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Photography Methods To Understand Rural Resilience And Environmental Literacy: The Example Of Fracking In The Bakken

Bruce Evan Farnsworth

PHOTOGRAPHY METHODS TO UNDERSTAND RURAL RESILIENCE AND ENVIRONMENTAL LITERACY: THE EXAMPLE OF FRACKING IN THE BAKKEN

by

Bruce Evan Farnsworth
Bachelor of Science, California State University Pomona
Masters of Education, California State University, San Bernardino

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This dissertation submitted by Bruce E. Farnsworth in partial fulfillment of the requirements for the degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

_____
Marcus Weaver-Hightower, Chairperson

_____
Joshua Hunter

_____
Steven LeMire

_____
Douglas Munski

This dissertation is submitted by the appointed advisory committee as having met all of the requirements of the Graduate School at the University of North Dakota and is hereby approved.

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Grant McGimpsey
Dean of the School of the Graduate Studies

_____
Date

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Bruce Farnsworth
August 2, 2019

TABLE OF CONTENTS

LIST OF FIGURES

Figure Page

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I'm intensely grateful for the patience and kindness my advisor Marcus Weaver-Hightower has shown me throughout my degree program. His mentorship and cutting-edge professional advice have served me well as an emerging academic. Perhaps more than anyone, he understands my passion for photography and my desire to explore the role of photographs/y in conservation and biocultural research.

I appreciate the support of all the members of my dissertation committee. I've enjoyed my conversations with them and they have provided many ideas and direction which have improved this work. Their expertise contributed greatly to the refinement of this dissertation.

ABSTRACT

This dissertation examines the social and environmental impacts of fracking through deep ethnographic interviews and observations with farmers and ranchers living and leasing on the Bakken and Three Forks shale oil formations of western North Dakota, currently the second largest oil-producing region in the United States. This study investigates how photographic methods such as photo elicitation, repeat photography, and aerial photographs/maps elicit local knowledge and testify to the resilience of ranchers and farmers challenged by oil development and the alteration of their environment. Motivated by heritage, political marginalization and the pervasive loss of ruralness, the participants express several roles, among them watchdog, conservationist and educator. The findings—largely photographic with the participants' own narrative—generate interdisciplinary discussions of photography in social research, provide the conceptual foundation for curricula that is more inclusive of the needs of rural communities visited by the oil and gas industry and may contribute to research in other parts of fracking country. Keywords: aerial photographs, art-based research, Bakken, conservation photography, documentary, energy development, environmental education, environmental justice, fracking, hydraulic fracturing, oil and gas, petroleum, photo elicitation, photography, repeat photography, rural education, science education, sustainability, visual research.

CHAPTER I

INTRODUCTION

Traditions of open space and agrarian livelihoods in western North Dakota have been disrupted by a flurry of activities associated with the high-volume hydraulic fracturing (fracking) industry on the northern plains. At the time of this publication, North Dakota—situated at the center of North America's Bakken and Three Forks geologic formations—is the second highest oil-producing state in the nation, surpassing California, Alaska and Oklahoma. The flat but gently rolling landscape of the central Bakken area is a patchwork of wheat fields and unfarmed land now riddled with oil wells, pumpjacks, and natural gas flares. North Dakota now produces over 1.3 million barrels of oil per day from 15,000-plus wells (U.S. Energy Information Administration, 2019). Unprecedented levels of oil are being extracted from the tight shale oil reserves of the Bakken and Three Forks formations of North Dakota, Montana, and Alberta, Canada, due to advances in the high-volume horizontal fracturing technology commonly known as "fracking" (USEIA, 2011). While North Dakota—the main focus of this study—has seen several oil booms since the early 50's, the effectiveness of new fracking technologies developed in the 1990's, has generated a massive influx of people, infrastructure and operations into the region in an attempt to extract the Bakken's oil, challenging parochial, agrarian ways of life and identities in these historically rural communities (Brown, 2013; Dobb, 2013) and presenting a host of environmental challenges. This ethnographic study explores how photography can be used to help articulate and better understand the impact

of these environmental and social challenges.

The participants in this series of case studies are landowners, ranchers and farmers, one of whom worked briefly in the oil industry. All of the participants have entered into ownership/royalty relationships with the oil and gas industry and, at some point, restricted industry access to their land at some point. The participants are two men and one woman, ranging from approximately 40 to 65 years of age. During the course of this research, I explored the educational histories of the participants, their personal experiences with the oil and gas industry, any role photography may have in their lives, and their connections to the land. I draw from research in disciplines as diverse as environmental education, conservation biology, visual research methods, documentary photography, citizen journalism, ethnography, historical geography, ecological literacy, and critical pedagogy to conduct a pertinent inquiry into the lived experiences of the participants.

Figures 1-3 provides a sense of the landscape in western North Dakota, in the region of the Bakken formation and along the shores of the upper Missouri River. Figure 1 depicts how the horizontal fracturing process enables extraction of shale oil reservoirs miles under the lake. In high-volume horizontal fracturing, several wells can be drilled on one large pad and, then, underground, the drills can be turned to drill and capture oil from deep reserves located directly below properties to which the operator does not have surface rights to place drilling equipment. Figure 2 shows one of the landscapes features in the study area, a butte sacred to the Three Affiliated Tribes of nearby Fort Berthold Reservation. In the photograph, a line of fresh dark soil marks a recent pipeline installation. The expansive agricultural region of western North Dakota, with large farm

and ranch properties ranging from several hundred to tens of thousands of acres, differs from the Marcellus shale gas region of Pennsylvania which has been heavily studied. Figure 3 shows two working horses in the study area one winter with a frosting of freshly fallen snow on their backs. With winter air temperatures frequently sitting well below zero degrees Fahrenheit, these are harsh working conditions for both the research

Figure 1. Oil drilling unit on the shore of Lake Sakakawea, Missouri River, North Dakota. Photograph © Bruce Farnsworth

Figure 2. Oil drilling unit on the shore of Lake Sakakawea, Missouri River, North Dakota. Photograph © Bruce Farnsworth

participants and the oil industry.

Figure 2. Landscapes of the study area include Rainbow butte, a place sacred to the Three Affiliated Tribes of nearby Fort Berthold Reservation. Photograph © Bruce Farnsworth

Statement of Need

The Bakken region of western North Dakota is the second-largest oil-producing state in the nation, relying on the non-sustainable extraction technology of high-volume hydraulic fracturing. There is a need for visual studies in the Bakken region of North Dakota. Geographically, it is under-represented in the social literature.

According to McGranahan, Fernando, and Kirkwood (2017), the "region is isolated, and the development impacts have not been well studied."

Figure 3. Late winter in the study area; two work horses covered in fallen snow. Photograph © Bruce Farnsworth.

This study follows the recommendations of Wright and Muma (2014) who looked at public perceptions of fracking in Kansas, and encouraged more "energy exploration studies in rural areas… (with a) focus on the perceptions of older adults who are often a higher proportion of the population in rural locations, (and) participants… located in a previously unstudied and often overlooked area of the country's energy boom (p. 109). Malin (2017), who found that Pennsylvania farmers contend with compounded environmental and economic risks and procedural inequities that may intensify over time, called for more comparative case studies in other locales, where unconventional oil and gas production has also boomed and has typically depended on leasing farmland (e.g. Colorado, Texas, Ohio, North Dakota, California)" (p. 11).

During my orientation trips to the study area, one prospective participant told me "farmers need Biology 201 out here to understand what is happening." Amid a panoply of impacts—cultural, social and environmental—local farmers and ranchers are marginalized by public policy, the lack of relevant education, and the scarcity of research which would share their lived experiences.

This indicates a need for community education, not just in the site of this research, but in the larger communities that must coexist with these unsustainable resource extraction technologies. What are the experiences of landowners, and how can photographic methods in educational research help to articulate them? How can photography be incorporated into environmental education in ways that help farmers and ranchers to have the knowledge and skills they need to manage oil and gas activities in their communities?

Purpose of the Study

The purpose of this research is to examine how the medium of photography can be responsive to local residents, give them voice and contribute to the development of new education tools. Through discussions facilitated by photography-based methods, this study seeks to elicit the environmental concerns of participants and consider implications for community-based education.

This research was intended neither as an exposé on the oil and gas industry nor as a broad survey of its impacts. Rather, it sought to elicit heartfelt responses to open-ended questions related to the social, cultural and environmental aspects of participants' coexistence with the industry

Research Significance

This is the first social research of its kind in the Bakken region geared to the lived experiences of landowners hosting oil and gas operation in the Bakken region. This work investigates their use of photography and use their own narratives to tell their own stories.

At the time of this research, fracking is underway in 22 states in the nation. To date, there have been only a few studies geared to education needs of oil and gas communities, and this is the first relying on photographic tools to give voice to the landowners hosting oil and gas operation in the Bakken region. The aesthetic and story-telling value of photography enables residents a tangible and graphic means to describe the depth and intricacy of their experiences. The findings of this study make clear the value of these farmers and ranchers as primary sources for improved community environmental and science education in communities hosting the oil and gas industry. While there have been studies reporting the experiences of ranchers and farmers in the

Marcellus shale, the full diversity of industry-induced impacts or changes to life patterns and the role of photography has not been so fully explored as it is in this study of ranchers and farmers in North Dakota.

The interdisciplinary approach of this study weaves strands from ethnography, historical geography, conservation biology and photographic methods and adapts concepts and methods in visual literacy and documentary photography to qualitative research. This research has generated several lines of discussion related to the applications of photography in social research, sustainability, and the educational needs of rural communities affected by the fracking industry. In keeping with critical theory that forms the conceptual framework for this study, the camera becomes a democratizing tool that liberates the farmer or rancher. This research responds to the need for research on the human condition of farmers and ranchers living in the Bakken.

Conceptual Framework

Maxwell (2013, p. 33) defined the conceptual framework of a study as "the system of concepts, assumptions, expectations, beliefs, and theories that supports and informs your research (p. 33). In developing my conceptual framework, I have brought in other disciplines and approaches.

My study is a multidisciplinary "bricolage" as described by Kincheloe, McClaren and Steinberg (p. 167 in Denzin and Lincoln, 2017). I am drawing on research techniques and perspectives from the fields of ethnography, visual research, citizen activism, environmental justice, ecoliteracy, historical geography, land use planning and documentary photography. I also rely on my previous professional experience as a zoologist, photographer and educator and ideas that have risen from my encounters in the

field during this research. All of these channels inform my ideas about reality (ontology) and how the study participants and audience would gain knowledge of it (epistemology). I have taken an ethnographic approach in which I seek to truly understand the culture of the rancher/farmer community in the Bakken as it relates to my study and research questions. I approach them with respect for their local knowledge and expertise.

Situating the work in education (formal, nonformal and informal)

I am interested in what the participants learn in their daily lives and their accumulated wisdom. What do they learn on the land? In my interviews with participants, I give space for them to describe their educational history to get a sense of the contribution of formal education (schooling). These farmers and rancher participants have gained an understanding of their local environment largely through informal learning in daily life and work. Dewey (1959) brought a related criticism of the U.S. education system that is of interest in this study:

> From the standpoint of the child, the great waste in the school comes from his inability to utilize the experiences he gets outside the school in any complete and free way within the school itself; while, on the other hand, he is unable to apply in daily life what he is learning at school. That is the isolation of the school, its isolation from life. When the child gets into the schoolroom he has to put out of his mind a large part of the ideas, interests, and activities that predominate in his home and neighborhood. So, the school, being unable to utilize this everyday experience, sets painfully to work, on another tack and by a variety of means, to arouse in the child an interest in school studies (pp. 76-78).

Most of environmental education in the United States, given the lack of a mandate for such instruction in the classroom (Greenwood, 2003) is gained via nonformal learning (books, social media or digital means without teacher-student contact) and the informal education or experiences of work and daily life such as Dewey described above.

Merriam et al. (2006) defined informal learning as spontaneous, unstructured, and taking place in everyday life without a formal curriculum. Livingstone (2001) added that informal learning also includes socialization and the kind of learning that generally occurs without awareness. While the participants in these case studies completed high school and college training, their field-based understandings, and the intense political context they share, have elevated their knowledge to local expertise. In dealing with fracking, the participants face problematic conditions, test responses via immediate experience and interact with others to make sense of their experience, all of which are key aspects of informal education according to Kolb (1984) and Moore (2010). The participants' very willingness to interact with this research is analogous to the final stage of experiential learning, a type of informal learning.

I contend that the participants in this study are learning what cannot be taught in textbooks, and it should be honored and assimilated into formal education useful to communities affected by fracking (fracking communities). Taking a critical and emancipatory lens to informal learning, I point to the work of authors who resist a common perception that informal learning has a lower status to formal education. Billett (2002) pointed out that learning in the workplace is often viewed as lesser in value than formal learning in educational institutions. Hager (2004) research shows that learning at

work is a valuable partner to formal education, working on the premise that knowledge is not solely provided via books delivered by teachers and confirmed through tests.

Environmental Education

I address environmental education in this primarily in the source material of the images of the participants. I crafted my interviews to give each of the cases the best opportunity to participants the opportunity to share their experiences in these photographs and maps and implicate them in potential uses for education. Conversely, environmental education can respond by creating curriculum that is representative of actual conditions of rural and agricultural communities, making them authors, contributors and members of editorial review committees.

Critical lens

I have taken a critical perspective in this work. Critical research seeks to elevate democracy by sparking changes in existing systems. This philosophy is derived from the ideas of George Hegel and Karl Marx wherein people are able to speak as a collective, free from fear. These rural farmer participants are intensely private and polite. The fundamental characteristics of this research, including the promise of anonymity and an emergent approach which allows participants to direct the course of interviews and the research itself, are, in themselves, emancipating and liberating. In this setting, the research participants are more comfortable in speaking about issues in their communities and the research effectively *removes* personal or political barriers, such as those encountered in public speech or statements to/against the State (of North Dakota) in this work.

The participants have documented failures to enforce statutes that monitor and protect air, land and water resources on their lands. While the skies of western North Dakota have lit up under a sea of natural gas flares, the participants are left in the dark with regard to having a voice in policy decisions and enforcement. In this research, I am influenced by the work of Freire (2005). In my work as a partner to the participants, my research may bring the participants, the "marginals", outside their society where they can become "beings for themselves" as Freire said (p. 75).

Critical theory is responsive to injustice and inequality in segments of society. The participants of this research expressed feelings of isolation and marginalization in their dealings with government agencies and interactions with the oil industry.

As Malin (2013) found in the region of Pennsylvania's Marcellus shale formation, I believe that my study participants, individuals who have allowed the oil and gas industry onto their lands, are uniquely situated as both "gatekeepers on oilfield practices" (p. 2) and as primary sources and authors for community-based education on these issues. I am making the argument that these ranchers/farmers are the experts or scholars who can contribute to responsive education about fracking in the communities. Mine is a constructivist stance on education. I believe that my participants learn and show knowledge by prior experience and reflection, as supported by Dewey (1938). On a cultural scale, families are adapting to the influx of transient operators and activities in their communities. As in my work portraying conservation photographers as pedagogues (2013), this research design creates a lens to promote the expertise and value of the rancher and farmer participants as educational sources.

My early explorations in the study region before research began taught me that the people of these communities may be intensely private or unwilling to disclose personal details of their lives. They may be dealing with multiple issues of the moment, attending hearings for permits, etc. I sensed that the status quo does not give residents a means to express their fatigue or skepticism or share what they have learned with others who may face the same difficulties. In my casual conversations, where residents expressed their frustrations with the oil industry, I found a helplessness; they know that the issues will be confronted again, because it had happened several times before. I asked myself how research could help them and give their communities better insight. How could a few of these farmers and ranchers contribute to education?

In this reconnaissance, I formed a hunch that the participants were waiting for a mechanism or means by which to share their experiences. In my previous research, I have found that photography and images present a more comfortable and less threatening means to have a conversation. Pictures invite and facilitate conversations.

Photographs provide a familiar, non-adversarial means to facilitates recall, conversation and empowerment. The photos of these case studies belong to the participants and, in this sense, they also own the messages associated with them. Photographs may allow them to regain control of the dialogue. The participants would become the arbiters of this visual information. Participants provide the captions and, thereby, the meaning.

This is also critical research because it is political. It seeks to challenge existing values and systems in society. The participants of this study speak against the oppression of a state-subsidized oil industry which externalizes the costs of production (primarily the

costs of impacts on natural resources and remediation where possible). Through their participation in research, the participants may contribute to improved education and empowerment of rural communities hosting the industry. This research aligns with a critical pedagogy tradition deriving from the work of Paulo Freire (2000). Freire's concept of *conscientization* focused on communities and forms the philosophy of critical pedagogy (Greenwood, 2003a). Certainly, critical education is afoot among the adult ranchers and farmers who are actively learning from, and teaching, each other across the Bakken region, and this citizen activism is seen in the courage of the participants in this study to contribute to research. Freire held that teaching basic literacy skills had to be situated in peasants' everyday worlds, using their own problems and concerns as the experiential grist for the development of teaching practices. Freire conceived teaching as an explicitly political act since people's concerns over land ownership, landlords' exploitative practices, water rights and so on were indicative of a rapacious and unchecked capitalism. In keeping with critical pedagogy of Freire, I am sympathetic to the participants feelings of marginalization. Their access to this research serves to shift power to the participants.

In my early reconnaissance, I attended meetings of regional resource councils, where farmers and ranchers gathered to organize and resist government initiatives that favor the oil industry and privatize their natural resources. This research and its lens of environmental justice supports aligns with the Marxist concept of the "commons" (Federici, 2011). For Kincheloe and McLaren (2002), critical theory is concerned with the power and justice of several issues in society including education. Morrison, et

al. (1995) wrote that "political agenda and … the task of the researchers is not to be dispassionate, disinterested, and objective" (p. 35).

Environmentalist writers

I identify with the fertile agitations of leading environmentalist writers such as David Orr and the late Chet Bowers. Their statements may be alarming, but they are based in science. As a zoologist by training, I'm responsive to strong and accurate messages of environmental conditions. Statements by scientists about the crisis and sense of urgency on issues such as regulating greenhouse gas emissions and planning for a future with climate change are not propaganda intended to move individuals toward a more liberal voting agenda, but the results of cutting-edge work using modern tools and techniques that derive from the rules, principles and conventions established over centuries of peer-reviewed research.

In "Environmental Literacy: Education as if the Earth Mattered, Orr (1993, p. 1) wrote,

> Yet there are better reasons to rethink education that have to do with issues of human survival, which will dominate the world of the twenty- first century. The generation now being educated will have to do what we, the present generation, have been unable or unwilling to do: stabilize a world population that is growing at the rate of a quarter of a million each day; stabilize and then reduce the emission of greenhouse gases, which threaten to change the climate—perhaps disastrously …
>
> And what is the role of education? Orr continued,
>
> I am not making an argument against education but rather an argument for the

> kind of education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics. The skills, aptitudes, and attitudes necessary to industrialize the earth are not necessarily the same as those that will be needed to heal the earth or to build durable economies and good communities. Resolution of the great ecological challenges of the next century will require us to reconsider the substance, process, and purposes. of education at all levels

Orr wrote (p.4) wrote of a collective societal consciousness of environment, and included this fine argument that is particularly timely today,

> The word "patriotism," for example, is devoid of ecological content. It must come to mean how we use our land, forests, air, water, and wildlife. To abuse natural resources, to erode soils, to destroy natural diversity, to waste, to take more than one' s fair share, or to fail to replenish what has been used must someday come to be regarded as unpatriotic.

In this research, I follow a path consistent with the recommendations of Chet Bowers. Bowers wrote in Culture of Denial (1997) that "the modern understanding of academic freedom must now be reconstituted in ways that foreground human dependency on increasingly stressed ecosystems" (p. 202).

Environmental Justice

I see research around hydraulic fracturing as quintessentially one of moral and environmental justice imperatives. Bullard and Johnson (2000) define environmental justice as: "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation,

and enforcement of environmental laws, regulations, and policies" (558). Hotaling (2013, p. 1), conducting social research on the Marcellus shale formation of Pennsylvania, discussed the moral implications of the fracking industry, with a study entitled in part "… basic rights and obligations to human flourishing." McCarthy (2013) approached fracking from an environmental justice lens and developed a primer for low-income landowners, providing a glossary of terms and tips for those considering lease agreements. In much the same spirit, I have situated my findings not solely as expressions of their own experience but potentially valuable ideas for educational curriculum. In a study in England, Short et. al (2015) describe fracking as an "extreme energy" process (p. 4), a term coined by Klare (2011) and make the case for investigating fracking through a human rights lens. In the UK, more work is being done with respect to examining fracking under an ethical or environmental justice lens. In my early visits to the study area, I gained a sense of the magnitude and intensity of oil & gas development and, as a result, I moved my research lens to one more focused on environmental justice.

Though my study is certainly *environmentalist*, it may deviate from traditional environmental education research. I am more interested in promoting the ecological literacy of the participants by sharing their photographs, ideas and explanations that I am in going back in time to examine attitude or value formation, or consider the participants' connectedness to nature.

I diverge from the frequent use of England and Albrecht's (1984) research model of Social Disruption Hypothesis in studies of oil booms, wherein rapid population growth occurs as individuals move into a boomtown area to take advantage of employment

opportunities and there is alteration, dysfunction or breakdown of social life, often in a community setting. In contrast to those studies, this research brings to light latent data, experiences and sensations which have laid dormant over decades, but remain fresh in the minds of the participants, transcending short-term response.

Reason (1988) used the term "critical subjectivity" to refer to a quality of awareness in which we do not suppress our primary experience; nor do we allow ourselves to be swept away and overwhelmed by it; rather we raise it to consciousness and use it as part of the inquiry process. (p. 12).As oil booms came and went, these individuals have turned to the power of images (photographs, maps) on a recurring basis to document, archive and share their stories, sometimes of their own free will and other times prompted by neighbors or this researcher. While there is disruption in this research community, this study focuses on the proactive responses of the participants that are a testament to their fortitude and resilience. I am a facilitator and this research may serve as an advocate.

This research benefits from my understanding of the aesthetic, technical and messaging components of photographs as a professional editorial and documentary photographer. This study adapts concepts and methods from the literature of visual literacy and documentary photography, and it has generated several lines of discussion related to the applications of photographs and photography in social research, sustainability, and the educational needs of rural communities affected by the fracking industry.

Photography has a long relationship with the social science disciplines. Becker (1974) argued that the fields of sociology and photography—as marked by the invention

of the Daguerreotype photographic process—were born at the same time. On the use of photography in sociological research, he wrote: "many photographers have undertaken projects which produce results that parallel those of sociology, and make claims that in some ways parallel the claims to truth and representativeness of sociology (p. 5)." I'm inspired by the work of documentary photographers such as Lewis Hine (1980) who, supported by the Russell Sage Foundation in his early survey work of life in urban communities (Gutman in Becker, 1974), completed photo essays that carried all the grittiness of those communities.

Photography—and our susceptibility to communication via imagery—is a part of research in a wide range of the social sciences and I am drawing upon many of these disciplines. In the book, Doing Visual Ethnography, Gardner (1999) wrote of the essential role of artistic sensibilities in cognitive development and learning theory. Pink (2013) describes "visual ethnography and the issues surrounding the representation, interpretation, and authoring of knowledge with the rise of digital media.". Dorrell (1994) reported on the use of photography in archeology and conservation. In Farnsworth (2012), I dissected the educational work of professional conservation photographers while Myers (2006) explored the psychological and cognitive pathways by which those images communicate.

In this study, I expand the use of photography in environmental education research with elements of historical geography (e.g. the tradition of repeat photography) and land use planning (e.g. the analysis of aerial photographs in maps) as I solicit participant narratives about industry activities and their contentious relationship with the operators that enter their land.

Research Questions

This research asks three research questions:

1. How can photographic images or photography-based interventions in educational research be used to elicit local storytelling and historical narratives that contribute to our understanding of contemporary fracking communities?
2. How do participants use visual methods to define and articulate community values on environmentalism and sustainability?
3. How might these findings contribute to the conceptual development of curricula that is responsive to local/rural needs for environmental and industrial science education.

Organization of the Study

Chapter I begins with an introduction to the study area and participants, and then provides an overview of the research problem, the purpose of the study, and its significance. The conceptual and empirical frameworks of the research are a weave of several disciplines and theoretical strands. This framework is based in a scheme of critical environmental education research, weaving a bricolage from the domains of ethnography, environmental justice, critical pedagogy, ecoliteracy, photographic methods and documentary photography. The research questions complete this chapter.

Chapter II is a review of literature germane to the conceptual thrusts of the research with additional background to provide context. There is an examination of peer-reviewed research and long-hand journalism pieces on the impacts of hydraulic fracturing and a look at some of the issues at play in terms of practice, policy, regulation, oversight

and enforcement in the industry. There is an introduction to the process of extraction, storage and transport of Bakken crude oil. Conservation photography is positioned as a valuable ally of environmental education research. Additional sections of the chapter include a review of research on the use of photography in educational research, and background on the photography-based interventions applied in this study, which include photo-elicitation, repeat photography, and the use of aerial photography. A discussion is provided on the value of photographs as a form of data and the role of photography in environmental education.

Chapter III is a description of the methodology used in the research such as the choice of a case study approach and a qualitative design based in Maxwell (2005). The selection of the study area and participants are described. This is a two-phase study of interviews and observations in Phase I, followed by photographic interventions in Phase II. This section detail site selection, participant selection and how the photographic interventions of phase two were chosen and utilized by participants. There are discussions on the researcher-participant relationship and the measures taken to ensure that photography and visual data were addressed responsibly in this research.

Chapter IV presents the results of the research by phase, beginning with the ethnographic interviews and observations of phase one, and then presenting the results of the photography-based interventions of phase two. The cases are presented within each phase. This section is rich with excerpts from the interviews and observations, and includes over 50 images presented by participants Cody, Trackfinder, and Phoebe or their families.

Chapter V is a discussion of the emergent themes of this research and

implications for the participants communities affected by the oil and gas industry. This section reviews the diverse use of photography by participants to describe their local knowledge and environmental literacy and how the findings provide the conceptual basis for more responsive education for communities affected by fracking, particularly as relates to rural farmers and ranchers who have managed the lands on which they live since an early age. The assertion is made that more content is needed in the areas of industrial science, math, writing, law, environmental justice and policy for grades middle school to university, to ensure that education is more responsive to the needs of youth and adults of rural farming and ranching communities who will grow up on their family land and become managers capable of monitoring, negotiating and leasing with the oil and gas industry on and near their lands. This paper concludes with thoughts on the use of photography-based interventions in social science research.

CHAPTER II

LITERATURE REVIEW

Research on the Impacts of Hydraulic Fracturing

There are many studies on the health impacts associated with the shale oil and gas industry and the operations unique to hydraulic fracturing. Some of the most foundational research includes Bamberger and Oswald, 2012; Colborn, et al., 2011; McKenzie, et al., 2012; Subra, 2013 and Vengosh, et al., 2014. Hirsh, et al. (2017) reviewed the growing body of literature on the mental health consequences related to fracking.

Working on the Bakken, Stangeland (2016) studied the environmental impacts and socioeconomic challenges associated with fracking generally and, specifically, looked at water use and contamination, induced seismic activity and air quality, and the socioeconomic issues in the Bakken of in-migration, housing, unemployment, and crime. He found the need for increased governance and regulation to mitigate impacts and the need for increased oversight through inspection and enforcement to the full extent of established penalties and fines for such issues as oil and wastewater contamination, ensuring well casings are sealed, holding companies to standards for capture of natural gas for market sale, among others.

Several authors have addressed the environmental and socio-emotional impacts to traditionally agrarian and agricultural communities and their marginalization, but mostly in the eastern U.S. and particularly in communities living on the Marcellus (gas) shale formation of Pennsylvania (see McGraw, 2012; Seamus, 2012; Jerolmack and Berman, 2013, Rast, 2013).

Malin (2015) conducted 42 in-depth interviews of farmers to determine the environmental justice implications of the natural gas industry's presence in rural Pennsylvania. Ferrari (2013) studied the social justice concerns of residents in the Marcellus shale region of Pennsylvania as the petroleum industry became established. Hotaling (2013, p. 1) discussed the moral implications of the fracking industry, with a study entitled, in part "… basic rights and obligations to human flourishing." McCarthy (2013) approached fracking from an environmental justice lens and developed a primer for low-income landowners, providing a glossary of terms and tips for those considering lease agreements. In a study in England, Short et al. (2015) describe fracking as an "extreme energy" process (p. 4), a term coined by Klare (2011) and make the case for investigating fracking through a human rights lens.

Jerolmack and Berman (2016) visited over three dozen municipalities in northern Pennsylvania and described many of the value conflicts and decision-making that landowners and their communities face as a result of fracking coming to town. Working in Pennsylvania, they drew upon Garret Hardin's reference to the *tragedy of the commons* (1968, in Jerolmack), as follows. While landowners have enjoyed generations of sovereignty in land-use decision, individual landowner are exercising their individual right to gain income via fracking and making unilateral decisions for themselves and their land that ultimately impact the quality of life of their neighbors and their larger community. Mehany and Guggemos (2015) surveyed the literature on the economic and environmental implications of fracking in the United States.

Several studies have address perceptions of benefits and risk (Wright, Muma & Radebaugh, 2016; Davis & Fisk, 2014; Sangaramoorthy, et al., 2016), the latter of which

examined perceptions of communities in West Virginia from a place-based perspective, examining the interconnections between social impacts, environmental effects and health. McCarthy (2012), in a study on the Marcellus shale formation of Pennsylvania, found that landowners would be better prepared to address the leasing process if more information sessions were held across fracking-intensive areas. Interestingly, Jones, Hiller & Comfort (2013) looks at the arguments being made for and against gas shale fracking in the UK from a public-relations messaging standpoint.

There are several studies of a policy orientation around fracking. Squillace (2017) addressed policy and regulatory concerns to make fracking more sustainable. Davis and Fisk (2014) examined public attitudes toward fracking in terms of energy policy and environmental regulation. Notable long-hand journalism pieces include these in the New York Times, Washington Post and the High Country News (Brown, 2013; Mufson, 2012; Kusnetz, 2012; Sontag, 2014).

Several studies on the laws and regulations on fracking as they relate to the local landowner's perspective. Schamber (2017) explored the potential for local controls or home rule so that residents can be better protected from hazards and more easily establish liabilities. McFeeley (2014) addressed rules on the disclosure of chemicals and other hazards in the fracking industry, and pointed out that only seven of the 22 states where fracking occurs have no chemical disclosure rule. Jones, Hillier and Comfort (2013) provide some insight into the public relations efforts of oil companies.

A recurrent theme in the literature related to the seemingly unbridled growth of the oil and gas industry in North Dakota is the lack of sound policy, oversight and—apart from industry reps—the general lack of familiarity with the intensity and extent of

fracking operations among the traditionally agrarian and agricultural residents of the region. There is a need for better enforcement of regulations intended to safeguard the public interest, however the State of North Dakota is charged with the regulation of oil and gas activities on non-federal land, and the oversight is led by just three individuals: the governor, attorney general and the agricultural commissioner who make up the North Dakota Industrial Commission. The director of the North Dakota Department of Mineral Resources has the dual and conflicting role of Chief Regulatory Officer for the industry and the individual charged with promoting the industry and its development. However, there is inadequate staff to inspect the 15,000-plus wells in the state and properly monitor compliance on standards for disclosing, reporting and remediating incidents for a variety of violations such as oil and wastewater spills. Similarly, there is inconsistent enforcement of penalties established for these occurrences or the failure to report them. Stangeland (2016) recommended that, for the State of North Dakota,

> a normalization of environmental fines for violations, including limiting the ability to reduce fines, would…convey a message that regulations are important and must be followed. To reduce fines for failing to follow safe practices or regulations is counterproductive to the protection, prevention, and mitigation of the risks associated with fracking.

He further recommended additional monitoring of "water consumption, water quality, air quality, and traffic impacts on the local environment."

Several authors have cited the "social disruption hypothesis" of England and Albrecht (1984) in descriptions of how the rural communities of western North Dakota have been impacted by the sudden boom-town onset of oil workers and how this changes

the social makeup of the population and social dynamics at the local level (Genareo, 2013; Fernando and Cooley, 2015; Caraher, et al., 2017). Fernando and Cooley (2015) used a holistic quality-of-life model to look at varying qualitative perceptions between stakeholder groups to the Bakken oil boom in the domains of family experience, work experience, social experience and community experience. In a case study, Genareo (2013) examined the responses of school staff and community members in a town in western North Dakota as they experienced an oil pre-boom.

Municipal governments have an important early role to play in minimizing impacts of oil development by addressing the influx of transient oil workers in city planning efforts related to temporary housing or man-camps, zoning actions and local ordinances to minimize crime and disorderly conduct. Several studies have addressed this in-migration to rural North Dakota's oil boom, looking at the establishment of "man-camps" from an archeological standpoint (Caraher, et al., 2017) and examining industry-induced impacts on social services (Weber, Geigle & Barkdull, 2014).

The Fracking Process

Hydraulic fracturing produces fractures in the rock formation that stimulate the flow of natural gas or oil, increasing the volume of resource that can be recovered. Wells may be drilled vertically hundreds to thousands of feet below the land surface and may include horizontal or directional sections extending thousands of feet.

Hydraulic fracturing is the process of fracturing layers of rock and shale. Fractures are created by pumping large quantities of fluids at high pressure down a wellbore and into the target rock formation. The procedure, in the Bakken region, requires the injection of between 1-6 million gallons of water (EPA, 2013) combined

with sand and a proprietary mix of up to 250 chemicals, deep into the ground (Finkel & Law, 2011). The use of water has intensified in recent years, and this has placed a higher demand on available water resources (Kondash, Laurer & Vengosh, 2018).

The continuous pumping generates extreme pressure, causing the underground shale or rock to fracture and release trapped oil (EPA, 2012). Hydraulic fracturing fluid commonly consists of water, proppant and chemical additives that open and enlarge fractures within the rock formation. These fractures can extend several hundred feet away from the wellbore. The proppants—sand, ceramic pellets or other small incompressible particles—hold open the newly created fractures.

In the early 1990s, the methodology known as directional drilling, or horizontal drilling, came into regular use (Mooney, 2011). Today, in high-volume hydraulic fracturing (HVHF), the drill that created the initial vertical well can change direction, allowing oil extraction laterally across the underground deposits. This allows horizontal oil wells to be installed in areas with obstructions such as building, lakes, and railroads. Wells can be established in areas where vertical drilling rigs have no access or permission. The performance or yield of a well is improved in horizontal fracturing as the plumes (pools) of shale oil deposits are often oriented horizontally, so the horizontal wells are better oriented for sustained extraction of those reserves. Figure 4 is a graphic from the U.S. Geological Survey showing the major steps in the extraction of tight shale oil and gas.

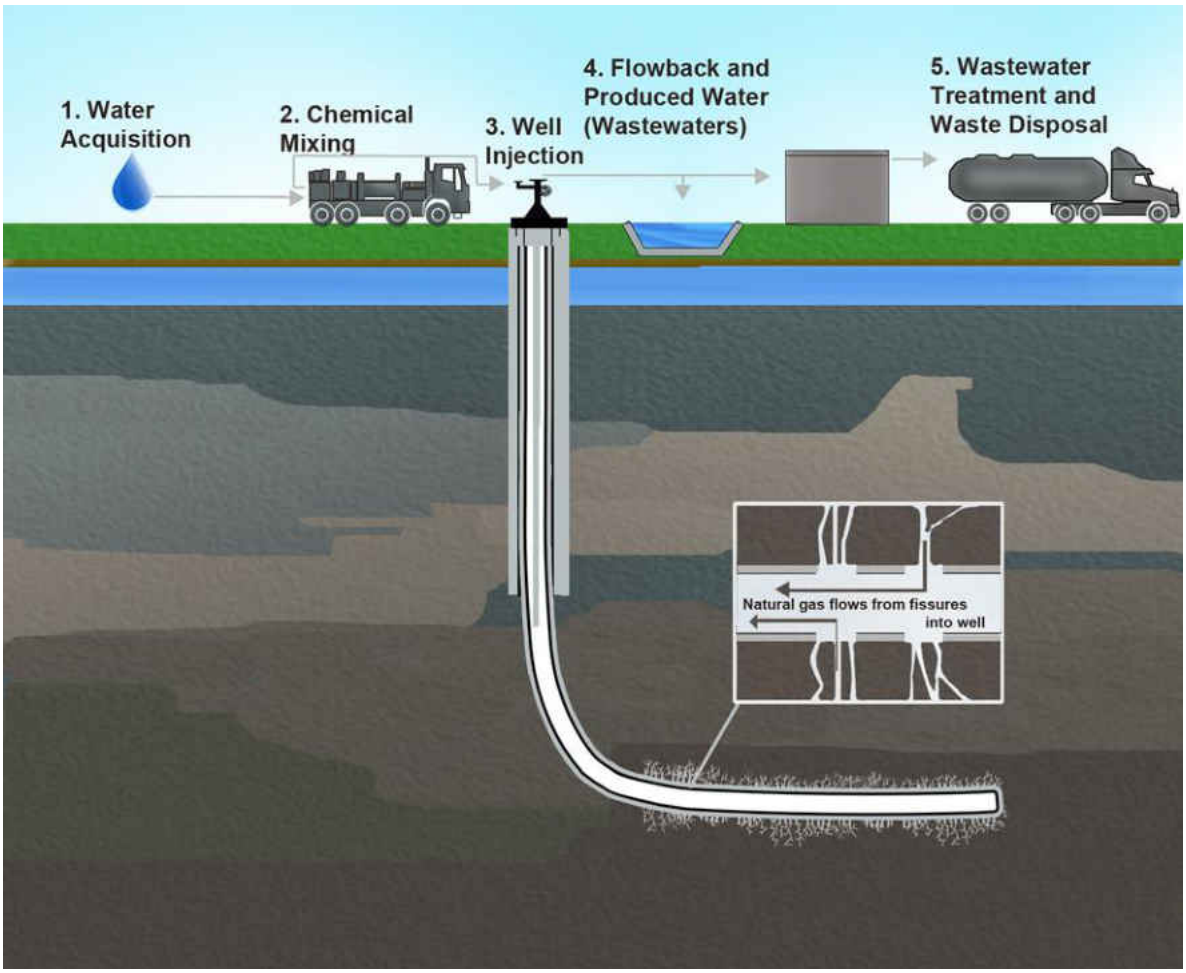


Figure 4. Diagram of the horizontal high-volume hydraulic fracturing (fracking) process. Adapted from 'Water-Quality Topics: Hydraulic Fracturing,' n.a., Copyright 2016 by U.S. Geological Survey. Accessed at https://water.usgs.gov/owq/topics/hydraulic-fracturing/index.html

The fracking fluid or slurry comprises only 1% of the volume of fluid forced underground but may contain over 1,000 chemicals with known toxicity including more than 100—such as arsenic, benzene, cadmium, lead, formaldehyde, chlorine, and mercury—that are associated with developmental or reproductive toxicity. Another 700 chemicals have yet to be tested for their effects on the human body (Elliott, et al, 2017).

In high-volume hydraulic fracturing, a slurry of water, sand, and chemicals are injected into tight spaces of subsurface shale following the drilling of the well, which initially is done vertically and then the drill bit is made to turn 90 degrees to drill horizontally, aligned with subsurface pools of shale oil. Then, millions of gallons of water are injected with the slurry at high pressure, to open fissures in the rock where the oil is trapped. Finally, as fracking fluids are brought back to the surface, negative pressure is created and the oil is drawn up to the surface.

The return fluids are known as flowback and must be disposed of properly. This is done by reinjecting the mixture back into either a non-producing well or a newly-drilled disposal well. While these liquids may be described simply as saltwater for their high salinity, they contain injected toxic chemicals, several of which are carcinogenic, plus naturally occurring materials such as brines, metals, radionuclides, and hydrocarbons.

