market. However, when examining housing as a
function of local planning and development, housing changes also became a partial function of local governance. That available, non-seasonal or vacant housing stock was low reflected a lack of planning for potential expansion of large-scale population growth because, for the most part, populations in this region have remained flat or declined over the past seventy years. Further, part of the emerging housing crisis identified by some residents was due to short-term profit seeking on the part of property owners and developers without an eye toward the larger, long-term consequences of these actions on the locality.

Many of these dualities also played out in other situations, such as emergency services, water and sewer, service provision, and wages and payroll. Placing the blame for these issues solely on local communities was unfair. As seen in the demographic and economic trends outlined earlier, the populations and economies in the Pennsylvania Wilds counties have been either stagnant or declining with few exceptions since the last resource development booms of the late 1800s/early 1900s. As a result, many communities likely thought they would never see growth and development at this scale again. State planning also was somewhat circumspect, with decreasing funds and assistance for counties and local municipalities reducing their capacity to deal with new and emerging changes. In many respects, Marcellus Shale development was a catalyst that exposed the shortcomings of the communities where it was occurring.

It was also important to understand the importance of the relationship between levels of the panarchy in creating many of these problems. A majority of the changes occurring from Marcellus Shale development occurred at the lower, faster levels. Unfortunately, the tools needed to deal with change at the lower, local levels, have been
reserved for other levels of the panarchy (i.e., state government control and oversight of drilling) or are prevented from being used through underfunding or understaffing (i.e., DCED local planning assistance). The lack of these tools at the lower levels was causing distrust of the upper levels, which, in turn, fed back into the perceptions that local residents had of government and local leaders. Overall, events within the panarchy, as it related to Marcellus Shale development, were pushing the system toward dissonance and conflict, especially in terms of intergovernmental relationships. This, in turn, has significant import for the emergence of community fields within and across the region.

It could be argued many of the issues in Appendix F could be sorted into one category or another. What is important was not which category the issue was sorted into, but rather the fact the items could be broken down into actual responsibility for the issue or concern rather than perceived responsibility for the issue. When the list of community responsibilities is compared to issues with interactive responsibility, it became apparent many of the issues could be addressed by dealing with them at the local level. Effective community growth could be seen as a function of effective planning at local and regional scales and as a function of effective responsibility distribution across these same scales – in other words, of effective interactional capacity.

However, as seen in the analysis of discussion circle and key informant issues, the perceptions of many individuals ran counter to the seeming necessity of planning and responsible development. The overall effect of information, trust, communication, and cooperation framing the emergence of risk perception and interactions led to uneven adaptability across the Pennsylvania Wilds. Some localities had hit release and moved quickly into conservation. Some localities are stuck in the release or renewal phases,
trying to move toward growth and potential stability. Others were stuck in a conservation mode and had not experienced any releases. Thus, those individuals living within such areas had differentiated perspectives on development and the need for planning, capacity building, and governance. How, then, can discussions be moved from those counter to effective cooperation, planning, and development toward those supportive of collaboration, communication, and trust? An important place, as noted here, is where individuals interact to form social fields.

**Community and Regional Community Field Emergence**

Pro-gas development organizations, watershed groups, local non-profits, local health agencies, and other groups are all forms of social fields. As seen, social fields were slowly emerging in response to Marcellus Shale development. However, very few currently qualified as community fields. Many narrowly focused on specific interests and were not open and inclusive for all community members. There was some potential for community fields to emerge throughout the region, but it was too early to tell if these groups would emerge as true community fields.

Could the same be said for regional community fields? The information gathered in this report indicated the potential existed for regional community fields to emerge at the county level. Several groups stood out in this manner. The Potter County Natural Gas Task Force was one such group that had the potential to become a regional community field. The group was open and inclusive to all residents and groups of the county, and served as a forum for open communication and dialogue to occur.

Beyond within county cooperation, there seemed to be little indication regional community fields would emerge across a broader region in the near future. The
Pennsylvania Wilds Planning Team represented the lone possible field from which regional community field to emerge. Currently, there were too many barriers to be overcome within the region, including:

- Strong local identity and lack of regional identity
- Cultural differences across the region
- Variance in previous experience with gas development
- Pennsylvania’s governmental structure and problems created by it
- Competition for economic development and jobs within and between counties
- Differing levels of development and intensity of buildup.

Many of the same barriers preventing the formation of local community fields can also be seen as barriers for the formation of regional community fields. These barriers were formidable and in many respects pointed to the various stages of adaptive cycles across space and time. Some were related to conservation of existing systems in face of change. Others were related to the renewal phase of development and limited the options available to communities in moving forward. Some were related to change in fast systems and the tensions created between the lower system and the slower moving, more stable upper systems. Some emerged from the opposite (change in higher systems influencing lower systems). Overall, it appeared the disarray of the panarchy as it currently stood in terms of uneven ability to work through the adaptive cycle would prevent effective cross-boundary cooperation, communication, trust, and information sharing in the short and long-term.

However, some of these issues might be overcome through reframing the discussion as suggested here. Does every county need to be a headquarters for a gas
company? Does every county need to have staging yards and infrastructure built to support major gas operations? Is every county going to have gas developed within it? Does every county need to house every type of support industry? Currently, economic development strategies within the Commonwealth force counties to compete with each other in an effort to maximize jobs and economic investment. The boundary maintenance created by this process results in very difficult barriers to overcome. Such barriers essentially precluded the type of cross county cooperation necessary for regional community fields to emerge on broader scale.

This is important because many of the issues identified related to Marcellus Development were regional in nature. Ecosystem impacts, especially to endangered or threatened species, will affect the region across local municipal and county lines. Water quality and quantity affects will similarly influence the course of local development for years to come. Transportation, housing, and other forms of infrastructure will require close, cross county cooperation and planning. Integration of the risk seeking, risk adverse, and conditional risk perspectives of the residents of the region will help to provide a clear, consistent voice for the quality of life resonant with the Pennsylvania Wilds region. As long as policy continues to push communities to build barriers around economic development, culture, and assets, community, as it has been defined here, will face significant hurdles for emergence.