The flowback and produced water is stored on site in tanks or pits before treatment, disposal or recycling. For disposal, it is typically injected underground into non-producing wells or new disposal wells. In areas where that is not an option, it may be treated and reused or processed by a wastewater treatment facility and discharged to surface water. Wastewaters pose contamination risks to ecosystems from spills and poor management (EPA, 2018). Howarth, et. al (2011) attributed most of the water contamination in the fracking process to three causes, and those are accidental blowouts, surface spills from storage facilities, and improper disposal of fracking fluids.

Advancements in fracking technology are driving the boom in crude extraction. Fracking can capture more oil than conventional wells which are reaching or may have

passed their productive life. Hydraulic fracturing drills can reach one to two miles underground then turn horizontally to tap into shale oil reserves situated as horizontal pockets or pools of oil. Several wells can be drilled on a single multi-pad at the surface but tapping multiple directions underground, without the need for gaining permits to surface installations above those reserves.

In this study, all references to fracking include the procedures of reconnaissance, the work of the landmen in meeting with landowners, seismic testing, permitting, contracting, site construction, the collection/injection/recovery/transport/disposal of water, chemicals and other materials, and any other activity or operations related to the industry..

While oil and gas activities can bring big revenues to leaseholders (not to mention government and other private industries), energy companies have to lease the mineral rights from landowners typically who receive royalties if the well produces oil. The landowners will live there after the work is done, and their concerns are many (Kusnetz, 2013), from pipeline construction (crude oil, recycled chemicals, and wastewater) to leaks and spills (Corbin, 2013), and the contamination of air, soil and water (Bamberger & Oswald, 2014; Cockerham, 2013; Colborn, et al., 2011). Fracking operations are largely unregulated by the federal government and taking place at a rate that exceeds the capacity of the state to adequately monitor oilfields, install safeguards and enforce compliance (Natural Resources Defense Council, 2014; Western Association of Resource Councils, 2011).

A variety of oilfield services have access to private lands, yet it appears landowners are not fully informed of these activities, so they are effectively marginalized

from decision-making and full knowledge of risks. Interestingly, a study by Boudet, et al. (2014), based on national survey data that sought to understand public perceptions of hydraulic fracturing, the authors found that "those more familiar with hydraulic fracturing . . . are more likely to oppose fracking" (p. 57).

The movie *Gasland* brought particular attention to methane contamination of water near natural gas operations on Pennsylvania's Marcellus shale formation, but there are several issues related to the use of freshwater and wastewater disposal in fracking operations (see Darrah et al. 2014; Vengosh et al. 2014).

Photography in Educational Research

Visual and participatory methods have gained greater acceptance as qualitative approaches that complement quantitative instruments in understanding livelihoods and evaluating the impacts of development projects (see Gotschi, Delve & Freyer, 2009; Keremane & McKay, 2011). The purpose of this research is not simply to catalog impacts but, rather, to offer photography-based methods as a more responsive form of research for those living in the oil industry's midst.

Arts-based methods have a conceptual frame that sees research as inclusive of many ways of knowing. Eliot Eisner (2008) wrote of the many forms of representation and the "expressive possibilities" (p. 1) of the visual. His words defend the non-positivist approach to research and foreground the participatory use of photography in this study. While certainly there are propositions whose truth value is significant and whose claims are testable through scientific procedures, there are also images and utterances that are highly evocative of the situations they are designed to describe. Consider photography. Photographs can be a powerful resource for portraying that which cannot be articulated

linguistically. We see this in the work of Edward Steichen, Dorothea Lange, Paul Strand, and other important photographers of the 20th century. But the ability to *reveal* is not limited to the talents of such photographers; it is available to those whose talents in photography are more ordinary.

The use of photography in this study underscores the value of visual literacy in our society at large. Metros (2008) defined visual literacy as the "ability to decode and interpret (make meaning from) visual messages and also to be able to encode and compose meaningful visual communications" (p. 103). Bamford (2003) asserted that visual literacy must also consider the implications of those images, and the participants stand ready to engage in the discussion of photographic images.

The visual sociology work of Becker (1995) and Harper (1994) is closely related to the field of visual anthropology (Banks, 1999; Collier, 1986; Pink, 2006; Ruby, 1981), a sub-discipline of social anthropology that examines the production of ethnographic photography, film and new media, but also looks at all forms of visual representation to include the performance arts, museums and mass media.

Visual research methods are central to establishing the cultural implications of place in my research. Place-based education is an emerging field of education that recognizes the role of the environment and generational ties to the land (Greenwood, 2003a, 2003b; Greenwood & Smith, 2008). Pink (2011) argued that interpretations of amateur photographs to establish a sense of place are best done with an accompanying theory of place. Thayer's (2003) concept of "bioregional thought" may be that theory, as the residents of rural North Dakota are very inclined to describe their community by historical attributes or natural boundaries such as rivers, ridges and buttes.

Jewitt and Van Leewen (2001), Prosser (2006), and Rose (2012) addressed the use of visual images in research. Prosser reinforces the qualitative value of photography by reminding us that "we don't see [images], we 'perceive' since the former is a biological norm and the latter culturally and psychologically derived" (p. 221). On the same hand, Verbeek (2004) cautions that technology today "shapes our relationship with the environment," and it can become "the terminus of our experience" (p. 207).

Several authors have examined the use of photography in educational research, including Cahman-Taylor and Siegesmund (2008), Dewey (1934), Goldstein (2007), Sinatra (1986), and Stokes (2002). Stokes (1989) advocated for the integration of visual literacy into education standards.

This study builds on the work of researchers who have used visual methods qualitatively in rural and farming communities, such as Gotschi, Delve, and Freyer (2009), Samuels (2004); and Van Auken, Frisvoll, and Steward (2010). Mitchell (2008) made use of photographs chosen by caregivers in South Africa to create an exhibit that gave insight into their work and garnered the attention of policymakers. Caroline Wang (1999) moved to brand a photography-based research methodology as "photovoice" in her study popularized by the film *Born into Brothels*.

This literature review should provide some historical scope on social and educational research that has relied on visual tools and extended interaction with the members of communities. This review of previous work provides a lens by which to view my experiences in the field and consider how photographic interventions gather data and facilitate story-telling by research participants.

In the peer-reviewed study Fracking Communities (Jerolmack & Berman, 2016),

co-author Berman contributes her documentary images, which are captioned with the real names of the subjects. This article is the closest I have found to my dual role as both researcher and documentary photographer. However, in the aforementioned study, there is no application of photography-based interventions as in this study. Lange (2007 is an excellent overview of visual methodologies in research oriented toward social change.

Photography-based Interventions Utilized in this Study

Photo elicitation is a method used in social research and marketing studies in which participants respond to images. Those images may be photographs, video, paintings. The images may be provided by either the researcher or the participant. Harper (1994) defined photo elicitation as a research method and overviewed its use in anthropology and sociology, where the technique has seen greatest use. Harper found that photo elicitation "evokes information, feelings, and memories that are due to the photograph's particular form of representation" (p. 13).

Using photographs brought to the study either by the participants or the researcher to produce data "offers educational researchers an entry point to the views, perspectives and experiences of participants," according to Mitchell (2008, p. 369). Apart from one year of pre-veterinary animal science study at Cal Poly, Pomona, I don't have an agricultural background. I reason that these visual methods serve to bridge a knowledge gap between me and my participants. It's been said that a picture is worth a thousand words.

It's important to anticipate how multiple images can work synergistically or play off of one another. Werner (2004), in the authoritative piece on *intertextuality*, writes,

> Whenever a pictorial image is read in terms of—or through, against, alongside—another image or a surrounding set of images and words, intertextuality is at work; meanings assigned to the image differ from those that would be drawn if it were interpreted in isolation.

Collier and Collier (1986, p. 105) suggested that "images invite people to take the lead in inquiry, making full use of their expertise." Certainly, one prong of my research philosophy in this work, as a visiting investigator, is to honor local expertise. Collier and Collier also suggest that using photographs in interviews promotes a flow in the research relationship continuing through second and third interviews, in ways in which merely verbal interviews do not. Radley (2010) examined how two different groups of lay people (hospital in-patients and homeless people) talked about photographs they had made with cameras that were provided by researchers.

Van Auken, Frisvoll and Stewart (2010) found that photo elicitation has "unique potential to empower participants' involvement in activities related to local planning for sustainable community development and natural resource management efforts" (p. 373). In Australia, Keremane and McKay (2011) conducted a set of case studies using photographs made by irrigating farmers to capture their emotions about water policy and sustainable development objectives.

There is power in the visual, and reason to believe that photo elicitation actually better at developing stories than straightforward verbal interviewing. Samuels (2004), for instance, found that the use of photo elicitation exceeded word-only interviews to evoke greater descriptions from the research participants. Samuels found that the descriptions were more emotionally charged than the word-only descriptions, and that the participant-

driven approach was an effective means of bridging the culturally distinct worlds of the researcher and the researched.

To facilitate objectivity during the discussion of images in the interventions, I adopted language from the Visual Thinking Strategies (VTS) curriculum (Museum of Photographic Arts, 2000) that examines historical and art photographs and draws from the cognitive psychological research of Housen and Yenawine (2000).

Photo elicitation: Use of family album and historical archive.

People tend to talk at length and with ease about their photo albums. I used an open coding process as the photographs were displayed as a body of images, and then the participant(s) chose a total of approximately a dozen images around topics or issues that were important to them. The images were not chosen with direct reference to categories and themes developed from the participant's phase one data sets, and certainly not prescribed my me, however many of the photographs and comments from the participants that sprang forth were intimately related to the themes they expressed in their interviews.

During conversations around the images, I gave the participants space to narrate the images and I listened. If I spoke, it was mostly to guide the participants with open prompts such as these three recommended in the VTS curriculum:

1. What is going on in this image?
2. What makes you say that?
3. What else can we find?

Van House (2011) provided guidance to coding the data collected during this technique— particularly personal album photographs made by participants—describing personal photography as "multiple overlapping technologies of memory; relationships;

self-representation; and self- expression, all of which are changing in the digital environment" (p. 125). Old prints offer an opportunity to discuss the generational use of photography and compare the medium to today's digital technologies.

Intervention two: repeat photography or rephotography.

This intervention entails the practice of returning to the exact location of an existing or historical photograph to repeat the photograph and discuss change over time. Typically, repeat images are composed similarly and may include the same camera position, framing, composition, lens focal length and lighting (Hales, 1987). A fine example is the Rephotography Survey project of photographer Mark Klett (Klett, Manchester & Verburg, 1984) whose small team of photographers revisited 120 locations in the American West that were surveyed by camera 120 years prior. The practice of rephotography is a great supplement to disciplines of geography or historical geography. Leading conservation photographers, including James Balog (http://jamesbalog.com/portfolio/portfolio-extreme-ice-survey/) and one of my mentors, the late Gary Braasch (https://dotearth.blogs.nytimes.com/2016/03/08/too-soon-gone-gary-braasch-visual-chronicler-of-climate-change/) have documented climate change and the loss of polar ice cover through repeat photography.

In this study, the technique of repeat photography is offered to participants as a means of social research. If repeat photography was chosen as an intervention, the participant selected the location for rephotography and whether one or both of us would make the new images at that site.

Intervention three: Aerial photography or agency maps.

Participant Trackfinder expressed an early interest in the use of aerial photographs published as maps he had been given privately by oil companies, the USDA Farm Services Agency (FSA) and the North Dakota State Department of Water Resources. Aerial photographs are often made available to individuals who manage large amounts of land. In this context, they are favored over oblique photographs when depicting large swaths of land because the scale of the aerial photography is relatively consistent throughout the entire frame. Also, there is no change of perspective over distance as near and far objects are photographed at the same camera-to-subject distance so the magnification is constant and, shot from altitude, there is no relative size difference (e.g. foreground-background).

However, one of the disadvantages of aerial photography can be the unfamiliar view, which is rather abstract to our normal on-the-ground view toward the horizon. In the overhead aerial view, it may not be easy to immediately identify all of the features (though cast shadows can depict or suggest the vertical height of objects in the scene such as tall structures and geographic relief), and this aspect of the aerial photograph contributes mystery that engages the viewer. In the aerial photographs, viewers may record their observations by describing them in two-dimensional terms, referring to elements by shape or the arrangement of lines in the image. Harper (2002) found that having several aerial photographs of farms available in an interview encouraged farmers to discuss how and why they had chosen one strategy over another. Skwirk (n.d.) provided a framework that would be useful as the starting point for interpreting and discussing aerial photographs. Participant Trackfinder chose aerial photography-based maps provided to him by oil companies and government agencies as the basis for conversations in phase two of this study and we

annotated them together using Siri voice recognition software speaking into text boxes we created over the images while viewing the in the ap Notability on my iPad.

Intervention four: New photographs by the researcher made at the request of the participant.

In this intervention, the participant would ask the researcher to make specific images which would then be discussed in a conversation between the participant and the researcher in phase two. The follow-up discussion would address the significance of the location and/or content and whether the image(s) represented the participant's attitudes or beliefs.

Photographs as data

All images used or discussed in the interventions were treated as visual data to be coded (Prosser, 2007). Prosser suggests that photographs be used as visual quotes in the same way we present a section in an interview to represent a concept or idea. I made use of coding that was both descriptive and conceptual. Conceptual codes included such terms as marginalization, privacy, or sense of place. In Visual Teaching Strategies (VTS), Housen and Yenawine (2000) developed a series of prompts for guiding observations and reflections on art. Their curriculum is designed to improve critical thinking skills in young students, yet I found the VTS system questioning suitable to photo elicitation.

Photography & Environmental Education

Several studies have been conducted on the use of photography in environmental education, mostly in the context of activities or supplements to biology curriculum or for use in science camps and outdoor education . In their essay 'The Failure of Environmental Education (and How We Can Fix It)', Blumstein and Saylan (2007) proposed several improvements for environmental education: the need to better quantify

impacts, teach the complex non-linear relationships of ecology, impart a worldview and integrate action and critical thinking approaches. The U.S. Environmental Protection Agency National Environmental Education Advisory Council (2005) has recommended it is time to "broaden the audience … by actively engaging all sectors of society", and to "improve the quality, accessibility, and dissemination of EE materials and programs" (p. 29).

Environmental education is not a core funded curriculum and, as such, schools have relied on supplementary curricula which are typically sponsored by industry. This is problematic and carries certain irony. For example, the Project Learning Tree curriculum is written and sponsored by the timber industry which is a proponent of clear-cutting, not a sustainable practice and the whose photographic documentation would be good scientific practice but ill-suited from a public relations standpoint.

Environmental education is typically provided as a supplement to biology programs and implemented as science camps and outdoor experiential education programs contracted out to private experiential education programs and the non-profit educational groups associated with research stations and government reserves. For example, there is the Channel Islands Institute of southern California and the Wolf Ridge program of northern Minnesota. Photography may enter these programs in the context of role-playing lesson designs where student "scientists" employ cameras to record diagnostic features of plant or animal life or document a "research site" in some way.

This research may identify content and new ground for the use of photography in environment education that features critical environmental needs and applications for those living with the oil and gas industry.

There are a variety of environmental education tour programs that may not be contracted by schools for local programs, but bring youth and adults to destinations. The Biosphere Environmental Education program (www.biosphere-ed.org) is one such program with summer youth and adult programs in Canada and Antarctica. The organization forefronts environmental photo-journalism and film making as a way for workshop participants to recount workshop experiences, reaffirm their experiences in nature and to create calls for action. Citizen science education, in which students collect data via photography to benefit local communities, is a growing movement in outdoor education.

Citizen science can advance the understanding of ecological systems (Cooper, Hochachka and Dhondt, 2012) . Through websites such as iNaturalist.com, citizens can provide photographs to assist in the identification of species, and document occurrences to refine existing data on the abundance, distribution, range or migration of species (iNaturalist) and even document the occurrence of rare ecological phenomena or disappearing species. The Lost Ladybug Project at Cornell University maintains digital images of ladybugs received from all over the United States. Through this project, two children in Virginia reported a nine-spotted ladybug, which had not been confirmed in 14 years (Losey et al., 2007). Their photographs led researchers to the location to collect individuals for captive breeding. The Biodiversity Group, an international conservation organization based in Tucson (USA), has implemented their Biodiversity PEEK curriculum for elementary and high school students in community-based citizen science programs across the U.S. Southwest, Mexico, Ecuador and Thailand

(https://biodiversitygroup.org/citizen-science). The photographic methods of scientists are a key component of the curriculum. Students become familiar with their local fauna, and learn how to photograph the diagnostic features of animals before contributing their image to an online database that can be used by scientists from anywhere in the world. The program works closely with the iNaturalist database which is linked to the Global Biodiversity Information Facility (gbif.org), one of the world's largest depositories of scientific data.

The participants in this study use photography to share their informal learning with members of their local community, and one of them has sought publication in local newspapers, a medium which can be interpreted as an existing vehicle for nonformal education. However, print journalism has declined because digital images are ubiquitous and advertisers have followed the trend toward online outlets. The reliance on user-submitted content has coincided with large scale layoffs at newspapers (Kaiser, 2012) This has promoted a rise in citizen journalism. Radsch (2013) defines citizen journalism as,

> an alternative and activist form of newsgathering and reporting that leverages networked social media and functions outside but in relation to mainstream media institutions, often as a response to shortcomings in the professional journalistic field, and which tends to be driven by different objectives and ideals and rely on alternative sources of legitimacy than mainstream journalism. Indeed, citizen journalism is a practice that refers to non-professionals who engage in acts of journalism, such as reporting, fact checking, documenting, verifying… (P. 159).

These are activities very much like the work of participants Cody and Phoebe to document impacts and seek outlets for their sharing, which include using them as proof at land-use and planning meetings.

Largely working in the editorial sphere, conservation photography is a discipline which distinguishes the work of ethical editorial natural history photographers working purposely in specific regions, projects or species who work closely with scientists and reserve managers and practice good methods to minimize their impacts to wildlife. The work of these professionals, and their in-depth captioning, give teachers a ready-made resource in topics of environmental education. In Farnsworth (2011), I dissected the work of professional conservation photographers and the scope of their educational contributions through editorial and documentary outlets. I defined conservation photography as:

> an inherently educational practice of communicating ecological messages visually, carried out by photographers with ecological understandings and collaborative skills who represent affected communities in the development of accurate and highly interpretive thematic photo essays, eliciting the critical stewardship and action orientation so needed in environmental education today (p. 16).

Ward (2008, in Farnsworth) provides an excellent historical overview of conservation photography and positions it as an issues-focused form of documentary photography that 'empowers conservation" (p. 1). I wrote a chapter in the book *The Media, Animal Conservation and Environmental Education* (2012), edited by John Blewitt, which features contributions from filmmakers, photographers, researchers and academics from around the world and examines the many ways in which the film, digital

media, television, and video can be used by conservationists and educators to encourage both a greater awareness of environmental and conservation issues, and practical action designed to help endangered species.

In as much as images are shared heavily in social media today, and this is considered a form of public education, Pearson, et al. (2016) looked at how social media may be contributing to sustainability awareness.

In response to the pervasion of digital media – that includes cellphone cameras and the like - Greenwood and Hougham (2016) critically explored the tension between new digital technologies and the core values of environmental education. Digital storytelling, which Greenwood and Hougham described as a "democratized version of oral history" (p. 109), uses digital technologies to produce multimedia stories of the lived experience of diverse individuals, families, organizations, and communities (Burgess, 2006; Lambert, 2002). The authors compare "digital trails" (p. 107) from the use of GIS, environmental monitoring projects, digital storytelling and other media with the "direct, sensory experience of the environment, the development of observation skills, and the capacity to care…cornerstones of the field of place-conscious environmental education" (p. 106). The use of devices/screens – and dependency on them as a way or learning and knowing - may interfere or distort such experiential learning. The authors also noted issues of sustainability in new technologies.

CHAPTER III

METHODOLOGY

For this qualitative study, I used an emergent research design (Maxwell, 2005) with naturalistic inquiry (Lincoln & Guba, 1985) appropriate to qualitative educational research in rural communities, examining three cases. The sources of data include both ethnographic interviews in the first phase of the study, followed by the discussion of photographic images in the second phase of the study. Photographs were offered voluntarily by participants as supporting artifacts to discussions of fracking activities on their land and offered additional opportunities to learn of the participants' lived experiences, perceptions and attitudes. Three individuals agreed to interviews to share their lived experience with fracking, and each was given the research pseudonym of their choosing. They are Cody, Trackfinder, and Phoebe.

My methods and approach follow in the qualitative research traditions of Corbin and Strauss (2008), Creswell (2007), Maxwell (2005), and Weaver- Hightower (2019). Corbin and Strauss (2008) emphasized the importance of the researcher being fully aware of potential biases and the presumptions he or she may bring to the research, and I devote some discussion to that in this section. Corbin and Strauss also stressed the importance of sensitivity for the research data and the importance, thus my use of extensive excerpts to fully honor their voice and their message. Creswell (2007) recommends a close relationship with the subjects being studied, and and I was diligent in visiting the participants before research began so they could get to know me and I could describe the work and obtain consent as appropriate. I have been sensitive to their needs in scheduling and meeting them where they live and work.

My work is ethnographic. In terms of methodology, I am embedded on their lands, using such methods as rich descriptions from deep interviews, observations of their behaviors in context, and documentation from the participants in the form of captioned photographs and stories from those experiences. I joined them on their daily activities, probing for their cultural understandings of place and watching their use of their land. I came to understand them as a cultural group and I found commonalities across them. The case studies share a basic culture, they seem one culture. This research is really an ethnography of rural western North Dakota oil communities.

This is a study of the cultural use of photography in rural fracking communities and its potential use in related education efforts. In terms of the research rationale, I am very much the participant observer and I consider the thoughts and analysis of the participants most important. I am not the traditional empirical researcher wherein I am the primary source of knowledge. To say I am using ethnographic methods should not violate the boundaries of my discipline as educational and social research become one in the study of conservation issues.

Another of my research approaches that typify ethnographic work is how I chose to solidify conceptual frameworks after engaging in fieldwork with the participants, allowing them to determine, effectively, the proper lens (and this conceptual framework) for analysis. I am open to unique experiences and new information, and I choose to meet the participants in places that are apt to present new information. Wilson (1977) wrote (p. 7),

> Those who work within the anthropological tradition cultivate the skill of suspending (the phenomenologists call it "bracketing") their

> preconceptions. They study prior research and theory as much as the traditional researcher, but they then purposely suspend this knowledge until their experience with the research setting suggests its relevance.

Furthermore, as would the ethnographer, I have given considerable thought, attention and writing to the aspects of how I enter the research setting and relate with the participants. I have also addressed my identity. I also give attention to both verbal and nonverbal communication and communication with the researcher prior to research

Maxwell (2005) provides a flexible model for research design that recognizes the interaction between research goals, research questions, conceptual framework, methods,

and validity. My adaptation of Maxwell's research model is shown in Figure 5.

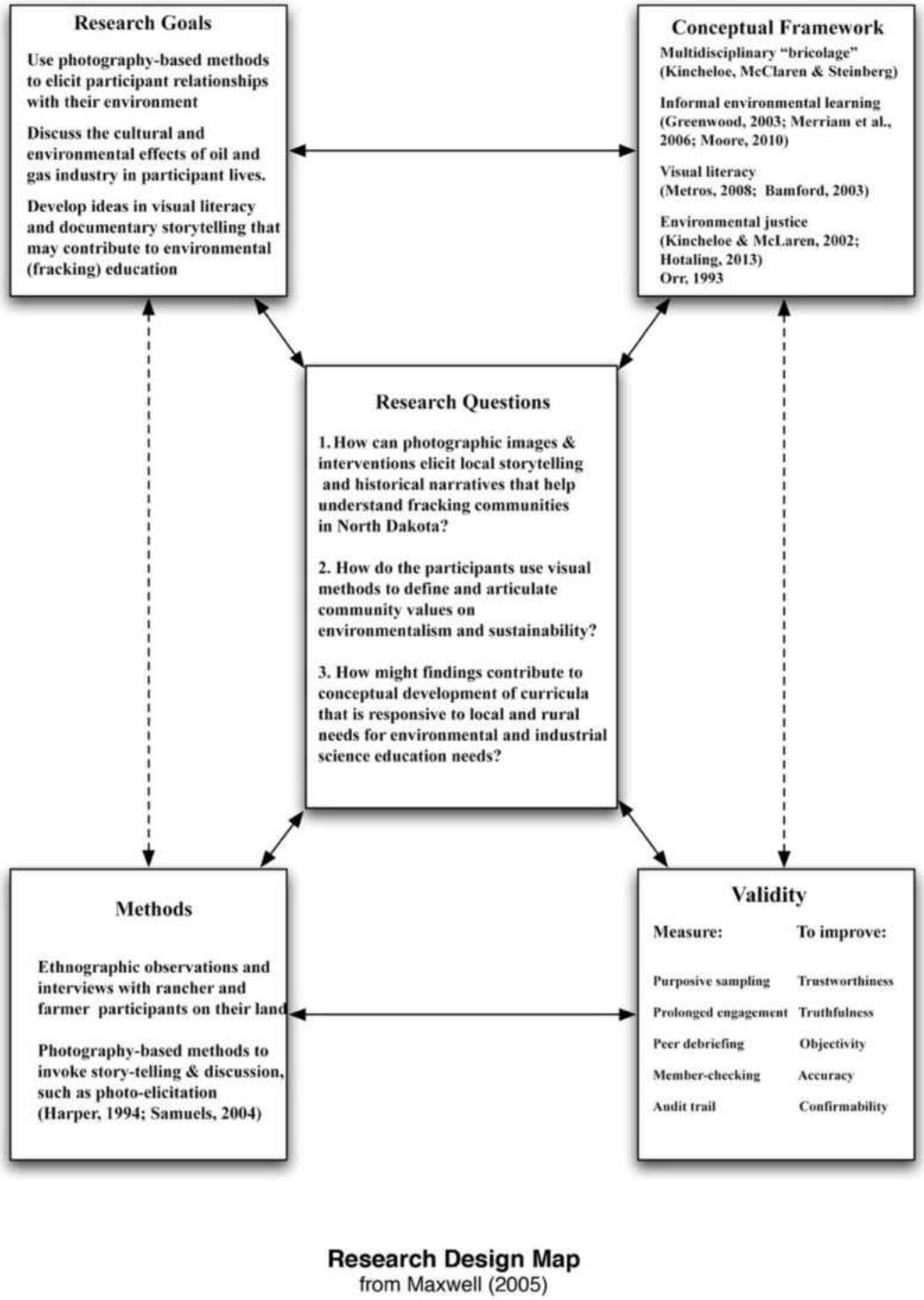


Figure 5. Model of this qualitative design of this research. Adapted from Maxwell's (2005) Interactive Model.

Research Questions

My study is not a survey of impacts per se, but an examination of how the medium of photography can be responsive to local residents in learning about and understanding environmental concepts and issues from their perspectives. There are three research questions:

1. How can photographic images or photography-based interventions in educational research be used to elicit local storytelling and historical narratives that contribute to our understanding of contemporary fracking communities in Western North Dakota?
2. How do the participants use visual methods to define and articulate community values on environmentalism and sustainability?
3. How might these findings contribute to the conceptual development of curricula that is responsive to local/rural needs for environmental and industrial science education?

Participant Selection

The two most fundamental criteria for participant selection were that each participant be a farmer and/or rancher residing in one of the four counties associated with the Bakken and Three Forks shale oil formations, and that they have experienced contacts with the oil companies regarding access to their land, easements or extraction of mineral resources. The isolated landscape of the Bakken oil formation required early orientation on my part and a few reconnaissance trips to identify prospective participants. For this work, I attended local and regional meetings of landowner associations and government hearings attended by local farmers, ranchers, business owners, and local tribal members. In this context, I was able to interact with local citizenry as they expressed concerns regarding the activities of oil development on their lands.

In terms of recruitment procedures, I contacted all prospective participants myself

using networks I established since 2013 when I began to visit the Bakken region and attend regional hearings of the oil and gas commission and the annual meeting of the local chapter of the Western Association of Resource Councils. Working from my referrals and initial meetings, I initially selected five individuals (three male and two female) with whom I began conversations. In essence, I relied on the single phenomenon of the prospective farmer/ranchers' shared involvement in business dealings with the oil and gas industry relative to their personal properties, a selection process recognized as homogeneous sampling (Glaser & Strauss, 1967). One individual chose to leave the study after the first interview as she felt she would not have adequate time to both participate in the study and attend to issues she was experiencing with oil industry activities on her land. Another individual was not recruited into phase two of the study as he did not see the relevance, or application, of photography in his lived experience. The three participants in this study are case studies, and they have chosen their pseudonyms of Cody, Trackfinder, and Phoebe. While there became some overlap in the days in which I met with them for fieldwork, they were mostly encountered in this sequence during data collection and so I present them in this order in the findings of this dissertation.

The sampling was purposeful to enhance validity; participants reflect a range of perspectives. They are both male and female. They are ranchers, farmers and one has worked formerly on oil operations. All three participants own or lease active oil wells on their land, while two of them have also, at some point, refused to lease mineral rights or grant property access to the oil and gas industry. All participants are members of regional resource councils or advocacy groups, though active to varying degrees. All of the participants had one phenomenon in common: their exposure to the growth of the

fracking industry. While a participant may have one or more affiliations, none are presented as organizational representatives. All participants presented their personal beliefs.

There are no Native American participants in this research, and the research was not conducted on Tribal land. However, I established relationships with several respected members of the Three Affiliated Tribes that reside on the Ft. Berthold Indian Reservation, and my work was designed to be sensitive to their needs in the event I would include Tribal participants. However, my cultural advisors stated that the Three Affiliated Tribes had not yet formed an Institutional Review Board (IRB), and that any research approval would have been unstable given the political environment of the tribal leadership, a council which has experienced changes with the current election cycle. None of my research or cultural advisors are participants in the research. I see this as a limitation to have not included Native Americans, and future research should include them and their crucial perspectives.

Site Selection

In order to study the lived experiences of farmers and ranchers directly affected by the oil boom in western North Dakota and understand their culture as it relates to fracking activities, I selected prospective participants who had their farms and ranches in the four counties associated with the Bakken and Three Forks deep shale formations and those counties are Dunn, McKenzie, Montrail, and Williams. Oil wells are typically situated on agricultural lands where landowners have historically earned income from crop farming and cattle production. Today, these private lands are easier for the industry to access, requiring fewer permits than government land. Figure 6 shows the study area.

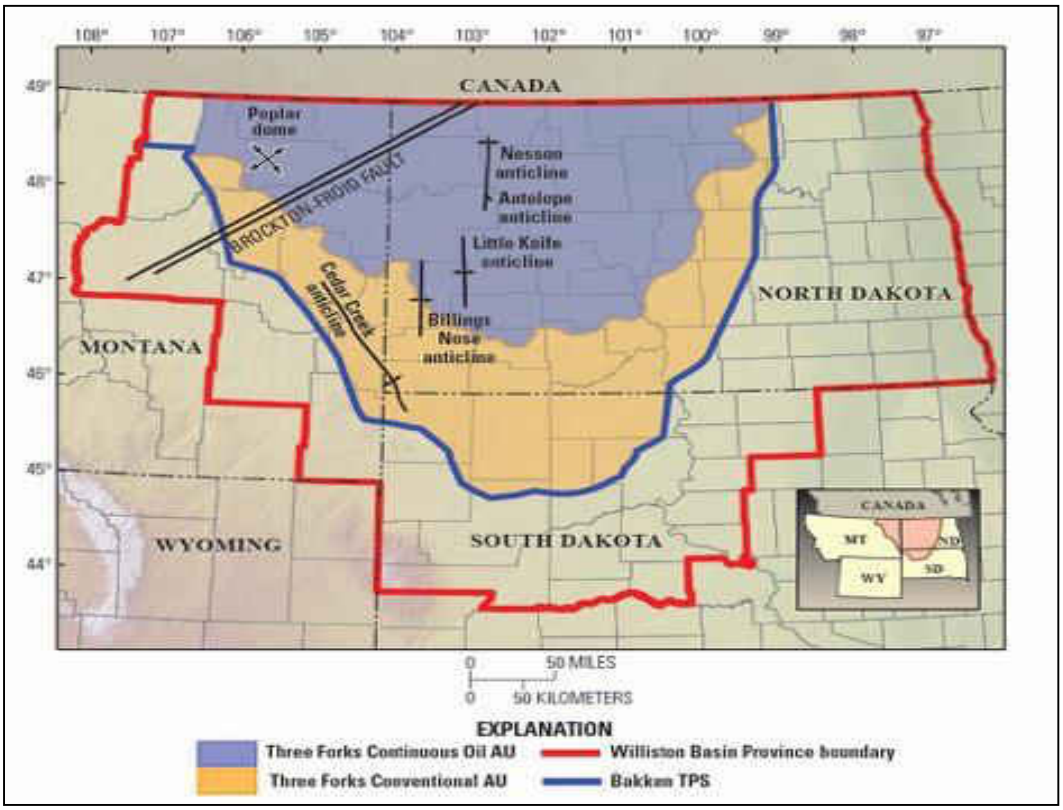


Figure 6. Map showing the area of the Bakken geologic formation in North Dakota in which the study participants live, farm and ranch. Adapted from 'Assessment of undiscovered oil resources in the Bakken and three forks formations, Williston Basin Province, Montana, North Dakota, and South Dakota, 2013,' by S.B. Gaswirth, et al., 2013, U.S. Geological Survey Fact Sheet, 3013(4), p. 3. Copyright 2013 by the U.S. Geological Survey.

Data Collection

In-depth, semi-structured interviews and observations are my primary sources for data collection during phase one of this emergent qualitative design (Maxwell 2005). Adding context to the personal interviews of phase one of this study, I relied on extended observations of participants. These observations took place as they worked on their own land or attended regional meetings related to oil and gas issues.

Participants chose from several photography-based methods in phase two of the research that served as devices to help them tell their stories, guided by the themes distilled in phase one. The range of interventions made available to participants included photo elicitation, using family archives or new images, repeat photography, use of aerial photographs from oil company or third agency maps, or images made by me at their request.

Phase two of this study made use of several photography-based methods that relied on the participants' use or interpretation of images to discuss or expand on themes developed in phase one (interviews and observations) of this study. These methods are described as interventions because they serve to focus participants and redirect the manner in which they consider their experiences in oil country. The fieldwork for this research was conducted between April 2014 and May 2015.

Phase one data collection: interviews and observations

In the interviews of phase one, I conducted three to five semi-structured interviews of 45 to 90 minutes with each participant. Sample interview questions (see Appendix) divided into four areas that move from life history, bridging to their local environment, their background in environmental education, and then to questions about their knowledge or use of photography.

Interviews were conducted at participants' homes, ranches and farms, and via internet-mediated chat and telephone. All collection and analysis of data were carried out by me. Some transcription of interviews was done by an off-site typist, who signed a confidentiality agreement and who I instructed in formatting the transcripts for my purposes. Conventions used by the transcriptionist included shorthand symbols for

proxemics, inaudible voice, laughter, interruptions, emphasis and drawn out, overlapping or whispered/quiet speech to enhance the accuracy of the transcriptions as data. For some of the interviews, I made my own transcriptions using HyperTranscribe software or the free online application otranscribe.com. These platforms allow multiple sound file types, adjustments to playback speed, and a two-second rewind each time playback is resumed to ensure nothing is missed. As some of the observations were done while walking across wet or snowy fields, I tried to get closer to the participant, pause our movement and shield the microphone from wind during conversations to reduce background noise. Time codes for the audio recordings of the interviews were placed at regular intervals in the transcription, allowing me to return to the tapes as needed to clarify my understanding as needed.

All of the participants are working farmers and/or ranchers, and I shadowed participants as they worked on their land or inspected oil and gas leases on their lands. Observations, lasting up to five hours with each participant, took place in the context of real work generated solely by the participants. In other words, the scenes or settings for the observations are natural and not manufactured or contrived by me. In all data collection, appropriate safeguards were in place to protect the privacy of participants and the security and confidentiality of the data, such as removing names, associates, property, land use, contracts and leases that may identify the subjects.

Before the formal interviews began, I sought a good sense of the many perspectives on oil and gas development in the state as a foundation for the interviews. For example, I attended two hearings of the Energy Development Committee of the North Dakota State Legislature and two meetings of the Oil Gas Task Force of the

Dakota Resource Council. From these meetings, I learned more of the issues which helped me to fortify my background knowledge, gain an improved sense of place, understand the values of the participants, and draft the goals, objectives and interview protocol for the research.

Data Analysis

This analysis of data, whether in phase one (interviews, observation and document analysis) or phase two (photographic interventions)—was designed to capture the pertinent opinions, beliefs, attitudes and experiences of participants. I analyzed data from phase-one interviews and phase-two photography-based interventions of all three case studies in line with accepted qualitative methods that require purposive (rather than random) sampling (Erlandson et al., 1993). Measures to address validity and trustworthiness are discussed in more detail later in this chapter.

Phase one analyses.

Initial descriptive coding was applied on a line-by-line basis to the interview transcripts, observation notes, and any artifacts collected. However, I also made accommodations for new ways of life in fracking country, in settings that are sometimes political or conflictual in nature. For this, I used some additional coding strategies such as Saldaña's (2013) use of codes for causation, and additional codes for in vivo, values, and/or process. Coding of the transcribed interviews was done on paper manually before refining them in Hyper RESEARCH™ qualitative analysis software (Version 3.5.2). The creation of memos during the data collection period helped me to refine research questions, identify problems in the study design and find early patterns in the results. Saldaña (2013) tells us such memos become a way of generating new codes for analysis

and form the transition between coding and writing the dissertation. I kept my research questions in front of me to guide my coding decisions and I keep the recommendations of Emerson, Fretz, and Shaw (1995 in Saldaña) in mind, such as:

- What are people doing?
- What are they trying to accomplish?
- How, exactly, do they do this?
- What specific means and/or strategies do they use?
- How do members talk about, characterize, and understand what is going on?
- What assumptions are they making?
- What do I see going on here?
- What did I learn from these notes?
- Why did I include them?

All of the codes gathered in phase one research were assembled into categories and subcategories, leading to the creation of themes. Figure 7 shows what Weaver-Hightower (2019) described as the "life of code" using an actual excerpt from a Phase I interview of participant Cody in which he refers heavily to water, and shows how codes were extracted from the text, leading up to the category of water, which is one of four categories supporting the major theme of the home-front.

Figure 8 shows how a holistic in vivo code (Saldaña, 2013) was applied to a large passage from a phase one interview with participant Trackfinder.

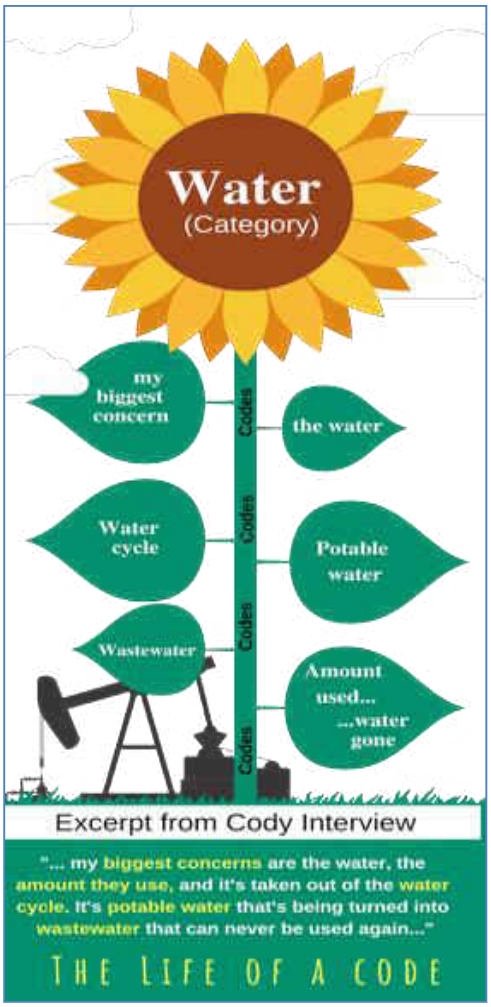


Figure 4. Diagram from the data analysis of participant Cody, showing the life of several codes (Weaver-Hightower, 2019) as they support the category of water.

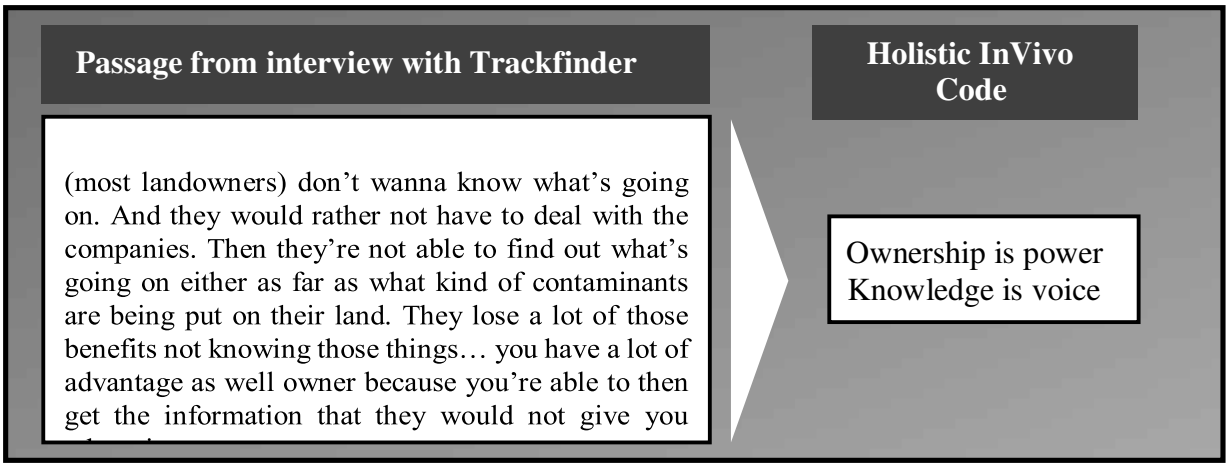


Figure 8. Sample of holistic in vivo code (Saldaña, 2013) in large block quote of participant Trackfinder.

Figure 9 shows the code-mapping process of data from Phase I interviews and observations with participant Cody. Using actual data from phase one findings for participant Cody, the illustration shows how codes become categories, and categories become themes.

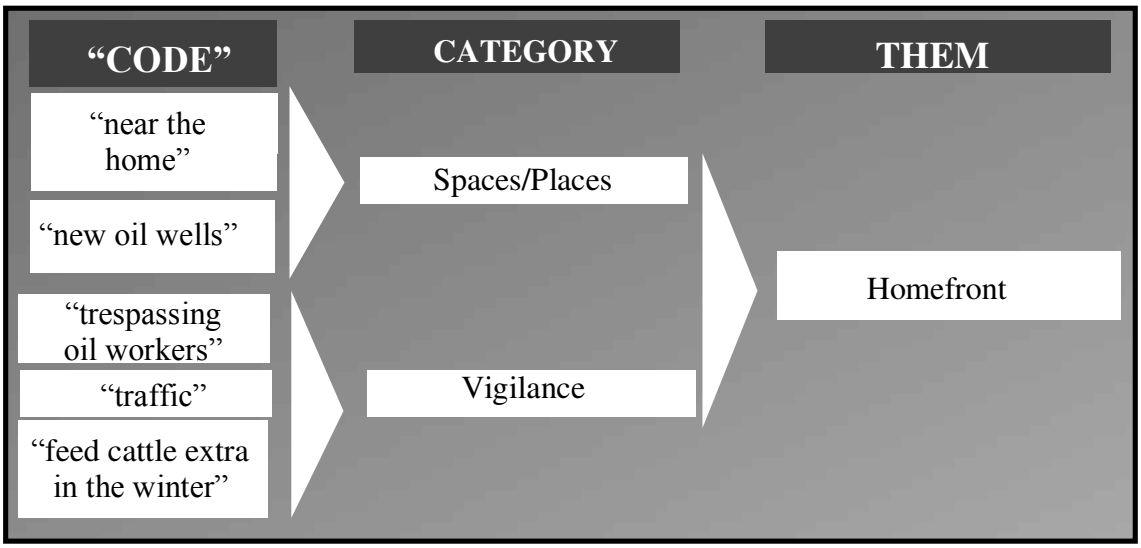


Figure 9. Diagram of codes-to-theme model of data analysis used in this qualitative research

It's important to note that, ultimately, the conversations I had with the participants about the themes that emerged in Phase I was perhaps more valuable to me to prepare me for how the participants might choose or frame their discussion of the images, than it was to direct them in same, and this was made clear to the participants. phase two would continue in the spirit of openness and responsiveness of Phase I, and Phase I findings were not interpreted as prescriptive.

Phase two data collection: the photography-based interventions

At the conclusion of the first phase of interviews and observations, I wanted to explore how photography had been—and could be—used by the participants in understanding and talking about the oil and gas industry activities they had experienced. I shared the research questions with the participants, and I helped them choose among a menu of photographic methodologies using short descriptions of each. The methodologies included:

- Photo elicitation using personal or family archives
- Repeat photography by participant or researcher
- Aerial photography in oil company or agency-provided maps
- Photographs made by the research at participant request

The emergent codes, categories, and themes distilled from phase one of the study were further explored, articulated, illustrated and reinforced through the use of visual research methods or interventions with each of the participants. These codes were developed primarily by me but member-checked also with participants. Work by Ganesh (2007) supports the argument that images or visual representations enhance participant access to, and involvement in, research while increasing the richness of findings by

offering visual supplements to interview-based textual data. These interventions lent additional insights into topics observed or discussed in phase one of the research which, by reinforcing links to place and experience, added personal relevance, authenticity and concrete visual references to the findings.

In my phase two sessions, I used the prompts of the Visual Teaching Strategies curriculum as prompts to guide the conversations about the images. The VTS prompts are sequenced as follows, with the first questions acting as good open-ended prompts in the phase-two work:

- What's going on in this picture?
- What do you see that makes you say that?
- What more can [you] find?—a question that can serve as a further probe

Three approaches are used in facilitation:

- Paraphrase comments neutrally.
- Point at the area being discussed.
- Link contrasting and complementary comments.

[Participants] are asked to:

- Look carefully at works of art.
- Talk about what they observe.
- Back up their ideas with evidence.
- Listen to and consider the views of others.
- Discuss other possible interpretations.

During phase two of the study, participants engaged with several interpretative and original uses of photography, freely choosing from among a menu of visual research

techniques that I gave them that included photo elicitation (based on participant images or family archives), repeat photography, interpretation of aerial photographs provided by the oil company or agency maps, and new photography by the researcher (each of which is described further in the literature below). During interviews in the second phase, I adapted my questioning and interaction to fit the chosen photography method.

Interventions chosen by the participants.

Cody chose the vehicle of historical and family archive photographs to describe his lived experience With Cody, I made sure to inquire about any generational stories about the photos and teasing out the connections to other relationships that the photos evoked for him. Trackfinder chose to work with aerial photographs in maps provided by oil companies and government agencies.

For Trackfinder, who chose aerial photographs, we used the photos to examine the lines, marks, signs, and symbols of these two-dimensional renderings that are largely the artifact of the flattened rendering of aerial photography, following and honoring his desire to discover the interpretive and informational potential of these tools for other farmers and ranchers. I asked probing questions to ensure I understood the aerial photography and we collaborated in the insertion of captions and explanations in software directly over the imported images.

Phoebe chose her personal essay of environmental impacts, submitted as a satirical entry to a regional tourism contest. She also found great reflection in the act of repeat photography conducted by herself, alone on her grandfather's historic homestead and then, requesting I complete repeat photography collaboratively there with her. Phoebe chose to speak from a personal collection of images made by her. She also

requested researcher-made photography and repeat photography, which we conducted at the family homestead location to show changes in the landscape induced by the oil industry.

This research was designed to be responsive to the needs of the participants and their home communities, using locally appropriate methodologies. I contacted the participants prior to meeting them at their farms or ranches for phase two work. To enhance validity, I presented them with the research questions, the major topics, and the themes that emerged from phase one, and the names and descriptions of the four interventions. I asked them to consider which intervention they would like to use to help share their stories and the major themes from their interviews in phase one. I informed participants that, if they chose to share prints from albums or archives, we could work with as many as a couple of dozen images, but to bring a few more if they felt the images were potentially interesting. This was a screening strategy, to ensure that the participants would make conscious decisions and be selective about which images they would share. The suggested number was somewhat arbitrary, though I felt two dozen images would be adequate to address a range of ideas, encourage some editing by the participant and preclude stacks of family photo albums. In any case, I told them to bring more if needed so that we wouldn't miss any potentially interesting images, and that I would help them to edit down the images if needed. Most importantly, the participants chose the intervention they felt was most germane to their experience, and the images that were most representative of the ideas they shared in phase one.

Documentary photography and photojournalism are closely related, though documentary work typically involves longer-term projects that require relationship

building and speak to change in a community. With the advent of digital photography, cameras have become accessible in remote communities around the world. While many print-based outlets for photography have closed, the fine art community has welcomed and contributed to the rise of digital documentary photography. Today, there are several foundations and online venues for both professional photographers and affected communities to share local stories.

A fitting reference to the use of digital photography in this study is another statement by Eisner (2008), as digital photography exploded. He wrote that "technology provides new means during each generation for representational possibilities to be extended and diversified" (p. 77). While I do hope that participants gain some sense of empowerment through their participation in this research (cognizant of my own constructivist tendencies as a scholar to extend these findings to other fracking-affected communities.

In all objectivity, the visual researcher must maintain a countervailing awareness that images, though they can be very powerful, are subjective. Goldstein (2007) wrote that "All photos lie" (p. 61). The images of the cases in this study may depict death and contamination, subjects that are charged with emotion. By applying reference frames by which to view the images in phase two analysis, this reduces the risk of becoming overcome by the content of the image in order to give it an objective analysis. At the same time, there remains the emotional impact of the image, which can even overwhelm the researcher and the viewer and can even preclude a proper analysis of content. This element cannot be ignored when we consider the power of the photograph or visual images.

Phase Two Data Analysis

Participants were asked to describe their choice of photograph(s) and then describe the meaning they found in them. During photography-based interventions, only those data that related to the research questions and the direct experience of the participants were analyzed. The interviews, observations and photography-based interventions of each participant were combined into his or her individual case. The discussion section of this study compares and contrasts the participants as case studies. There, a combined thematic analysis of the findings in phase one and phase two is used to find the prevailing patterns, themes, and assertions for this research.

Analysis was applied to the photographs to understand the interpretations of participants and their relevancy to research questions. Complimenting the participants' choice of interventions in phase two of the work and their own descriptions of the photographs and the context in which they occurred, I chose from several frameworks to analyze the images and make meaning of them. These analyses, and the relationship of the participants' phase two contributions to the research questions, are examined in the discussion. There are five frames I drew upon for analysis of the images in phase two.

Visual Teaching Strategies (VTS).

I used the VTS prompts to inquire of the participants as they initially presented the images in phase two. This is also a lens available for my own use in reflecting on images, looking at both technical and aesthetic elements. The VTS prompts are appropriate given they the prompts are designed for the educational setting and considering the potential educational use of images provided by the participant.

Clarke (2005) Analysis of Visual Data.

Another analysis framework I used is that of Clarke (2005; see also Weaver-Hightower, 2019) who provides several topics or frames by which to examine photographs and which I adapt for this study. Most of these topics of art elements and principles of design are familiar to photographers, and address technical and composition elements. However, Clarke's system includes an additional few topics that are very effective devices for getting at the choices of the photographer that speak to his/her intention, and the message of the images (intentional or not). These latter topics of analysis are marked with an asterisk in the list below.

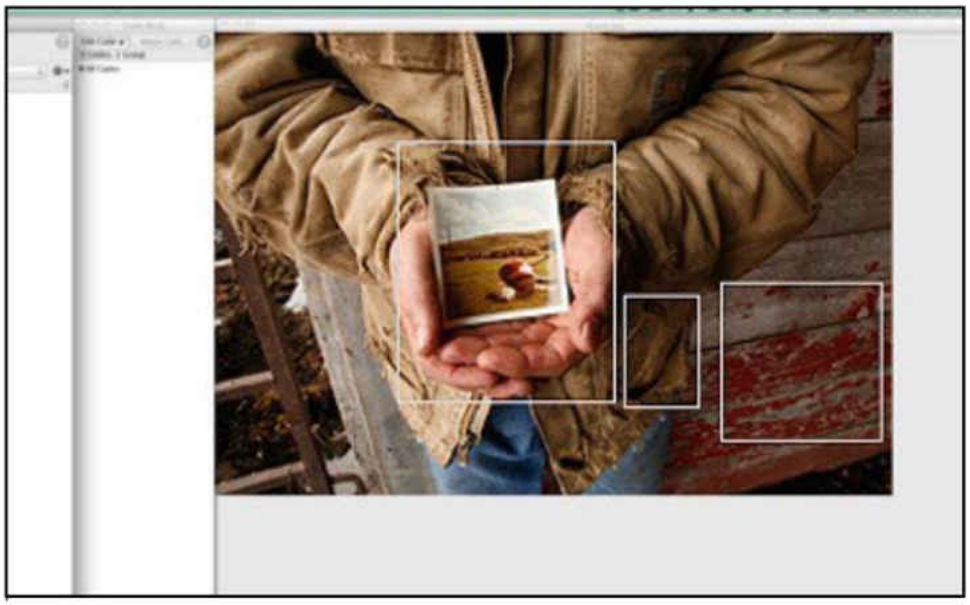
- Selection of subject
- Focus
- Framing
- Emphasis
- Audience
- Viewpoint
- Composition
- Light
- Color
- Texture
- Scale
- Presence/Absence *
- Commonness/uniqueness *
- Situatedness

- Work of the image *
- Relations w/visual cultures *
- Injunctions to the viewer *

On page 223, Clark defines several of the terms in his scheme of analysis as follows. S*ituatedness* refers to how the image is situated "historically, geographically, temporally." The topic "relations to visual cultures" means "to what visual cultures does the image belong, either in the past or currently?" The topic "Commonness/uniqueness" asks if the image is "like no other" or "like many others." The "work of the image" refers to the function(s) of the image. Does it do something in the social world? Is it hidden away, highlighted or ever-present? The topic "injunctions to viewers" asks "what, if anything, are viewers being told to do or think or be? Not to do or think or be?"

Simultaneous coding.

Saldaña defines simultaneous coding as applying multiple codes to the same text. In this third form of analysis, I coded photographs as if they were textural data. On occasion, I applied multiple codes to a single image that was particularly rich in content or conveyed meanings. To do this, I coded the associated area of some image(s) with either short labels, concepts or full quotes from participants that reflect both the content and aesthetic qualities of the images and that is shown in Figure 10. Simultaneous coding was valuable where a datum (a photograph in this case) appeared to present multiple interpretations. Figure 10 illustrates how codes were assigned to defined areas of images. In code mapping, specific regions of the image are outlined for discussion; in simultaneous coding, any one region may yield multiple meanings. Note that the area outlined at left of the image has been assigned two codes.



Outline box	Photo element (datum)	Code applied
Left	configuration of hands	caring
Left	'80s polaroid of calf killed by H2S flare-out	impact to air, livestock
Middle	torn jacket pocket	frugal
Right	worn paint in barn	weather

Figure 10. Example of simultaneous coding (Saldaña, 2013) applied to photographic data.

Critical media lens.

A fourth form of analysis I considered in the examination of photographs presented in phase two was from a critical media perspective. I'm influenced by the studies of the late sociologist Stuart Hall who examined the use of photographs in media and refined the concept of representation. Hall (1997) wrote that "The image itself—whether moving or still and whether transmitted by a variety of different media—seems to be, or to have become, the prevalent sign of late- modern culture" (p. 5) and that "this

notion that somehow representation represents a meaning which is already there is a very common idea and, on the other hand, one of the ideas that I'm going to try to subvert" (p. 6).

In finding the meaning of photographs during phase two, I relied largely on the owners and authors of the images to interpret them. I found often stark differences in the portrayal of the study area landscape when comparing local news media coverage with the analysis of images brought forth by participants in the interventions. St. Pierre and Jackson (2014) questioned traditional, almost reflexive, valuing of participant words and the assignment of codes to bring scientific legitimacy to social science data collection. To that end, I am confident that the photography-based methods utilized in this study yielded a more complete reflection of the attitudes and beliefs of the participants.

During the discussion of photographs in phase two, the participants were found to discuss activities, experiences or relationships that indexed the contentious or political nature of oil and gas development in the study area.

Application of other codes or themes (Saldana, 2013).

Various coding strategies were used to make sense of the photographs from phase two. Emotion codes label the "feelings participants may have experienced, or inferred by the researcher about the participant" (Saldana, p. 105). Several emotion codes may lead to a statement of a participant's emotional experience. Saldaña (2013) wrote that "themes may be descriptions of behavior, explanations of why something happens, iconic statements and morals from participant stories" (p. 176). Participant Phoebe offered that she felt sadness when visiting her grandfather's homestead to make her own repeat photographs. Miles, Huberman and Saldaña (2014) wrote that "this coding provides

insight into the participants' perspectives, worldview, and life conditions" (p. 75). which is appropriate to the sentiments of marginalization and sadness that emerged in the interviews.

Values codes describe a participant's value, attitudes and beliefs, or their worldview, were appropriate to use in this study. This is a technique very well-suited for this study exploring the experiences of the participants in case studies. Participant routinely reflected on his values of protecting open space and land closest to his clean water sources.

Versus codes "identify in binary terms the individuals, groups, social systems, organizations, phenomena, processes, concepts, etc. in direct conflict with each other" (Saldaña, p. 94). This study addressed conflicts, environmental injustices, marginalization and power balances. The participants frequently described us vs. them relationships with government agency or oil company actors. Trackfinder asked me to photograph the oil well on his land where the oil company had maintained access by falsely stating it still produced. He was very proud to have won a lawsuit against the oil company when he proved the deception. I coded the pictures I made with the versus code of "farmer vs. oil company."

Secondary codes were applied to several images in phase two to indicate the source (e.g., participant, researcher), origin (e.g., made, found, contributed by a third party or re-photographed), location (place in which the photograph was made) or date (when each image was made/published and/or provided to the researcher).

Throughout the coding, I was looking for ideas or opinions unique to the participants (and the subjects in the photographs) but also patterns and, in looking at the

entire data set, I was attentive to commonalities across participants. For example, while two farmers may have differing opinions on how well their lands have been remediated from petroleum development, it is valuable to code the fact that they both share a concern about the restoration of their land.

Validity and Trustworthiness

I followed best practices to promote the credibility (truth value), transferability (applicability), dependability (consistency), and confirmability (neutrality) of the data collection and findings (Lincoln and Guba, 1985). Trustworthiness began with purposive sampling and my efforts in participant selection as described previously. The technique of triangulation—sourcing data from a variety of locations to reduce bias is also a feature of this research. Data is drawn from interviews, observations, discourse gleaned from artifacts, documents and notes taken in public hearings and community forums, analytic memos and photography-based interventions. As early as May 2013, I began establishing a rapport with several of the prospective participants, contributing to prolonged engagement, which promotes truthfulness in research.

When I conducted interviews and observations, I recorded audio and made note of nonverbal elements of communication, but I also noted the research context (physical setting, mood/behavior and other interactions). During interviews, I probed and asked follow-up questions, seeking clarification and following new directions offered by participants in my conversations with them. Analytic memos and the feedback provided by participants in member checking help to make the analysis more robust. After Phase I, I reviewed the major themes that emerged from the initial interviews and observations, and the participants agreed with my assembly of their attitudes, concerns and priorities

with respect to their livelihoods and their land as it may relate to the changed landscape of the current fracking wave. It's important to note that I coded only my raw data, which consisted almost entirely of field notes from observations and the participants' words in verbatim transcripts of their interview; I did not code any of my questions, probes, responses or interpretations.

At the same time, if a participant repeated information, particularly that which was not relevant to the research questions, I reserved the right to remove duplicate data from the analysis. I am careful to include enough data—such as excerpts from the interviews—to give the reader a sense of the participants' ways of life, reasoning, motivations, and attitudes toward the local environment, but where participants focused heavily on areas outside the research questions, such as details of financial, contractual, or legal matters, I redirected the conversation toward the use of photography and photography-based methodologies.

Peer debriefing also contributes to the validity of the data. During data collection, I met regularly with my advisor to ensure I was completing my research properly. As stated previously, I relied occasionally on one or more cultural advisors for guidance, both from Native communities and from environmental organizations. These individuals were knowledgeable outsiders who were not participants in the research,

This is a naturalistic study, where data was collected within the context of research relationships formed. I relied heavily on the participants not only for their original ideas (data) but also to confirm that the analysis I generated from the data is accurate. One of my favorite techniques to improve validity is member checking, wherein I review preliminary findings with participants to ensure that my characterizations are

faithful to their experience. Throughout the findings and discussion of my research, I include the voice of participants through the liberal use of participants quotations and in vivo coding.

During fieldwork, I maintained notes of my research activities, interactions, preliminary findings, and musings on what may be worthy of discussion. All of this is part of the record keeping or audit trail necessary to establish the legitimacy (truthfulness, confirmability, and credibility) of the research should it be audited.

In phase two work with the photography-based interventions, I enacted several measures to promote validity and reduce researcher bias. Prosser (2007) recommended that, when using visual research methods in a study, it is best to use more than one method to enhance validity. Ultimately, each participant chose one or two intervention types, but I did not direct their choices. To prevent researcher bias, I avoided displaying or describing any photographs of my own before participants completed their phase-two intervention. In this way, participants were not influenced by my work or the choice of subject matter, concerns for technical quality or other factors that may have prevented them from free choice in their selection of photography-based interventions or photographs.

With the use of these photography-based interventions, I realized that not only did they offer a means for story-telling, but a motivation to do so. By giving choice to the participants, I promoted voice. And, despite the amount of advance planning and research into the historical use of the interventions, their application came quite naturally. The participants chose the method based not only on what I anticipated would be some subject matter compatibility, but they chose the interventions that ultimately worked quite

well with their personalities, attitudes/values and, as if a form of differentiated instruction, each participant chose the method(s) that best served the way that he or she desired to express their knowledge.

Researcher-participant relationships

I'm an outsider to these rural farming and ranching communities, having moved to North Dakota from my native California in 2008. I likely differ from the participants in one or more of my personal values and philosophies. However, since 2013, when I first obtained IRB approval for this work, I have visited the study area and established relationships that have allowed me to recruit prospective participants and have in-depth conversations with them.

I became familiar with the issues of the region during my early exploratory trips to the western part of the state to view the research area and meet with prospective participants. I attended government hearings and meetings of community-based organizations addressing oil and gas issues and legislation in the state. Trust is important. Most of the prospects have expressed some fear of speaking about the oil and gas industry, an economy that now supplements or supplants farming/ranching incomes for them, their families, friends, and peers, both directly and indirectly. I realize that participants may have been reluctant to reveal information that could jeopardize their standing in their own communities or constituent groups, and I have been diligent to remove identifiers from the data, both textual and photographic. In both text and images, where names, family size/relationship, locations, distances, business names, geographical references, affiliations or memberships, and other elements arise in the data which could identify the participants, they have been redacted or renamed to protect the identity of the

participants. Additionally, the participants were not told the identities of each other. In photographs where the participants appear, their faces are not included or were obscured. Aerial photographs and maps have been redacted to remove township information, residences, and identifying buildings, cross-streets, and landmarks. While the rural nature of their communities has faded as industrialization continues, most of the prospective participants remain intensely private individuals and committed to staying on their land and practicing their agricultural livelihoods.

Conversely, some participants may have been more prone to disclose information to me because I am not a member of their local community. Furthermore, the anonymity of research may have presented a kind of safe zone to the participants, enabling them to express personal opinions. The private conversations with a researcher may offer some relief or catharsis to members of small and isolated communities. One of my participants was enthused by the idea that his or her experiences would be translated into research findings that help others in similar circumstances. In any case, I explained to all participants before the work began that this is primary research and they cannot expect me (or the research) to effect changes in laws, policy or practices related to the topics we discuss. I offered no assurance that I could or would solve their problems.

While a relative newcomer to North Dakota, I am not foreign to the field of oil and gas development. I have observed the oil and gas industry closely in Ecuador and southern California. As an educator living in the Napo Province of Amazonian Ecuador, I witnessed large-scale excavations and pipeline installations in the rainforest of indigenous lowland Quichua communities. As a consulting biologist in southern California, I monitored oil and gas operations adjacent to the critical habitat of a

federally-endangered bird and trained oil/construction workers in the identification of native and invasive plants to minimize their role in habitat disturbance. In that work, I developed techniques for the use of photography, including the use of panoramic images at photo-monitoring stations to document habitat restoration over time.

At the time of my data collection, I was living in North Dakota and making photographs of my own related to sustainability topics in western North Dakota, and one of the prospective participants knew me in this role. The discussion section devotes attention to my dual identity as researcher/photographer and how my previous experience in photojournalism shaped both the design of the research and my analysis of the data.

My background in science helped me to structure questions and interpret responses. I bring a B.S. in Field Zoology and an M.A. in Environmental Education. I have worked as a consulting biologist and as an Interpretive Park Ranger for the U.S. National Park Service. I am a former conservation chair for a regional chapter of the National Audubon Society. More recently, I served on the Board of Directors of two international conservation organizations and on the Board of Advisors of a third. All three of these organizations feature the use of photography to varying degrees in programs of citizen science and education. As a professional editorial photographer, my feature and assignment credits include such magazines as National Geographic and Smithsonian. My documentary photography has received fiscal sponsorship from the Blue Earth Alliance, a consortium of leading documentary photographers based in Seattle, Washington.

I am also a highly-qualified photography instructor with training in the Visual Arts department of California State University at Fullerton and two teaching credentials

(Art Education and Arts, Media and Entertainment). I bring ten years of photography teaching experience in secondary, university and workshop settings. Today, as an academic/practitioner investigating the educational use of photography, I have published in international peer-reviewed publications and served as a volunteer editorial reviewer for the journal Environmental Education Research, based in the UK on the use of photography in environmental and educational research.

I bring a disposition informed by personal experience in disciplines aligned with this study. I am both an artist and a scientist. This background helps me to form professional hunches that contribute to the design of legitimate interview protocols, insights, and analyses.

Photography and ethics

Working with photography-based methods, I am particularly attuned to Maxwell's (1992) concept of descriptive validity and his call for no "making up or distorting . . ." (p. 285). Several authors have discussed the ethical concerns implicit in photography (and research applications of photography). In a study of Salvadoran people using "participatory photography," for example, Prins (2010) cautioned that "although participatory photography has many potential benefits, researchers and educators must also anticipate its unintended consequences, attend to ethical considerations, and recognize how this tool is mediated by the sociocultural setting" (p. 426).

Prins described photography as "a technology with contradictory potential for social control and surveillance, and for the recovery of marginalized groups' subjugated knowledge…" Something akin to this paradox is that one study participant may use aerial images provided by an oil company to identify buried pipelines or oil debris left on his

farmland in previous "oil booms," and another participant may use photography both as a tool for monitoring industry and as a vehicle to describe historical and aesthetic values for the land.

Despite the apparent simplicity or immediacy of photography, a host of ethical questions arise in the act of making pictures. Concerns for truth and neutrality are implicated in the use of photography, perhaps more so in this era of digital photography. There has been much interrogation of photography and visual research based in concerns for representation (Tagg, 1988), privacy, cultural responsiveness and authenticity (Kelsey, 2002; Sontag, 1977; Taylor, 2000). Berger (1982) examined the tension that exists between the photographer and the photographed. Care has been taken to protect the privacy and anonymity of the participants. Among the ethical concerns is an obligation to represent the participants lived experience and the participant photographs have been included in this dissertation with their permission.

For my participants, it is my hope that I can help them to see their lived experience in a new light, as they choose the photographic interventions they feel is best suited to help them share what's important to them, and that the readers of this research see the participants' lives as the participants wish themselves to be seen. To me, this brings tremendous authenticity and responsiveness to this research. The interviews of phase one of this study help us to get to know the participants and give great context to the images in phase two.

Prosser (1998) advises researchers to be cognizant of several aspects of visual research that differ from traditional qualitative research, and to take concrete steps in research design,

> Be ethically sensitive: be alert to your responsibilities as a researcher when engaging in research-created or participant-generated image work . . . To add richness and depth to your study as well as bolster trustworthiness and credibility . . . try not to rely on one visual method, mix these up as well . . . make sure the research questions and visual methods are linked . . . the relationship between how an image is made and how it is interpreted in an intimate one and can lead to all sorts of problems usually concerning inappropriate analysis . . . the medium can affect how the image is read . . . think of images as visual 'quotes' . . . how will what you write affect how people view the image you present? (p. 220).

In designing this study, I made certain that the participants could make informed choices of the photography-based interventions that best matched what they wanted to say and the images they wanted to make or discuss. In this way, I have promoted authenticity, richness, and trustworthiness in the data. Certainly, the research questions are tightly linked to the methods as this investigation looks essentially at the responsiveness of visual methods.

A great strength of the use of photography in this study is the use of technology to slow down, reflect on experiences and encourage deeper reflection on perception and meaning (McDermott 1977; Mehan 1993). Guided by a facilitator, the participant's own visual acuity may question aspects of connotation and significance, or they may revisit observations that are often taken for granted by members of their community.

In the findings that follow, I have made extensive use of verbatim excerpts from the field interviews, sprinkled with my own observations and sensations, to give you a sense, as you join me in the interviews, of who these participants are and what motivates

them and gives them the resiliency they need to manage their farming or ranching as they encounter aspects of the oil industry that may be surprising in both their subtlety and their pervasiveness.

CHAPTER IV

FINDINGS OF THE STUDY

The results for each of the three case studies are presented here in the order in whch I met with them: Cody, Trackfinder, and Phoebe. There should be no import ascribed to the order in which I worked with them or the order in which I present their findings. Each of them has a unique history and all of them offer rich details pertinent to their lived experience interacting with the oil and gas industry.

During phase one of the research, I gathered demographic information was gathered and the participants were asked about their early education, experiences as farmers/ranchers managing oil industry activities on their land and then the conversation bridged into needs they perceived for community education. In phase one, there is much insight into the participants' coexistence with the oil industry and how agricultural traditions interface with the extraction-based economy in rural North Dakota. In phase two, the participants shared personal photographs, made them or asked them to be made in concert with one or more photography-based interventions. The findings include the conversations that ensued between the participants and me in phase two and, much like the phase one reporting, the body of the findings for phase two is rich with quotes from the participants, giving the reader a true sense of what the photographs and the interventions meant to them.

Cody: Phase One Findings

At the time of the research, Cody was an approximately 50-year-old male, born and raised in western North Dakota, notably the region of North Dakota associated with

the Bakken geologic formation, source of North America's most active shale oil "play." All of his siblings live in North Dakota. His older brother has a ranch, too, and they share some land. Another sibling lives in a small town that straddles the Montana border. He says "I grew up here on the farm, been here pretty much all my life." He has about 7,500 acres of land plus some federal land he rents and grazes cattle on. This land has been in the family since his grandfather homesteaded in the late 1800's.

His income is split between ranching, farming, and oil. North Dakotans are particular about the label of farmer vs. rancher; a farmer grows cash crops and a rancher raises cattle. Cody does both. He grows durum wheat, corn, and barley as cash crops, and now diversifies with flax, oats, barley, corn, and peas on cropland he's expanded to about 500 acres. Cody raises several hundred cow-calf pairs, and he has a small feedlot and pastures for cattle near his home. Farming also puts hay in the feedlot and corn is grown mainly for silage, meaning he stores it in a silo to use as animal feed in the winter.

The feedlot and cattle are kept close by to monitor cows and calves. The calves stay with their mothers until they're weaned and then the cows are already pregnant again. One batch of calves is weaned about October-November and then fed until February-March, at which point they are sold, and it's time to start calving again in the spring. Cody keeps a few yearlings. This operation requires land and clean water.

Cody says his income draws almost equally from oil-related revenue and farming and ranching, although he is about to experience growth in oil income with many new well pads being plotted out by the oil companies. His oil income comes mostly from royalties and easements that give the companies access to install vital infrastructure such as roads, well pads, and storage facilities. There are often additional payments to

compensate for damages associated with oil-related installations, such as damages to his property which includes but is not limited to crops, irrigation lines, roads, fences or outbuildings. Though his income from easements, new installations and damages associated with the installation of any one well pad will eventually recede, royalties continue as long as a well continues to produce oil.

At the time of this fieldwork, approximately 50 wells dotted his land, with new drilling pads being programmed for installation at those sites. Roughly speaking, each producing well may generate one to two thousand dollars per month in income, depending on the terms. He can't entirely predict the timing or production though. In the contracts he makes with the oil companies, Cody makes sure he's paid for surface damages associated with easements, such as roads, fences, crop damage and damage to his land when well pads are created. He said, "it takes a long time for plants to recover."

A lot of activity occurs each year in April, as the ground thaws. It's calving season, and he's checking on pregnant cows and births, cleaning seeds for planting and getting equipment ready. I joined him on a couple of rides inside his new tractor with a modern cockpit. Spring sees a surge in industrial activity as well, but not all the wells on his land are producing oil. At some sites, "the company"—a term used to collectively describe the various oil industry actors, be they oil company representatives, seismic testing outfits or related contractors, affiliates or employees working throughout the region—is installing "multi-pads,," where several wells will be drilled in one place. Cody told me about one such site on his land and when I asked how many wells were anticipated;; he said "quite a large number." That amounted to about 50 wells at least, with ongoing drilling and the projected installation of newer well pads. He said that in

“one little space,” they are doing 25-30 new wells.

I asked Cody about oil royalties. He explained that the minerals come with the land, and the landowner can keep them. Cody said, “you can sell them with the land, or let them go with the land.” They can also be sold separately. Cody said his dad sold some land in the ’30s and ’40s with the mineral rights. He said this was a time when there wasn’t as much oil and times were tough. People sold the land without any real knowledge of the component mineral rights. “People sold minerals years ago, not knowing what they were worth. That's why it's called the split-estate, where someone owns the land surface, but not the minerals underground.” In the ’40s and ’50s landowners started to realize the significance of mineral rights and gave them a value when selling land. Cody reflects on his experience with the oil industry, sharing,

> … the oilfield, we've seen a couple boom-busts. I've lived around oil all my life. Started here in 1953 and basically, we didn't have any minerals hardly here or where the oil was. We kinda lived between two oil wells. Now this boom, we are actually getting some royalty out of it because we own some minerals here where the home place is and a couple spots that had never been drilled so, of course, we're getting some royalty there. We've seen the worse side for many years, and now have benefit, but it's kind of a trade-off.

When asked about current oil development on his land, the complexity of the situation is apparent.

> Right now, you can see from our place, up on the hill two to three rigs to the south of us. They are building two pads on my land. Right now, really busy. Told they are going to build the government out, off of private. Finally came to agreement

over a year. Over 3-4 years on a mile and a quarter will have 3 pads with 25-30 new wells on them.

The horizontal fracturing technology was particularly vital to oil extraction during the research period given a 2015 ruling by the Obama administration that put a moratorium on all new drilling on federal land. As Cody mentioned, with the advent of horizontal fracturing, the oil company gains access to his (private) land and then, from this location, they can extract oil from underneath the adjacent federal government land, thereby avoiding the federal permitting process. Cody told me that "a section of land [a section equals one square mile or 640 acres] in western North Dakota could have 100 mineral owners, spread into small minute pieces so that a lot of people don't really get anything out of it.

When I asked him how one determines the owner of such mineral rights, he said "you have to go to the courthouse. That's what 'landmen' do. They go through the abstracts and so on and try and figure out who's got the mineral rights." More than once, Cody and his father grew accustomed to being approached by landmen from the company seeking access to their land.

Generally speaking, oil construction limits Cody's use of his own land. While easements assure the oil company access to a given area, they also prevent Cody from installing his own roads and fences in those areas for his ranching and farming enterprises.

Cody keeps the land surrounding his home strictly off-limits to the oil industry. In his leases with the industry, he routinely has a stipulation for "no surface" use on specific land, meaning there must be no drilling, placement of wastewater tanks, pipelines or installations of any kind. Near his home, he wants to protect the cattle, the feedlot and

water sources for both his family and his cattle. I asked Cody how the “no-surface” policy come about.

> We own the minerals around our home. My father had a no surface use policy and so they can't do anything without permission. We kept them a certain distance away from our home. They can still get oil by drilling from two miles away, but close to our land, our cattle, our feedlot, our water is all spring-fed. We try to protect it. They knew they kinda had to deal with us. Close to a whole section worth of land that is no-surface.

More than once, Cody has denied the oil companies access to his land. Cody said his father was “of the mindset” that oil companies weren't going to be around there much, but they come close to his home on several occasions. He said, “Right above here we own the land, but we bought other land later on and we have no minerals there. So, we couldn't stop ‘em from going in there, but it's right next to where we have no surface.” On another occasion, his farm hands encountered oil company workers near his home. Cody recounted that one year, the oil company called him in the middle of winter. “We went to meet them,” he said. I. “It was a record snow and we had to travel by snowmobile.” He asked the company to move the well they were set to install. Multiple times he has had to reassert the no-surface policy, reminding the company that he allows no wastewater disposal or wastewater lines across his land. Cody told me he denied a wastewater pipeline near his home and cattle feedlot recently.

> They called the other day about an area of no-surface and asked me ‘how much would it take’ and I said ‘no, it's not going to change. If you offered me a million dollars a foot, it's not changing. Just go around me.

I asked Cody about the land itself. Even though the ground was thawing, his main concern was to have enough moisture, because they experienced a "mini-drought,"

> We haven't had much snow. We did go into fall with fairly good moisture so I'm not too worried to start out. It's just whether it's gonna rain or not in the spring. When it's gonna thaw out. We've had some pretty cold weather so it might be a late spring. It might be a while before the frost goes out. Plus, we calf at the same time, in April-May, so you're really busy calving and still feeding calves and trying to get in the field. Weed control is a big concern. You gotta' get in and get started early enough to get the weeds under control. But if you start too early then you're just wasting your money.

Cody said August-September-October is another busy period is when the second round of calves are born, the products of artificial insemination on this production ranch. He's multi-tasking with the harvest and cattle work, "getting pregnancy testing, vaccinations, things like that, getting ready to wean the calves" he told me.

The cold winters are hard on people and animals. One day in April, as I spoke with him by phone from my apartment at the University of North Dakota in Grand Forks, he asked me the temperature and I said it was about five degrees below zero. He replied, "that's a heat wave." When the temperature drops, he said he increases the grain for his cattle by 30%. He said "that's how they keep warm. They just don't move much. Keep them where there's lots of shelter out of the wind." His cattle are his livelihood.

At a very early age, Cody was responsible for managing the farm. He told me, "when I was 14 or so, in 7th grade, I was working basically like a full-time person …. about the time my brother went to college… I had to kind of take up the slack…"

Cody, who was on the high school livestock judging team in these years, said he benefited from vocation agriculture courses, primarily skills related to the business side of agriculture. In his "ag accounting" class, he said he said he learned how to do spreadsheets, cash flow statements, and balances. Other curricula he found helpful were "vocational ag" instruction in livestock and nutrition and training in auto mechanics and electronics. Cody told me that the high school vocational ag classes were geared specifically to the farm and ranch setting. He said, "I remember one portion when we spent a couple months and learned how to use a welder and cutting torch, you know, if you didn't already know so."

One day in middle school, his dad suffered a head injury and asked Cody to run the farm. Cody said, "that was my first experience with oil and gas." His work included talking to oil company representatives at the farm. Oil companies were doing seismographic testing for possible drilling sites and his father told him to make sure something was put in the agreement for clean-up costs.

> He just told me to take care of it. He said, "Well, you know, they've agreed on most of it but, but you finish it up." I think he kind of did it probably so that I'd learn a little bit about it and I did because we had problems.

Cody recalls one such company he dealt with as a teen::

> Well, they were negotiating on a price for doing it and all about the clean-up is mainly where I ended up having issues. You know, they didn't clean-up like they're supposed to and [my dad] told me make sure that they put in something to keep them away from water sources and things like that…at that time they drilled holes and blasted and then they'd have to come around and fill them in and clean-

> up the mud and things like that. That [seismographic testing] took in the whole area … most of our land that we had at the time… He told me he didn't want them here by the house or anywhere close to here…Matter of fact, they tried to sneak on here at home and do some. We caught them.