**Resilience and Community Well-Being: Policy Implications for the Marcellus**

As discussed in Chapter 6, perceptions of Marcellus Shale development were varied and nuanced, forming around social, environmental, and economic indicators. Perceptions were influenced by prior experience with natural gas development, political
philosophies, and proximity to Marcellus Shale development. These perceptions guided the groups, organizations, and other individuals residents interacted with and the information sources from which they sought guidance. Perceptions, interactions, and the information access bounding the two helped identify potentials for miscommunication, a critical barrier to both social well-being and the formation of community fields at any level or scale.

Interactions emerging in response to Marcellus Shale development illuminated local practices of taking information and putting it to use within and across communities, counties, and regions. This informed the adaptive cycle in several ways. First, it allowed us to locate the loop path of a particular perspective. That is, it allowed us to see if the perspective was based around the preservation of an old, closed system (K-phase oriented), whether it endorsed the creation of a new, open system (Ω-phase oriented), or whether it represented the emergence of a particular viewpoint or resource use in the reorganization of an existing system (α- or ρ-phase oriented). Second, interactions helped identify networks of action and information, which in turn highlighted whether a group was open and interested in addressing multiple needs and issues across a community (a community field) or whether it is simply engaged in fields directly benefitting themselves, sometimes at the expense of others (a special interest group). Third, identifying networks of interactions helps in the understanding of where community fields could emerge in response to Marcellus Shale development.

With the continually changing nature of Marcellus development and its influence at local, county, regional, and state levels, new and innovative approaches to dealing with impacts and opportunities are needed. These approaches need to inform resilience – the
ability to absorb change and still maintain function - within communities as well as provide an avenue through which adaptation to change could occur. These approaches also needed to break down barriers to the emergence of well-being and community. Following the theoretical model and data collected in this dissertation, the ensuing discussion revolves around how these ideals might be fostered within and across communities of the Pennsylvania Wilds.

On the basis of the conceptual model used here (Figure 3.3), it is clear much of the information expressed by residents in the region pointed towards the emergence of dissonance within the Pennsylvania Wilds region. In a few instances, such as the aforementioned Potter County Task Force, consensus was emerging. In other cases, consensus appeared to be emerging from dissonance, as was the case with the emergence of a visioning effort in Tioga County. Regardless, it was more likely resilience and/or consensus was emerging at differing levels of the panarchy in differing ways spatially and temporally.

Several policy and practice implications emerged around resilience and the build-out of the conceptual model. First and foremost was the recognition that quality of life was a key and essential ingredient of life in Pennsylvania generally, the Pennsylvania Wilds more specifically, and in the counties, towns, and villages that made up the state. The forests and streams, towns and villages, rolling landscape, and cut valleys all are threatened by transformations tied to the development of Marcellus Shale. The aesthetic variable of quality of life may be the most important but oft forgotten threshold variable for the state of the system. In Pennsylvania Wilds concept, in essence, celebrated this quality of life, albeit from an economic development perspective. Development of the
Marcellus Shale was a threat to the established quality of life, or conservation phase, for three-quarters of the state. Marcellus Shale development also presented an opportunity to reinforce the quality of life that attracted people to the state and its regions. It could provide many with the financial means to reinvigorate local philanthropy, place new lands in long-term conservation easements, redevelop downtowns, and improve roadways and infrastructure. The key, as has been stressed throughout, was to develop resilience and interactive capacity within communities and regions to be able to absorb to and adapt to change as releases, such as Marcellus Shale, occur.

Local communities must be assisted in developing the tools needed to be able to deal with short-term rapid growth and development as well as the tools needed to be able to think and plan for the long-term. Communities that are closed or rigid need to gain experience from other communities in the panarchy. Regional community fields might be one avenue for this to occur. Open and flexible communities need to develop the capacity to stay that way through developing their interactive capacity. Likewise, government agencies need to learn flexibility to adapt to change and promote these abilities in lower levels of the panarchy.

Unfortunately, reduced funding for planning and governmental support has hindered the ability of local governments to deal with the changes associated with Marcellus Shale development. Cultural barriers to planning and zoning must be addressed and new and innovative ways of planning must emerge. Short-term development must be balanced against the broader, long-term quality of life and be inclusive of the needs and impacts it brought to all people of the town, county, and region. Regional planning should be given additional emphasis and cooperation fostered between counties for
development instead of competition to gain access to the most jobs, companies, and infrastructure. Planning should include the development of human capital for more than just plugging and playing into specific jobs or industries.

Effective risk communication, management, and education should be implemented throughout the region and state. Reframing issues in terms of voluntary versus involuntary risks would help local leaders, residents, and industry representatives better understand the basic viewpoints of all sides of an issue while helping them find a common middle ground from which new discussions could move forward. Unbiased, realistic education about the risks, uncertainties, and realities of gas drilling – the hazards and outrages – should also be encouraged. Non-partisan risk information and education programs should be instituted. These programs should include epidemiologically based risk, emerging risk research, and acknowledgement of the risks inherent to local quality of life. Acknowledging the risks inherent in the industrial process of Marcellus Shale development, rather than dismissing or minimizing them, would go a long distance to reducing risk aversion and outrage based conflict over Marcellus Shale development.

Understanding the perceptions of local residents, how they are formed, and what sustains them is critical to developing effective education, outreach, and development programming. Means for using targeted information designed to fill in the gaps, i.e., overcoming the Vanna White Effect, could emerge from the lessons of this study and other Marcellus related-studies currently being conducted in the state. Education and outreach could also help overcome cultural and social divides, a critical issue to be addressed if regional community fields are to emerge. Education is needed to help people understand they have choices, can make a difference, and that there are at least two sides
to every story. Each of these is critical to help move people from an inflexible conservation perspective to a more resilient adaptable one. Education would also help to connect $\rho$- and $K$-strategists from various phases and levels of the panarchy together, bringing about a better understanding of the intricate nature of Marcellus development and its impacts on communities.

Redefining the problems of Marcellus Shale drilling in terms of responsibilities and interactions would provide a needed lens through which a new understanding of these issues and a framework for moving forward could emerge. Instead of pointing a finger and placing blame on those new to the area that were catalysts for change, residents of an area could assess the root causes of many of the problems, rather than symptoms as they emerged. Placing responsibility where it was due would overcome many of the conflicts emerging around distrust, misinformation, and miscommunication, and as a result, save everyone time and effort, allowing resources to be applied where they were best needed.