Cody went into more detail on an impact that concerns him most, when he said,

> damages are when they put it in. Tearing everything up, and then if they should leak. A saltwater leak is much worse than an oil leak. It sterilizes the soil and nothing will ever grow there. Only way to get it to grow is to haul in good topsoil

When landowners give oil companies access to their land—usually by leasing an easement—they largely lose their own use of that land. North Dakota law requires companies extracting minerals to compensate ranchers and farmers for that loss. However, industry only reimburses that lost use at rates based on grazing or agricultural permits, which may be no more than $40 per acre per year and there is no compensation for the loss of land adjacent to the well pad. Cody had a well pad built in the center of a large pasture on his land. As a result, the entire pasture could not be farmed. Nevertheless, he still had to pay taxes on the full acreage of that pasture and the payments from the oil company didn't cover that.

Cody's local environment is changed with the increased industrial activity related to oil extraction, and there are other changes beyond air, water and soil:

> Then there's the social element of the criminals that came in. Traffic.
>
> Infrastructure can't keep up. Our counties and townships are broke. They can't keep up. With all the money that's coming in, they still can't keep up. Everything's so expensive.

At well sites, natural gas is vented off and burned at the tops of exhaust stacks in a process known as flaring. Cody said,

> these last seven years, it's almost unbelievable the amount of change in the landscape. You can't go anywhere without seeing it at night; it's the flares. In the day, it's the rigs and pumping units and roads and power lines. We were very, very rural before that, not a lot of people.

Flaring is the process of burning waste gases which creates emissions such as sulfur oxides (SOx) and greenhouse gases (CO_2 and CO). In certain conditions, such as storms or strong wind, the flare may lose its flame. In these events, a constituent gas, hydrogen sulfide (H_2S), can escape into the air. It's a denser molecule than air so it sinks, filling low-lying areas and depressions in the ground with this toxic gas. The gas can be lethal to humans and animals; the gas is also highly corrosive to farm facilities and equipment. Public health concerns about gas flaring have existed for many years in different regions near natural gas facilities. Some of these concerns are related to potential long-term cumulative health effects on humans from exposure to hazardous chemical concentrations released during incomplete combustion of flare gases in addition to acute episodes where humans, livestock, and others are killed (Zadakbar, et al., 2011).

I'm with Cody at his home one evening and he says, "Here by the window looking out, it's half daylight outside and they're a mile and a half away." He's referring to the gas flares. As they continue to burn, he said he is concerned both for air quality and the wasted source of energy. Cody said, "it harms our children and our grandchildren. And there's really no need to be doing it. If they could slow down the permitting process and allow the infrastructure to get in" [he's referring to a system of pipelines to harness

the natural gas and transport it to storage where it can be sold, providing income back to the mineral owners]. He continues, “There's lots of ways to use it off-site. Now we're hearing rumors of them stealing it by using it on site and then hauling it elsewhere.”.

Cody added, “hydrogen sulfide gas is really bad and can kill you in an instant. There's a lot of volatile chemicals in the air. Benzene and all kinds of things like that that are harmful to you and your health.”

Cody told me that his uncle nearly died from H_2S gas exposure,

> Years ago, my uncle was gassed and nearly died. He was flown to the hospital in Bismarck. His lungs were bleeding. He got gassed twice. He's very lucky he is alive. We've lost cattle and horses and wildlife to H_2S. There's been people that died right close to us over the years from H_2S.

Cody remembers how it happened,

> My uncle was trying to re-light a flare that had went out, and the wind was blowing down the coulee toward their house. He had a rag burning on a pole trying to relight it and then the wind switched back and that's all it took. Technology is a lot better they don't go out as much anymore.

Hydrogen sulfide gas is not just bad for humans and livestock. Cody said,

> We have a lot of fences, metal, it will eat it up. Metal buildings, it just goes through, it eats it up. You can tell it on fences. Fence on the high ground is good and barbed wire on the low is like it's 100 years old.

Changes are in the sky, too. Cody describes the loss of darkness, thinking back to years ago, “there were beautiful sunsets and dark skies at night so you could see the stars.”

More than just the flares had changed the area, though. Cody became concerned for his safety and that of his family and farm crew given the increased traffic from oil company trucks. His feedlot is across the street from his home.

> Around 15 years ago, I'd be out all day and never seen anyone. Maybe one or two neighbors. Now you have to plan it because of the traffic and the sites. There's a lot of activity. Gotta cross six, eight, ten times a day and about every time we cross, we gotta stop for somebody, where years ago you wouldn't see anybody all day on the road [laughs]… right where you turn off the state highway, a little over a year ago, there was three deaths turning off the road… with the icy roads, I don't know how many deaths. I don't know how many deaths. There's been more accidents in the last three days then we had in a whole year, years ago.

Cody expressed many concerns about oil and gas activity in his community, including changes in the landscape, safety concerns, effects on water, land, and soil and natural gas flares, but most frequently the conversation turned to water. He reminded me that anywhere between one to five million gallons of water are needed to "frack" one well and the companies are "getting water anywhere they can,," including from the same water table he needs for his crops and cattle. Cody said,

> the environmental concerns that are my biggest concerns are the water, the amount they use, and it's taken out of the water cycle. It's potable water that's being turned into wastewater that can never be used again and then deep injected. You know, contaminating aquifers is a concern. Spills, just the change in the landscape

I asked him to elaborate on the role of water,

> It's just the amount of water that is being used. Getting permits. There's just no limit on permits. Our water table is dropping. Contamination. Spills. Big saltwater spill in Mandaree running into the lake. Big concerns about how much we're using. At some point, we're going to be short on water. This part of the country doesn't have a lot of water. It's not a high rainfall area. It has shallow aquifers with not a whole lot in them. You can't have irrigation. It's about how much people are using and wasting.

Regarding the sources of water used by the oil industry, I asked him if they are getting it piped in or drawing it primarily from Lake Sakakawea, a portion of the Missouri River created when 1953 when the Army Corps of Engineers constructed the Garrison Dam, named after the Native American woman who acted as a scout for the Lewis and Clark expedition. Cody replied,

> Anywhere they can get it. They'll suck it dry if you let them. They're having trouble getting enough water. They are now getting permits to take water from the lake... I just got a call the other day for an easement for a water line that's going to draw it out of the lake. It took em six years to get a permit from the Corps. They're using our rural water which should be used for our houses and our cattle. Now it's being turned into commercial use. They're using it out of wells, out of surface water, anywhere anybody will sell it to them. I'm sure they're drawing from aquifers nearby, but I don't sell water.

Another concern is the injection of fracking wastewater—known as saltwater—back into the ground as a form of waste disposal. He said it's already happening, and old drilling wells are being converted to injection sites. He said, "they're doing it all around me.

There's all kind of saltwater injections right close by." He's concerned because wastewater has entered the groundwater where the casing on wells—which would normally seal them—have failed allowing wastewater to escape into aquifers.

Cody also believes he has seen changes in the abundance or visibility of wildlife. He said it hasn't affected the game bird population as much but "deer, the numbers are really down. The mule deer: it's changed the way they move, their routes. More people disturbing them, more poaching. The deer are staying in one area a little more."

I asked Cody what are his sources of information on matters of the environment, and what the state agencies do. About a year ago, he had to contact the health department, because he caught a crew putting oil into tanks and H_2S was going into the air near his cattle. He said that the state agencies don't monitor or enforce, and that,

> as far as state agencies, they really don't do anything or report anything. As far as I'm concerned, they're kind of worthless. There's the industrial commission, oil and gas division, the health department, the water department, they all kind of fractured it up on I think on purpose. If you have a problem, they just send you to the other one, and then they say they can't help you and it goes on and on 'til you get frustrated and give up.

I found myself interviewing Cody in the busy month of April when cows are calving and the oil companies are very active again, so I ask him if the demands of the farm are compatible with his need to monitor oil industry activities on his land..

...they do slow down in the winter here. A little bit, it doesn't seem usually as bad. Then it'll pick up in the spring through the summer and fall, its super busy for them. They can just do more without fighting the weather. I mean, they're still working right

now. They're getting ready to move a rig in. They just built a site on some of my land… to drill wells… they came in and drilled the rat holes…a small drilling rig like a water drilling rig and they drill the first 200 feet…Because it's easier to do that and cheaper to do it than bring in the big rig and drilling the whole thing. Then they put in the surface casing… the stuff that's supposed to keep it from leaking in the aquifer.

Cody sums it up by saying it's always busy, but he's not wanting to "fight for the water." I asked Cody what he sees for his land in 20 years, and he replied,

> hopefully, looks like it will be going bust if the price keeps going down. The time frame is kind of a moot point. They are going to be here when the oil prices are right and they can extract this oil, and as technology gets better, they will be able to extract more. The industrialized deal is here to stay for a couple generations.

Cody: Phase 1 Themes

Looking carefully at Cody's conversations with me during Phase I, through the process of coding the data, four major themes emerged (see Figure 11). Similar themes emerged in my work with Trackfinder and Phoebe.

1. Cody is concerned about the home-front, based on his frequent references to negotiating land use and lease agreements, his vigilance for this local environment, reference to special spaces and places and focus on protecting water quality for his family, cattle and crops.

2. Cody's sentiments about his co-existence revolve around heritage: many of the anecdotes and photographs he shared involved is father or his uncle, and he refers to them often when expressing his own values for the land, and so there is a generational reference in speaking about his relations with the oil industry and

preserving the vitality of unleased rangeland and open-space on this land.

3. Through his involvement with agricultural associations and this research, Cody is interested in sharing with his peers what he has learned in his interactions with the oil industry. He has a spirit of continuous learning.

4. Cody referenced several dichotomies during the research, staging commentary in opposing or contrasting perspectives of homesteader or transient, long-term or short-term, and government or private (the latter often a reference to land ownership or jurisdiction)

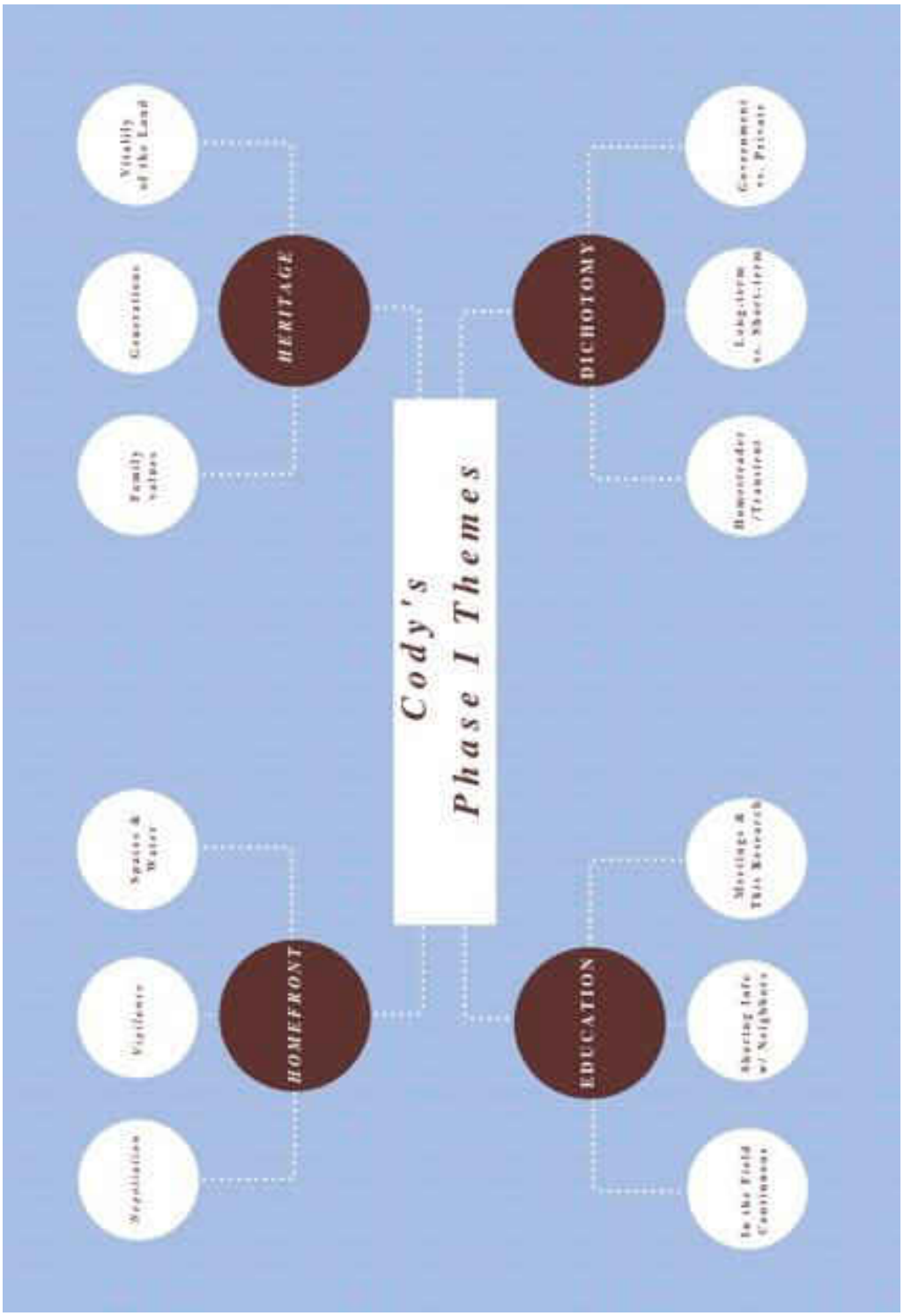


Figure 6. Categories and themes distilled from the phase one data of participant Cody.

Cody: Phase 2 Findings

For phase two work, Cody chose to make use of personal photographs, specifically photographs he or his immediate family had made since about 1970. Cody also chose the intervention of my photography, as he would ask me to make a few photographs.

I asked Cody to select the photograph(s) he wanted to share in advance of my arrival. As he showed them to me on a table in his home, he spoke contemporaneously about them, at times drawing from dates and handwritten captions on the reverse side of the prints. Most of the figures in this section are my photographs of the prints chosen by Cody from his family archive as he placed them on the black wood-grained table in his living room.

The images he chose for Phase two, and his descriptions of them, are reflective of the major themes distilled in Phase I and displayed in Figure 11. The pictures illustrate impacts he's witnessed on his family's land since he was a young boy and his explanations reference the meaning of the places, efforts to observe and monitor industry today and the importance of education to him and fellow ranchers to preserve the heritage value of their homestead lands and their agrarian livelihoods in western North Dakota. Cody said,

> Let's start off with some older pictures because we've been dealing with this since the '50s… We still got the same problems. Maybe not quite as bad as it was then…Then move up to some new stuff and kind of mention how it relates. The same problems still are around and yet we have newer problems now with the new

oil boom.

Cody said, “We just wanted to show you know, you have the fire dangers and the spills. They burn them off a lot if they’re oil. That one in January 1970 looks like a nuclear blast…” (See Figure 12).

Figure 7. Series of three images made by Cody's uncle. The two images at left were made October 2, 1971 of burning oil on Cody’s family land, and the third image was made on January 18, 1970 wastewater storage facility fire near Cody’s home.

Next, Cody placed three prints dated September 1970 onto his table (see Figure 13). I asked him to tell me what’s going on in the set. He said there was a pipeline leak underground and a hydrogen sulfide gas release, as well. He recalled,

> this is a gas leak that we had on our land. As you can see, the pictures, you can see the dead birds. This is a porcupine. You can see how far he made it into this. Where it was. He just barely made it a few inches and he was dead. Different kinds of birds and the porcupine. There were insects. A lot of insects dead.

Figure 8. Images by Cody's father of a dead porcupine and dead ducks who died at the site of a pipeline leak and release of hydrogen sulfide gas on Cody's land in McKenzie County, North Dakota in September 1970.

I asked if these things still happen, and he said they do but not as often. Then I asked him why the ground was dark in these pictures, and he said the leak killed the vegetation. He said he was eight years old and he remembers it well because it was July 4th, and he and his father came upon this scene when they drove back from a fishing trip that day. He said,

> We had lawn chairs in the back and there was an oil executive there who was saying that it wasn't dangerous. There's nothing wrong. You've got dead animals there and my dad finally had enough. He grabbed a lawn chair and gave it to the guy. The guy was from Texas or somewhere south. My dad told him to go sit on the downwind side if it wasn't dangerous. The oilman threw the chair and left. That's how surface owners were treated at that time. Still to this day, as a surface owner you don't have very many rights… The oil guy took off. We stayed there with some others to try and get him to do something.

Cody explained that "the Bakken [formation] doesn't have as much H_2S. You have a lot of natural gas, but it doesn't have as much H_2S. It's a little different. But it's still

dangerous."

> Next, Cody laid down the print shown in Figure 14 and described it,
>
> this is a drilling pit… what they did is they dug a big pit and threw everything in. They threw garbage, everything, as you can see…if they had supplies left over then they would be cut back on their budget so they'd just throw it in the pit and cover it up. They just threw them in and covered it up. Because then they would get more money for the next job. They'd have supplies like brand new pipe fittings or whatever. That's how corporations work and how our government works. The reason I pulled this out is two years ago we finally got [the state] to outlaw these sorts of pits.

The caption on the reverse of the print reads, "all the sludge and junk in it… photographed in July 1982"

Figure 9. Image by participant Cody of a drilling pit on his land, which an oil company excavated and filled with oilfield waste

Cody went on to say “they still have dry cutting pits they could use, but they have to keep all the liquids out. We don’t allow dry cutting pits either on our land though. Because they still have radioactive materials in them” (dry cutting pits are allowed for the disposal of drill bits and small pieces, but no fluids).

The conversation turned to radioactive waste. Drilling at depth requires the introduction of large amounts of water, and a slurry of water, sand, and chemicals is injected into the well, pushing oil to the surface. The water returns as waste and brings with it radiation from underground (see Chapter 5 for an explanation of exposure to radionuclides in hydraulic fracturing operations). Oil companies are required to dispose of wastewater properly, which may include re-injection into aquifers. Under North Dakota state and federal law, radiologically-contaminated hardware and other materials (drill bits, casings, pump filters, gloves, etc.) must be dumped at designated federally-approved disposal sites, yet independent operators have been found to be transporting radioactive waste to clandestine and abandoned sites (Nowatski, 2014).

I asked Cody about the current situation on the disposal of radioactive material waste and he told me that the state of North Dakota was planning to raise the limit on the number of picocuries (a measurement of the quantity of radiation) permissible for regular waste disposal in the public landfills operated by county governments.

Next, Cody placed on the table a group of five pictures that were taken on his family land. The image on the left shows what appears to be a small shack or installation and a dead cow. The remaining four images show one dead horse, four dead cows and eight dead calves. Figure 15 shows all five prints, and they are described individually in the captions for Figures 16-19).

Figure 15. Grouping of five prints placed on the table by Cody. The image at far left shows a dead cow beside an oil pump jack in August 1985. The horse (top center) was killed by exposure to hydrogen sulfide gas in April 1969. The cows and calves in the snow at top and bottom right were gassed in the fall of 1968. The eight calves at bottom center were killed by oil contamination after suckling their petroleum-soiled mother after she had lain at the site of an oil spill.

Figure 16. Closer view of the image at the upper right of Figure 15. This photograph was made by Cody's uncle when he was seven years old. His uncle's caption reads "4 dead cows exposed to gas break fall of 1968." Participant Cody commented, "I now operate that place."

Figure 17. Closer view of the image at the top center of Figure 15. This is one of four horses that died as a result of hydrogen sulfide gassing in the Fall of 1968 when Cody was seven years old. The handwritten caption by Cody's uncle on the reverse (at right).

Cody spoke about the image of eight dead calves (see Figure 18),

> I remember being told about this as a boy…There were thousands of barrels they thought had went down the creek at that time…in the spring… Then because of ice

jams and such…. all that oil was left up on the calving pasture where they had the cows. The cows laid in the contaminated pasture… when they got up their bags were all with oil and stuff and the calves were sucking.

Cody explained that the spilled oil was transferred to the bellies of the cows, and when the young calves suckled their mothers' udders, they ingested the oil and died.

Figure 18. Closer view of the image at the bottom center of Figure 15. This photograph shows eight Hereford calves that died as a result of oil contamination.

As that afternoon of phase two work continued, Cody brought forth something very different. Figure 19 shows the print. It contains four red circular images with dark spots. Cody explained these were scans made of his uncle's lungs at the hospital following his exposure to hydrogen sulfide gas on their farm. Cody continued,

Remember that one picture where my uncle said he was gassed? (Cody refers to

pump jack location shown in Figure 16). He was gassed two times. Nearly died. He's very lucky to be alive. They had to medivac him. Fly him to Bismarck. Those are pictures of his lungs bleeding … These dark spots you see is where his lungs were hemorrhaging. He would wake up. His wife said that after that, for a long, long time, he'd wake up after sleeping and his pillow would be all blood. He'd cough or breathe it out during the night. And then he got gassed again after that.

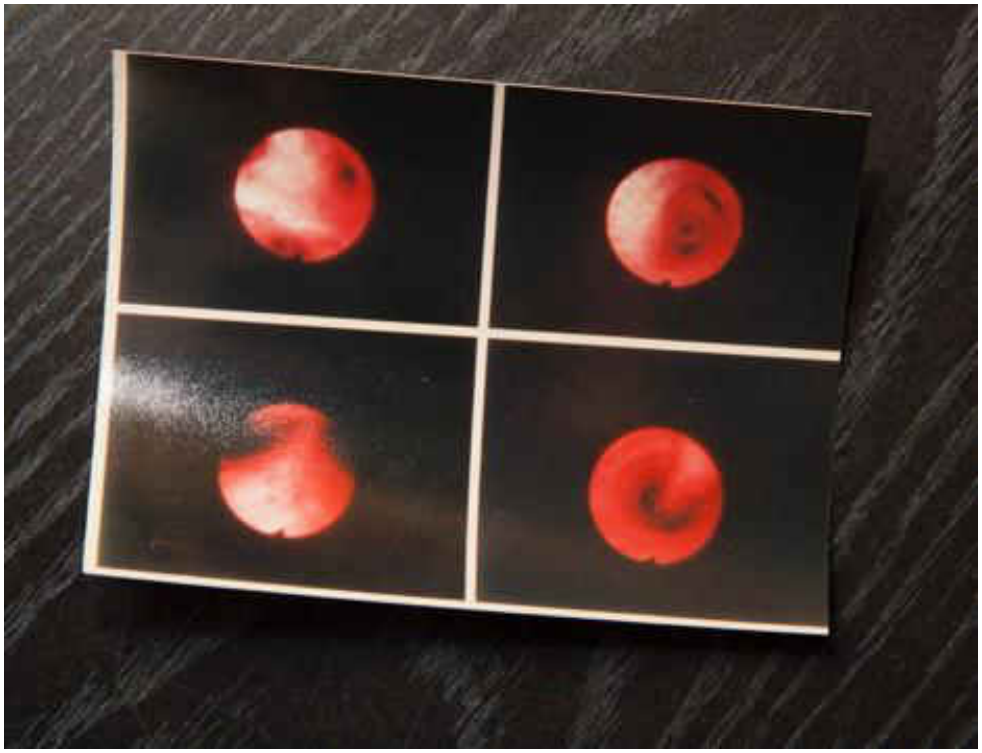


Figure 19. Lung scan. Print furnished by participant Cody shows a series of images that document damage to his uncle's lungs caused by exposure to hydrogen sulfide gas at a natural gas flare blowout on their family land.

While we discuss the images that depict the gassing of livestock and Cody's own uncle, he pulls out two more prints. One shows a group of pipes leading into a metal drum and another of a rusty shed (see Figure 21). Cody says,

That's actually an old flare. You can go out here right now and take a picture anywhere. It's a big problem now. We're having everybody talking about all the waste flaring. Well, they were doing the same thing back then. So, they knew. They know these problems

Cody explained that all the pipes in the image shown in Figure 20 were coming from different wells. Cody said, "Before it was like this. They run them to one spot, run them in a barrel and fired them… That's how they flared back then."

Figure 10. Flare pit. October 1969 print of an image by Cody's father that shows an early "flare pit" where pipes venting natural gas from several wells are brought together and burned off inside a barrel on the ground.

Today's natural gas flare is designed as a tall upright column, so that if the fire goes out, the gas has an opportunity to dissipate in the air, ideally with some wind, before sinking to ground level. Figure 21 is my photograph of an abandoned one-room school

house in the Bakken region. In the background of the scene is a well pad with oil storage tanks and a natural gas flare.

Figure 21. Abandoned one-room schoolhouse in the Bakken region with adjacent natural gas flare. Producing oil wells typically have a row of storage tanks and a flare to vent and burn off natural gas at the well, producing air contaminants and wasting harvestable energy. The risk of hydrogen sulfide gas exposure is greatest at the well site when the flare blows out. Photograph © Bruce Farnsworth

Referring to the vertical flares of today, he said the rationale is,

> by then it's dissipating so hopefully it's a much, much less likely that somebody will get gassed. Doesn't mean it won't happen… That's a very cheap way to try and cure a problem. The problem is flaring should just not be done. They should be capturing the gas because it's a health hazard and it's a waste.

A picture of an old metal shed was the next print he laid before me. The whole exterior of the shed is rusted in the print dated October ‘69 and photographed by Cody’s dad (Figure 22). Cody said the shed was located near a gas flare which had blown out in the past, saying “here’s what H_2S doe to metal.” (see discussion for an overview of occupational and environmental exposure to hydrogen sulfide gas).

Figure 11. Metal shed oxidized by exposure to hydrogen sulfide gas. This print of an image by Cody's father dated October ’69 shows a storage shed on family land severely rusted by H_2S gas.

The next print that Cody presents is one of dead sparrows on the soil (Figure 23). It’s dated 1987. He said, “the same thing. It’s just showing a gas leak. Then you’ve got the dead birds and the sterile soil. So, like I said, these just keep on going.”

Figure 23. Dead sparrows on the ground. This August 1987 image by Cody on his land in shows birds killed by hydrogen sulfide gas leak.

And then Cody said,

> I'm sure I've got newer pictures. I'll have to take out. I just don't take that many anymore because why? You're so used to it. You did it over the years and years and years. You just don't do it anymore because you know what they look like.

In the next photograph, Cody took me to the location of a creek on his land, where a July 1987 spill took place (Figure 24). In the July 1987 image made by participant Cody, a trench has dug as part of the cleanup of a pipeline break near a creek. Note the two large abandoned oil storage tanks at the upper right. The inset photo is a magnification of the two abandoned oil storage tanks at the upper right of the photograph, showing the large opening in the near tank created by a missing panel. Cody expressed concern that the abandoned tank is still there and his cattle can go inside it. He said, "Those tanks are still there today. And not being used. They weren't being used in the

‘80s… abandoned.” He expressed that he’s concerned about the lack of remediation of old oil sites, telling me, “you can see there’s a chunk of it that’s missing there, and so [my] cows go inside of it.”

Remediation is a term used the natural resource, development and land use planning disciplines. The term refers to the abatement, cleanup, or other method to contain or remove a hazardous substance from an environment. In the context of this study, participant Trackfinder is referring to the obligation of the oil company lessor on his land to ensure that any spills, contamination or impacts to the site are cleaned or restored prior to leaving the area. Many permits require that a bond is put up; the bond should only be released when remediation is verified.

Figure 24. Participant Cody’s 1987 image a pipeline break at creek on his land. Inset image is a closer view of oil storage tank still abandoned in 2015. Cody is concerned because his cattle can enter through the opening created by a collapsed panel in one tank.

With the next print, Cody brought out a photograph of a 1992 pipeline break on his land, with a trench dug to access the broken pipe and red plastic hazard tape encircling the

oily pit (Figure 25). As he tossed this print on the table, he said, "so like I said a lot of older ones there just to show why we don't trust them or what the problems are and how they haven't really changed." I gathered he was establishing a pattern or a history of such issues.

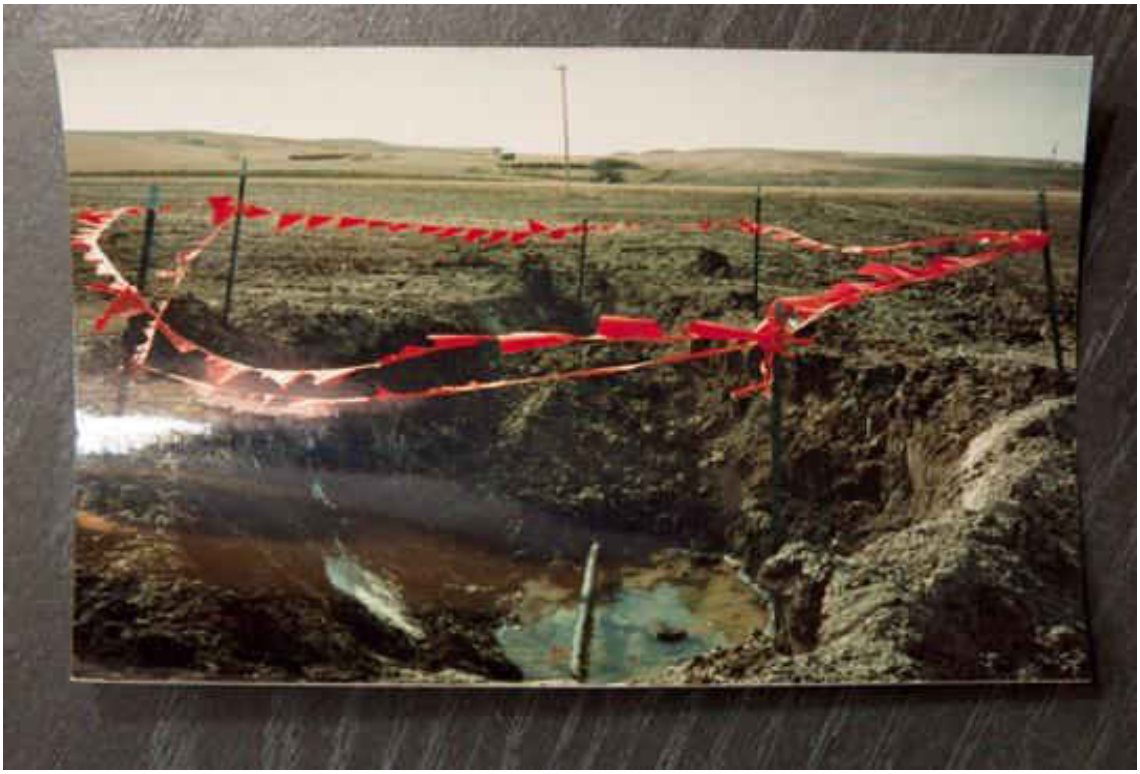


Figure 12. Pipeline break. Image made by Cody on his land on March 18, 1992. Trench shows the removal of contaminated topsoil from the location and the placement of orange flagging.

Cody then moved to a set of four pictures, two of which are aerials, that show more recent oil development on the banks of Lake Sakakawea (see Figure 26). He was approached by an oil company wishing to lease his land near the shores of the lake, and these are among the photographs the oil company representative shared with him. He said, "these are newer wells, taken [about 2014]" and,

> they threw these pictures in. I assume they do it to everyone. Here, we know what

it looks like. We already know. But a majority of the mineral owners don't even live in the state. They get this and look at it. They go, oh, wow, this is neat and I'm going to get a bunch of money. Cody said, "… it shows how close they are in proximity to the lake. I mean, they are just a few hundred yards from it. You know, you've got the cliff here going to the lake."

Cody was referring to the risk of water contamination if there were a pipeline break or oil spilled past the containment berm of the well pad, given the position of these wells at the edge of slopes draining directly into the Missouri River. He then used these

photographs to explain to me how the industry uses private land to access oil reserves under federal land and bodies of water, as the horizontal well can reach out laterally some two miles to access oil across thousands of feet of the wellbore.

Figure 14. Newer generation oil drilling platforms. These four prints were given to Cody by an oil company interested in access to his land. They show drilling platforms established about 2014 on the bluffs above Lake Sakakawea near land that Cody owns. given to Cody by an oil company interested in access to his land. They show drilling platforms established about 2014 on the bluffs above Lake Sakakawea near land that Cody owns.

He then spoke of something strategic in the oil company's use of photographs of new drilling platforms. It's a technique he's noted since he first met with the oil companies in 7th grade,

> They're not like the other ones but sooner or later you're going to have the same problems as things deteriorate. Or the oil starts to go down or the price goes down. Like it just recently has. Then you'll start to see how shoddy it'll look. We could probably go and look at these in another couple three years and they'll look a lot different.

Cody told me more about his land on the shores of Lake Sakakawea and his experience with land men seeking access to his land to drill,

> It's not just pasture land. It's more valuable than pasture land because of the proximity of the lake… the scenic of it. The remoteness. They've tried to get to drill on the federal and they don't like to jump through the hoops they make them. So, then they came to us. Then they threatened to put the wells on without compensating us for damages. Then they tried to go to the state on a 1280-acre spacing. [horizontal wells are most often spaced on either 640-acre or 1,280-acre units] They tried to throw it into a bigger spacing unit that had wells already drilled in it so they could claim that it was being produced and hold our lease. We actually caught them in a lie.

He said that, ultimately,

> We gave them rights to drill, but they never got it done. They just sent us a [letter] that indicates that they don't think they will get it done. Its Continental Resources is who it is. Because of the slow down they don't want to pay us for damages and things like that.

Cody explained how the price of oil, fluctuating from over $110 per barrel at one time down to $30 per barrel at the time of this research, influences what the oil companies tell

him,

> First of all, [the decline in the price of a barrel of oil] actually makes it worse in the area we're at because we're in the best part of the Bakken. So, they move out of all the marginal areas and come to this area because they can still probably make a profit here by drilling. Well, they have to be or they would quit. Which also brings up a point when it was $110 a barrel. Think of what they're making. When they can break even or make money at $30 a barrel, just a little point to make. Now when they start saying, 'oh, well, look at the price of oil. We're not making any money,' look at how much they made. They should have been looking ahead to put some away for remediation… We now have an unprecedented boom that's 10-20 times larger than it ever was, so we'll have 20 times more sites and more pipelines and more spills. It's just going to happen. They may have improved with technology but you're still going to have them. If they claim they have no money, then they won't remediate even the ones that are 50 years old… we have sites they haven't even reclaimed since the '60s… How are they going to remediate the ones that are here now?

Cody reinforces his point as he tells the story of a Texas oil executive who came out to have a look for himself,

> When you have two executives sitting in Dallas, Texas, saying this and this, how do they know, if they don't listen to the people out here or come and look? And in fact, then it happened, they came. It was Amerada Hess at that time that bought out Texaco. Hess actually came around to my uncle and my father and a couple others and said, what are the problems you see? And they took them around and

they took them to well sites, abandoned well sites they didn't even have on a map that they did not even know they were buying. Two of them have not been reclaimed yet. This was back in the '80s—'90s. They were older than that but Texaco never reclaimed them. Hess hasn't reclaimed them either.

Next, Cody showed me a set of three photographs, two of which were made at the site of a 1985 pipeline break. Cody is shown in one image, walking the area after it was covered in topsoil (Figure 27).

Figure 27. Images by Cody of a 1985 pipeline break on his land. The spill is shown in the creek bed at the upper left. The image at lower left shows the site after the oil company completed remediation, removing contaminated soil and back-filling with new topsoil. Another unidentified oil spill on Cody's land is shown at the upper right.

In May 1998, participant Cody photographed the effects of illegal wastewater disposal on his land (See Figure 28). You can see that the soil has turned white. This

effect is diagnostic of fracking wastewater contamination and is due to the extremely high alkaline nature of the fluid. This photograph was made in the area of Antelope Creek which runs into Lake Sakakawea.

Figure 28. These are Cody's images of an illegal wastewater disposal in 1998 on his land near Antelope Creek, North Dakota. The white landscape of chemical precipitate is characteristic of the impact of the highly alkaline wastewater, the toxicity of which is minimized by the nickname "saltwater." Cody said that wastewater spills are worse than oil spills because they sterilize the soil and nothing grows.

After an afternoon of sharing photographs with me, Cody took me on a drive to a few locations on his land to show oil sites in various stages of development. What follows is the verbatim transcription of my recording as I listened to Cody narrate the one location we visited,

> Ok. We're coming up. There's government land on my right here and right behind us on the left is federal and state land. It's a road-less area. We're just crossing onto my private here. Right ahead of us is the first site. They just finished drilling I believe it's five [wells]. Three or five we can see as soon as we get up there. They're going to come back drill more on that site. What they're doing is using

my private. I've made a deal with them. Because it's a road-less area, they're going to drill out into the government … This site is going both on the private going west and then into the government to the east, so it's off spacing wells… I can refuse by law but we made a deal and got paid fairly well for it. This is a mile and quarter about. This is the first site. Now they just came back the other day and from this site west about a half mile they want to. They're talking about another pad too. That pad will drill into the north unit or north stuff. Ahead of us is an existing pad with three wells and they're going to come in and expand that one. I'm not sure how many wells there. Then when we get down a little farther is the huge, big pad. It's like 21 or 27 acres and it's going to be, so far, 18 wells are what they're saying total will be on it. They have just come to stake it so they haven't moved anything there. But that will probably be the next step here. Down there. See where that cattle guard is, they're going to have the site here. They haven't really staked it yet. But from there on up to right where we are a little bit farther north they are going to have I believe it's about 22 acres is what I, if I remember right. They are going to cut into that big hill there. Take a whole bunch of that dirt. Put over on that one and build it up so they can expand that site. Then this site is supposed to be 18 wells so far on this plus a [storage tank] battery. I don't know how many they're going to put on that existing site. Then that site we came from there's three drilled and I've been told another five up where we parked your car if you go a half a mile to the west. Now they just told me they want another site, half a mile to the west with 5-8 wells probably, drilling the government that's to the north of us which they hadn't talked about before. So,

> what would it be, basically, not two square miles but a little over a square mile they're going to have those four pads with, I'm not even sure, probably. They first were talking
>
> 30-35 wells. Now they added another pad. So, they're probably talking 40 wells at least… which they say they'll have drilled within about 4 years. They're supposedly coming to start on this big pad.

Cody asked me to make a panoramic photo of the site described in the long quotation above, as a "before" picture prior to the development. It is shown in Figure 29.

Figure 15. The site of planned oil development on participant Cody's land which he described in a long block quote. Panoramic photo composed of 15 images stitched together using the Photo Merge tool in Adobe Photoshop software. Composite photograph by Bruce Farnsworth.

In conversation, I asked Cody why there seemed to be so much pressure on him to develop his land (and place more responsibility on him for monitoring the same). Just prior to this research, he said, the Obama administration issued a fracking moratorium on federal land and required the disclosure of chemicals used in the fracking slurry on all new wells. He said they don't have to disclose the chemicals they use to frack on private land. Another reason for the intense interest was the fact that the land directly above the desired oil is designated as "road-less" by the federal government so the oil company cannot set up their operations there. However, they can lease Cody's land which adjoins the road-less area and access the oil from there (using the horizontal fracturing method).

On this topic of the company's apparent preference for private land, Cody adds,

> Those are two of the reasons and the third reason is it's quicker to deal with me than the government. They can come to an agreement. It took us a year to come to an agreement here, basically not quite about ten-and-a-half to eleven months. The fourth reason is just I think it was cheaper for them because just the way it was set up.

We look out at some green storage tanks and Cody says, "They just got done fracking this. Some of them are oil. Some water.". The conversation turned to water again as Cody describes how the oil company has chosen his land as a drilling site,

> It's all concentrated. It's got a good main road. It's got a water line coming in so hopefully when they had to haul water for that. Well, they didn't. They run an over the groundwater line here. I gave them an easement. But this spring they're putting in a water line that drawing water from the lake. They'll put a pond back here and then they'll just run a little short line. That will save them many, many thousands in truck trips.