Finally, these issues all pointed toward developing a better understanding of how people joined together around issues brought about by development of the Marcellus Shale. By redefining the arguments and understanding the role of adaptation within local communities, residents, and leaders could focus on ways to foster distributive justice, open communication, tolerance, collective action, and communion. By supporting local community well-being, regional community well-being could emerge. However, by continuing to elevate economic interests as the key indicator of well-being, crucial elements of quality of life are missed, continuing to create conflicts where none should be found.
Conclusion: Moving from Observation to Practice

This research sought to understand perceptions of Marcellus Shale development, the source of these perceptions, how they could be reframed, and how they could be implemented in relation to understanding resilience and adaptation of individuals and how these emerge into adaptation of communities. The research illustrated how communities might emerge as open and flexible systems or fall into traps that make them closed and inflexible. Risk and risk perception emerged as a main driver, and provided further insight into how people engaged in information seeking and cooperation in response to hazards. Information for the study was gathered through facilitated discussion circles, observation, discourse and narrative analysis, focus groups, and key informant interviews.

This research is important in several ways. First, it highlighted the need to keep Marcellus Shale development centered strictly as a catalyst of and for change, not as an enemy or ally causing change. This can be difficult to do but it is crucial to not get mired down in blaming the natural gas industry or environmentalists for everything a locality, county, or state might face. Future education and research should focus on and integrate more fully the perceptions that residents within the state have and how these can be utilized to create and guide public policy and decision making related to Marcellus Shale development.

Second, this research highlighted the importance of recognizing the presence of fear, judgment, and cynicism within perceptions and how each of these concerns promoted barriers to individual development and well-being (Scharmer 2009). While the changes occurring were part of a continuous cycle of development, the lenses through
which we viewed the change differed by the perspective taken within the adaptive cycle. In many respects, the choices individuals made related to trust, information, communication, and cooperation were influenced (both knowingly and unknowingly) by fear, judgment, and cynicism. By not being open, tolerant, and communicative, we shut the doors to equity and communion among people and organizations within an area. We create barriers through which we attempt to maintain boundaries, which can prevent trust and networks from forming to deal with certain issues. Additionally, we create potentials for revolt between levels of the panarchy and disallow the potential for remembering to occur. In other words, the stronger we try to conserve something in the face of change, the more we stand to lose in the long term.

This research highlighted the need for continuous education and reframing of conflicts emerging from the conservation phase of the adaptive cycle. Industry needs to do a much better job of taking responsibility for the impacts it does have on communities and the risks that accrue to development. Additionally, companies need to reach out to groups across the region, rather than focusing their attention on local political leaders and economic elite. Communities, on the other hand, need to stop blaming industry for things the locality has direct control over. Both parties need to become better informed and engage in educating each other more effectively and efficiently, covering gaps and addressing the shortcomings which perpetuate many of the problems this research has uncovered. While the interactive effects of local control and industrial development are difficult to untangle, this research points to the fact with careful thought it can be done, and by taking care of the things a community can take care of, many of the major issues would disappear.
This research illustrated the importance of resources – natural and human – in the emergence of resilience and community fields. Following Wilkinson’s lead, we need to recognize that developing people is just as, if not more, important than developing industrial capacity. The quality of life found in this region, while not as economically strong as in other parts of the state, was extremely valued in the eyes of local residents and included many things not captured in economic assessments – aesthetics, family, faith, and community. Thus, quality of life became the rallying point for the conservation of the system as it is or was perceived to be, forming the foundation for conflict as change emerged.

This research showed the importance of realizing how residents of the region emerged as ρ- and K-strategists of the adaptive cycle. They were the ones who perceived change, reacted to it by planning and creating alternatives, and implemented these alternatives based on a shared commonality of life, whether collective or compartmentalized. We need to be able to equip people to move between different parts of the adaptive cycle with a minimum of disturbance to the entire system. We need to open channels of communication, build relationships, and provide adequate, unbiased information. Also, we need to be more cognizant of the perspectives brought to resilience by the ρ- and K-strategists of the locality and industry and how such perspectives can be better utilized as communities (and other systems) move from phase to phase in the adaptive cycle. This recognition needs to occur in all phases of action and at all levels of interaction within the panarchy, from internal behavioral actions to external corporate citizenry. Research can aid communities by identifying areas where conflicts emerge and where releases might take place, providing the basic tools needed to move through the
release phase into the renewal and growth phases quickly and with as minimal conflict as possible.

This research adds to the literature in several ways. First, it builds upon the existing natural resource boomtown literature and the emerging unconventional natural gas development literature by documenting what appears to be the beginning stages of a period of energy development related boom within Pennsylvania. It seems likely that many of the issues studied within this literature emerge from different phases of the adaptive cycle for both individuals and communities. Building from the work of other researchers such as Smith and Krannich (2000) and Smith, Krannich, and Hunter (2001), it seems likely that different aspects of the social disruption literature – culture clash (Price and Clay 1980; Jobes 1995), the gangplank hypothesis (c.f. Smith and Krannich 2000) – are all descriptions for how K-strategists and ρ-strategists respond to change within the adaptive process. In many respects, this research describes the process through which the “boom-bust-recovery” cycle noted by Brown, Dorius, and Krannich (2005) emerges. This research also provides a foundation from which future resource development cycle research can emerge and provides a source of comparison to studies emerging in Texas, Wyoming, and other states in the American South and West.

Second, it adds to the community and resilience literature through linking interactional field theory to adaptation and resilience. It provides an excellent starting point for the expanding the exploration of power and barriers (Brennan and Israel 2008) in interactional community. It provides a starting point for context specific understanding of the emergence of social, community, and regional community fields in promoting
community development, furthering work done by others (Wilkinson 1970; 1989; 1999; Bridger and Luloff 1999; 2001; Bridger and Alter 2006) in exploring this avenue.

This research provides a unique application of risk, risk perception, and risk response to resilience literature as related to natural resource based community and economic development. This merging of these theories highlights several fruitful avenues for future research and exploration and connects nicely with work being performed internationally on resilience, risk, and community development. For instance, the relationship between information sufficiency in leading to personal action was not thoroughly explored (Griffin, Dunwoody, and Neuwirth 1999). It would be an interesting expansion of this research to explore further what drives the level of information completeness within vying risk perspectives and whether this is influenced by trust of the source. It would also be interesting to explore whether these differences in information gathering lead to different levels of action taking by individuals in response to gas development. Likewise, it would be worthwhile to understand the subcomponents of involuntary exposure (c.f. Slovic, Fischhoff, and Lichtenstein 2000b) that are most driving people’s cognitions of risk exposures and driving them to action within social fields. While this research hints at this, further work needs to be done to understand this connection in relation to Marcellus Shale gas development.