I said to Cody, "So they know you pretty well, it sounds like" and he replied,

> With this oil company, I have a pretty good relationship with them. That was probably the last reason they came is because they were probably, assumed that they could make a deal with me. I'm going to get, I'm just going to admit, I'm going to get a lot of money out of this. Because I wouldn't have did it otherwise.

I asked Cody a question that had been on my mind, "How much is a well worth? How much would you get on one well? Cody replied, "That all depends on what you negotiate. I can by law refuse them they're going after that state law I heard now too. …" After

some time, Cody answered my question, "So I charged them quite a bit a money for them. We came to an agreement. I'm not going to say what. That's proprietary I guess you know." Cody had every right not to provide his income, and it may be in Cody's best interest to make the deal himself, so he can establish the terms and not the State of North Dakota. As Cody told me,

> But you can refuse them if you own the mineral rights. But they told me that up front. I already knew it. But if they don't make a deal with the person, then they go to the state. The state will probably approve it, which they did… because I don't own minerals here. I just surface them.

Cody just described to me his desire to make a deal with the oil company now so that he can determine where the oil company sets up. Otherwise, if he says no, he loses control as the oil company will go to the State of North Dakota and get approval. He said,

> It was well worth it. I guess you'd say, plus I don't want to see them go in there and drill that. We run cattle on that for 20 some years so I know it real well. It's still one of the few places left here is western North Dakota that doesn't have a whole bunch of roads and oil wells in it… from here it would be probably three miles [to my land]. Because they came already on the reservation and drilled into it from that end from the east and if they get this, they can drill in from this way. They'll cover the whole thing without having to go in there [his pristine land]…]…which to me, I kind of want to see that. I live here. I know that area. It was worth something to me. I guess you'd say, not monetarily but … keep a little bit of place where you can go out and those buttes there and not see an oil well or road with.

Hearing this apparent reference to the legacy value of his land, I asked him if all the local families are this thoughtful. He replied,

> I think some of them are wishing they would have been now. Some of them are. Some of them aren't. Some of them don't care. They wanted the money and got out of here. Some of them are. It's just like anything with a population. Some are. Some aren't… A lot of those don't have kids coming back. My family, we have three here yet. We all grew up in tough times. We became connected to this land I guess you'd say. So, we want to see some money out of it, but we also don't want it destroyed. A lot of people my folk's age didn't have kids that came back. They went off. Or now they came back in the boom when the money was here. But they have no connection to the land really. Some of them do but most of them, it's just about the money.

The interviews and observations of Cody gave me a rich understanding of his experience with the oil industry on his land. His choice of images that referred strongly to his uncle and father show his personal connection to the legacy of the homestead. His descriptions of the photographs included more than captions but revealed what they represented in his thinking, how they can be interpreted and suggested an educational value in seeing a more comprehensive view of the oil and gas industry over two generations. Cody clearly has an interest in seeing that images are used in an educational context, as he takes time to identify and explain the significance of individual elements in the photographs. Throughout both the phase one and phase two findings, he refers to the dichotomies of landowners-company, federal-private, and short-term/long-term interest. The photographs that Cody shared in phase two reinforced the major themes that

emerged in which he found himself protecting his home ground, motivated largely by a desire to preserve open space and clean land and water.

Trackfinder: Phase 1 Findings

Trackfinder—his choice of pseudonym—was a 61-year-old farmer in McKenzie County, North Dakota at the time of the research. While his grandparents settled early Minnesota, he was just over a year old when his father moved to the western North Dakota after military service in Wisconsin. They lived in Watford City before setting into his current home where I met with him. I asked him what kind of change he had seen in North Dakota over his life, He said, "Ugh, a lot of destruction of the water, air quality… for me, it's air quality. And to that we can't drink the water, so that's pretty drastic and, and uh, the way of life, it's just totally deteriorated, for… the farm life and rural life, it's gone to industry, hmm, racing to… get their objectives accomplished, no matter what anybody else was doing.

I'm meeting with Trackfinder at his home. I enjoyed the drive out to the Bakken region, at least when not on truck-clogged roads. Never at night would I drive because of the heavy truck traffic. In the largely flat landscape, I would pass buttes on occasion. Trackfinder tells me how these buttes come to get their names. He said blue butte looks blue with the lighting. He said, "I think that's how they got their names, like saddle butte, table butte, chimney butte because of their outward looks or features."

Trackfinder grew up in a family of seven children. One of his brothers died at a young age of "complications" he said, and he is the oldest of six siblings. Only one of them lives within a hundred miles. Trackfinder said his dad grew up "here," in McKenzie County, but was injured in a farming accident when he was about 30 years of age. That

left a lot of the responsibility to Trackfinder and his grandpa, to "make sure things were taken care of and got done on the farm…" He added that all of his siblings moved away after high school in about 1970-71. He said they moved just to get away from home. These were "economically challenging times," he explained.

From the '50s into the '70s, as the oldest child, he teamed up with his dad and grandpa on a fairly large farm and ranch. He grew wheat, corn, barley, and oats as the main crops. He started with spring wheat and gradually converted to durum wheat because it was more profitable. Similarly, corn production moved to barley. He said corn was fairly labor intensive. On one particularly bad year, the corn had a low nutritional level and it didn't even make good cattle feed, so they switched to barley because it's more of a consistent energy crop. About half of the crops fed the family; the crops farmed for the cattle were considered part of their ranching operations. He also planted alfalfa because it provides more energy.

Trackfinder's experience familiarity with fluctuations in the price of crops and beef may have prepared him for the variable price of a barrel of oil and bred some resilience. When he was in high school, the family had between 250-600 head of cattle, and the economy moved between times of good production and times of good prices. They would sell more cattle off when there was more profit. Trackfinder began managing the cattle and farm operations at 19. Trackfinder described the family business of producing both cash crops and beef calves as "pretty much very back and forth." He said that of all the years they raised grain, "we only had maybe three or four years out of fifty years that were good profitable grain years… you, you put your resources into cattle to pay for your bills 'cuz the grain farming was just not profitable."

For grade school, he had "just kinda a country school" near where he lives now. He attended middle school for three years in Watford City. He said he had about 20-25 students in the classroom and now, "I guess it's just terrible there," referring to the population boom from oil worker families.

Getting back to my question about what education he received in high school or college that help him to manage the current environment with oil, he said,

> in high school we had pretty good teachers, but where I see it, it would have been better if the kids would have been able to have more education younger, but in a farm community that's pretty tough to do… because the kids are all working on the farm.

A profound comment, I thought. I wanted to resume the conversation about his education. He said he had "lots of mathematics, and science, and some farming, ag-related classes." I asked him if he had his transcripts still and he said, "no, but someplace I got my FFA jacket." That would be the Future Farmers of America Association, which, like the 4H Club, is active in many high schools in agricultural areas. In high school, he says "it was "just a basic uh, like Earth science… I didn't take biology… or maybe I did [laughs]. It was probably basic, their science I suppose." He had some social studies, such as North Dakota history and world history, but he gravitated toward math. Like a good memory, he shared that in high school "they offered some short courses on advanced mathematics," and he continued, "my grandparents taught me a lot of dealings of what was going on and we discussed the North Dakota history book." I knew by the tone of his voice that he was referring to the oil industry, and I clarified, "they told you about oil industry at seven years old?" Trackfinder said, "yeah, because they told me precisely that there were gonna be

problems with these companies…… that I would have to be the one watching out for, because these companies were going to take advantage of everybody."

He said his Dad "wasn't involved," "politically inclined" or willing to acknowledge what the oil companies were doing, he said. I asked him what his grandpa told him. "He showed me the… the trickery in the mathematics that the oil people were using to deceive people, and some of the legal things that I had to study. They wanted me to study law…" Astonished, I replied, "you were seven years old, and they wanted you to study law?" He said,

> Yeah… people understood things back then. I understood stuff back then… you know, 'cause I was out working with cattle, milking cows… and my grandparents wanted me to be able to watch out and help the family, and they wanted me to go to law school, and they said somebody has to be aware and keep a watch on these companies because they're only out here to take advantage of people and the environment; they really couldn't care less about what it is that the people living out here.

Seemed that grandpa had some previous experience and concerns for the future of the family farm. Trackfinder said, "people were coming and leasing, and…they had no real safety measures;; it was all wildcatting." Wildcatter is an informal term for a prospector for oil or minerals in areas not yet proven to contain the resource. Wildcatters are typically solo operators, not affiliated with an established oil company.

Trackfinder's mathematical inclinations quickly became apparent in and his example of an apparent bait-and-switch tactic he has seen used. He explained the maneuver,

> When [the oil company] came they told my grandparents …in order to come out here and do development, they wanted to get a little more of their percentage, so they said 'We'll buy ten percent of your royalty,' and they said they'd do it in a lease. Well, they didn't necessarily mean they were going to do ten percent of his acreage, they wanted the ten percent of the lease. So, if (grandpa's) lease was for twelve and a half percent and they took ten percent, that would only leave grandpa with… two and a half percent—they weren't taking ten percent (because) ten percent from twelve-and-a-half percent is more like maybe closer to eighty percent of what my grandpa would have gotten if there was production. It wasn't ten percent of… that lease….

I commented to Trackfinder that the landowner had to be pretty math savvy, and he said "yeah." He explained,

> …it was a trickery and uh… how they stated the facts to my grandparents and, of course, you know that they're conning and that the people back then weren't familiar with the percentages and the manipulation of facts, just as… it is right now, they're doing the exact same thing to the people right now…

Trackfinder began to explain another tactic—using "unitization"—that allows the oil company to profit from large areas of land that are not producing oil, but I gently paused the conversation. At this point, and not Trackfinder said, very far into the interview, that I noticed his focus on numbers. It seemed Trackfinder's mathematical reasoning skills are considerable. He spoke with the confidence of a landowner who might be a formidable partner, if not opponent, of the oil industry which he portrayed always had an angle for maximizing their profits.

Next, Trackfinder explained how the industry steps in where the state government has not provided oversight or regulation, and how oil companies appeal to local values of frugality and stability in their approach with landowners,

> The math can kill the revenue going to local people by trickery. It's not trickery, it's mathematics. But do the local people understand that? Or do they understand oil? No. They don't understand either one. They shouldn't have to. The state is supposed to look out for them. That's one of the forms of trickery that they used because people are not familiar with mathematics… There's legal and mathematics. And mathematics is not necessarily the total answer, it's understanding of the industry, practices, see? …That's why they thought they would use the same scenario on say let's unitize … dividing more wells should logically mean a more stable revenue. So, this is the way I tell it, would you rather have a thousand dollar check every month and have the chance of maybe losing a little bit if your production goes down or be guaranteed ten dollars a month for the rest of the life of the oil field? …

He talks about the good nature of people—and deception,

> the people don't look at it that way, they're trusting, and they got a free meal out of it, they got to go to a meeting, get a free meal, and sit down and visit with the people, face-to-face. The (oil companies) were lying to them. Yet, they were not lying; they were just not telling them the truth. Or they weren't telling them the whole story. I guess, they were telling them the truth about what they were telling them.

He said "the state is supposed to have people out there, monitoring, checking to make

sure people aren't taken advantage of…" and so I asked what is the name of the agency charged with that. His reply was much like Cody's, that it's difficult, if not impossible, to rely on government agencies, and he replied,

> Well, they always try to switch who it is it's supposed to be in charge. They say EPA, they say Industrial Commission, they say their inspectors—as soon as somebody brings something up, it's always somebody else's department. "Call somebody else," you know, "Don't call us", or "We'll send somebody out to look at it', but they don't wanna file reports, they don't wanna be accountable. If they know there's gonna be a problem they make sure that they're not available or can be available in the future [laughs]. It's passing the buck and not have somebody there—how would you like it if you called the hospital, said "We have an emergency", and they said, "We'll send the next available ambulance when the guy gets off vacation?"

He reminded me of the appointed role of government in the oil boom and his actual experience,

> They have to have somebody to protect the people that are unable to deal with these companies on their own. And that's why we allow the state to manage the oil and gas industry. Now, we shouldn't have to hire an attorney, they're supposed to be the attorney, it's the legal court that takes care of and protects us. But can we rely on them? Are they out here putting on meetings, telling us that we need to not allow companies to undertake certain operations, because it could be in violation to the state law? No. They're not. They're not out here to try to help us at all!

Trackfinder claimed that at the same time oil companies express a reluctance to pay for the use of private land, they depreciate it,

> they don't wanna pay what other ones have paid, we shouldn't have to pay you. And they use really lame excuses like we're not paying what the other companies are paying, what the market is. But yet, no one can build next to their facilities, because it's hazardous, it's dangerous, and nobody wants to so they lower the value of your property… (the companies) created a disturbance in that area that makes it devalued

I ask Trackfinder, given his concerns, if the royalties compensate for the devaluation of the land, Trackfinder applies his economic reasoning to the long-term degradation of the land,

> that's where I was emphasizing the fact that now the rest of the State is realizing that if it's allowed to continue, these people profit by taking the minerals away from the land for some fee, that the surface person is left with the responsibility of cleanup, because a mineral developer is not gonna be responsible for cleanup. Even though the State claims that they're gonna have it covered under bonding, it ultimately falls back on the land

Trackfinder explained that if someone wanted to buy his land, now contaminated, a bank would not issue that person a loan. He said the land now…

> becomes contaminated, it's an environmental liability, because these companies will walk away from it, and we have quite a number of them that the state won't come remediate or reclaim or clean up cause it's too expensive, they don't have the money, and it falls on the land owner. Even if they have no minerals on it, the

clean-up that they created falls to the land owner, so they have to take on the recordings, and record that they own the minerals, but yet they're leaving the liability of the cleanup to the person who owns the surface—Now, that's gotta be totally legally inappropriate…They're extending the liability to the land, which they're claiming not to have any right to or liability to. It's kind of a fine line that they're stretching out, saying we do not have our name on the land, do you follow me? …the State gives us the right to mine those minerals but yet, the State is not gonna' hold us accountable to clean that up…they do they make people believe, psychologically believe, that they're owners. It's a misconception of the facts.

…the oil people from Texas and Oklahoma said "let's do this" to North Dakota and the rest of the states one at a time. Let's go to the politicians. Let's make them believe that we're gonna' run the show. We wanna' be able to mine, do what we wanna' do, but we don't wanna' be liable for the environmental impact. So, let's put the liability to the land owner so we're not liable to clean it up. The state definitely isn't gonna be liable because they can just wash it away, just say 'no, land owner, looks like you're stuck with it.' You know, and what's he gotta' do? Get an attorney and sue? He can't sue the State, they're not liable. They won't pay for it. Oil companies, you'll never get, you might get something out of them—but it's still a problem… that hasn't been fixed.

Trackfinder provides the basis for the impacts perhaps,

they do not wanna be liable so that's separating liability and ownership. Now, you can't do that, in the law they say you can't do that. But, the oil industry has found

> a way to manipulate it. To the State … they're separating the liability and the ownership from the landowner— they're conveying the liability to the landowner, but they're trying to separate the right to profit and take the revenue form the land, which are the royalties.

I presumed that not all farmers, ranchers have this same experience. I asked him what kinds of interactions he may have had with neighbors on these issues, and do any of them have a desire to educate others from their experiences. In one of our conversations, Trackfinder told me that "their family and ours are pretty much the only ones in the area that have been trying to educate other people.."?" I have certainly noticed in my own informal conversations and reading articles in newspapers and magazines that, when residents of the region are asked about their feelings about oil activity in the region, there are frequently the ambivalent responses such as "mixed feelings" or "there is good and bad." I thought that, perhaps, Trackfinder could help explain those responses, He told me,

> And we don't necessarily see people disagreeing with what we're doing, we see those three avenues, of either being not informed or not understanding or inability to comprehend. people need to be able to follow a well-established path to get to the point of what it is that they need to know

Calculating asked him to compare the environment where he lives with a previous oil boom around 1981-1982. He had this to say:

> Well, it started off as everybody said "oh this is a blessing, we're gonna get some revenue… that's gonna give us a boost"…it happened so quick … before people realized it had started, it was over…. a lot of people kinda got geared up to

> thinking that this is gonna be the way of life … it really caught a lot of people in disadvantage because people tried to raise their standards.

Trackfinder told me the demand for land is much different. He said,

> now it's really crazy, there's offers every day in the mail, everywhere to try to buy rights. You know, mineral rights… Some companies even sent out (a letter that) your interest is burdensome is such a small amount, if you would, we would prefer to just buy it from you so we don't have to deal with your accountants…. And they don't say, if we buy your interest you would be giving up all rights for the future. That would be granting all of your rights but it doesn't say that after you die it's gotta go back to the—to the surface owner.

he owns. He's down to about 4,000 acres of land from the days when he was operating with his grandparents and they had close to 9,000 acres. He said he's "kinda average in the larger owners," as half of the landowners have more land, about a quarter of them hold about a thousand acres and the remainder own between 10-700 acres.

In terms of oil infrastructure on this land, he has eleven "unit operations." These include a variety of installations such as oil wells, pump jacks, pipelines, wastewater storage facility, a fire station. He showed me one site on a map, telling me it's a "combined—it's a disposable site, there's well tanks, there's a recycling plant, it's all… encompassing the area." He said, "otherwise, they are just interested in wells." The companies work quickly and the landscape is always changing as new drills are disassembled and new towers spring up. As for the huge drilling platform I saw when I came for my last interview with him, he said, "yeah, that's down now."

Trackfinder gave me some insight into just how busy the region is with oil

development. He said an oil company is proposing right now to do twenty more drilling platforms in the following year on his land, and this will involve several different entities and subcontractors. He took me to the Oil and Gas Well Search page on the State of North Dakota website (https:// www.dmr.nd.gov/oilgas/findwellsvw.asp) to see just how many companies manage oil leases in North Dakota (primarily in the Bakken and Three Forks formations, of course). A single mouse click brings the drop-down menu for Operator/Select Company and reveals a list of over 500 oil and gas operators working in the state. Landowners leasing rights to the oil companies use the site to review their leases by choosing the oil "field" (geological pool holding the oil) entering the section/township/range information for their parcel of land. With a password, owners can see geological surveys, information on pipelines, and downloadable maps.

Clearly, Trackfinder's greatest concerns regarding oil company use of his land rests with leases, cleanup/remediation and related contracts. All of the study participants, at some point in our conversations, reminded me that oil leases remain in effect as long as one well on the lease continues to produce.

Trackfinder told me he would be attending a hearing on petroleum activity. He's learned a lot about the strategies for drilling and accessing oil and these led him to photographic interventions in phase two of the research.

Despite the travails of working with the companies, Trackfinder only saw his involvement increasing in the future. From the interview over the spring and into the following fall, he was expecting to have "in excess of twenty, twenty additional wells just on our acreage." He explained how drilling and extraction activity increases with the rise in oil prices::

> They may just hold that acreage for five or ten years and the price oil would go to say, twenty or two hundred dollars a barrel, all of a sudden they would get interested. But, you know with where it is right now they may not be quite so interested, but the concept is that the brokerage firms, there's I believe four of them that have been calling me, are talking about the QEP stock skyrocketing. Ok so, in other words, say if the QEP stock is sitting here at twenty dollars a share, let's say. And all of a sudden the investors buy a billion dollars' worth of stock. Well QEP then will come out here without a question and probably drill out forced by the investors buying stock to drill out the fields and their shares might go up ten times the value… Stock market driven. Where out here, the people out here are only just concerned about royalties, they're not concerned about being on the stock market, where these other guys are playing two angles.

He told me he was recently contacted by a North Dakota landowner who suffered a major oil spill of tens of thousands of barrels. He said he told the man,

> Probably you don't even wanna accept a cup of coffee from them or talk to them on the phone other than to make sure you have everything in writing. And don't sign anything, I said, because they may try to get you to sign off for the damages that they've caused. And with twenty or forty thousand barrels of oil in the ground, on their property.

I asked about remediation for the site. He said, "well I saw that they had done a lot of digging and excavations so that the oil could drain in into an area where they can just pump it out."

In the midst of our interview, Trackfinder made a very good point. He said, "you

know all we really got to talk about was the basic psychology of what is happening to bring light (to) this oil activity. We didn't even really get into the needs." Trackfinder sees himself as a teacher, and he wants his community to understand. He said

> you know the problems we're having—people don't understand. You know? 'Cuz what I just kind of explained to you, the rest of the people aren't even there yet … the [[landowners]] are unaware of all of these different procedures and the fact that is happening…What do we do to get the people to understand? So that they can, you know, speak up.

So much distrust, as he refers to an upcoming statewide hearing to taken complaints from landowners related to oil and gas activity on their lands. He says

> they're there because they have a complaint and they want it registered…but the state is really good at pegging people…they get them to say they have a concern, and by doing that they trick them into… it's like, let's go have coffee and talk about it [laughs] you know? And then we'll come back and put it on record

Observation on Trackfinder's land

We headed out onto his land. We stopped about two miles from his home and, just as with Cody, he continued, "see there. On that hill, they're drilling I think four wells and over there they're drilling some more, and right here there's gonna be three… and there's gonna be four right there." I asked him how many well she has active, and he replied, "twenty-eight and they're gonna drill another thirty in the next couple of months." That's close to 60 active wells in which he has an interest of up to about ¼ percent of all the oil captured from the ground. Trackfinder makes a strong link argument that landowners who insist on part ownership are better able to regulate and

monitor the use of their land. He said, "state laws allow us to participate with our ownership and then they have to provide us with the documentation."

Trackfinder explained that most landowners would rather sign a lease agreement for royalties vs. be a part owner…" but "you're giving the oil company the majority of your oil. Sometimes for as little as a couple of dollars. And then they get tax benefits, and … you don't always know if you're …getting the right royalty." Trackfinder said,

> (most landowners) don't wanna know what's going on. And they would rather not have to deal with the companies. Then they're not able to find out what's going on either as far as what kind of contaminants are being put on their land. They lose a lot of those benefits not knowing those things… you have a lot of advantage by not leasing to them because you're able to then get the information that they would not give you otherwise… how else can you determine what your costs are, you know?

Trackfinder insists on part ownership in the wells on his land. I needed to move Trackfinder from the intricacies of contracting with the oil companies toward the indirect social, cultural and environmental benefits coming from his involvement. Has part ownership helped him maybe to learn more about oil activities on land, water, or air? He said it is particularly valuable as relates to testing the oil companies may do on his land,

> if they were to have done testing for the water to know what it was or what was put in it, you would then know what those chemicals were, so that you could test for them. And as it is now, you know what volume they use… and if do test for hydrogen sulfide gas on the well, you would then know what the levels were. To know what (natural gas) was being let off, (what gas) doesn't get marketed, would

> give you an idea of the quantity… that's marketed and not flared.

Involvement as a co-owner gives him better access to information about his land. I shared with Trackfinder that I learned the oil wells in western North Dakota vary greatly in the amount of hydrogen sulfide (H_2S) gas associated with their natural gas flares and he said, "yeah." He has a better idea of H_2S risks. He explains

> you would then know if you should be extremely aware of how dangerous it is… if (the natural gas) is going towards your house, close to your house, it would be something that you should then be severely aware of…

I asked him what other benefits he obtains as a part owner. As a part owner in a well, he said, "you know what kind of chemicals are used so…"

We went out for a drive on his land, and I asked him about the unremediated location, that place with pipes still jutting from the ground. I asked him where that is, and he said, "it's just over there. This is the other one that they photographed for that testimony hearing and, mine are, this one right here." He continued,

> This is the one they had to come in and dig out the tank and some other things, I think there were cables… and some other junk that was buried in here, and the State came in and cleaned up, said they were gonna remediate it, put it back into shape and then… and they said 'but we don't have enough money to fix this'… they're allowing these companies to come in here and do business and they're gonna give them their bond money back… I think that the people that are in charge should be fired. They're elected duty… You don't give somebody their bond money back when they haven't done reclamation and—look, there's still a mess here.

As for the significance of such unremediated sites, Trackfinder said, "until this gets remediated properly, it's just contaminated and it's not gonna grow anything." I asked him specifically what is the contamination in there, and he said "chemicals and salts from years ago… It just won't grow anything. Won't even grow weeds."

"What do you suspect happened here?" I ask him.

"Well, as far as I know,," Trackfinder says, "the state, has never tested the ground to find out what still remains in the ground, but it must be terrible. Chemicals. And hopefully we can get those people from—is it Duke University that's coming out here." He's referring to a water quality study from the university that would be coming out to sample several sites in the region. He said, "…to find out why nothing would grow there. And it's gotta be an underlying soil that is coming through."

We arrived at the place where the debris was dumped. I ask him, so is this the place where the pipes are still sticking out of the ground? He says yes. He also mentions the danger to him and farmers in general, should their harvesting equipment accidentally come in contact with oil field debris as it can damage the equipment and risk injury.

It's windy and cold, the ground covered in thick blanket of fresh now, and I ask him if he can drive the truck a bit closer to see the site, and he says,

> I don't know. We could fall in…you don't wanna be doing that… it's got huge, three, four-foot ravines where they washed over that area over there, you just can't really see them from right here. I took pictures of them when I did my testimony to show them where it washed.

He explains that "not having it reseeded and reclaimed right" (all part of proper remediation) is the reason for the erosion as it "wasn't able to take any of the moisture, so

it just ran off." "But, you know, Trackfinder said, "that pipe is probably the indicator of where the well head is. Right below it. So that means basically everything is right there, it's just marking it." That was an ominous remark regarding the oil field waste sitting underneath us that caused me to pause and reflect on the urgency with which he just cautioned we not move the vehicle closer.

Trackfinder reveals the issue. With all the focus on mineral rights, the company has gained access to many acres of surface rights. He told me,

> And that's the problem … even if you just have one mineral acre, and it's six hundred and forty acres (of the surface) that you own, you lease one mineral acre...You just gave them the right to own your surface. Because they list the surface acres on the lease. So, most people aren't even aware of that fact. They don't even think of it. They're so excited to get paid for that little area.

Trackfinder's scenario explains why he and participant Cody make sure to determine what the oil companies will do and lease an easement for installation of well pads, roads, and any infrastructure as well as secure payment for any impacts on the surface to existing crops, roads, or other property or valued features. He explains how land titles give oil companies access to so much surface even though they may be leasing only a single acre of mineral rights. "Well, they do a title on your land, and it's generally by 160 acres," he says, "so, then it would generally be for the 160 acres that that mineral acre would be under, but they may include all of the surface acres. If they want to put a well in a different location to access that oil, they can. He said

> they have to give you notice that they're gonna (install another drilling platform)… but you've already granted that, by leasing that surface. Even if it's

just one mineral acre… because you don't have minerals in it, you granted them the right on all those acres… They're getting that surface for nothing. They don't pay anything for it.

He shows me that this site was being reclaimed because there's a pipe sticking out in the ground. He says, "(landowners) want this on your records to show that this un-reclaimed… somewhat reclaimed, but un-reclaimed. The piles are there where someone leveled… uh… the pit was pushed in, and that—that could be the pit that's washed over there too. That's got the— where they kinda just pushed there." As we look at the ground pushed up over a likely pile of 30- year-old oil field debris, Trackfinder tells me about the company who abandoned their equipment here.

He tells me the system for monitoring oil industry activity is corrupt,

You know, the Industrial Commission needs to be a different group of people, you know, not the people that are in there. But, maybe a group from somebody out here… that's aware of what's going on… but the thing is, they know it's gonna do everything exactly the way they want it done… that's just unacceptable.

On our return to his home, we have a conversation about the red roads into and out of the various oil production sites. They are built on pads of scoria, a volcanic rock much harder and sharper than pumice. He pointed, "The hill over here is one heck of a source of scoria," and that now a family is getting some real cash out of it.

Suspicion abounds. He tells me that,

the people at Texas, and Oklahoma, and Colorado (he's referring to the major oil companies), they thought this was one heck of a way to deceive everybody and take advantage of people that didn't know any better, is to allow them to profit at

the other people's expense. Well, and they've been doing it ever since and they just don't like it when somebody brings that up.

I know Trackfinder now, and I'm certain he's referring to himself in this last remark. Referring to the liberties given to oil companies in the state, Trackfinder said,

> it would be like selling your house in town and telling the people that buy it "Oh by the way, from time to time I'm gonna come by and I need to use the garage… whatever I need, you'd have to just get out of it, because I'm gonna use it, but you're gonna pay the taxes, and heat and everything, and if I come in there and it burns down or anything happens to it, well you better have insurance to cover it.

Trackfinder approaches his interactions with the oil company with caution and skepticism.

Trackfinder: Phase 1Themes

The major themes and their categories in my phase one work with Trackfinder are these:

1. Trackfinder demonstrates to me the mathematical reasoning skills he has applied in court and public agency hearing settings that, combined with his distrust and suspicion of the profit motives in regional oil policy and land negotiations – born in personal experience – these experiences give him a certain rightful claim to local wisdom, as a de facto representative of farmer interests. Together with his interest in educating fellow farmers and his desire to share the visual data found in aerial maps in this research, he positions himself as both a steward and a watchdog.
2. A theme of lack of integrity is indexed repeatedly in Trackfinder's

mentions of the state not fulfilling its fiduciary obligations/role, in the misleading representations by the oil companies, and his mentions of "manipulation," "take advantage," and "not gonna be responsible."

3. Trackfinder, perhaps in part through boastful reporting of his own legal victories, points to the naiveté of landowners who are not as practiced as him in wrangling with the oil companies. He speaks of "profit at your expense," "free meal," (for landowners who lease) "not able to deal," and "people don't understand."
4. A central theme in my conversation with Trackfinder is his mention of the impacts of fracking, with such phrases as "can't drink the water," "rural gone to industry," "low air quality," "traffic" and "dust."

Major categories and themes of the interviews and observations were discussed with Trackfinder after Phase I, and he was invited to choose from the photography-based interventions to guide him in further exploring the themes. As with all the participants, I offered Trackfinder a kind of menu of several interventions that included names and short descriptions of each.

Trackfinder: Phase 2

For phase two work, Trackfinder chose to use aerial photographs in maps provided to him by the U.S. Department of Agriculture (USDA), Farm Services Administration (FSA), State of North Dakota Water Resources Department or oil companies he has worked with. In one instance, he worked with Google map imagery. Trackfinder also chose the intervention of my photography, as he would ask me to make a few photographs. I asked Trackfinder to prepare the images he wanted to share in

advance of my arrival. As he showed them to me on a table in his home, he spoke contemporaneously about them, drawing from dates and handwritten captions on the reverse.

He chose to the use of images provided by a third party, specifically aerial photographs provided as maps by both the oil companies leasing his land and the U.S. Farm Services Agency and Google map imagery. He said he thought they might have some educational value for me. He pulled together several maps and illustrations. He also asked me to make photographs on his land, and those images will be presented later in these findings.

Arriving the first of several afternoons for phase two work, he invites me to have a seat on the large L-shaped sofa and lays some large images before me. I sense this is a familiar setting for him, speaking on issues, sitting beside a table or sofa with materials spread out. If not sharing photos, I would see Trackfinder reviewing his leases, or scouring the minutes of oil and gas commission hearings. Almost every horizontal space in his living room, dining room table and nearby desk seemed covered in papers.

As a way to ensure we made efficient use of the aerial photos and communicate well, I spent a little time in orientation. I shared an article on aerial photography, which included the "pros" and the "cons." Trackfinder gathered a set of aerial photographs and placed them into the order in which he wanted to discuss them. I numbered them and scanned them to a PDF document. This PDF would form the central part of my phase two work with Trackfinder. To attach notes to the images, I used the *Notability* app on my iPad. This allowed me to create text boxes directly over the images and, in several instances, both Trackfinder and I used Siri voice dictation to fill those notes placed over

the photographs. Notability also allows lines to be drawn and areas to be circled in several colors; the indicated areas can be moved and deleted easily. I have redacted location names, property descriptors or information that could serve to identify him. In photographs of him and his land taken on the ground, I have obscured his face, details on signage, such as well numbers, and other identifying details.

To guide the conversation around these images, I suggested we talk about the relative size of objects in the picture. If a scale is provided in the image, I suggested we estimate the size of features we discuss such as the extent of pipelines. Trackfinder said "yeah."

Finally, the aerial photos are redacted to obscure location information, such as Township/Range/Section, oil pads, homes, etc. to protect the identity of individuals.

Trackfinder's "1"

Figure 30 shows a screenshot of a satellite image that Trackfinder created of an infrared image he loaded into Google map making software. He has marked it as "1." The large white spot, he said, corresponded to a site we visited on the ground in November 2014, where a large pipe-like drill casing was sticking out of the ground and extending above his head, which will be presented later in this section.

Trackfinder says of the image,

> That's 3 years ago. Technology's getting better all the time. Because that's really red on their…. It's not all the way reclaimed because there's no topsoil on the surface…the well is not capped or reclaimed… and the well pipe is still sticking out of the ground.

He's referring to the red areas in the image that correspond to vegetation. He points to the

square-shaped white spot on the image and tells me this is the R site which is still not reclaimed for many years and it's here we saw with the large pipe sticking out of the

Figure 17. Screenshot of a satellite image over Trackfinder's land. Trackfinder viewed this infrared image in Google mapping software. He has circled an unremediated well site on his farmland that includes a pipe jutting five feet out of the soil.

ground. The site is a few miles from his home.

Trackfinder suggests,

> wouldn't that be good to have the state well file on there? … because then people could look at the state file and see what that looks like… [remediation] was supposed to have been done there… it gives it a purpose… it's precise.

He offers me the state file well number, a four-digit number, so I can label the image. Clearly, Trackfinder is already engaged with the documentary or educational use of such aerial photos and maps, but I'm also concerned that he may not understand still this is pure

research. He mentions the use of marking up images as may relate to the April 8, 2014, Oil and Gas Commission public hearings. I'm unclear as to whether he thinks he is supporting educational research or my efforts to articulate his political agenda.

Trackfinder says the significance of this image is the fact that the State of North Dakota Oil and Gas Commission released the bond for this site without ever verifying that reclamation had been done. He said online tools like this allow landowners to markup aerial images with well details. This becomes a tool for checking the status of reclamation sites and can be coupled with dated, time-stamped photographs that were taken on the ground. He also suggested that a landowner could apply information from a state hearing onto the image, such as the time in the transcript when matters related to that image was discussed.

Trackfinder's aerial photo maps "2a" and "2b"

Trackfinder brings out two Farm Service Administration (FSA) black and white prints of aerial photos of land and immediately begins pointing to areas on the image. They're titled "USDA Farm Service Agency" (FSA) and captioned below with township, range and section information. He has marked them as "2a" (Figure 31) and "2a" (Figure 32). Figure 32 overlaps with and extends further south than Figure 31.

I asked him how farmers would normally use these aerial photos,

> It's to prove your acreage sign-up. Which means program benefits and the acreage for each of the commodities that are being grown. Everybody that owns land is getting these. If you're a landowner, you get a map, if you want to participate in the farm program…

Figure 31. Aerial photo provided by Trackfinder. Image shows three sites on his land outlined in black that remain unremediated since oilfield waste was buried there in the '60s. These sites contain pipeline, wellsite and drilling materials that could damage his farm machinery during harvest.

Trackfinder's aerial photo map "2a"

At the bottom of Trackfinder's aerial photo "2a" (Figure 31), I point to brackets placed at the corners of what may signify squares of land. I'm referring to the double lines that look like picture corners. He says the FSA adds those marks, "so they can see where the corners of that ownership tract are. I own these tracks so they mark it with those double lines. Because double lines define out where your property quarters are." I asked him how these FSA aerial photographs might be useful to the farmer given today's multiple demands on land and landowners and he said,

> Well, it gives them the map that they can draw on and say this is the only area that is suitable or that we'll allow you to use for out of our acreage. And draw on it and have that as their exhibit. They can show previous use and where they would want to keep that party to a certain portion of their land and not disturb additional. It lets you know where these gullies and roads are in relationship to the whole tract.

Trackfinder's aerial photo map "2b" (Figure 32)

Outlined in red at the base of his aerial photo "2b" (Figure 32) are several old drill sites on his land that were established in the '50s or '60s and have not been remediated, about 60 years later. Trackfinder explains,

> this is an old oil well location, how it shows up so clear here. Here's another one. These have been abandoned for years. But still … they just show up. There's nothing there. Of course, that's a road going in. But it just shows real plain that there's no topsoil there. It's not regrown.

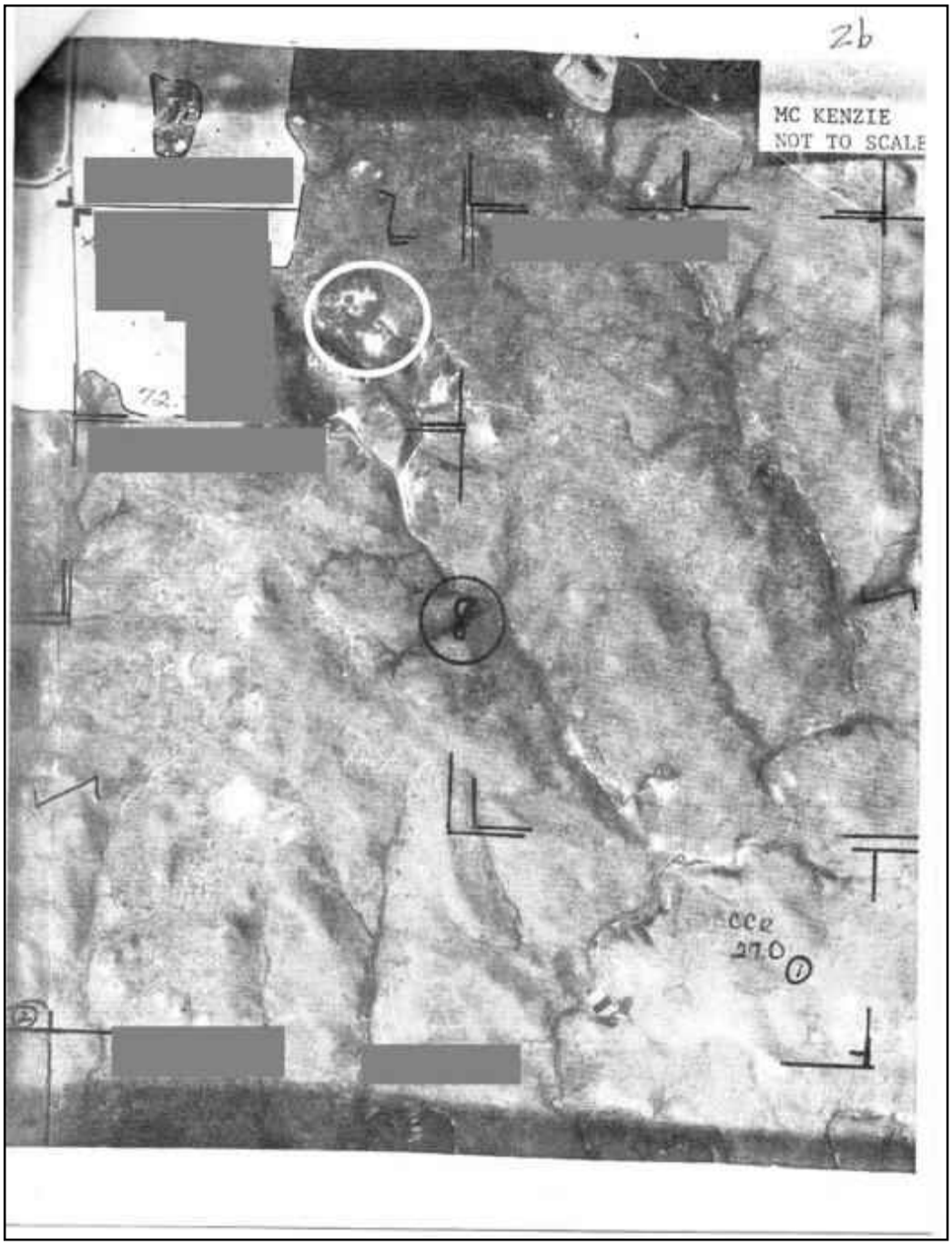


Figure 32. Site of an unremediated oil well site on Trackfinder's land in aerial photo provided by the Farm Services Administration or oil company. The area circled in white is buried oil field waste dating to the 1960's that includes an exposed drilling pipe.

Today, a large pipe juts out of the ground at a location Trackfinder and I call the "X" site. The location is shown circled in red at the top of Trackfinder's aerial photo "2b," which is now Figure 32. The large pipe, perhaps a drill casing, is just the most visible item in this dump of oilfield waste that lies largely under the surface. The site has laid unremediated since at least the '60s. Track finder told me that the state released a bond that the leasing oil company has paid before verifying that the clean-up and remediation was completed.

He said there are four sites that aren't reclaimed just in the areas shown in Figures 31 and 32. I'm busy creating "sticky notes" in Notability and placing them over the aerial photos that Trackfinder is sharing and I see that he is clearly enthused by his use of aerial photographs in our discussion. He said he believes these aerial maps may be invaluable to landowners in the event they attend a hearing about industry regulations that may affect them or their land. He said the aspect of dating them is very important in his view:

> by taking dated pictures… because I think that's critical they come and date a picture. Because otherwise they get in there and they say having a date is really important to identify when you were there to prove what is really taking place on your property or not taking place.

He said landowners when faced with a hearing or meeting with oil company representatives, "need to know what they need to bring." He says,

> I think it was (North Dakota Senator) Triplet that said we need three things: We need a picture, we need the well file, we need the information…. You know, the dates, what is that associated with and what company. If they had any kind of bonding to cover and that's in the state well file (a document available online that

provides all the details regarding oil wells). If the bond was released or if there's still a current bond…to cover the reclamation.

Trackfinder wanted to use images to show that the remediation still has not occurred. First, he presented me with a screenshot of his work in Google, using a landsat image of the land he obtained in Google. He circled the R site on it (See Figure 32).

Next, we examined the FSA aerial photo he marked "2b" by Trackfinder and shown in Figure 32. The image is dated within a year of our interviews and covers land overlapping with, and just to the south of the area shown in Figure 31 where three other sites remain abandoned and unremediated. Trackfinder said, "this just gives that broad view, an overview of the south area of what we were talking about in 2A."

As I circled the area of the pipe protruding from the ground, he corrected me, "it actually only goes right in there… this is that pipe sticking out of the ground… that black area right there in the white." I allowed Trackfinder to participate in marking up the illustration 2B (Figure 32) and thereby placing the raw data into Notability himself. I handed him the stylus and he drew a circle around the debris site himself to indicate where the exposed pipe and debris field is located.

Next, I created a "sticky note" in the Notability document, and moved it adjacent to the "" site of concern on the screen. Trackfinder wanted to use the Siri feature to speak caption info on the site directly into the note. He voice-dictated this caption into the sticky note,

> area circled is well location with the pipe sticking out of the ground presumed to be the well casing marker sticking approximately 5 feet out of the ground, well location not fully reclaimed, deep washouts, apparently no topsoil in place, grass

not growing on location. Matches up with photo taken on the ground 11/14/2014. Trackfinder is clearly engaged with the use of the Notability software to circle and mark areas directly onto the aerial photos. The research is becoming very participatory as Trackfinder enjoys this use of technology. Reflecting on the aerial photos of 2a and 2b, Trackfinder told me the value of having both aerial FSA photos and pictures on the ground at the reclamation site is that it enables the landowner "to show a more definitive area of disturbance and needed reclamation, and to establish growth to get the property back to more of an original state."

Trackfinder wanted to show me the location so that I could make a photograph of the site, thus requesting researcher photography as an intervention in phase two. We needed a break in the work at his home and so he drove me to the site. It was November 2014 and there was thick snow. He drove carefully and parked about 30 yards from the location, pointing it out to me from a distance. The air temperature was just below zero and the wind was brisk, but he would not risk parking his work truck any closer as the extent of this oil field waste site is unknown and it is difficult to see the ground surface in the snow. Figure 33 is the photograph he requested I make of him, kneeling beside the exposed drill casing.

By having both aerial FSA photos and pictures on the ground of the reclamation site, the landowner is able to show a more definitive area of disturbance and needed reclamation and to establish growth in and take to get the property back to its original state. Trackfinder was talking about pictures I took on the ground at the reclamation site.

Figure 33. Participant Trackfinder at abandoned oil field waste site on his land. He is standing beside a piece of equipment abandoned since the ‘60s. Photograph by Bruce Farnsworth.

Remediation and the bonds that are supposed to hold the oil company to remediation is a sore topic for Trackfinder. Trackfinder is very concerned about how bonds are issued and released to compel remediation in the industry. The state is expected to require a bond from oil companies before they begin a well. Companies are expected to put up a bond, and the state is expected to take the bond money and hold it. Before the bond money is released, the state is supposed to inspect a site and determine if remediation is needed and confirm that all remediation is completed before the bond money is released from the state. Trackfinder says,

> The state released the bond without it being taken care of…. Well, then everybody should go to the state and say, why are you not protecting us? Why do you not have a bond on this? And the state doesn't even ask if you, to release the bond.
>
> They do it themselves. And that's one of the things that we need to be able to have… Well, the bond may not even. They may have already given [the bond] back to [oil company], or they may not even put the bond up.

It's very difficult to pursue if the state government is not inspecting sites, he says,

> Well… the state has to make them put up a bond… But how are you going to force that company to do [the clean-up or remediation] if the state doesn't say you have to put the bond up before we can give you [the permit to drill or build a well]? But when the state just gives them the bond back, they just say, 'oh, it's done.' They never even go look at it. That's what they were so curious about in the [state oil and gas commission hearing in April 2014] … when I had the well file.

Trackfinder's aerial photo map "3a" (Figure 34)

Now we move to Figure 34, a color aerial photograph labeled by Trackfinder as "3a" which Trackfinder identifies as a "state water map." Trackfinder quickly engages with the image, providing interpretation. Along lower part of the track the white line shows pipeline after, years after it was put in. You are able to follow the route of the pipeline across the property. Even where it was farmed it's visible through the imagery. One should put these photos in the file for that property as a reminder of where the line is at all times and have that as a reference for future knowledge of your property.

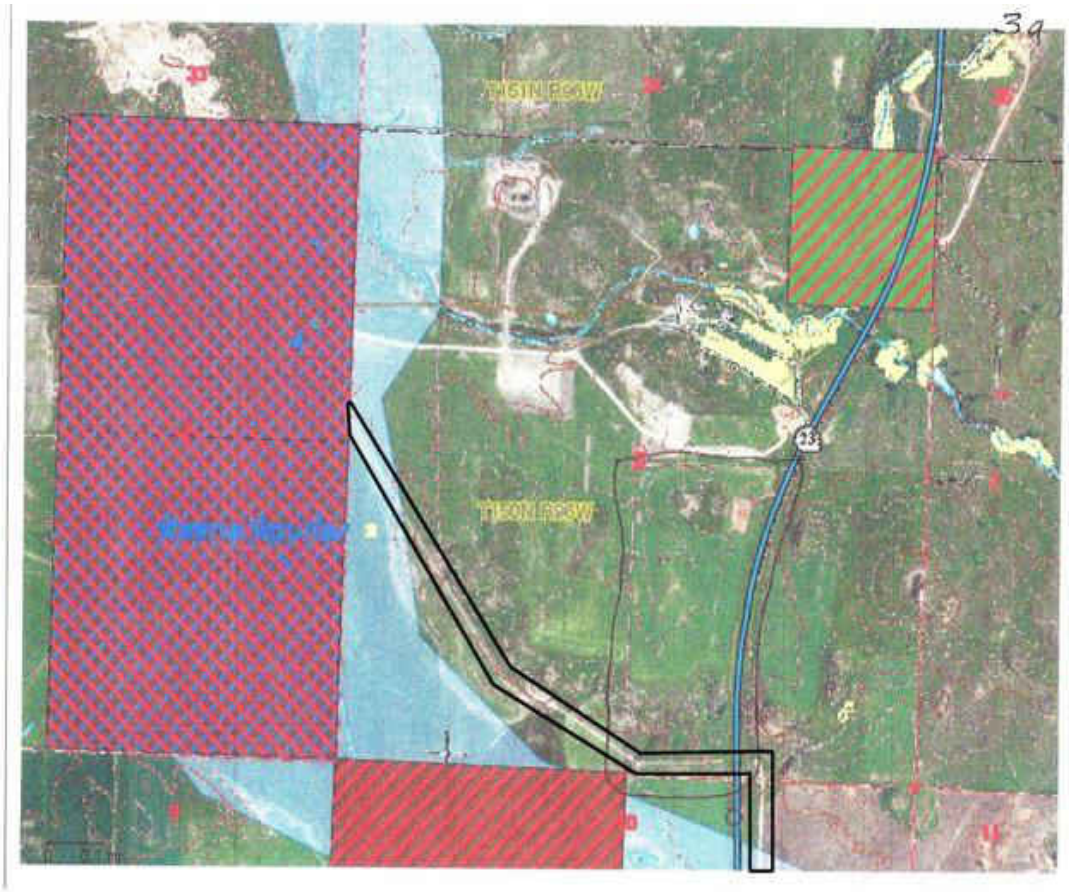


Figure 18. Aerial photo of Trackfinder's land in a map provided to him by the North Dakota State Department of Water Resources. An underground aquifer at left is marked in red and light blue crosshatching. Trackfinder found an oil pipeline with this map and outlined it in black.

As we examined the image in Figure 34, I said, "we need to circle some things here." Trackfinder points to my iPad and says,

> here's the pipeline, starts down here and goes up here. Then it's bored under the highway. Where it bores under the highway it disappears. That's critical. It appears to end but this is where it's bored under the highway and reappears on the

other side of the highway in the white line.

Large blue areas at the left of the aerial photo are aquifers, colored by the state, and then there is a pipeline that Trackfinder shows me moving across the color aerial image from bottom center to upper right. He guided me in Notability software as I traced around the pipeline path in black.

Trackfinder responds by saying,

> the additional area of following the pipeline is highlighted giving us a long lasting visual of where it's proceeding so that it can be logged into one's files for future reference and verification of existing pipelines

Back to those blue areas indicating water. Trackfinder tells me that the blue coloring, resembling a stream and pools along the path, is the state's projection of their estimation of where undergoing water resources are." He says that the blue area actually follows more "where the pipeline is located and is farther expanding than what the diagram shows." Trackfinder said, "that's probably just kind of penciled in an estimate by the water people at the state water commission, but prior to hydrology study having determined exactly where that [water] is."

Trackfinder speaks to the value of the aerial photo,

> Along the lower part of the area photographed a white line shows evidence of a pipeline years after it was put in and you're able to follow the route of the pipeline across the property. Even where it was farmed, it's visible through the imagery…One should put these photos in the file for that property as a reminder of where the line is at all times and have that as a reference for future knowledge of your property.

Trackfinder's reference to "future knowledge" means that should the land come under the interest of landmen or an oil and gas operator for possible well-site construction, he will know the history of the land that may indicate the best placement of facilities or roads and potential hazards on the land. The aerial images provide both historical and inventory functions and a visual record which is precise and irrefutable if and when such visual data is verified and corroborated on the ground (ground-truthing).

Completing the interpretation of the aerial photo shown in Figure 34, the red cross-hatched area is an area of approximately 320 acres, which is equal to two quarters or half a section. Trackfinder is allowed to draw water from that section of land. He commented that the "poor use of color coding on the map blocks out everything else on the land."

Trackfinder says the value here is "the pipeline is highlighted giving a long lasting visual of where it's proceeding so that it can be logged into one's files for future reference." I recall what my participants have all told me about old pipelines, unmarked and unmapped for decades, lying underground and posing hazards.

And as for those blue areas at the left of the image, "that's just the state's projection of their estimation of where underground water resources are." Certainly, that's important information for farmers, ranchers, and landowners because it tells them where the aquifers are located so they have a sense of where they may drill a well for water for irrigation or installing water troughs for cattle. It also tells where not to lease surface use to oil companies for drilling wells if they have any concern about the integrity of well-casings the potential for leakage of toxic fracking fluids from the wellbore into the groundwater. Furthermore, if there are concerns for the placement of oil or

wastewater pipelines or the risk of spills of the same, then these activities should take place some distance from aquifers.

Trackfinder continued with an anecdote,

> They're just an estimation. Because the state, over six years ago was going off of this and a guy from Billings (Montana) come in and got a permit. And couldn't find water on his property. He's like, well it says it's there. The states like, well, we just drew that in. We don't know that it's there. But they drew it in and it wasn't there, so his permit is basically worthless…

Trackfinder himself found the mapping of the blue-line streams to be inaccurate: ""this isn't right this blue, because I drilled a well on my property up here. This blue should be up there farther. The state has got to do that hydrology." Trackfinder found it concerning that the large blue area, indicating the aquifer, "follow more into the line of the property where the pipeline is located." He said, "this was just somebody sitting in an office at the state water commission with a piece of paper and ruler and just kind of sketched it in because they didn't have any idea where it went."

The three large cross-hatched areas on his "3a" (Figure 34) are portions of land located on top of portions of existing aquifer that landowners have permits from the state water department to draw upon. Trackfinder notes, "it's not a good idea, the way they do it (referring to the cross- hatching), because it just blocks everything out so you can't see nothing."

Trackfinder's aerial photo map "3b" (Figure 35)

The map marked "3b" by Trackfinder is Figure 35. It's a black & white FSA aerial photo of the same land shown in the color aerial photo he marked "3a" (Figure 34).

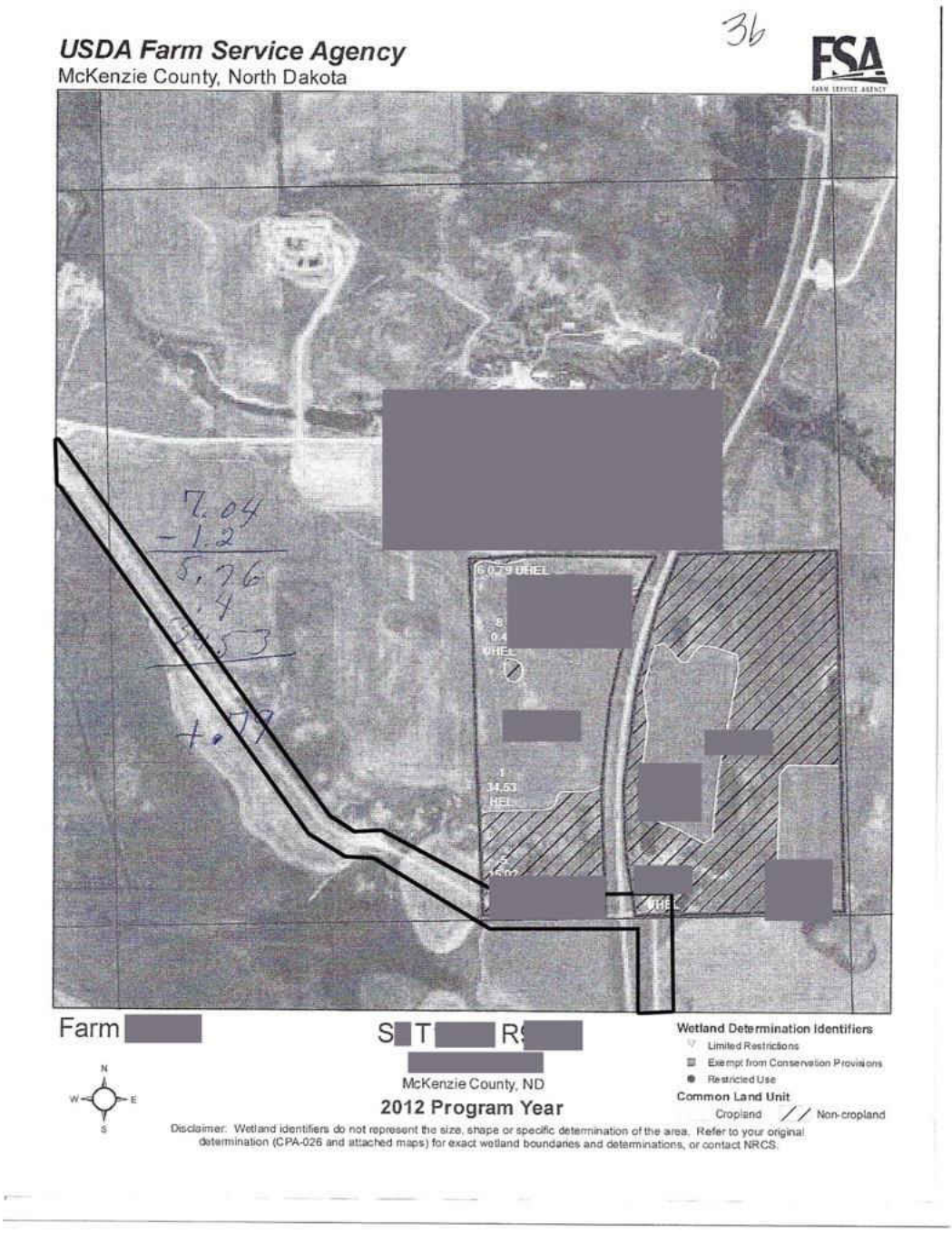


Figure 35. Farm Services Agency (FSA) aerial photo map of Trackfinder's land which he has marked "3b" at upper right. This black and white image also revealed the full path of an old pipeline buried under his land.

In the black & white FSA map of Figure 35, the pipeline is still visible and not obscured by cross-hatching and blue areas indicating water allotment and aquifer locations, respectively. Trackfinder finds the black and white version offered by the FSA more useful for examining his land for this reason as it is not obscured by mark-up. On the FSA map, the tracts are labels by "field, acreage and soil type" which he also finds useful as reference. This aerial view is labeled throughout by field number, acreage and soil type. HEL indicates a highly-erodible soil condition.

It's important to note that Trackfinder makes use of multiple images to understand the full reality of his land. The images are only fully meaningful in tandem—intertextually.

This referencing of two aerial photographs requires a kind of multidimensional view from Trackfinder as he relies on more than one image to combine the data provided by two interpretations of the same area. Forthcoming in this section is a discussion of the interpretation of aerial photographs in the agricultural setting, with an introduction to the influence of soil type, "marks," and variables of soil composition on the appearance of ground surface in aerial photographs.

Trackfinder's aerial photo map "4a" (Figure 36)

Next, Trackfinder shared an aerial photo he labeled as "4a" (Figure 36). It's an FSA map of grassland and pasture on his land.

Figure 36. Farm Service Administration (FSA) aerial photo map of Trackfinder's land which he has marked "4a." The numbers indicate acreage of individual fields. This image shows Trackfinder the condition of vegetation, but the scar from pipeline

installation is not visible. The image has been redacted to protect the privacy of the participant.

To describe the image, I again allowed him to use Siri voice recognition software to complete a text box I created directly over the image in Notability software,

> The green areas are the more productive with more vegetation and the lighter areas are less vegetation… better detail on this one. The outlines just (help you) know where your field boundaries are. Otherwise it just gives a good location of where everything is located on your property such as the wells, farmstead, and your pastures. The numbers represent the total amount of grazed range for example for all your land or just the area that's in that particular farm.

However, Trackfinder finds good value in the FSA color aerial of Figure 36, stating,

> it really gives a good overview with the coloring and their mapping in darker green shows you have better vegetation… this one breaks down your acreage, with the computer programming and gives you the acreage… the greener areas are the more productive with more vegetation, and the lighter areas are less vegetation. … The outlines just give an area to know where your field's boundaries are… It's broken down into units, with your unit sizing, how your fields and, compiling your acreage… it just gives you a good location of where everything is located on your property. The wells, your farm stats, and… your pastures for the farm unit….

Trackfinder said this is "one of the FSA maps of this kind, they went into a better scheme when they did this. This is probably their newer software, I think."

Trackfinder's aerial photo map "4b" (Figure 37)

Trackfinder compared the color FSA aerial of 4a (Figure 36) with a black and white aerial photo he labeled "4b" (see Figure 37). In this aerial photo of Trackfinder's land provided to him by an oil company, the image shows the scar of a pipeline installed in the 1960's that he has outlined in black. Handwritten over the photograph are acreages for each field and, adjacent to it and circled, are the total units of the land type with an acronym. The image has been redacted to protect the privacy of the participant.

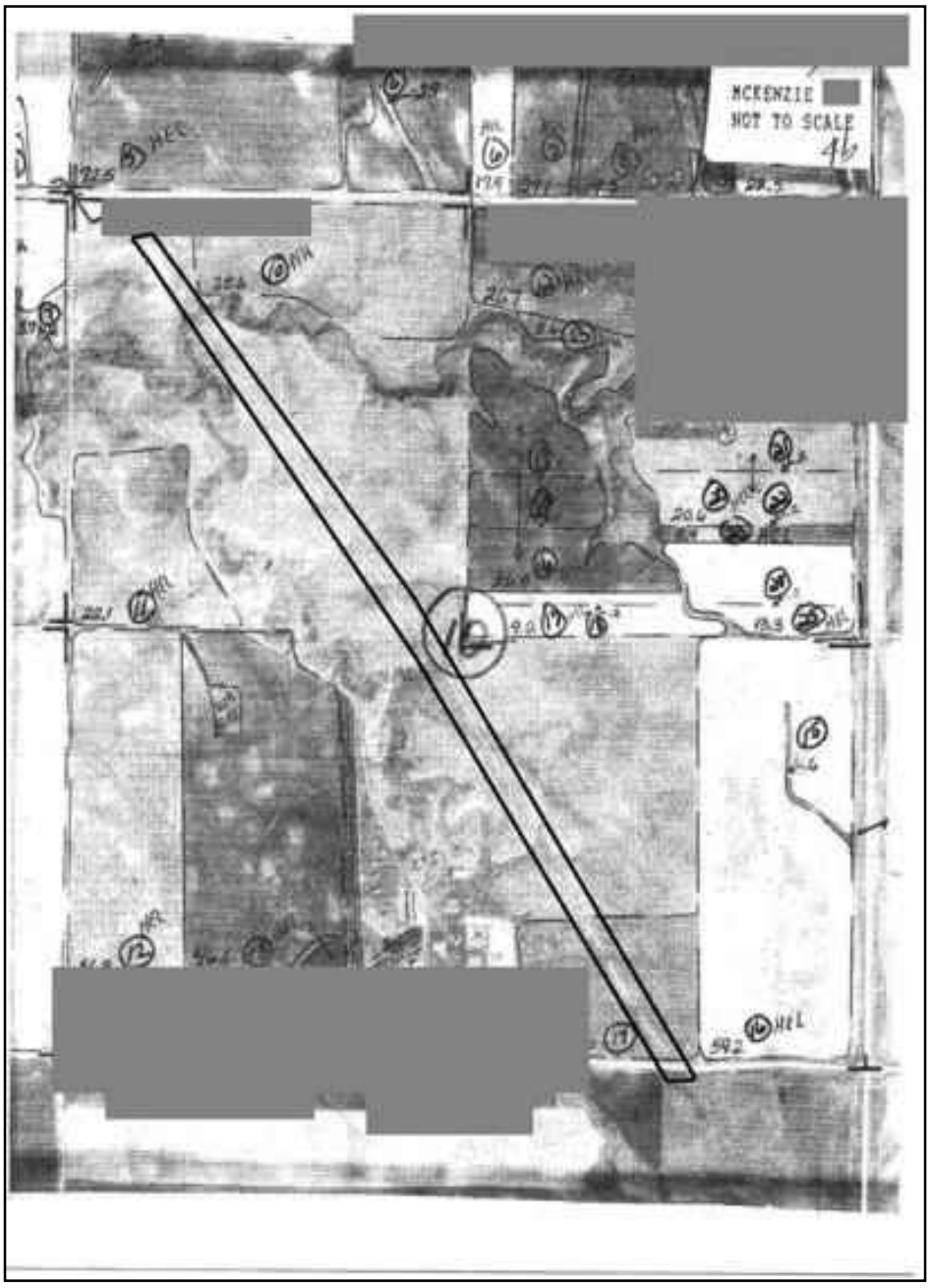


Figure 19. In this aerial photo over Trackfinder's land provided to him by the oil company, he has outlined in black the scar of a pipeline installed in the 1960's . Handwritten over the photograph are acreages for each field and total units of crops. Acronyms are conventions for describing the production status of land. The image has been redacted to protect the privacy of the participant.

For example, several acronyms from the USDA Natural Resource Conservation Service (NRCS) are found on the maps in Figures 34, 36 and 37, and these include HEL (highly erodible land), NHEL (non-highly erodible land) and UHEL (undetermined for highly erodible land). Landowners who plant or produce an agricultural commodity on highly erodible land must follow an NRCS-approved conservation plan or system.

Trackfinder and I were most interested in the fact that a pipeline was not visible in the color version of 4a (Figure 36), but is visible in the black and white aerial image of 4b (Figure 37) which he outlined in black. He said the pipeline may be 40 years old. We did find that by adjusting the brightness and the contrast of this image, the pipeline path would be more visible. Adjustments to image brightness and contrast of images is one tool that can be part of any adult curriculum related to the use of photographic methods by farmers and ranchers. Once an image in imported into an imaging software, changes in brightness and contrast, sharpness and highlights/shadows are among the basic adjustments in digital image editing software that can be applied to enhance the contrast or clarity of an image.

Trackfinder has found that the abandoned pipeline is not always visible on the FSA aerial photos and oil company aerial photographs. Three types of land markings are identified in agricultural contexts and these are “damp marks,” crop-grass-weed marks” and “soil marks” (Ceraudo, 2016). Such marks are best studied from images made when no crops are growing or grasses have large died off (Mason, 2019).

Granted, the author Ceraudo (2016) speaks to evidence of buried structures that are not pipelines, but the pipeline Trackfinder detected in the aerial photograph is an example of the “topographical anomalies” and their visibility can vary according to the

nature of the cause.

Depending on their former use, composition, depth and state of decay, they may have present with a unique consistency or soil chemistry. The loose composition of the soil and the slumping in the areas of filled in pipeline trenches may explain the tonality difference in area photographs, due to variation in soil color and reflectance. In Pennsylvania, aerial photography is similarly being used to identify the locations of wastewater ponds and establish a link between illness and proximity to those reservoirs (Schiffman, 2014).

Given his interest in the use of images, particularly agency maps based in aerial photographs, Trackfinder would be an excellent co-teacher or co-leader of a workshop for farmers and ranchers interested in making more robust interpretations and uses of their maps.

The literature on the use of aerial photography in farming, geology and archeology provides several factors that may be at play in making discernible an old trench or ditch in the landscape, let alone the fact that it may contain a buried pipeline. This will be presented in the discussion.

Trackfinder: Phase 2 Researcher-made photographs

I revisited Trackfinder in April 2015, after the snow had melted away. He invited me back for additional photography-based intervention employing my photographs. Trackfinder asked me to photograph the pump jack near his home that was the subject of legal action (Figure 38)

Figure 20. Pump jack and instrument, equipment at the center of a lawsuit that participant Trackfinder won, in which it was found the oil company pretended to record activity at a well that had ceased to produce crude oil. Trackfinder believes the oil company did this because access to his land was contingent on continued production. Photographs by Bruce Farnsworth.

. At a pumpjack almost within view of his back door, the uniformed worker wearing a hard hat would swing by in the company truck every day. He would get out with a pad of paper and appear to make notes from the red gauge box, ostensibly recording barrels of daily oil production.

Recently, he won a lawsuit against that oil company. Trackfinder discovered the well was not producing. In fact, the gauges weren't even spinning. The company had been pretending for some time just to maintain access to his land. So, he took the oil company to court and won a lawsuit. Trackfinder told me the oil company "didn't have the right to hold that lease. And they didn't have the right to profit from these other wells because they didn't have a lease! But they were saying they did! Well, that's a lie," the judge said.

In asking me to photograph this pump jack and gauges, he has asked me to document a significant place and event in his informal career of adversarial negotiations with the oil companies, which he began learning in 7th grade. I felt that I had earned his trust, and also that he enjoyed having my audience and reveled again in this success, this triumph over the deceptive practice that continued until he confirmed his suspicions. One of the two versus codes I attached to these images from phase two were "Trackfinder against the oil company."

Phoebe: Phase 1 Findings

Phoebe lives closer to Lake Sakakawea than Cody and Trackfinder. Out of courtesy, I didn't ask her for her age, but it is comparable to Trackfinder. Beginning our conversations, I asked participant Phoebe what she does, she said, "I farm." She lives in a very rural community on the flanks of Lake Sakakawea. She said her closest neighbor is about a mile away. When I asked about the population of her township, she did a quick count in her head and added just as many transient oil workers. They're living in campers and trailers, renting a little space adjacent to residents, drawing power from those homes.

She told me that the majority of her income had been from farming "until the oil boom. Now, sadly, that is my main source of income." Where does the sadness come from, I asked. She was very open with me,

> Well, we have always been a farming family, and what our income always was, and we depended on that. Switch it over to something that industry wasn't too fond of, to begin with, is sad… I wish it would go back to the way it was before.

As a mineral owner, the major source of her income has changed from farm income to oil income. As a farmer, Phoebe does what is called small grain farming, growing primarily

durum wheat. “I have some alfalfa, but I just have a neighbor hay it for his cows, and he pays me per bale on it.” Her total farming operation is about 1100 acres, of which 600 is cropland and another 500 is open rangeland. Of the cropland, she has been planting close to 400 a year and then she has about 200 that is set as aside as “summer fowl” for wildlife and hunters. She has a couple of quarters of land (that’s 160 acres each) for cropping that is about 15 miles away; otherwise, most her land is close to home and connected or contiguous.

This is the essential dilemma for my participants and so many in oil country, this trade-off between traditional livelihood and new revenue from oil. I probed on this, and asked her if she has shifted more to oil simply for the increased income or if there are other practical reasons, and she said,

> Well, I still farm, but I just-- I-- It’s not profitable like oil. Oil is a lot higher than what I am getting farming… A lot of it is because the traffic on the road and the overall environment of the oil being here. I farm about 15 miles from where I live and I probably haven’t farmed for the last 4 years because of the road construction and traffic and I have older equipment and it is really too scary to go down there.

I asked her to talk about her land and how it is used and she told me “our land consists of small grain farming and non-grazed rangeland and a wetland area utilized mainly by wildlife. The rangeland is hayed occasionally.” Her father farmed with his brother, and her grandparents homesteaded near the Missouri River and farmed all of their lives where they homesteaded. She described her land as “mostly gently rolling hills which includes the farmland. Rangeland has steeper sloped hills and coulees.” That’s a common scenario for my participants, on these flat lands near Lake Sakakawea,

describing how they came to this land and how they live on it today

We interviewed by phone for the first two sessions, and then I met with her in her home. It took some time. She told me she is not one to give interviews or be in the media. She described herself as a shy person: "I was never an activist or an outspoken person…(unless) I had to give a speech in school" but said she agreed to this work because she feels the research is important. I suggested maybe that's one of the benefits of research like this is she wouldn't have the visibility of a newspaper article and she said "that's one good thing, yep."

In terms of education, she described herself as a "high school and junior college graduate" and she received an Associate of Applied Science degree in Agribusiness. Those studies included one year of high school physical Science, a year of high school biology, and college classes of plant and animal science and soil science. She hasn't received any training on oil and gas industry operations.

As the youngest of several daughters, I asked how she became the farmer. She said, "I was the youngest and dad needed help, and the other two already had their jobs when they got out of college." She got an agricultural business degree "so I was kinda preparing myself to be on the farm." Her oldest sister is a registered nurse and the middle sister got an ag business degree, worked in a bank for 25 years and now works with crop insurance.

When I asked her if the local environment had changed in the last few years, she said it "is noisy, disturbed, and industrial compared to previous peaceful, quiet solitude." She said it was a mixed-race community which was not too tightly-knit, but now "since the oil boom it has been fractured to a point where no one knows anyone, no one trusts

anyone, families are split, there are pro-oil and anti-oil, and long-time locals are leaving for quieter, safer lives." In a study by Alter, et al (2010), participants expressed worry about the negative effects of oil development on the land (e.g. noise, increased traffic, dust and rapid change) and that it would have a lasting impact on the rural life they have come to enjoy.

While she leases her land for oil and gas activities (inspection, easements for roads and various facilities), she considers it a "forced lease." I asked her to explain. She said if a person does not own 100% of the minerals in a spacing unit (usually 1280 or 640 acres), he or she must lease. She tells me she does not want to become a part owner of the well, which includes "being partially responsible for all expenses and included in possible lawsuits brought against the oil company." While the concepts of distrust and inevitability, observed in my work with Cody and Trackfinder, appear very quickly in my work with Phoebe, she sees well ownership as more of a liability than a position of power as Trackfinder saw it.

Phoebe spoke of pipeline concerns in her Phase I interview. Pipelines first came up when she said the state may take control of some land for pipeline installation using eminent domain. She said,

> we never allowed any pipes on our land. We never allowed any pipelines on our land. The way it's sounding they are going to be pushing for eminent domain for pipelines because they are having such trouble getting landowners to give them easements now because of the poor jobs they have been doing on it.

I probed and asked her to tell me more about these poor jobs with the pipelines.

> Once they get the pipeline in, they haven't been packing it good. They will put

them in in the winter so they just drop the frozen lumps on it so you get a line and you can see where the pipeline has been because it's brown. Once the soil starts settling, you get these big dips. I've heard tractors have just fallen in and been stuck there. Then some don't pick their rocks. The pipeline companies, when they dig down, they bring up a whole bunch of rocks from down deep, and then, they'll leave them laying there and some of them won't go along the line and pick them up like they should. Then some don't put the topsoil back on so you end up with all this subsoil. So, you have this 50-foot stretch, some are 50 feet wide, depends on how many pipes they are putting in, where you can see the pipeline has been because they don't reclaim it correctly.

I ask her, "And that's where the tractors can fall in?" She says, "yep, they can, yep, and any implement they might have there. Their seeder or their sprayer or anything. They haven't been packing them correctly." I acknowledge that pipelines are a very sensitive issue. She said, "yes," and continued,

> Yes, because seems like you have all these different companies putting in their own pipelines so they're coming to the farmers or landowners so many times asking to put in another line on their land even though there is already a whole bunch in there… There are so many pipelines now, that companies may be finding ways to share lines, you know with the companies we have, in our township now, who've actually gotten a couple of them, they share a pipeline so we don't have different companies' pipelines everywhere… I know there's a salt water disposal in this township that they're planning on running salt water through the same pipelines. Two companies are going to use the same pipeline to

do that so.

I asked her to share what are some of the concerns she has for her local environment and she shared many. Overall, Phoebe is concerned for the degradation of the quality of life, water, and air quality. With the number of roads and pipelines getting installed she spoke about loss of habitat and fragmentation, which is making oil units unfit for wildlife because of stress caused by noise and a 24 hour/day activity. She fears for air pollution associated with the fracking gas flares and she would like to see the integrity of oil refineries and saltwater (wastewater) spills used by the industry. Impacts to the region include emissions from flares, chemicals used by the oil industry, saltwater spills sterilizing farmland, pipeline leaks of gas, oil, saltwater, and the dangers of traveling (traffic, many oil workers have criminal histories).

Her mention of people leaving for quieter, safer lives struck me and I asked her to talk a little bit about the loss of quiet,

I don't even know where to start on that. It's changed completely from how it was because we had quiet and that's what we wanted, that's why we were living in the country… I mean you can hear the fracking noise. We live about a mile from the nearest site and when they are fracking, they will go a month of fracking and the noise is 24 hours a day. You can hear it in the house, through the walls, windows shut, everything. We live on a hill with a steeper hill to the south of us and those trucks come with their Jake brakes. You know, you can hear them coming from I don't know how many miles out and they keep those jake brakes on all the way down the hill. … constantly hearing clanging of pipes and it's just noise now.

> I've told many people one of the greatest joys of spring was hearing that first meadowlark, even if it was further away from the house. But now you can't even hear them, you have to get way far away from the road to try hear the meadowlarks. …I do a lot of bird feeding in the winter and I've had chickadees and redpolls land on me and they'll eat out of my hand… a couple winters ago, I had them sitting on me and a truck went by. You could see them flinch when the jake brakes came on. I was watching a coyote and it did the same thing, just jump and flinch… There's a lot of things like that that disrupt. That would be one of my concerns about when you're asking about the different seasons. For spring I think it's disrupting a lot of reproduction because it's just so noisy and disturbed all the time. It's not what they need to raise their young.

Given Phoebe seemed very informed about her local environment, I speculated she might have a role in educating others. I asked her if shares what she knows and learns with others. She may be shy, but she is certainly not withdrawn. She is on a local board that sees issues of land use. She said she shares some of what she learns with friends, family, and acquaintances with similar concerns. She may share it with township officials or include it in letters to the editor of the local newspaper.

Clearly, she felt strongly about impacts to the environment, and I wanted to know what she thought could be done by landowners, government, industry and non-North Dakotans regarding this. She said first that she would like to see the state "take more care of the environment." She told me that "landowners should band together in terms of leasing, etc. and that government should enforce regulations." She said "residents' interests and concerns should come before oil companies' interests." Given the pace of

the development, she would like to see the state government "slow down permitting to prevent the waste of flaring gas and build infrastructure" to transport and sell the gas. She said if the state government won't slow down the industry, the industry itself should slow down to prevent the waste of natural resources and money. She would like to see the industry better respect state, county, and township laws, the residents and their way of life, and the environment.

Phoebe was quick to describe the impacts she listed above. I reminded her of how she said the oil activity has made it harder for her to continue in her industry of farming. I asked to explain more about how the oil industry has affected her work in farming. During the research, area railroads were busy as tanker cars transported Bakken crude all the way to the eastern seaboard and so I anticipated some indirect impacts given the heavy use of the rail lines for the oil industry. She said "we couldn't get the rail cars we needed for hauling the product, because the oil was taking up all the track for that." They got behind on fertilizer, too, due to rail line delays. Phoebe said it's not only the railroad tracks that are occupied but the grain elevators used to store seed and crops. Many of the grain elevators have been converted to storage silos for the sand used in the slurry for fracking operations. She said,

> the grain elevators would be full and they couldn't get any cars to the elevator or tracks for their railcars to haul it the grain out of here. So, we either had to store it ourselves in bins if we happen to have empty bins or else on the ground (where it is subject to rot) … I think it makes it worse because it leaves less places for the farmer for which elevator to go to. It used to be you would have three elevators here in town that you could use. I mean, if they'd run out of room in one, you

could go to another one. It just made it inconvenient more.

She concluded, "I think if they had just planned ahead to build some of this they wouldn't have had to move in on the agriculture part. They could have built their own."

A road near her property was damaged from heavy oil industry traffic. She said they finally got it repaved, but over time the truck traffic kicked a lot of dust onto her crops next to the road. She said the dust "just coats the whole plant so I mean the photosynthesis is getting out of whack there." I thought to myself, these are the behind-the-scenes of farmers getting their crops to market. Another thing that is blowing into her fields is pollen of Canada thistle, an invasive weed that's thriving near the lake and becoming one of her largest problems. She told me the oil companies are not controlling the weeds on soil piles at their sites, the non-native Canada thistle (weed) are growing there, and that the thistle pollen is blowing onto farmland. The trash is an issue, as well; she said,

> Of course, I have the complaints of all the garbage that blew off the oil site onto my fields. I had picked up a garbage bag full of all kinds of little, just packaging of stuff. It was a mess, so I cleaned up all that by hand. I itemized the trash and sent it to them. I was just feely ornery.

Given these recurrent disturbances to her land, I can understand her frustration. She made it clear that part of her frustration is the fact that relatively few people understand the nature of the impacts that come with the intense activity on roads around their land. She said it's very important to educate members of her community. I asked her what might be the role of education in this experience of dealing with the changes. She said if people were more educated, there would be more awareness statewide of what is actually going

on and educated decisions could be made. She said her sources of knowledge on matters of the environment are the Natural Resource Conservation Service, publications, articles on oil/gas and agriculture and wildlife.

I wanted to know who should be the target audience for such education and so I asked her who needs the education the most. She believes it should be for "everyone," from teachers, students, landowners and mineral owners to oil workers. She made a good argument, too, for product safety and labeling requirements,

Using some farm chemicals requires classes and certification. Farm chemicals are EPA approved and have ingredients listed on labels and can be tracked. I don't know that any of this is required of oil companies regarding frack sand and to what the workers are being exposed.