Finally, this essay has shown the need to realize we all live in cycles. History has shown this region is intricately connected to its environment; Marcellus Shale stands to send the region into its next phase of the boom-bust cycle, with significantly more human development and activities in place than in any other era of resource development. The adaptive cycle illustrated stability could be reached again – if we are aware of where we
are in the process, what we need to do to move through the cycle, and how we need to proceed when the time comes to do something. Everyone in the region needs to work toward helping to maintain a healthy and safe home for everyone. This understanding is paramount to developing and maintaining a long-term, forward looking perspective integrating environmental, economic, and social perspectives on Marcellus Shale development. Doing otherwise leads us back down the path we have already taken, and from which our children and grandchildren will bear the burden of overcoming the fallout of our decisions.

Marcellus Shale development is a fact of life in Pennsylvania and, barring a major breakthrough in long-term energy research and production, is likely here to stay. Instead of bogging discussions down in an attempt to maintain the conservation phase of a non-gas influenced social and economic system, we should recognize the value of a new asset. We need to move through the release cycle into a new era of renewal and growth incorporating the quality of life residents of the Pennsylvania Wilds have come to expect, and the wealth, jobs, and environmental changes the natural gas industry will create. There are right and wrong ways to go about doing this, as has been highlighted and discussed throughout this research. If we are clear on what is important to us, we can make informed, educated decisions which both protect the things we hold dear and incorporate the things that stand to change them.
References


Baughman, J. 2010. Marcellus shale has wells have been drilled for years[sic]. Bedford/Blair County Shoppers Guide, July 10, 2010.


———. 2001. Building the sustainable community: Is social capital the answer? 


McMullan, C., and J. Eyles. 1999. Risky business: an analysis of claimmaking in the
development of an Ontario drinking water objective for Tritium. Social Problems
46(2):294-311.


379-424.


University Park: The Pennsylvania State University Press.


Morgan, D.L. 1997. Focus groups as qualitative research. 2nd Ed. Qualitative Research


landscape management and wildfire preparedness in Minnesota and Florida.
Society and Natural Resources 18:321-336.

Neuwirth, K., S. Dunwoody, and R.J. Griffin. Protection motivation and risk


Westport, CT: Praeger.


(logging, coal, rails, metallurgy)


Appendix A

Facilitated Discussion Circle Ground Rules

All participants complete IRB forms upon entering meeting space.

Everyone sits in a circle or oval, depending on meeting space. Facilitator(s) and easels are located at one end. Facilitator introduces topic, process, and groundrules. Starts discussion for each question with a different person and goes in a different direction.

**Topic**

Perceptions of Marcellus Shale development, information sources, interactions with others, and potential for regional collaboration within PA Wilds.

**Process**

Each person will get a chance to answer the question presented to the group. We will go around the circle and each person will provide their insights. We will do this a second time. We will continue to go around the circle until we run out of ideas, or if we slow down in the second round, the circle will be opened up to the group for additional input.

After the last question, the adaptive circle begins. The facilitator asks the group to go around and state what they learned in this group and how they will use the information they were exposed to in the group. Any needed discussion can then occur after the adaptive learning process. The participants are then thanked for their time and released from the circle.

**Groundrules** (written on PPT, easel paper, whiteboard, or chalkboard, depending on facilities)

1. Everyone gets a chance to answer the question, be respectful of each other by listening and waiting your turn. [Explanation: Everyone is expected to respect and support the right to be heard. Wait your turn - don’t speak when someone else is speaking. Stay focused on the task and the person of the moment.]

2. “Seek first to understand, then be understood” (S.R. Covey): [Explanation: Practice both active and reflective listening. If we need discussion, before making your own point confirm you have understood the views of others by restating their point in your own words and seeking agreement that you truly understand their points. Request an example if a point is not clear.]

3. Keep an open mind and respect all ideas given. If need be, agree to disagree. [Explanation: Be open to new concepts and to concepts presented in new ways. Expect to change your own mind, but not the minds of others.]

4. Relax, have fun, and be prepared to learn!!!!!!
Appendix B
Informed Consent Form for Discussion Circles and Focus Groups

Title of Project: Marcellus Shale Natural Gas Development and Water Resources in the Pennsylvania Wilds

Principal Investigator: Jason L. Weigle, 301 Armsby Building, University Park, PA 16802
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Advisors: Dr. A.E. Luloff, 114 Armsby Building, University Park, PA 16802
814-863-8643, aeluloff@psu.edu
Dr. James C. Finley, 302 Forest Resources Building, University Park, PA 16802
814-863-0402, fj4@psu.edu

1. **Purpose of the Study:** The purpose of this project is to research how local leaders perceive and make decisions about Marcellus Shale natural gas development in relation to impacts on water resources in the Pennsylvania Wilds.

2. **Procedures to be followed:** Focus groups will be conducted using information drawn from this study. You will be asked to provide feedback on this information and a series of questions regarding your experiences with Marcellus Shale Natural Gas development in your area. The focus group dialogue will be audio recorded. The recordings will be transcribed to text. Notes on flipcharts and handwritten notes will also be taken during the focus group process.

3. **Duration/Time:** The focus group is designed to last approximately one hour.

4. **Statement of Confidentiality:** The information you and other participants provide will be kept confidential; only the project team members listed above will know your identity. Reports of this research will use code numbers or pseudonyms so no personally identifiable information will be shared. The recordings, notes, and flip charts will be stored in a locked drawer in the office of principle investigator. Only the investigators listed above will have access to these recordings. The audio recordings will be destroyed 3 years after the project has ended (August, 2012). If you speak about the contents of the focus group outside the group, it is expected that you will not tell others what individual participants said.

5. **Right to Ask Questions:** Participants have the right to ask questions and have those questions answered. Please contact A.E. Luloff at 814-863-8643 with questions or concerns about this research. Questions about your rights as a research participant may be directed to Penn State University’s Office for Research Protections at (814) 865-1775.

6. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty.

You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

You will be given a copy of this form for your records.

Participant Signature ___________________________ Date __________

Person Obtaining Consent ___________________________ Date __________

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Appendix C
Key Informant Interview Instrument

Jason L. Weigle
Marcellus Shale Natural Gas Development in the Pennsylvania Wilds
Key Informant Interview Instrument

Please tell me your name, a little about yourself and what you do, and how long you have lived here in [PLACE]. Please tell me about your community. What makes it unique within Pennsylvania? What makes it unique within the Pennsylvania Wilds?

When you hear or think about Marcellus Shale development, what comes to mind? What are the issues you see emerging around shale development? What are the opportunities?

Please tell me about Marcellus Shale natural gas development in your area and in particular, the changes it has brought in your community. Please tell me how you feel about the changes that are happening within your community. How has your community responded to these changes?

Please tell me about any conflicts you’ve seen or heard about in terms of water resource use in your area. Have you seen conflict between the Pennsylvania Wilds and Marcellus Shale in terms of using local natural resources? Where are those conflicts occurring? Who is involved in them?

What industries or businesses have you seen change in, either in relation to the Pennsylvania Wilds or Marcellus Shale gas development. Do you feel these industries complimenting existing ones? Are they detracting from each other? Please talk a little about your perspective on the proper balance of industry in your community.

Please describe where you go for information to make decisions related to resource impacts in your area, especially in relation to Marcellus Shale gas development and/or the Pennsylvania Wilds. Whose information do you most rely on? Have you changed how you make decisions based on pressures from either the Pennsylvania Wilds or Marcellus Shale development?

Please discuss the people and agencies you work with or have networked with to find information about or solutions to the problem in your area. Please describe whom you work with and the decision-making process you go through in selecting those to include in your network.

Do you have other thoughts that you would like to share?
Appendix D  

Informed Consent form for Key Informant Interviews

Informed Consent Form for Social Science Research  
The Pennsylvania State University

Title of Project: Marcellus Shale Natural Gas Development and Water Resources in the Pennsylvania Wilds

Principal Investigator:  
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814-863-0402, fj4@psu.edu

1. Purpose of the Study: The purpose of this project is to research how local leaders perceive and make decisions about Marcellus Shale natural gas development in relation to impacts on water resources in the Pennsylvania Wilds.

2. Procedures to be followed: You will be asked a series of questions regarding your experiences with Marcellus Shale Natural Gas development in your area. The interview will be audio recorded with your permission. The recordings will be transcribed to text, and you will have the chance to review those transcripts. Handwritten notes will also be taken during the interview process. You may be asked to participate in a future focus group as a result of the interview.

3. Duration/Time: The interview is designed to last 60 minutes.

4. Statement of Confidentiality: The information you provide will be kept confidential; only the project team members listed above will know your identity. Reports of this research will use code numbers or pseudonyms so no personally identifiable information will be shared. The recordings will be stored in a locked drawer in the office of principle investigator. Only the investigators listed above will have access to these recordings. The audio recordings will be destroyed 3 years after the project has ended (August, 2012).

5. Right to Ask Questions: Participants have the right to ask questions and have those questions answered. Please contact A.E. Luloff at 814-863-8643 with questions or concerns about this research. Questions about your rights as a research participant may be directed to Penn State University’s Office for Research Protections at (814) 865-1775.

6. Voluntary Participation: Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty.

You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please check one of the boxes below and sign your name and indicate the date below.

_____ I give my permission to be AUDIO taped.

_____ I do not give my permission to be AUDIO taped.

You will be given a copy of this form for your records.

_____________________________________________  _____________________  
Participant Signature      Date

_____________________________________________  _____________________  
Person Obtaining Consent      Date

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Appendix E
List of Issues Perceived or Identified to be Associated with Marcellus Shale Development

Planning Concerns
- Increased gas development is forcing counties and communities out of complacency and making them actively plan for their futures.
- County planning and zoning concerns
  - Lack of county input on development
  - Cost of revisions for various county planning documents
  - Zoning for Natural Gas Development
    - legal issues of preemption
    - what can or can’t be zoned
    - pending court cases could change landscape of planning in state
  - Land-ownership changes within the Wilds, including split estates
    - halos around public lands
    - impacts on public lands
    - absentee landowners reap rewards and bear no impacts
- Agricultural Issues
  - loss of agricultural lands – transition to what?
  - Farmers retiring – who takes over
  - Transition from one type of ag to others – ecological and economy transitions and impacts
  - Land developments of ancillary infrastructure (ex: Compressor Stations, man camps)
    - oversight – who, costs, ability to keep up
    - clear communication of regulations
    - aesthetics and sprawling development
- Expanding road systems
  - bonding and permitting
  - land disturbance for right of ways and road expansion
  - building of new roads to access sites – construction and decommissioning standards
- Right of ways for roads and pipelines
  - long-term operation and maintenance
  - recording of easements and public noticing
  - impacts to natural features, local roadways, other infrastructure
  - plans and permits – who reviews, notification process
- Well pad placement in floodplains and other critical areas
  - consistent regulation
    - O&G can but others can’t
    - some offices allow development, others don’t
  - requirements for closed loops, retention basins, other safety features
- Traffic and transportation issues
  - increased traffic on all roads
  - safety at intersections
  - road width and turning radius issues
  - roadway degradation
  - speed limit postings and enforcement
  - increased commute times
  - use of engine retarders in residential areas
- Cultural and heritage site preservation and cataloging
  - have they all been cataloged?
  - are they adequately addressed in planning and construction?
- does development and infrastructure mesh well with site – PWPT Design Guide

- Governmental relations concerns
  - Lack of enforcement and oversight
    - are the enough inspectors to do the job correctly
    - priorities – complaints, permits, or inspections
    - can inspectors keep up with number of wells drilled
    - other state agencies affected by Marcellus Shale but only DEP is getting funding to work on issues
  - Lack of coordination among county, state, federal agencies and government
    - legal requirements for reporting and commenting leave gaps in communication
    - follow through on implementing local regulations, concerns
    - lack of clear outline on who is responsible for what at which level
  - Lack of coordination within/between counties and communities
    - political issues
    - legal impediments
    - fragmented governmental structure
  - Focus on economic development as opposed to community development
    - competition between counties and communities
    - chasing the white buffalo
  - Lack of credible, unbiased information
    - half-truths
    - misinformation
    - lack of information
    - lack of timely information