With thoughts of the photographic interventions or methodologies that would be made available to her in the second phase of the research, I asked her if she had any interest in photography, either recreationally, in your work, or as it relates to her livelihood or community. Phoebe said, Phoebe said she see's value in photography as "a hobby, but it can also be used to document changes and proof of violations, etc.". She likes to make pictures and view them.

I asked her specifically how she uses photographs or photography in her life, and said she enjoys capturing "nature photos and changing scenery" and added, "I submitted photographs of smoking flares and oiled ducks to newspapers for public awareness." She told me that "visuals can have more of an impact than words." She may be shy by nature, but I certainly detected a boldness as she continued. She described another use she has made of photography in what would become part of her phase two contributions to this

research. She recounted, “I also submitted several photographs of oil impacts to a regional tourism photography contest just to make a point. They didn’t use them.” It dawned on me that her use of photography was ironic, subversive, not just a way of documenting. I was getting to know Phoebe’s inner strength and dry sense of humor.

I recalled those two quarters of land she farmed some 15 miles from her home, traveling there typically in large, heavy and slow-moving farm machinery. I’ve driven in that area, coming and going for my research, and those dusty highways can be crowded with oil tankers and a swarm of industry support trucks. I asked her to recount any experiences she might have had with the oil industry along the way. I learned about a significance of roads and transportation that are different from my own. She said,

> Well I was still (farming that land) just when the oil boom was starting, but since it really got going … I really haven’t taken my larger equipment down the road. Last two years it was road construction all the time on the highway, so don’t think I could’ve even gotten through there without finding some other side roads. But then we have a lake in between us so that makes it more difficult.

She spoke fondly of wildlife. I asked her to tell me a little about the wildlife on her land.

> We have upland birds, pheasants, grouse, partridge, do get some ducks nesting out here… coyotes, deer, porcupines, all those prairie animals, but the last couple years have been really bad for nesting. I’m not sure if it’s oil related. I always just go to that conclusion right away…

I asked her if she had seen any changes in the seasonality of wildlife or frequency of sightings with the influx of the oil industry and she said, “I have I have noticed it mostly

the last two or three years, but the last two years I've noticed it a lot more," and she gave me several examples::

> the Sprague's pipit [a ground-dwelling sparrow-like bird] has become pretty rare. We used to have them nesting here in our rangeland… we had them, but I read that they depend so much on habitat staying visually the same, so anytime they see it has changed when they are up in the air, they avoid it. I have noticed the last couple years now we have not had any here. I have heard them fly over and they don't stay anymore so that would be one thing.

The Sprague's pipit is an uncommon bird occupying prairie and grassland habitats of the U.S. Midwest and northern Great Plains, and it was proposed for endangered species listing in 2016. The fact that she was able to hear the pipit fly over, means she has observed the bird and recognizes it by its vocalization alone.

The Northern Plains have lost up to 99% of native grasslands in the Sprague's pipit's breeding grounds (which historically could be most of North Dakota) … The Sprague's pipit is particularly sensitive to anthropogenic disturbance. The birds avoid roads, for example. Increased oil and gas exploration and extraction have likely increased disturbances throughout the pipit's range and caused habitat losses as well. The increase in roads is true in the Bakken region.

> Another affected species was the Marbled Godwit, a shorebird. She noted that it always nested here. There is wetland along our main road, but that has now become pretty much a major semi road… The Sandhill cranes used to come feed on these fields just northwest of our place here and now they've got oil lights all the way down the whole length where they used to be, so they pass over us too.

Given her attention to wildlife distribution and abundance, I asked her if she had noted had any informal observations or reports on other wildlife, such as mammals. She said,

> I know the deer have decreased dramatically. I know, all the wildlife I see now is dead on the road because it gets hit by something… I've seen porcupines, fox, coyote, deer, grouse, partridge, get hit on the road. Other than that, I don't see a whole lot anymore. Smaller birds seem to have started to avoid the road now. There always used to be a lot of horn larks and meadowlarks along the road but they kinda stay away from it now.

I reminded her of the wetlands she mentioned on her land. She said that it, too, had been negatively affected by the recent oil extraction boom.

> We mostly have one wetland that dad had a little dam put in our pasture many, many years ago so we get the spring runoff and any rain we get it to fill up then… spring runoff, probably April- May, fills up pretty good… depending on the rainfall during the summer it can dry up probably in August or so. The last few years now it stayed through the fall, now it's a real gathering spot for most to come drink… I've spent a lot of hours there with the birds.

She sketched up a bird list for her wetland in a calendar, and that is shown in Figure 39.

Figure 39. Bird list of participant Phoebe which she handwrote on a calendar. Phoebe maintained this list to record the species of birds she observed in the rangeland and wetland next to her home.

As a field zoologist by training, I can see that Phoebe knows her local fauna. She said to me, "Oh yeah, I am a birder." It was apparent to me wildlife brings her joy, and the movement of migrating birds marks the seasons for her. Given her early mention of photographs she made of dead wildlife, I was confident that her wildlife observations would be relevant to our work in phase two of the research. It's no wonder she chose a bird called the phoebe as her research pseudonym. North Dakota has two: The Say's Phoebe and the Eastern Phoebe.

We'd spent some time talking about the impact, direct and induced, by the influx of oil industry activity near her home, but I was left wondering just what activity was

actually happening on her land. I wanted a broad picture of how many wells have been drilled on or immediately adjacent to her land, and how many drilling platforms have been gone up or were scheduled to go up. She said,

> Well I don't have any wells on the land where we live because we did a no surface drilling lease so they are not allowed to come on here. They can just go under it. But on the land 15 miles away, that is co-owned with relatives. They leased theirs, so we leased ours as allowing drilling on it, which I didn't want, but they had already done it. I didn't care to fight about it, so we did it. We have two pads out there. I think there is only 4 drills so far but they are planning on expanding the pads and drilling more on them but haven't worked out any payment on it yet so… I think most of the mineral acres have already been leased in this area … but we have noticed the last few months now they are building a lot of new pads, which we didn't think they would… for each new pad built then the landowner will be getting payment on it.

I asked her what kind of infrastructure is going onto that land she co-owns, and she is very attentive to what can be the conflicting nature of oil-related decisions::

> We have oil pads and they put in power lines to it, and they've got gas pipe line and oil pipe lines coming from it. What I didn't like was they were putting scoria on the sites because it's supposed to be a better sealer and I wanted just regular gravel because on scoria, the scoria pits there bring a lot of invasive weeds and stuff with it… but scoria's better in wet times so I did end up with quite a bit of scoria on it even though the county extension agent was saying when they are bringing in all these scoria, it's bring in weeds we didn't have in the area.

I asked Phoebe to give me a sense of her family's interactions with the oil booms over time, since the days of her grandfather's homesteading. She told me that her dad homesteaded starting about 1912, and he kept it in the family. Her dad farmed and his brother did, too, and Phoebe and her sister have been farming after they passed away. Phoebe said, "So they didn't see any of the oil. They managed to pay their taxes and hang onto all our minerals anyway." She explained to me that,

> back in the '30s, when it was so dry, a lot of the homesteaders couldn't pay their taxes so the state took the land and they kept the mineral rights when someone else would buy it. That's how the state ended up with so many minerals.

Drainage is a critical principle in livelihood of a farmer, and I realized just how attuned Phoebe is to the matter. Phoebe is not happy with changes to drainage, and she explains in detail how industry activities on and adjacent to her land influence drainage—and crop yield,

> So now we get pot holes and water standing where it never used to;; it used to drain much more easily. It sits there and eventually soaks in. That was some of our best crop land… they built a dike, so it starts pooling… a big mud hole now or starts washing down the fields… we are getting some erosion and almost creating a wetland that shouldn't be there… I've lost cropland because of that… you can't even get it to see anymore because it doesn't dry up. But if you do get it seeded, then the water comes and it just floods it out and you've killed your crop.

Phoebe had mentioned that she does some still photography. I asked her if she is documenting some of these things that she has mentioned to me and she said she has done some, but tells me, "I actually find it really depressing, so I try not to get out there

too much, but I have done some of it." She once told me she submitted some photographs of "smoking flares" to a media outlet. She said, "yeah, there was one flare that went for about three days that was just pouring out black smoke. I took pictures of that. I even contacted the EPA on that one… They did contact the oil company and they made them fix it.

About one year prior to this research, there was a big spill nearby, but it didn't impact her land. Recently, though, there was a spill on her land,

> and they deliberately pumped it off the site into my field…. they were pumping it all the way down, it ran all the way down the fields, down towards the lake. Then I never could get the [[North Dakota]] oil and gas division to get it straight in their records, what was different, I mean the spill and the deliberate pumping … the permanent record is not correct. I have tried to get them to change things on it. The oil company said that was too expensive, so they would just pay the fine instead of remediating it.

For a time, there were open pits for oil storage nearby land. She said,

> the ducks would land in these open pits because they look like big open areas of water. They are actually full of oil. I mean water and oil and everything. They would land in there and then they'd be soaked and then they'd die down inside or they would get so far out. We had two (ducks) over here on our farm that made it this far and we didn't have lights for about a mile from us.

We changed gears to the status of the oil boom. I asked which concerned her more,, the current situation or talk of a decline and an upcoming oil "bust"? She replied, "definitely the current situation." If the industry declines and they start pulling out of the

area, she said, “I think it would be good for it [the area?].”

I asked her what are some other aesthetic aspects of the environment that you feel have gone away to some extent?

> Just the whole area now. When you looked out east, you just looked for miles and just the open prairie or crop land. There it was just open, and now there’s sites everywhere, there’s water depots, there’s all these collection sites for the oil, there’s dresser stations, there’s a gravel pit. … and then at night the flares, it’s not even just seeing the flare. They’re below the horizon but you can see the glow all the time. You have a huge expanse of where it’s not dark from the horizon upward so the only stars you actually see are pretty much overhead. … Yeah, there’s roads everywhere, there’s power lines everywhere.

Another time she summed it up, “… gone from such a nice rural area to just industrialization that we never wanted.”

On the traffic, I ask her if she’s had any experiences with friends, animals or livestock being hit by traffic. She said,

> I haven’t but I worry about my dog. We’re about a quarter of a mile, off the road but I’ve managed to keep her away from there so far. But I’ve seen dead dogs on the road … I know some of the Native Americans let their horses have free range and they’ve been hit on the road.

Stories of death and danger continue. We shifted to a discussion of the chemicals used in the fracking slurry. I asked her if she had ever asked any of the operators what chemicals are being injected at wells on or near her land, and she said she hadn’t because “the state was supposed to have it on their website. They have a site that was supposed

tell all the chemicals." The site is https://fracfocus.org/node/117. She said,

> there's a lot of companies that just don't put them up there even though it was supposed to be a law now. Some companies, they still skip chemicals that they have in there. So, we really don't have any idea what they are putting in.

The industry is operating on the lands on and around her, operating 365 days a year, all four seasons.. I asked her to describe the series of activities taking place there from start to finish. She said,

> They first come in, they scrape it all level. They'll pile up the topsoil which they use when they clean the site. They say they put a layer of clay down as a barrier but we never see it done. After they get it all level they come with a lot of scoria, put that down. They set up all their tanks before they start their drilling… crude oil tanks, saltwater tanks…separators to remove the water from the oil. Then they'll come in and start drilling and they have like a little town on the site. They bring in their trailers, trucks, and all the equipment. They don't have electricity on site at the beginning, so they have these big generators that you can hear forever while they're trying to drill.

For Phoebe, the sense of powerlessness is exacerbated with the sheer intensity of the oil apparatus: the amount of equipment, the space taken, the noise and the lack of "checking in" with local residents. Tapping further into this sentiment that the government agencies have so much authority on the management of the oil industry and its waste, I asked Phoebe to speak about how land zoned for agriculture may be appropriated for industrial use. Her reply speaks to how landowners are feeling very much displaced by the oil industry,

> Correct, yep, and not just for oil and saltwater but they're also using so much agricultural land for gravel now. They have gravel pits that have taken many acres of cropland out. For compressor stations and office buildings. They are putting up all these office buildings on productive agriculture land. Of course, the landowners are letting them do it. If the landowner is a willing participant, so to speak, they can go to the zoning commission either county or township and apply for whatever they want on their land if it's not controlled by the state.

Routinely the oil companies have approached or entered her land without communication. I asked her if anything had ever happened to her land without her consent and she told me when the oil company first built the site on her grandparent's homestead, they came in and did it before they had their access road in. She said,

> they came up on my gates and fences and just went in across the fields with their big equipment when it was muddy. That was something I was not happy with. Then, another time last year when they had all the water on the site, they pumped it off without asking and they just pumped it down the fields.

I said to Phoebe that she must have a different type of level of awareness than you had in the past and she replied,

> oh yeah … I mean, I'm on the zoning board of our township, so I'm trying to watch our township all the time to make sure companies aren't just going in and doing something without coming to us with an application.

I replied, "That way you're sure to see what's proposed for your land, right?" Phoebe replied, "Yeah, right."

I asked her the relative roles of the state, the county, and the township in terms of

enforcing laws related to the environment?

> Well, the state the industrial commission has complete control of permitting where oil sites are and where disposals. The county has some control on waste pits. And the township has their own zoning to have some control on locations of compressor stations and waste pits and that sort of thing. but now the state is saying if they have a salt water disposal site that they have approved they can permit the pit for oil field waste on there too and the county doesn't have a say so. That's something that we're trying to fight now but I don't think it's going to work.

Moving to the future, I asked her how she sees her land in 20 years. She said that partly depends on legislative decisions on eminent domain, decisions concerning privately owned lands, and what the industry will be allowed to do. She said "I will fight to keep it as it is. If it is not farmed, then planted to wildlife plantings for suitable habitat.

I brought up the federal Natural Resource Conservation Service, and the local soil conservation districts, and asked Phoebe what kinds of services they provide to her. She said,

> a lot of programs and meetings set up. A lot of education mostly… they do a lot of seed plantings. They write up the programs for the conservation of soil and putting in dug outs, springs, and all farm related, livestock related… they will plan dug outs if you wanted to put a dug out on your land or dams or anything that would hold water for your livestock. Or for wildlife too… I know they having meetings on the impacts on the environment and they were encouraging land owners to all band together when they do their pipeline leases and just mineral

> leases too. So, thinking there's more power in numbers than everybody doing it on their own.

I asked her if she had seen any other articles or stories about wildlife and she had seen a few "game and fish" articles, that it is "getting very bad … because of the fragmentation and all of the activity and they are losing habitat." She said she had also talked to some wildlife officials,

> At the state fair, I talked to some… and one of the game and fish guys said we are not allowed to have an opinion, so… I talked to our district conservationist there for NRCS (National Resource Conservation Service) and he told everybody, well, just talk to us after the meetings then we can say what we really think.

To maintain objectivity, I present her with a devil's advocate stance, as some have said that pesticides in the region impact the suitability of habitat for wildlife. She responded,

> I'm not that big on pesticides, but I would have to stick up for them somewhat I guess … people complain about comparing fracking and pesticides, which is worse, and all our pesticides have to be EPA approved. You have to have all their ingredients listed, you have to have the labels with you, so you know what you are spraying. People applying them, if you're gonna use a restricted pesticide, you have to get certified… with the fracking, I don't think these people working with it have any kind of classes. I don't think they even know what they are dealing with, what they are handling.

I asked her what are some of the things that you do on your land to minimize your impact as a farmer in terms of irrigation for example to minimize impact to local wetlands or blueline streams or water table. What are some of the measures you take in your farming

practices? She said,

> Like I said, I don't use a lot of chemicals because I know they can reach down if they don't breakdown before. If you get a lot of water, they are going to leach, and they are not going to break down before they leach. I haven't been using any anhydrous fertilizer because I don't think that's good for the water and I don't think anhydrous ammonia is good either for the soil. I know I take a loss in production but I wait until my weeds are big before I spray, so I don't have to do it twice.

With all this discussion of potential impacts and concerns she has, I asked if she felt her science courses in high school and college prepared her for this work with the oil industry, and she quickly said,

> No, we had pretty basic classes and the science was fertility-based mostly, what we would need for different types of crops and yields and all that. And I think with the oil it's a lot more of a geology sort of field.

I asked Phoebe what are some of the environmental regulations that you have relied on, or sought enforcement for, in the past? She said the NRCS would be the "swamp buster and the sodbuster." She said, "you couldn't drain wetlands or break up soil." Phoebe told me, "if the oil companies had to go by what the farmers had to go by, it'd be completely different." I gave her a tough question, to choose from the categories of water, air, and soil, which of those areas would be of greatest concern to her. She responded,

> Oh, I don't know, I mean they all would be because with the fracking I worry about the aquifers and with the pipelines I worry about saltwater spills destroying the land. The flaring and the chemicals, it's all going into the air. So, all of them.

I shared with Phoebe that landowners have spoken about their desire for more local control. I asked her to explain what the phrase local control means to her, and she said,

> Well, around here, our township has its own zoning ordinance so we are not under the county zoning, but there is a lot of townships that don't have their own zoning so they're under the county ordinance. And then there is also the city ordinance that has zoning. They are within city limits and a mile out of city limits.

She mentioned local associations working on these issues include the Northwest Landowners, ERC, Dakota Resource Council and the Bakken Waste Watch Coalition. She's a member of national groups, including the National Wildlife Federation, Natural Resource Defense Council, National Audubon Society, National Humane Society and the Wildlife Land Trust. She was active with a local birding group as well.

Phoebe told me that over the next 20 years she would fight to keep to keep her land as it is. If it is not a farm, then plant it to wildlife for suitable habitat. I asked her to tell me a little bit about how you would convert farmland or plant it for wildlife if it's not farmed. She told me,

> Up through the years I've planted just wildlife plantings. I plant the grain mix or the food plot for wildlife and then I just don't farm it after that. But, also, two years ago, I put in about 15 acres of native grasses. I didn't put any crop on it.

She said she planted that contiguous with rangeland that "we haven't done anything with." I asked what her results were, and she said,

> Oh, it looks beautiful now. I was actually walking out there a couple days ago and that was the only place I saw any birds. I saw pheasants and grouse in there…. once I got into the native planting I had, I saw some actual birds… we did have

wood ducks last year

I found Phoebe to be quite attuned to her environment and someone who would be considered a conservationist. I asked her if her values for the land and conservation are similar to her neighbors or different, and she provided some insight into their motivations,

> I think their concern with conservation, I think it's probably for a different reason than mine is because nearly everybody here still does farming. So, they have their concern with the soil and the water and, but they are doing it mostly to benefit their end result in farming to get the full yield. I think my conservation is more for the wildlife side like I said. I take a lot of cuts probably in yields by doing things differently than they do… But otherwise, I mean they are doing good at conserving soil. They don't till or anything so.

I asked, what are some of the topics that come up related to oil and gas when you have town meetings? She said,

> Well, I know one of them is the flaring. People talk about the flaring, what a waste it is. Mineral owners are losing their money… the state pretty much has control of everything. No matter what, we're trying to keep it the way we want it here. The state can probably overrule us if the oil companies go whine to them enough. They have been starting to do that now so… There's all the roads. So many roads built … and they're just kinda chopping up fields so you've got patch work fields now when they used to be able to farm an area.

There are spills continually. She said, "of course everybody talks about the spills too… anything from oil to water spills. The deliberate dumping's and all that." I asked her if

she's referring to wastewater trucks which reportedly have drained their loads while they are in transit, and she said,

> oh yes, because we've seen trails, you know, of wet track down the road. You know they're dumping. We've seen on the sides of the roads where they have just pulled over and there'll be a big oily spot or wet spot. It's pretty obvious that they've been dumping something… We have been calling the county emergency coordinator… but I think he's been a little lax on it because he's so overworked though he tells us we should keep calling.

I was curious, given how outspoken she seemed on matters of the oil industry if she had suffered any repercussions in her community. I asked her if she talks with neighbors outside the town meetings, and she said "we are pretty friendly with each other but some of my other neighbors have, they've kinda, I don't know how to say this but they've gotten mad at us and there isn't much contact anymore or communication with them." She said she's getting some people who won't talk to (her and the other members of her government planning committee) because "they feel it's their land and they shouldn't have to have permission…"

I was curious about how water is sourced for the industry. Phoebe explained how water is brought to some well sites, reducing the amount of truck trips required to supply water to a well. Perhaps this serve to mask the high demand for water. Estimates are that two million gallons of water are used to frack a single well. Phoebe explains how water from an offshoot of the Missouri River is collected,

> We have a water depot in the township it's about a mile from where I live and that water comes from the lake and it's piped through the depot probably a mile or two

> miles, about two miles. Then from the depot they, one oil company has hooked up water pipes, underground water pipes, directly from the depot that goes to their sites. Then they don't have to have the trucks hauling the water. They have a water source when they want it.

Upon our conclusion of the interviews comprising phase one of the research, I asked Phoebe if anything else came to mind while we were talking or that she might want to ask me. She replied, "well, one thing that comes to mind is I hate interviews, and if it wasn't for the oil, I wouldn't do this."

Phoebe: Phase I Themes

Four major themes emerged in my phase one work with Phoebe:

1. Phoebe is the conscientious, community-minded farmer, expressing concern for her neighbors, serving on an advisory committee, and listening to what's on the minds of others at town hall meetings. She refers to best practices in sustainable farming.

2. The marginalization of farmers is a recurrent theme, stated or implied. Phoebe refers to how farmers have been disrespected via exclusion by government planning in advance of the influx of the oil industry and in current policy decisions, oversight and regulations. She refers to farmer displacement by traffic and the oil industry appropriation of rail lines and silos. She points to resentment and hostility as neighbors clash over opinions over industry and land use.

3. The fractured land is a theme that unifies Phoebe's mention of direct and indirect impacts of the oil industry to her place-based identity. She refers to being "divided" – by roads, pipelines that disrupt daily activities and access to her land, and to being "disturbed"

as her land and farm yields are impacts by waste pits, gravel being laid down and resultant dust and weeds. She comments on "changes in the landscape," loss of wildlife reserve centers, the loss of "darkness" and "silence." She says that "no one know each other" and she is sad for all of these things.

4. Phoebe is conservationist because she sacrifices yield to provide wildlife habitat, is very attentive to minimize pesticide use, is knowledgeable of native fauna and flora and defines the seasons by them, she expresses an aesthetic appreciation of nature, and is a member of regional, state, national and international conservation organizations.

5. Resilience is another theme from the phase one work with Phoebe. While facing challenges due to the incursions of the oil industry, she maintains a strong sense of place, going into nature to seek solace and staying involved in continued education. She sees this research as important and sees the photography-based interventions as a way to reconnect with her heritage. She is financially prudent and secure such that she can survive on farming alone if oil-related income wanes.

I invited Phoebe to choose from the photography-based interventions to guide her in further exploring the themes. As with all the participants, I offered Phoebe a kind of menu of several interventions that included names and short descriptions of each. I asked Phoebe to select any photograph(s) she wanted to share in phase two in advance of my arrival.

Phoeve: Phase 2 Findings

I emailed Phoebe prior to our meeting and asked her if she had gathered some of the photographs she had mentioned, such as the early homestead, her photo contest entries, her nature photography or any she'd made that might help her tell her experience of living with the oil and gas industry.

Ultimately, Phoebe chose to speak from her personal collection of images, made by her recently and made by her family members historically up to two generations ago. She also had a collection of images that she entered, tongue-in-cheek, in a regional tourism photography competition. She also liked the idea of re/photography, at the family homestead location to show changes in the landscape induced by the oil industry. She also liked the idea of rephotography, which we both conducted side-by-side at the family homestead location to show changes in the landscape over time. The latter intervention was carried out both by researcher and participant Phoebe.

We began phase two at her home. I invited her to show me any image that struck her as meaningful related to our conversations in the first phase. These might be pictures of nature, documentation of changes in the environment or anything. Maybe she had, I told her, pictures in a shoebox or historical images from the family archive. I let her know I was open to discussing anything regarding the potential use of photography to help her share her experience.

Before we went out for a walk on her land, I took a walk with Phoebe on her land. It was early March, and the ground was still covered in snow but thawing, wet and spongy. We were inside her house. She started with a few pictures that included a muskrat and a sora. She showed me a picture of two trees. “This is American elm, but it’s not the one we looked at. It’s just to the west of there, down along the coulee,” she says. I saw American elms with porcupines sleeping in them.

She remembers driving from her home to farmland 15 miles away before the boom. It was 1995. She was driving a tractor that pulled a “drill” used to seed the crops. Driving about 5- 10 mph. She is showing me a picture made by her sister looking out

onto the empty highway pre-oil. A pair of sunglasses sits on the dash of the tractor. She said that back then you could look at everything. I thought I was going to smash a turtle. He just looked right at it. You look at scenery. You look at whatever is going on. Whoever is farming where. Now you're looking for who's going to hit you.

She handed me a page from the calendar shown in Figure 39, and told me, "This is just a list of birds." She's handwritten the name of the birds she's seen in the wetland near her home, where we're about to go walk. She points to one bird on the list, "yeah, that's Sprague's pipit…Grasshoppers I heard," referring to the grasshopper sparrow found near her home. "I've seen them out in the pasture but not right around the water. Saw a kingfisher go down and get something."

Phoebe was clearly eager to share these photographs with me. I was happy to see her interest in sharing the images. I asked Phoebe if the knowledge that I was coming out there to look at photographs had stimulated her to make photographs, and she said "I do it a lot anyways. I try to carry my camera with me quite a bit."

Phoebe showed me a set of small square original photographs, made about 1930 she estimated, discolored and perhaps made by an old Eastman Kodak Brownie box camera or equivalent. "This is grandpa's homestead," she said. They are gathered in Figures 40-42.

Figure 21. Photograph circa 1930 of members of Phoebe's family with turkeys at the North Dakota homestead near her current home today.

Figure 41. Circa 1930 photograph of the homestead of Phoebe's father. A group of mule deer is seen near the historic barn.

The next photograph (Figure 42) shows Phoebe's grandpa at the historic homestead house, circa 1930. Phoebe's first reaction to the photograph was how fit and trim he looked. She said the image conveys a sense of newness and opportunity to her.

Figure 42. Photograph of Phoebe's grandfather at the historic homestead house in a photograph made about 1930 according to Phoebe.

The Contest Entries

Phoebe placed a striking image before me. It was a dead duck, covered in oil. The bird flew into an oil waste pond adjacent to Phoebe's home and died near her doorstep. The duck likely confused the sheen of oil as a resting pond and landed. Phoebe created a formal composition of the oiled duck placed in the middle of a cloth. She then entered the image into a regional tourism photo contest under the category of "Wildlife." Figure 45 (below) shows the caption on the reverse of the duck image submitted to the North Dakota tourism photo contest.

Figure 43. Picture of an oiled duck that died at participant Phoebe's doorstep one night.

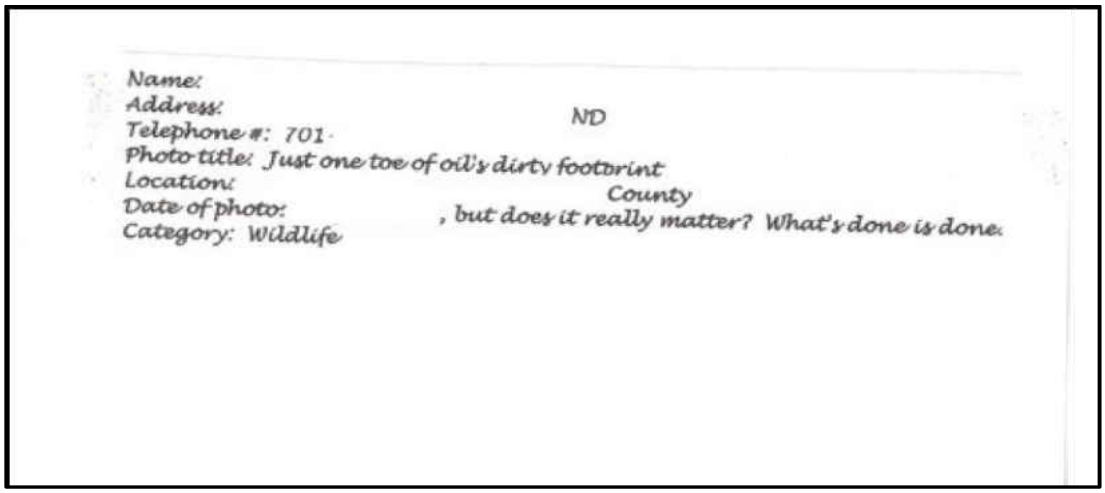


Figure 44. Caption on the reverse of Phoebe's photograph of an oiled and dead duck reads "… does it really matter? What's done is done."

She told me about the series of pictures she submitted to a state tourism photo contest, and this was one of them. I asked her where she got the idea to do this photo contest and she said, "I actually wanted to do it with real pictures but after what we'd seen in this part of the state… they always had promotional pieces going and they had the categories that seemed to fit…" Phoebe submitted this one in the wildlife category.

The pictures were made between 2010 to 2012 on or near her land. The composition, messaging and impact of these images is examined in the discussion in response to the second research question of how she used visual methods to define and articulate community values on environmentalism and sustainability.

The next picture (Figure 45) is dust and haze obscuring what appears to be blue sky and perhaps a road. Dust kicked up by an oil truck in front of her broke her windshield just after this picture was made. She entered the image into a local tourism photo contest, in the category of "scenic." She explained "I couldn't see anything but I knew that the truck was up there somewhere. This was on my gravel road."

Figure 24. Phoebe made this image through her windshield as she drove down the dirt road to her home. Just after she made this picture, dust kicked up by the oil truck ahead broke her windshield. She entered this image in the *scenic* category of a regional photo contest.

She brought me to the next image showing what appear to be the back ends of tractor trailers in a row (Figure 46). She told me "that was north of the town. Along 1804. This one for events [category of the contest] I thought worked well. Fracking around here is a huge event because it's traffic, traffic, traffic and busy, busy, busy, so it's got to be an event. This was on that road you just came from on the homestead. There's like these big rocks and there's water had run all over and washed it out." I asked "those are all trucks?" and she said, "no, those are the frack tanks, big tanks with fresh water" for fracking.

Figure 46. Trailers filled with fracking water. Participant Phoebe made this image of the containers lined up beside an eroded gully near her home. Then she entered the photo in the category of *events* for a regional tourism photo contest.

The next print from the contest entries is a scene of billowing black smoke from an oil pit (Figure 47). She said she contacted the North Dakota State Health Department and the U.S. Environmental Protection Agency (EPA) who came out to this storage site on her land. She said it an oil company used to burn off excess oil near her home and it "burned like that for 2-3 days." "She called the North Dakota State Department of Health and the Environmental Protection Agency (EPA). Later, she entered the photo into a regional tourism photo contest in the category of "attractions."

Figure 47. Image of black smoke over a burning oil pit. This is where an oil company burned off excess oil near the home of participant Phoebe. Phoebe made this image and entered the photo into a regional tourism photo contest in the category of *attractions*.

Phoebe's final image is the series is taken in the winter, showing a highway going into the distance. The scene is taken from road side foreground that is muddy and stained from truck traffic. A drilling platform can be seen at the distant left. She placed this entry into the category "adventure." The image is shown in Figure 48 below.

Figure 48. Phoebe's image of truck tracks along the roadside near her home. Phoebe entered this image into this image in the *adventure* category of the tourism contest.

After the novel experience of viewing a gallery of industry impacts ironically through the lens of a tourism promotion, we went for a walk on her land before visiting the historic homestead. These images are examined more closely in the discussion.

Walk to the wetlands with Phoebe

It was 42 degrees Fahrenheit with a light breeze, and Phoebe took me on a short walk from her home to a nearby thicket with a large pool thawing. I was with Phoebe and her sister in light-duty winter clothing with light jackets and boots. Very little snow cover. It was melting, wet and mucky.

We walked up through a field, no neighbors in sight. Phoebe paused to show me a swale on her land at the base of several hills creating a nice drainage into a depression filled by shrubs, a couple American Elm trees and smaller trees. She said, "most of them are plums." Phoebe said, “this is a place that I would come down and sit, even in the winter. I’d come sit out in the sheltered areas on one of the trees that fell down with my dog”.”

We walk another 50 yards up with a beautiful depression filled with water and footprints all around, probably coyote coming in to get water. While we’re on the walk she tells me that she found the old photo of the homestead, and she went back yesterday to take a couple of pictures. There’s water trickling between our feet from up in the hills. Beside the pond formed by a dam her dad created years ago, we talk about birds and what must be an abundance of nests in the Spring. She points out the stubble of alfalfa in a field and tells me “should look good in May, June harvest, blooming in July but this depends on moisture.” We joke about this rural place.

She tells me she doesn’t have a cellphone, but you can call my home phone and my sister can listen to the message on her cellphone.” I always wondered about those piles of rocks on the edge of fields. She tells me it’s not a cairn, has no significance. Just need to get those nasty boulders in one place so the farm equipment doesn’t run up on ‘em. We headed back to her home to prepare for our trip to the old homestead.

This walk and observation with Phoebe contributed much to my understanding of Phoebe’s knowledge and appreciation of nature and regulations related to their protection. She had a very detailed vision of how to promote wildlife habitat through the management of a wetland. I could see that Phoebe maintains her connection to nature here, a refuge from the activities of the oil industry all around. She said she is willing to

take a hit on crop yields in order to keep this land out of production, letting it go further into restoration back to mixed woodland and riparian habitat.

Rephotography of the 1912 Homestead with Phoebe

Phoebe brought over several square prints of her grandpa's homestead circa 1912. "This is Grandpa (Redacted) homestead" she happily shares. Before we headed out, she showed me the image in Figure 49. It shows the barn at the historic homestead beyond a wave-like field of snow, and told that the site is now occupied by two oil pump jacks in the area of the background of the photograph.

Figure 49. Photograph of the barn on the homestead of Phoebe's grandfather, made about 1912. She and the researcher returned to this site for repeat photography in phase two of the study.

Both Phoebe and I were fascinated by how the snow in the foreground of the historical image looked like a wave receding from a beach. I said to Phoebe, "that must be the California in me," referring to my native state. "Here is where I tried to recreate it a little," clearly happy about her entry into the research intervention of re-photography and she showed me her picture in Figure 50. I took a moment to ask whether Phoebe was stimulated in any way to make pictures of the homestead because I was coming out for phase two of the research. She said, "I think so. I've tried to carry my little digital camera with me."

Figure 25. Participant Phoebe chose the visual methodology of rephotography during phase two of the research and made this image of her grandpa's homestead barn in 2014, more than a century after that 1912 image shown in Figure 49.

Referring to her picture shown in Figure 50, Phoebe said “There you can see this barn was pretty good shape until we had that really heavy snow. It was either in 2010 or 2011 when we had those huge, huge snows and the roof caved in.” I remarked, “Oh, just the snow load, huh? I hadn’t even thought about that. These old homesteads, the collapsed roof. It’s the snow load.” Her description of how the roof caved in was a realization for me of just how history is lost. Phoebe told me that after the roof on the barn on grandpa’s homestead collapsed,

> This barn was in pretty good shape until about 2010-2011 and the roof collapsed from the snow load. We had over 100 inches of snow that year…So then we had the roof caved in and we still wanted to save it in some way. And then we get these people. We don’t know who they are. But these people come and start tearing off the sides where the old barn was… they take them and sell them to the people who are making picture frames… doing crafts. That made me really mad cause they’re just cutting the gate and going in… we’ve had a locked gate and no trespassing signs.

The remaining sides of the barn are being dismantled. Phoebe suspects that as workers came to operate various facilities in these farmlands, family members came to know of the old homestead barn and began harvesting the wood. She said, "we've got a locked gate, a no-trespassing sign and they have my information, my name on (sign)… but that didn't stop them, they came in through the lake. They park along there and go over the fence.” I asked how she knew that wood is being used for picture frames, and she replied, “craft shows have old barn wood picture frames… and one of the neighbors actually caught the guy and his wife who would sell them. I guess we kinda put the two

together. They make planters from them too."

Phoebe explained that this is yet another of the growth-induced impacts brought by oil. It is bringing new people to the area who may not share their sense of place and respect for heritage and generational values. Phoebe said she would take me out to the site, and that she would like me to make some images of the place. We headed out to the homestead site. On the way out, we pass one of the new rail loading facilities to get the oil out of the Bakken and onto trains heading all the way to the eastern seaboard. The sisters are talking about the original filing of the homestead.

It's a muddy parking situation for Phoebe's 4x4. She explains, "the oil company built a berm, which blocks the flow, and the water pools up and now we've got cattails on the edge of our land." I'm contemplating the re/photography and wanting to avoid having her truck in the background of the photographs. Phoebe says, "right here," indicating where she will re-park.

She tells me she was over there about a month ago, and that she tries to check on the place every once in a while. I told her that I'm interested in how the visits make her feel and she said "sad" with characteristic shy but smiling demeanor.

We see the barn adjacent to the homestead home, and another part of the barn fell in because they took the sides off, and now they are taking the sides off the part that's still standing. Clearly this is upsetting to Phoebe, and I'm seeing how wide these tentacles of growth-induced impacts do spread. Phoebe asked me to make a photograph of the old barn, with its no- trespassing signs in place and her hand-written pleas to the craft vandals on white paper.

Such was the case with participant Phoebe, who felt it would be useful to revisit

her father's farm, and the ranch house where she grew up. The site, along with outlying barns, was being frequented by fracking-induced activities. A set of wells was positioned a short distance from the home. The family barn when we visited was weathered and imploded, perhaps triggered by the theft of siding by trespassers collecting old wood for crafts and antique décor. Phoebe asked me to make a panoramic image that replicates the same camera position and field of view of a historic image she shared from her family archive. She holds that historic photograph in the scene below, placing it over the identical scene that I rephotographed.

Figure 51. Rephotography. Participant Phoebe, standing at the location from which the historic photograph was made, holds that 1912 image of the current barn with pumpjacks and oil storage tanks in the background.. Bakken region, North Dakota. Photograph © Bruce Farnsworth

That day, Phoebe told me several times that it was “sad” to return to the homestead because each time she sees the buildings falling apart, and she found that metaphorical for the state of the environment as it falls under the impacts of the oil industry and contaminations it has introduced. The discussion includes some reflection on the act of repeat photography for both Phoebe and myself, a closer analysis of the significance of the images and some examination of the effectiveness of repeat photography as a way for Phoebe to share her values.

In an act of collaborative rephotography of the barn with Phoebe, I decided to include her in a way that might portray her dedication and her sadness, without including her likeness. I wanted to include the historic 1930 photograph in the picture. Certainly, I wanted to commemorate the day we were there as it was just over 100 years ago that the homestead was granted to her grandfather.

CHAPTER V

DISCUSSION

This research adapts concepts and methods in visual literacy and documentary photography to qualitative research, and it has generated multiple lines of discussion related to the applications of photography in social research on, sustainability and the educational needs of rural communities affected by the fracking industry. During this study, I found that visuals created the space for participants to examine their own lives in new ways.

In this discussion, I will accomplish three tasks. First, I examine the emergent themes of phase one of all three participants. I then examine the research questions via a close examination of images presented during the photography-based interventions (what I have referred to as phase two) and using a variety of frames by which to interpret them.

In the implications, I make the argument that industrial science training is needed at the middle school and high school that is responsive to the youth and adults managing fracking operations on area farms and ranches, and that more content is needed in high school and area agricultural colleges in the areas of writing, law, math and policy to better prepare future farmers for the monitoring, negotiating and leasing they will be involved in. I also suggest curriculum needs in the area of social and environmental justice and the need to include the voice and images of local residents in the curriculum for a more realistic view of the legacy of oil. I conclude with final thoughts on the use of photography-based interventions in social science research.

Themes Across the Cases: The Experience of Living with Fracking

Looking across the case studies, I could clearly see important similarities that

defined the experience of these participants with extraction activities in the Bakken. All of them lament the new industrialization, and cite a range of impacts to the environment and their way of life which are both direct and indirect, dramatic and subtle, but all receive income from oil leases and easements. All of them lament the loss of darkness and silence.