- Education
  - revamping of local educational programs and colleges
    - provide training on gas drilling
    - provide training on gas drilling related activities
    - provide training on construction and maintenance activities to support gas industry
  - education on gas drilling practices
  - education on risk, risk perception, and risk analysis
  - education to enhance community capacity to deal with change

- Landowner rights
  - Leasing
    - do leases made 100 or more years ago still hold legal weight
    - do leases without formation information allow drillers to continually come back or change the style/type of leasing without a new lease
    - drilling vertical wells to hold lease terms without producing any gas for potentially a long time
    - oil and gas versus coal – which is dominant, are landowner losses offset
    - rights of landowners to fair treatment, non-surface disturbance leases
    - small versus large landowners – are small landowners treated fairly in the leasing process?
    - how are leases recorded?
    - how are addendums recorded?
  - Drilling units
    - what are standards for drilling units?
    - how many acres are in one?
    - how are they designated?
    - do they accurately depict the area from which gas is being withdrawn?
what happens to inholdings? what are their legal rights?
gerrymandering of lines to avoid stubborn landowners while still capturing their gas

**Socio-economic Concerns**

- **Population impacts**
  - Private land owners and public land owners receive substantial gas lease income
  - Jobs related to gas development may help stem the flow of youth from rural Pennsylvania.
  - Jobs related to gas development may entice residents to go back to school and retrain themselves, increasing the educational attainment of the rural workforce.

- **Housing and real estate**
  - Vacant commercial buildings / land leasing by gas companies and their suppliers and support service companies equals new income for owners
  - Increase hotel and rental rates
  - Decreased units available for other uses
  - Higher cost, less availability - new wave of homelessness?
  - Leases being terminated by landlords to re-rent at higher costs to gas industry workers
  - Bubble market
    - higher demand increasing rent values
    - higher demand decreasing supply
    - will new housing units come online to offset lack of supply?
    - will new supply decrease value in other units?

- **Service provision**
  - Increased demand for services – federal, state, local government, private businesses
    - Restaurants and entertainment businesses have seen increased business
    - Equipment repair and welding businesses have seen increased business
    - Construction businesses and trucking companies have seen increased business
    - Stone aggregate suppliers have seen increased business
    - Consultants providing land surveying, geology, engineering and permitting services have seen rapid growth in business
    - State agencies have seen increase in demand for services such as permitting, review, inspection, oversight
  - Lack of certain skill sets needed within communities to meet rising demands
    - Health care and Social Services
    - CDL certified drivers
    - EMS crews
    - Firefighters
    - Police
    - Lawyers
  - Higher wages being paid by gas industry changing local work force
    - Equalizing rural wages to urban wages
    - Local businesses losing workers to higher paying gas industry jobs
    - Can local businesses compete long-run for qualified workers with higher wages
    - Will local businesses raise prices to compete – will other businesses follow suit?
    - Barrier to entry into market – need more capital to pay higher wages
    - Fixed/low income dilemma – if cost of living increases, can they survive in the area?
    - If local business cannot find workers, will recruitment be used to bring in new workers? Will they move? Will they fold?

- **Philanthropy**
  - Will new money stay in the area?
  - Can it be applied effectively?
Can new avenues to leverage funds be found to encourage diversity in the economy and in the communities?

Can sustainable foundations be created to build for a long-term tomorrow

Tax Implications

State Oil and Gas Lease Fund has received hundreds of millions of dollars in lease revenue which has been transferred to help solve State Budget problems

Potential new revenue to counties and municipalities might be very large if legislation enacted by the PA General Assembly provides for reasonable allocations to local governments

Increased property values can lead to increased tax revenue for local municipalities.

Multiplier effects – what is realistic?
  - In many rural, Northern PA counties more than 50% of land owned outside of county
  - Gains in some sectors may lead to losses in others – will they offset?
  - What are the effects of the housing market value increase on other sectors?
  - What are the effects of housing market value increase on consumer spending?

Outlays versus income – governmental bodies will be expected to do more with less
  - Township and Boroughs – increased roadway impacts, increased demands for services
  - Counties – Bonding issues, planning issues, road impacts, increased demands for services
  - State - All state agencies experiencing increased workload, no offsets other than DEP
  - School Districts - ESL provision, tracking transient families, ability to plan long term, facility expansion

Service provision – who pays?
  - Increased property values may create new revenue, but will it be enough?
  - Low and fixed income residents, especially those who are not landed, will bear more of a burden of increased taxes, rents, and service costs than others
  - Increase in demand for social services at state clinics, especially homeless, D/A, sexual health, mental health – everyone pays

Infrastructure implications

Rail freight traffic has increased substantially and more local train crews are being hired with increased revenues - rail trail reconversion?

Roadway impacts
  - Roadway degradation and patching
  - Increased traffic
  - Increased large trucks on small roads
  - Year around, day around traffic
  - Difficult for local municipalities to gain access to aggregate to build roads – most is going to gas companies for road/well pad construction or trucks are tied up to haul materials

Sourcewater protection and drinking water provision
  - Drilling in sourcewater areas
  - Drilling leaks and losses
  - Accident and spills
  - Dust and air pollution settlement
  - Non-point source impacts and water treatment for potability
  - Increased demands for drinking, laundry, etc. water due to increased populations
  - Utility expansion in high population growth areas – is it really necessary in the long-term?

Waste water services
  - Increased demands for water treatment due to increased populations
- Increased demands for frac water treatment – plant expansion
- TMDLS and discharges – fees and permitting
- Long-term necessity or short-term deficiency?
- Plant capacity and treatment costs
  ▶ Electrical services
    - Increased demand due to increased population
    - Expansion of the grid to meet demand
    - Who pays?
    - Environmental impacts of expanding the system?
  ▶ Phone coverage
    - Cell service still limited in many areas
    - Expansion of service into dead zones
    - Environmental impacts of expanding the system?
  ▶ Landfill impacts
    - Premature filling of landfills from accepting drilling muds and materials
    - Increased permitting costs for expansions and opening new cells
    - Long-term impacts – designed failure inherent in landfills
    - Increased traffic in landfills makes it harder for local trash haulers to dump loads in a timely manner, losing contracts and customers
    - Radioactive loads
    - Long-term effects of drilling muds on water and leachate – chemical interactions and decomposition in anaerobic environment
  ▶ Emergency services
    - Increased demand for all emergency services
      - State police – roadway inspections of trucks, calls for accidents, incidents
      - Local police – speeding in towns and villages, use of engine retarders in restricted zones, accidents and incidents
      - EMS – increased calls for accidents and incidents
      - Fire fighters – increased calls for accidents and incidents
    - Volunteer base
      - New, higher paying, long houred jobs in industry requiring less free time for volunteerism
      - Will volunteers be available to answer calls consistently and in a timely manner
      - Burnout rate – will it increase?
  ▶ Roadway impacts and access
    - Road damage makes it difficult to access some areas
    - Increased vehicle maintenance costs
    - Traffic considerations in towns and on roadways
  ▶ Well pad response
    - Are volunteers equipped to deal with incidents on pads – educationally or equipment wise
    - Time to access and cordon off area
    - Prompt reporting and advising of problems
  ▶ Who pays?
  ▶ Rapid growth and cultural impacts
    - Social conflict – ‘culture clash’
    - Social impacts – ‘pushing us out of our favorite places’
      - Rural PA losing its draw as retirement area – cusp of outmigration of retirees
      - Fixed or low income families evicted (legally through leases) for higher renters
      - fixed or low income families even more cash strapped due to higher costs, taxes, fees
    - Increased potential for substance abuse due to increased population, stress increases

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Increased divorce rates – both driller families and local families as stress increases
 Increased crime rates
 - DUI
 - theft
 - trespass
 - prostitution
 - violent crimes
 Loss or damage to historical sites of cultural value due to development
 - drilling in parks
 - drilling in forests
 - aesthetic impacts in areas of special consideration
 Transition of economies
 Amenity development to industrial development – moving from one resource dependency to another?
 - loss of rail-trails to restored railroads
 - impacts to state forests and state parks from drilling and pipelines
 - impact to dark areas from flaring, lights on drilling rigs
 - Forest access issues – closure of roads to allow truck traffic to run within forests
 - waterway access points being converted to withdrawal areas
 - Fisheries impacts from water withdrawals and spills
 - traffic and roadway problems chase away tourists
 - lack of hotel rooms during peak part of season or during events will chase away tourism long-term
 - full restaurants and poor service will chase tourists away
 - expansion of hotels and restaurants to meet demands – will it be sustainable long-term?
 Education and educational opportunity
 - Technical training providers (e.g. PCT and Career Consortiums) have strong market opportunity for their graduates and new sponsors for their training
 - New “brain drain” sending today’s youth out of state when wells are drilled?
 - Overemphasis on gas drilling development and not other forms of service provision?
 - Money in community – can it be put to use to support schools, colleges, and universities to help address problems
 - will youth want to work long, hard hours at these jobs
 Loss of long-term tourism draw due to conflicting land uses

**Health and Safety**

Infectious diseases and potential outbreaks due to increased population
 - TB, STDs, Coccidiomycosis - workers act as unknowing vectors of diseases
 - Can providers appropriately diagnose diseases rarely seen in PA
 - Waterborne illnesses due to land and water disturbances and drilling process
  - endocrine disruptors in drilling chemicals
  - NORM/TNORM
  - Hydrocarbons and VOCs
 Air pollution
 - increased asthma cases
 - breathing issues from dust, particulate matter
 - Increased demand for free condoms and other health materials at state clinics throughout region
 - Increase in risky behavior among workers in terms of drinking, driving on off days
 Access to health care and providers
Increased population already straining primary care providers
OB care for increased population
Hospital capacity to serve increased populations
Increased population could mean more uninsured and underinsured, therefore increased
use of ER for non-emergency care and use of free health and human services
Worker’s families face additional stress and loneliness, may not have access to services
or be aware of their existence

Emergency and police service impacts
emergency responders preparedness for gas site incidents: fires, releases
emergency responders prepared for gas drilling injuries: burns, hazardous materials
out of state gas workers who are on probation must be supervised by County Probation
Officers which adds workload and costs to County governments
traffic incidents and accidents from increased traffic, mud and rock on roads
increased calls to bars and restaurants to stop fights, respond to assaults, DUIs, accidents
coordination between fire companies, county emergency services for long term planning
and equipment purchases

Environment
Use of dwindling state forest land reserves for general fund – future health of state forests and
funding to support them
impacts to tourism infrastructure
impacts to hunting/fishing heritage
impacts to wood products industries
will eventually run out of land to lease
very small amount of state forest lands are leasable without irrevocable harm

Drilling related concerns
Gas by-product and brine disposal
on-site containment and capture
manifesting and tracking of disposal
brine application on roadways
impacts on landfills for disposal of residual waste
impacts on wastewater treatment plants for disposal of brines
impacts of pipelines and treatment systems for flowback waters
habitat fragmentation
pipeline leaks
tracking and monitoring of water movement

Compressor Stations
leaks of natural gas from pipeline – explosive safety hazards
noise from engines, exhaust systems, pipeline pressures
emissions from gas and gas by-products to the air around the site

NORM (naturally occurring radioactive material) and Technically Enhanced NORM
ground water contamination from drilling
surface water contamination from storage of flowback and residual waste, strings
proper disposal – manifesting and tracking
low-level radioactive material landfills – where are they? what are the risks of
transporting TNORM contaminated materials through communities

Gas wells in floodplains
risks to surface water aquifers
risks to riparian zone stability and vegetation
risks of gas release during floods
- risk of materials being swept downstream during flood and plugging bridges, streams, causing excess damage
- deforestation and impacts on stream temperature, algae growth
- risks and impacts from spills, leaks from vehicles and equipment

- Environmental Changes and Potential Impacts
  - Airborne dust and particulate matter from operations, traffic
    - impact will it have on streams from stormwater runoff, land disturbance, roadway runoff
    - impact to plants, cover and smother, contamination of certified organic crops and animals
    - impacts to humans engaged in activities near well sites, wildlife, farm animals, pets
  - Water quality impacts
    - non-point source impacts
      - expanded road systems
      - pad development
      - pipelines
      - new and expanded aggregate quarries
      - gas wells in floodplains and floodways (erosion, stormwater management impacts)
    - point source impacts
      - wastewater treatment facilities
      - spills and leaks
      - intentional dumping
      - smokestacks and flaring devices
  - Water quantity impacts
    - permitting of withdrawals in HQ, EV streams
    - flowthrough requirements
    - enforcement
    - how much is being used
    - where is the water going
    - who is using it
    - who is selling it
    - are public funds being used to provide cheap water to gas companies
    - impacts to groundwater supplies
    - opportunities to develop well fields to provide water to companies and communities
    - opportunities to clean-up AMD and other polluted waters for use in drilling
  - Habitat fragmentation
    - creation of pads in areas of special consideration
    - creation of new pipeline corridors, no emphasis on sharing lines means more lines and more disturbance
    - edge species and what transition species emerge
    - changes in migration and movement patterns in wildlife
  - Impacts to threatened and endangered species
    - PNDI review and inspection – adequately staffed and updated
    - Are drillers following restrictions related to seasonal limitations
    - will expanded development reduce desirable habitat
  - Deforestation and fragmentation in special consideration trout streams (wilderness, HQ, EV, Wild Trout, etc)
    - water quality impacts
    - water temperature impacts
- runoff from clearings for roads and pads increasing storm flows destabilizing streams
- increase in roads is decrease in wild areas, streams may lose designation
- increased access means increased fishing, potential decline in sensitive species in some streams
  ➢ Introduction of non-native plant, insect species
    - brought in on equipment
    - brought in on/by staff (landscaping plants, seed stock)
    - disturbances in habitat may provide niche for non-natives to emerge
    - disturbances may force ‘desirable’ species out, allowing non-natives to emerge and implant
  ❖ Aesthetic impacts
    ➢ Noise from compressor stations, drilling operations and heavy truck traffic
      - counter to wild/wilderness experience
      - may disturb wildlife, hence wildlife viewing
    ➢ Viewshed impacts
      - clearings for pads
      - clearings for pipelines
      - drill rigs on the horizon in scenic areas
    ➢ Light pollution from 24/7/365 operations
      - dark skies impacted from lights and flaring
      - homeowner impacts from lights may prevent sleeping
Appendix F: Key Issues Sorted By Responsibility

<table>
<thead>
<tr>
<th>Issues Related Directly to Marcellus Shale Development</th>
<th>Issues Related to both Marcellus Shale Development and Community Governance</th>
<th>Issues Related to Community Governance</th>
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<tbody>
<tr>
<td>Water quality impacts</td>
<td>Road creation, use, and maintenance</td>
<td>Planning</td>
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<td>Water quantity impacts</td>
<td>Land-ownership issues</td>
<td>Zoning and Ordinances</td>
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<td>Residual waste generation, tracking, disposal</td>
<td>Agricultural issues</td>
<td>Land developments</td>
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<td>NORM/TNORM creation, tracking, and disposal</td>
<td>Floodplain and Floodway Management</td>
<td>Intergovernmental cooperation and communication</td>
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<td>Pipelines and right-of-ways</td>
<td>Traffic related issues</td>
<td>Health and human service provision</td>
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<td>Drilling unit creation and related issues</td>
<td>Information creation, dissemination, and education</td>
<td>Preservation of cultural heritage sites</td>
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<td>Light pollution from flaring</td>
<td>Population impacts</td>
<td>Overemphasizing gas drilling for economic development</td>
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<td>Housing and Real Estate Issues</td>
<td>Landowner rights</td>
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<td>Higher wages</td>
<td>Education and human capital development</td>
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<td>Workforce competition</td>
<td>Philanthropy</td>
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<td>Tax implications</td>
<td>Source water protection and drinking water provision</td>
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<td>Railroads and rail-trail conversion</td>
<td>Culture clash and social conflict</td>
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<td>Provision and expansion of utilities</td>
<td>Feelings of alienation and loss</td>
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<td></td>
<td>Emergency service provision, training, and equipment</td>
<td>Economy transitions and adapting to economic change</td>
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<td>Increased substance use</td>
<td>Natural resource dependency in economy</td>
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<td>Hotel/motel unit levels</td>
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<td>Increased crime and criminal activity</td>
<td>Restaurant and bar crowding</td>
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<td>Increases in STDs and other diseases</td>
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<td>Increased calls for police on worker off-days</td>
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<td>State forest, state park, game land development</td>
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EDUCATION
Ph.D., The Pennsylvania State University: Rural Sociology and Human Dimensions of Natural Resources, December 2010
M.S., The Pennsylvania State University, Community and Economic Development
B.S., The Pennsylvania State University, Soil Science
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RESEARCH
Research Assistant
- Penn State Cooperative Extension Marcellus Community Response Project (2010) (Brasier, Kelsey, Whitman)
- Susquehanna Transitional Zone Ecosystem LTER/LTAR Project (2008-2010) (Brasier, Findeis, Stedman)
- Brookings Institute Metropolitan Policy Program Rural Pennsylvania Revisit (2007) (Luloff, Bridger)

PUBLICATIONS

GRANTS AND AWARDS
College of Agricultural Sciences Paul Hand Award for Graduate Student Teaching Achievement, 2010
The Pennsylvania State University Graduate School Teaching With Technology Certificate, 2010
Penn State Department of Agricultural Economics and Rural Sociology Ken Wilkinson Award, 2009
The Pennsylvania State University Graduate School Teaching Certificate, 2009
Rural Sociological Society Preparing Future Faculty Professional Development Track Certificate, 2008
Penn State College of Agricultural Sciences Extension Excellence Stimulus Funding Grant, 2010
Penn State College of Agricultural Sciences Seed Grant, 2008

TEACHING EXPERIENCE
Teaching Assistant – CED 152(SP08), CEDEV 505(FA08)
Instructor – CED 152(SP09), CEDEV 452(SP10/FA10)

OTHER WORK EXPERIENCE
- Alaska Department of Environmental Conservation (ADEC) Environmental Program Specialist IV – Superfund Project Manager, Statewide Military Munitions Response Program Coordinator
- ADEC Environmental Specialist III – Solid Waste Program Specialist, Municipal Team Lead
- Tioga County (PA) Conservation District Watershed Specialist

PROFESSIONAL MEMBERSHIPS
International Association for Society and Natural Resources
Rural Sociological Society
Community Development Society
Gamma Sigma Delta, National Honor Society of Agriculture