The participants have learned to take all sides of the land management issues as they have land with mineral rights and without middle rights. This may be easiest for Cody. He has served on the Bureau of Land Management (BLM) board for his region. Cody has lived with oil all his life. All are politically active, attending regional meetings of the oil and gas commission, supporting farmer/rancher and community organizations or serving on county panels.

All of the participants are dependent on the land and their self-identity is tied to it. This connection to place, combined with years of actively dialoguing with oil development matters in his community, make all of them knowledgeable, yet it is Cody and Trackfinder who are most vocal. In much the way that Beh and Bruyere (2013) gave the indigenous Samburu community in Kenya photographic interventions as a means to contribute their ideas, each of the participants in my study would have an opportunity to express their experience in the photography-based methods of phase two.

Water

During my conversations with Cody and Phoebe, there were many variants to the theme of water: freshwater versus contaminated water, water sourced from lake, pipe, creek, spring and aquifer, saltwater waste, melting snow and the thawing of the land in spring, proximity of oil operations to the creek and wells near his

home and cattle. With Cody and Phoebe, I was struck by the amount of activity taking place in the spring. Just as the harsh winters waned and the frozen ground began to flow with water, he has simultaneous responsibilities to ranching and farming, cows and calves, seeding and weeding as well as dealing with an influx of oil industry operations. I asked him, given the timing, whether there can be compatibility of farm and ranch activities with oil and gas activities. Cody says it's always busy, but he's not wanting to "fight for the water." See Gardiner (2017) article about where the water goes in fracking.

Horizontal wells

In all objectivity, as Squillace (2012) notes, since horizontal wells often extend more than two miles, unconventional development can potentially allow oil development across a large circular area of four or more miles. This can facilitate fewer impacts on the surface and the positioning of well pads that are further removed from homes and schools, reducing the negative health impacts on residents. However, because the Bakken and Three Forks formations are so rich with oil reserves and technology has improved to recover more of it, there has been an influx of oil industry and industry-induced impact (such as congestion, crime, impacts to infrastructure, pollution, dust, and others) that this benefit of the technology is negated.

Easements

Cody spoke of the easements he leases for oil company use on this land, so they can put in roads, drilling pads, and other facilities. He also makes sure to get payment for damages which he said take place "when they put it in. Tearing everything up, and then if they should leak. A saltwater leak is much worse than an oil leak. It sterilizes the soil and

nothing will ever grow there. Only way to get it to grow is to haul it good topsoil."

Abandonment

There is a sense of abandonment among the participants in that the oil industry puts much more effort and apparent care into getting access than is given to "the exit," as Trackfinder phrased it. All three cited many examples of inadequate remediation. When I asked about support he may receive from county and state agencies charged with monitoring and enforcement, he said the agencies don't monitor or enforce. He said they were "basically useless."

A pervasive theme in the attitude of all the participants is that of marginalization, that there is inadequate communication with them as landowners, and they are imposed upon in so many ways. All of them have dealt with abandoned well sites and oil debris from previous oil jobs left behind or buried on their lands, sometimes even from decades ago. Their farms and ranches are impacted by concerns for erosion, invasive weeds, dumping and other growth-induced impacts. All of the participants felt, to one degree or another, left in the dark and not knowing what is happening, all of which contributed to a sense of powerlessness.

Uneasy relations

A theme of uneasy relations or friendships arises in the agreements that all three describe their dealings with the oil companies. Trackfinder contends that maintaining some ownership in an oil platform he is able to monitor somewhat and have a voice in decision-making. While Cody has reason to be concerned about this land, there is an opportunity for income. The oil companies, despite the fact they might not normally associate with these proud landowners, find themselves making deals because the

alternative--gaining access via government tracts--is a lengthy process, but oil companies, despite demands of ranch/farm families, is easier than getting permits to access surface of government land. Yet the deals are not always fair.

Speaking of the past

All of the participants spoke of the past, of the way it used to be, and how they have also inherited a landscape which has now become riskier. While the design of natural gas flares has improved, they still burn out and pose risks of gassing humans and animals alike. In the grouping of pictures of Cody in Figures 15-18 made by his late father and uncle, we came to the image of the four dead cows gas break fall of 1968. That image may seem old and irrelevant, but Cody said "I now operate that place" meaning he inherits the risk of this old infrastructure and he sees the impact as his own, years later.

Issues persist

During phase two work, all three of the participants—Cody, Trackfinder and Phoebe— made one assertion throughout, and that is that many of the issues highlighted in the pictures he shared continue to this day, albeit less frequently or in different forms. His use of historical (actually vintage) pictures is significant what these older images show is the potential that they know is there for generational impacts. If something goes wrong, the impacts repeat or continue in a similar form. The fact that Cody deliberately picked older images says something dramatically important.

It felt that Cody—and all of the participants—had reached a point of saturation.

Cody told me "my father literally died fighting the oil companies." Cody's father monitored, negotiated with and engaged with every aspect of the oil industry's activities through two boom/bust cycles in western North Dakota from the '50s through the'80s.

Trackfinder spoke without hesitation about the manipulation he sees in the leasing process. Phoebe had become so sad in visiting the dilapidated homestead that she almost didn't take me. In my research, I worked hard to maintain objectivity, and was concerned that the lack of more recent oil activity in the picture might, in and of itself, weaken this study. However, it is not appropriate for me to intervene in their selection of images, and this is not a legal case: they have no calling here to prove that they still encounter any of the scenarios described in their photographs.

Nuances in the impacts

In the presentation of photographs by the participants, there is a macabre theme of dead animal and livestock and contaminated land, water and air. And the impacts, we learn, are not always direct. Cody told the story of the young calves shown in Figure 18 that died suckling their mothers—after the cows laid down in the oiled pasture after a pipeline break. He showed abandoned oil storage tanks, still in place 30 years later, which his cattle enter, perhaps at risk of injury from rusted debris and oil residues on the ground.

Cody commented that the oil execs came from Texas once and found oil wells that weren't even on their maps. This becomes a theme because Trackfinder also commented on how he discovered waste buried underground by driving to land scars he found on aerial maps provided by the oil company.

Space

There is a bigger scale to the land here in western North Dakota, where ranchers and farmers commonly have several hundred or thousand acres. Jerolmack (2103) reported that in the Marcellus shale region of Pennsylvania about the "spillover effects"

when one landowner allows fracking and neighbors don't. He reported that, "small landowners often reported that one reason they felt secure leasing was because they knew their property was not large enough for energy companies to install a gas well or other infrastructure on it at most, a horizontal lateral would be drilled a mile or more below the surface" (p. 198). However, in the Bakken the parcels are larger and Cody knows that the oil company may build 35-50 well pads on his land, so he is more likely to be concerned about isolating the activity to one area of land through the use of carefully written easements to define surface use (well pad and road construction areas) to protect the watershed near his home and cattle and leave contiguous tracts of land between his home and the Missouri River.

Cody talked about land men showing aerial photos of new installations to entice landowners into entering leases and easement contracts. He said many of the landholders around him now come from out of state and don't know this history of practice by the company.

Interactions with oil companies

Trackfinder documented how the oil company maintained access to his land under a term in the contract that allows such access while wells are still active and producing. Every morning, an oil worker pulled near his home to check the gauges on a pump jack, recording notes in a notebook. Suspicious, he checked. It turned out the well was not active and not producing. The books were doctored. The morning rounds were a charade, a fraudulent claim of the oil company to maintain access to his land for oil exploration and development purposes.

Cody also commented how he caught on oil rep in a lie, when they tried to throw

a well into a bigger spacing unit that had wells already drilled so they could claim that it was being produced and hold his lease."

Cody told me that, ultimately, the company that enticed him with the aerial photos of attractive new oil installations on the bank of the Missouri River, in an effort to make a deal with him, never completed their work on his land. He said "because of the slowdown and they don't want to pay us for damages and things like that".

Long-term planning

All of the participants spoke of the lack of foresight or long-term planning by government agencies and the oil companies. During the research, Cody described the link between the price of a barrel of oil and production and the clean-up of his land. One oil company backed away from cleanup claiming they could not make any money on the declining price of a barrel of oil. Cody responded to me "they should have been looking ahead to put some away for remediation." Cody is very attuned to the impacts induced by oil and that these costs to the environment are not factored into things. Trackfinder and Phoebe really felt as though the agencies charged with protecting their land and their rights had abandoned them and the costs of the impacts were placed upon them.

Externalization

Morris (2013) wrote about external costs or "externalities" (p.1) in a white paper when addressing pollution writ large caused by industry, "market transactions between a producer and a consumer may cause uncompensated impacts, good or bad, to other producers or consumers." Economists refer to these uncompensated impacts as "externalities." The impacts (and costs) are real, but "externalized" to other entities that are not a party to the original market transaction. A common example of this is the

pollution caused by production and/or disposal of materials. Pollution can result in a variety of costs to society, including but not limited to health impacts, disabilities, cognitive impairment, property damage, and reductions in the productivity of ecosystems. When these costs are not reflected in the market prices of goods (i.e., the cost of a gallon of oil), society as a whole is less well off. Production and consumption are higher than they would be if the market prices reflected these externalities.

Cycles in the business of oil

Cody calls on his experience negotiating with oil industry and the repeated cycles of enticement and abandonment, and he brings forth a tone inevitability in referring to those aerial photos of new oil installations on the banks of Lake Sakakawea,

> these are very new… but sooner or later you're going to have the same problems as things deteriorate. Or the oil starts to go down or the price goes down. Like it just recently has. Then you'll start to see how shoddy it'll look. We could probably go and look at these in another couple three years and they'll look a lot different.

The attitudes of the three participants parallel the results of earlier studies examining community perceptions of energy exploration and development (Wright & Muma, 2016). Their findings of the perception of increased economic benefits for the community, damage to infrastructure, especially roads, and negative changes in the quality of daily life were similar with what all three participants shared with me in Phase I and phase two of this study. Wright and Mumm found this also in studies of the exploration of the Barnett shale formation (Anderson and Theodori 2009; Wynveen 2011) and in studies of families living on the Marcellus shale formation (Schafft et al.

2013).

The participants—particularly Cody, given his father's close calls with death—mentioned concerns about health or environmental impacts as noted in other recent studies (Brasier et al. 2011; Ferrar et al. 2013) though Cody's tolerance of, if not positive attitude for, the oil industry on his land may be tied to his ability to lease mineral rights attached to his land, as was found in studies in Pennsylvania (Jacquet 2012; Kriesky et al. 2013) and Texas (Theodori 2012).

Cody and Trackfinder, most likely due to the level of activity on their land, had negative comments about large energy companies that had entered the community and leased mineral rights. In other studies, distrust of the oil and gas operators was mentioned frequently. Wright and Muma found that the intensity of concern for health and environmental impact, as well as mistrust of energy companies, increases with the duration of the oil boom. Cody spoke of a rolling series of oil booms since he was a young boy. It seems oil drew him away from agriculture before it did Trackfinder and Phoebe, and that may be simply a matter of blind luck in terms of where one lives on the oil reserves.

Complexity.

There is a lot of activity on his land to assess, conduct seismic testing, stake, drill and frack for oil and Cody is aware of every piece of this land and what stage is underway. In addition to the intricate steps in assessing the proposals of the oil companies and in leasing his land, he is constantly referring to a veritable patchwork quilt of landowners and agencies. The diagram in Figure 52, from a 2013 USGS report ,shows the many parties controlling land in the Bakken oil region of Montana, North Dakota and

South Dakota, but in the region of the study participants, the land is mostly private, with some state holdings.

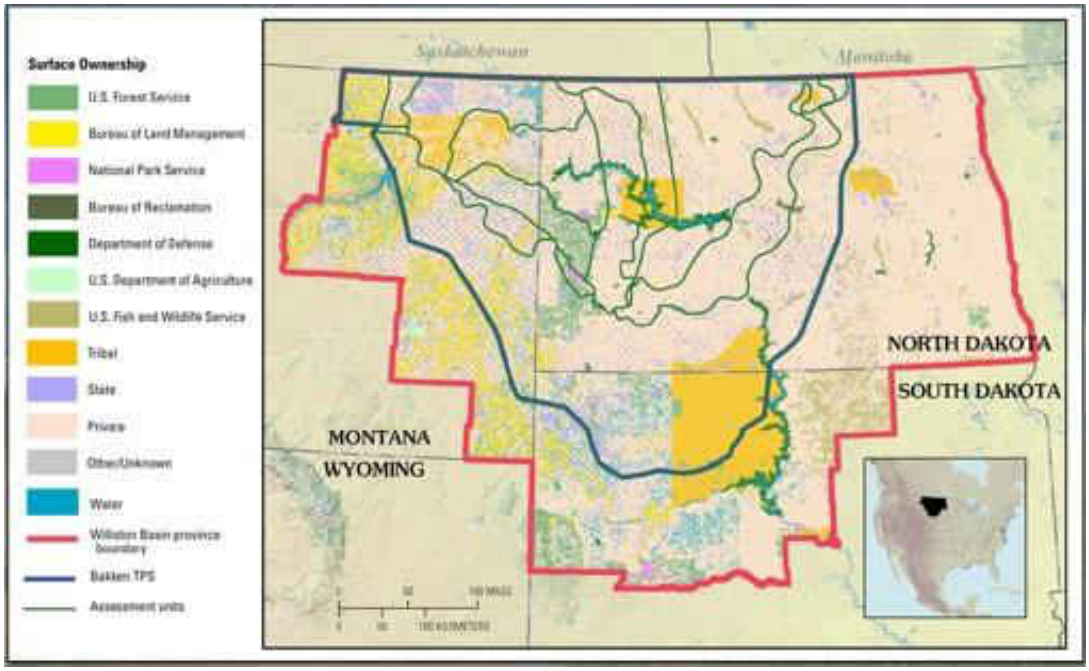


Figure 52. Bakken geologic formation outlined in blue. This illustration shows the multiple private and government landowners in the region (USGS, 2013).

There was an elephant in the room, or at least in my own mind, as I began this research, and that was resolving this conflict between the emergent and conflicting themes of development and preservation. The pressure on Cody and Trackfinder to develop their land is constant. Cody was able to quickly dispense with four reasons the oil companies seek access to the oil via his land. Paradoxically, these incentives for the oil industry have given Cody an opportunity to have a role in managing industry activities on and around his land. In leasing his land, takes an opportunity to balance short-term opportunity with long-term protection.

Cody said his position is weak on his land where he has only surface rights but no mineral rights. He said, "you can refuse them if you own the mineral rights… but if they

don't make a deal with the person, then they go to the state. The state will probably approve it…" By leasing, and preventing the oil companies a possible work-around via state agencies, Cody and Trackfinder have kept their voice in order to protect their land. They can set the terms and be confident which land will and won't be used. I was heartened when Cody told me this,

> I don't want to see them go in there and drill that. We run cattle on that for 20 some years so I know it real well. It's still one of the few places left here in western North Dakota that doesn't have a whole bunch of roads and oil wells in it…. I live here. I know that area. It was worth something to me. I guess you'd say, not monetarily but … keep a little bit of place where you can go out and those buttes there and not see an oil well or road.

I made a pedagogic decision in pairing the panoramic photo I made at Cody's request with his monologue description of the installations planned for that site. I did this because I believe it captures the simultaneity of this serene landscape and the intense pace or pressure of industrialization. I felt during this study of driving along rows of farmland and then seized by concentrations of truck activity around active drilling rigs and fracking operations. Bright lights and signs all around these sites, tapering off into the scattered natural gas flares that dot the landscape as far as the eye can see.

Loss of Darkness, Loss of Silence

Participants Cody and Phoebe both referred to the loss of darkness and silence with fracking. Berman (2013), who studied families living in the Marcellus shale region of Pennsylvania, found that "Like the traffic, the smells, noise, and light pollution from fracking do not stop at the property lines of those who hold or profit from gas leases.

Everyone experiences a diminished capacity to access peace and quiet, unbroken vistas, dark skies, unhurried country roads, and the sounds of nature.

Phoebe spoke to me of her great despair for the loss of darkness and quiet, and the fact she could no longer amble down the highway in her tractor at 15mph watching frogs jump out of her path and birds flying overhead. Jerolmack & Berman (2013) wrote of their work with residents of the Marcellus shale gas region of Pennsylvania,

> residents viewed the degradation of these previously taken-for-granted rural "goods" as a price worth paying for progress, but for others the loss was so disconcerting that their surrounds became alien to them and their attachment to place withered. So, while material spillover effects such as water contamination sometimes led to the physical displacement of residents from their homes, the despoiling of less tangible common-pool resources could prompt a psychological displacement (p. 203-204).

Ferrari (2014) found that residents of fracking communities most wanted "more information and protection from the environmental impacts they are concerned about" and "that the natural gas industry needs to be properly regulated by all levels of government, as well as in the communities where it is occurring. Participants feel that this is the best way to have their lives, communities, health and safety protected in the short and long term" (p. 148).

Discussion of the Interventions as they Answer the Research Questions

I started this dissertation with three basic questions in mind:

1. How can photographic images or photography-based interventions in educational research be used to elicit local storytelling and historical

narratives that contribute to our understanding of contemporary fracking communities?

2. How do participants use visual methods to define and articulate community values on environmentalism and sustainability?
3. How might these findings contribute to the conceptual development of curricula that is responsive to local/rural needs for environmental and industrial science education.

Before a discussion which serves to answer these important questions, I will make a distinction between the first and second question. In response to the first question, I will focus on the use of photography by the participants that was significantly guided or facilitated by me. This work may have included some discussion or brainstorming between the participant and me to ensure that areas in existing images were identified or analyzed. It may have involved some step-wise procedure. Clearly, these are photography-based methods in which I intervened or collaborated with the participant(s).

In this section, I respond to the research questions using representative images and interventions presented in phase two of the research. Just as participants chose the intervention by which they brought their images into phase two, I draw upon the lenses or frames of visual analysis presented in chapter three.

Research question one.

The first research question asks how photographic images or photography-based interventions in educational research be used to elicit local storytelling and historical narratives that contribute to our understanding of contemporary fracking communities?

The aerial photographs of Trackfinder.

Trackfinder chose to examine aerial photographs, and Phoebe chose repeat photography. I will share the experience and examine the images more closely in terms of content, technique and aesthetic interpretation. Through this work, Trackfinder and Phoebe clearly used their images as the interventions to tell stories and historical narratives of how the landscape has changed and described the arc of their relationships with the land.

Aerial images are helpful to the landowner's interpretation of farmland use as they show expansive areas in a discrete, simple, map-like format. The aerial images, such as the aerial photos provided to Trackfinder by the USDA or the oil company show a large number of features but also display patterns created. It's those patterns which give landowners added perspective on their lands, such as "vegetation, transport, settlement and relief" (Skwirk, 2014).

During phase two of the research, Trackfinder offered a series of aerial photographs, produced by either the State of North Dakota Oil and Gas Commission, USDA Farm Services Agency or by oil companies pertaining to leases he maintains or otherwise acquired. Trackfinder identified pipeline scars in three images, and the combination of two aerial photographs in color and black and white, respectively, of 3a and 3b will be discussed here. It should be noted that Trackfinder had visited the site previous to the research and was able to "ground truth" the site, which means he confirmed that the white line running diagonally from upper left to lower right (and outlined in black) in Figure 53 is not a road and pertains to a buried pipeline. That aerial photo maps are shown below.

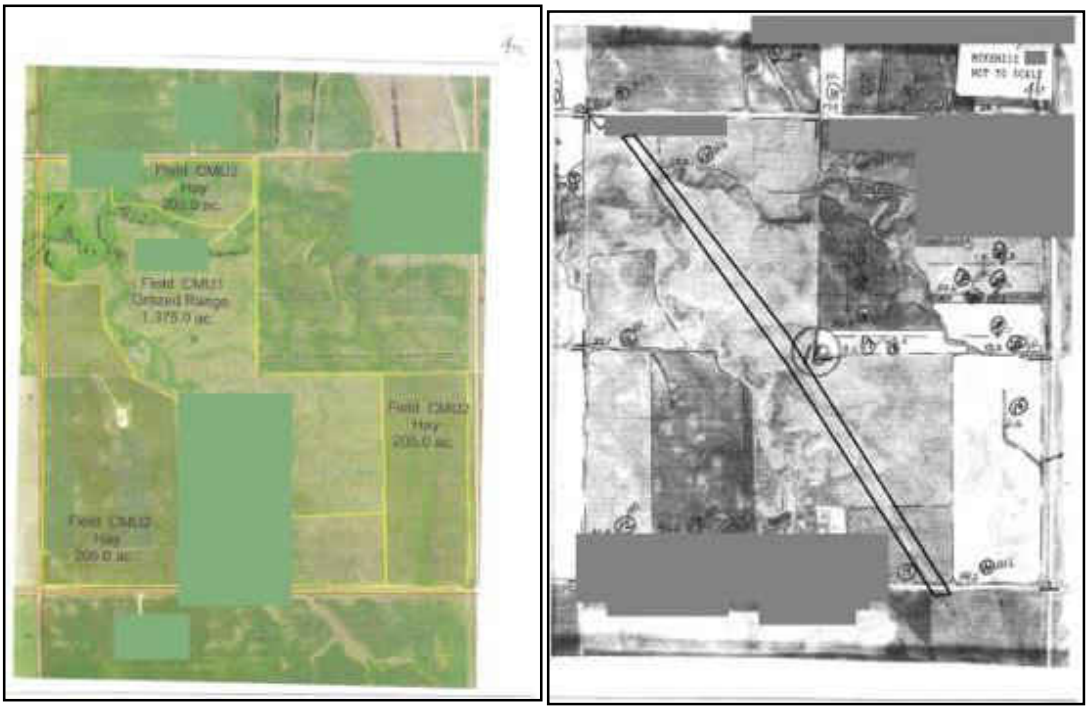


Figure 53. Aerial photo maps provided by Trackfinder. Color aerial was provided by the FSA; the black & white image provided by an oil company. The oil company image revealed an old pipeline to Trackfinder which he outlined in black.

Notice in these two images taken of the same area, that only the black and white image on the right shows the path of the pipeline (outlined in black). There are several factors that may explain the discrepancy, including methods that reveal ground disturbance associated with pipeline installation. These related with the nature of the ground, the depth of the pipeline burial, the nature of the material in the ground, the seasonality (hardness of ground, vegetative cover and moisture), and the direction of the light, which are explored in the discussion below.

Pipelines are a great concern to members of the farming and ranching community and a topic featured often in the conversations of Phase I of all three participants. Given

the intensity of well construction in the Bakken, there is a corresponding increase in the number of pipelines needed to transport oil between pumping sites and to storage facilities and rail transport hubs.

And this is not the first oil boom in North Dakota. A series of boom-bust cycles have left a myriad of pipelines underground. One of those, a six-inch line under a cornfield in Tioga, North Dakota ruptured in September 2013, spilling over 800,000 gallons of oil and resulting in the largest inland oil spills in U.S. history. Sensors purportedly installed to detect the sudden loss of internal pipeline pressure did not notify the pipeline operator and the leak was discovered by the farmer/owner. What I learned in speaking with the participants is that it's not the new, well- marked pipelines that worry them, but the old, unmapped and abandoned ones. Trackfinder has found pipeline paths from the '60s that are still visible to him in the images provided by USDA and Farm Services Agency and he has confirmed them on his land.

Bringing aerial photographs was helpful to Trackfinder, as was our teamwork in marking them up in Notability. Perhaps the research caused him to focus. The work in phase two helped Trackfinder both in thinking through the value of the aerial photos, with some metacognitive and brainstorming work. We made good use of Notability software for mark-up.

Trackfinder spoke to the value of these aerial photographs provided by the FSA when it comes to leasing his land for industry use, and he said,

> To know where in relationship the area that has been prior utilized is to what you want to utilize for allowing somebody to build or to put a pipeline or the oil location on. It is extremely beneficial to have an aerial view so that you may use

> that as your starting agreement on where you're going to allow someone to go--to allow a pipeline or a building to take place on your property. Prior to having a surveyor come in because this gives you the area that you're allowing that person to access. And as your first acknowledgement of use of the area for that.

I put this to Trackfinder, "Pretend you've never seen an aerial photograph like this before. What are things you're going to want to key into on this?"

> Well, you want to find the field or the road that's in close proximity to where you know there's a well or a pipeline… the map will give you the approximate size of the area disturbed and you will be able to measure it off on the scale to calculate the total disturbed area… With these areas marked up, you are able to locate on your map the proximity of these areas to the rest of your property. It would be very helpful to show at a hearing or in a meeting of what the disturbed area is…

Participant Cody emphasized the danger of pipelines when we were talking about tractors. He said there's always a danger of farm equipment falling into the sites of unmarked and unmapped pipelines. He said in wintertime he's using a tread on the tractor tires that are like 20 inches wide to manage the snow. They are pretty wide, and the ground is hard. In the spring they go to a narrower tire, and the ground is thawing. "A 10-inch pipeline," he said, "is buried in a ditch this wide," he gestures. "The tire's that wide, gesturing again. "Boom, into the hole," he said. It just drops in because the ground has been disturbed for years.

Trackfinder made use of aerial images in a way that's analogous with the field of photogeology that includes looking at scars on the ground. Trackfinder's use of aerial images also parallels the use of such images in in archeology, such as the search for

evidence of lost civilizations and for searching feature not visible at the ground level view, under the ground or which cannot be detected walking on the land.

This aerial work caused Trackfinder to think of himself as an educator as he eagerly suggested applications of the maps in our phase two work that orienting ranchers and farmers to their use. Aerial photographs are invaluable to the farmer in identifying landmark features and, as all of Trackfinder's neighbors possess them, he sees them as a bridge—even with neighbors with whom he may have formed a more conflictual relationship due to land issues—to offer them insights into the history of use on their land and an expanded tool in their farm management and negotiations with oil companies.

Rephotography at the historic 1912 homestead site with Phoebe.

Repeat photography or rephotography is the process of recreating pictures at the exact vantage point of the original image. This process brought me into great introspection as I envisioned how the original pictures were made and as I tried to find the exact place from which the original photo was taken. Phoebe and I are carrying the old photographs with us. Phoebe would like to join me in re/photography of the homestead and the old barn, and she has brought her camera as well. We are going to try to recreate the photograph of the image of the barn with the "wave of snow."

First, we move close to the barn. I'm thinking to myself about depth-of-field and getting those two pump jacks sharp in the background (Figure 54). After a couple photographs, we walked closer to the barn. Phoebe reached down and picked up a fallen plank, trying to match it to the space from which it may have fallen. That's sentimentality, I think to myself. I join her and help. We chatted about how this old barn may have slumped and fallen.

Figure 54. Historic barn on the homestead of Phoebe's father. According to Phoebe, the barn has collapsed from the winter snow load and dismantling by craft enthusiasts. Photograph © Bruce Farnsworth

I also made a photograph of another building in relatively good condition, with a close-up of the wooden planks and the No Trespassing sign in place (Figure 55). I redacted her name and phone number in Photoshop.

Figure 26. Close-up photograph of structure at historic homestead of Phoebe's grandfather. The no-trespassing sign was placed by Phoebe; her personal information is redacted. Photograph © Bruce Farnsworth.

She's made a couple photographs and returns to me as I open my tripod and take my camera out. Phoebe is holding the historic photo and helping me find the location from which the picture was made. "This is more this way, and this one is more straight on, but I can always, once you get those in, I can get that angle" is the conversation. We found the experience to given an entry into visualizing not only the photograph but we had images in our minds of the family that was once there, walking in the snow. The methodology was a door into history and we felt very alive in those moments of reconnecting at the point of rephotography.

Just the day before, Phoebe made a repeat photograph of the barn on her own (Figure 50), anticipating our visit. I asked her what are some of the thoughts you had

when you were making those pictures? She said, “I looked at all those historic pictures. These guys are young and now they're all dead. And the buildings they are in nice usable shape and now they're falling apart, kinda like the rest of this place.” Phoebe’s reference is akin to that of Memento mori! a reflection on mortality, the vanity of life and the temporal quality of what we have and do on earth.

“Is there anything about seeing that and the oil activity together?” I ask Phoebe.

"Depressing...it's part of the reason we hardly ever get out here anymore because it's become so depressing... and to see everything falling to ruin. And it used to be so quiet out here... We'd just come out here and hear birds and whatever and now you hear that” and she points to the two pump jacks beside her grandfather's homestead.

While we're looking at those pump jacks, I comment that they're not really moving that fast and ask if they move faster sometimes and make more noise. She says, "sometimes they'll have a squeal that takes them months to fix, and that's horrible... actually being normal sounding now.”

“Did they say how long they'll be there?”

She says "past our lifetime anyways...they say they'll going to be here for 40-50 years...they'll just keep drilling wells around here until they get everything, I suppose," with a mildly sarcastic tone.

I'm setting up to make a panoramic of the homestead. I'm talking with her about leveling the tripod as she is standing there. Thinking she's bored with me prepping photos, I tell her how I will shoot a series of verticals and stitch them together...if I don't use a wide-angle but a normal lens, it will stitch together very nice in Photoshop. I make two or three long panoramas of 180 to 360 degrees (Figure 56). I joke to her sister Carol

that she must have felt like I was chasing her because she had to keep moving as I kept rotating the camera for the next image in the series. There is evidence of oil activity in the panoramic, but it is most easily seen when viewing the image at high magnification.

Figure 28. A panoramic rephotograph of the historic homestead made by the researcher at the request of participant Phoebe. Photograph © Bruce Farnsworth

Rephotography of the barn.

Figure 57 shows the 1912 image of the barn surrounded by snow that Phoebe and I both attempted to re-photograph.

Figure 57. Circa 1912 image of the barn on the homestead of Phoebe's family. The photograph shows the historic barn in a snow drift adjacent to the main house.

In her attempt at rephotography (Figure 58), participant Phoebe takes a wide view to show the landscape, but places the barn in the center of the image. She has been an avid photographer in the past, and so I observed her. She made just two pictures that day. Phoebe told me that the photography-based activities were sad but also comforting for her, revisiting the areas but with a sense of purpose for a study that might help others to see the land in her framing, her perspective from both a photographic standpoint but also a historical and a philosophical one.

Figure 29. Participant Phoebe's repeat photography of the historic barn seen in the original 1912 photograph shown in Figure 57.

As I prepare to make my rephotography of the barn (Figure 59), I'm talking with Phoebe, trying to figure out the exact place from which the historic picture of the barn, when it still stood, was made. We take some closer looks at the scene of the barn with that shallow wave of snow in the foreground.

Figure 59. Researcher rephotography of the 1912 barn image shown in Figure 57, made at the request of participant Phoebe. In this scene, she stands at the location from which the historic photograph was made, holds the circa 1912 image of the barn as current pumpjacks and oil storage tank are seen behind the collapsing barn. Bakken region, North Dakota. Photograph © Bruce Farnsworth

Clarke's (2005) system of topics for analyzing visuals provides a framework for breaking down the technical and aesthetic decisions I made to create the repeat photograph of the barn on Phoebe's family homestead and including her in the scene.

I framed the image so that viewers would see the falling barn as well as the two pump jacks and oil storage cylinders in the picture. I framed it tightly to include the main elements of barn, oil infrastructure, landscape covered in the last patches of snow which give a wonderful sense of place, the colors of the landscape and the barn all to give a great sense of the rural. And there is the hand of Phoebe. The viewpoint is low and level

to the ground. I used a normal 50mm focal length as it approximates the human field of view, giving the image a certain comfort and accessibility that is communicated on a subconscious level via the familiarity this technical aspect contributes to the image. I purposely placed equal emphasis on the early photograph and the barn. Graphically, the two are reunited, in a sense, vis-a-vis their similar size relationship and careful placement of the early print, with a subtle rotation, such that the top edge of the print aligns with and continues into the line of the fallen roof of the barn. The viewer has a desire to look above the picture and there is found the two pump jacks and storage tanks evident of the industrialization of this place.

I was struck by the weathered hand of Phoebe and the classic corduroy of her jacket. The overcast lighting was a gift that allows the viewer to see the soft textures in the foreground and the warm palette of grass and wood all around. In my own photography, I am very much attracted to texture as a visual element in my scenes and, for me, the texture and detail in this scene is what imbues it with the same feeling of connectedness and adoration that Phoebe herself feels for nature and the rural landscape.

The image was also technical. I made the photograph with camera on tripod, allowing me to achieve use a small aperture in the lens that produced more depth of field, allowing me to record both the print in Phoebe's hand and the barn in good detail. Small apertures require longer exposures so I needed a tripod to prevent camera movement, but what about Phoebe's movement. For this, I braced one of my arms across the tripod, just below the scene, allowing her to rest her forearm on mine. This allowed her to keep her hand (and the print) motionless. This was critical to recording both the print and the details of her hand without having to resort to harsh strobe. I will go to great measures to

work with the beautiful softness of natural light.

The rephotography of the barn conducted by participant Phoebe and I serves to invite an exploration by the viewer and cause them to ask questions about the image. The work also provided a vehicle to get to know Phoebe better, especially her deep emotions of sadness. Her rephotography requires a revisitation to the family homestead which conjures up memories from the past. Thirdly, these images we made—linked to the early scenes—capture the enduring elements of the western North Dakota landscape. While these images pay tribute to the past, they also remind us that the oil industry now enters the frame of the participants' daily view.

As I prepared to make my image, I gave much thought to establishing the same point from which the original image was made. As for me, I continue to talk though my process. I had the tape recorder going as I made pictures as I was moving back and forth between Phoebe's responses to the homestead and my own rephotography. Here's what I said to myself as I tried to position the camera:

> I think it was taken low, that's why it looks tall. See that horizon there… the person might have even been sitting down on the ground because see how the sides stick up? She says, "yeah." I continue, "and where's this side? ...it's more oblique, like here, but wait a second, it's got the whole house in here, so it's taken...I think that shifted...could they have picked (the barn) up and moved it? I wonder if that was taken, could it have been taken... wide-angle here. Could that have been a window there? No, they wouldn't have taken it from/through a window

Both Phoebe and I, in our attempts at rephotography, found significant personal

responses, getting immersed and wanting more to investigate this place and how the people of this scene would have conducted themselves. Phoebe spoke reverently of the old homestead, yet the photographs she made and the panoramas she requested I make, left her with bittersweet memories each time. In the re/photography, seeing the old buildings juxtaposed against the pump jacks caused her sadness.

Repeat photography is frequently used to show changes over time in landscapes. Smith reminds us to consider the social bearing of such work:

> Yet repeat photography is more than an illustration of glacial recession, vegetation change, or the effect of cultural change on a landscape. Repeat photography can produce ethnographic knowledge; it is an embodied experience that allows the researcher to ask questions that can only be posed by identifying, as closely as possible, the original site, looking through the camera lens, and retaking a photograph. It is a multilayered and complex way to make the past present and to present the past, which, through this intricate relationship, allows us to investigate historical and contemporary social realities (p. 185)

The Rephotographic Survey Project of photographers Mark Klett and Joann Verburg, and historian Ellen Manchester (Klett, Verburg & Manchester, 1984) re-created western expeditions and relocated the camera positions of late nineteenth century survey photographs and rephotographed over 120 of them. Besaw, 205 (p.32) wrote that "in the process, the team became intimately familiar with the challenges and visual choices that faced the nineteenth-century photographers. The resulting photographic pairs of before-and-after images created a dialogue between past and present" just as Phoebe and I experienced in our side-by-side participant-and-researcher repeat photography at her

family's original homestead site.

Participants Phoebe and Cody both have the simultaneous responses of romanticism and sadness—nostalgia—in revisiting sites during phase two. Making images reminded Phoebe of "how fit and active they were" and she set that against the "slumped and falling barn."

Research question two.

The second research question asks how participants use visual methods to define and articulate community values on environmentalism and sustainability?

The participants used several visual methods to define and articulate community values on environmentalism and sustainability. In particular, I discuss the five images that participant Phoebe made of oil industry impacts as entries to a local tourism photography contest. The images will be examined closely in terms of content, technique and aesthetic qualities. Phoebe's images, which can be considered documentary work, engage for her also with therapeutic values of satire and catharsis.

Phoebe's tourism photo contest entries. Photographs can expose problems and get people to care. For this series, Phoebe gathered a set of images she had made within 5-10 miles of her home between 2010 to 2015. Figure 60 presents the five images as one. She told me, "I actually wanted to do [the tourism photo contest] with real pictures, but after what we'd seen in this part of the state… they always had promotional pieces going and they had the categories that seemed to fit…" The series is part documentarian. It is part eulogy. It is part political satire.

Figure 60. Contest Entries. Five photographic that participant Phoebe submitted to regional tourism photo contest featuring her photography of fracking-related contamination near her home.

While the events that yielded these images were not scheduled, the impacts and the conditions in which they occur, are predictable and sometimes replicable because they continue today. Phoebe's assembly of a photo essay that unifies the images under

the theme of tourism is both cohesive photo essay and political satire. The images align with the themes that emerged with Phoebe in Phase I of the research which motivate her and inform her decisions.

The composition, messaging and impact of these images is examined here in response to the second research question of how she used visual methods to define and articulate community values on environmentalism and sustainability. As a photographer, I strive for the purposeful and expressive, more so than the mechanics of the camera, the latter of which Phoebe gave little thought.

Phoebe's image, though ugly, is motivated by nature. Phoebe is not concerned with the objective components of aperture and depth of field, shutter speed or ISO. Her work is rich with the subjective, an eye that understands nature, how it was, but now seeks out the stark contrasts and dichotomies in this industrialized rural place, where elements of quietude and pure color in nature are found further from the road each day and colored by dark gray palettes of soot, sand and smoke.

Her images show a holding-on in a fractured landscape. They express the sadness of the marginalized farmer. She is political and photography is her activism. If she is articulating community values on environmentalism and sustainability in these pictures, she is showing us her values of preservation and the invading values of exploitation and ignorance. The pictures have a voice that's available anytime they are viewed. Between the loss of darkness and silence, these pictures scream to be heard. They are a testament to her resilience.

The oiled duck. Contest category: wildlife.

She found the duck (Figure 61) one night as it walked onto her lawn, likely the

victim of flying or falling into an oil storage pond near her home. It died, likely of ingesting oil in its attempt to preen its feather or hypothermia, having used its energy reserves to arrive at her yard on that cold night. It looks to be a female Northern Shoveler (Spatula clypeata), a bird which has its breeding distribution throughout the northern U.S. plains states (https://www.allaboutbirds.org/guide/Northern_Shoveler/overview).

Compositionally, she placed the oiled bird onto the center of a plastic bag, unavoidable to the viewer's eye. You can't look away, but its situation is all Bakken. The view straight down is just how the oil industry dominated it. The green grass is an illusion of a better habitat perhaps. The use of flash to make the picture was necessary as it was dark, but the harshness of the light captures the reflectivity of the wet and oiled carcass. The white bag glows white perhaps calling on afterlife connotations among some viewers and enhancing the impact of the duck's death photo. The work of the image is to remind you both farmer and fowl are not understood here.

Figure 31. Photograph of a dead duck. Participant Phoebe made this image of a female Northern Shoveler duck that died from hypothermia as a result of oil contamination at an oil waste pit near her home. The duck walked to her back doorstep and died as she attempted to clean it.

Though she is untrained in photography, Phoebe's work is in keeping with the best traditions of photojournalism and today's conservation photography (Farnsworth, 2011). Her documentary image of the oiled duck, a bird that died without its feathers, rivals Brent Stirton's dramatic photograph of a de-horned Black Rhino titled "Memorial to a Species," an image for which he was awarded BBC Wildlife Photographer of the Year (Stirton, 2017). The image is every bit as heart-stopping as the epic prize-winning World Press Photo Awards-winning image Stirton made of Congolese park rangers carrying the carcass of a beloved male silverback gorilla out of the forest in Democratic Republic of the Congo after it was killed by rebel fighters. (http://www.brentstirton.com/photojournalism/uf0abznsb263pfcyxev0903phznxlh).http://www.brentstirton.com/photojournalism/uf0abznsb263pfcyxev0903phznxlh

Phoebe knows birds, and she has detected in her own informal way—from regular walks to the wetland, knowing their vocalizations—that they are not as ubiquitous as before. She keeps them close, though, in a handwritten journal and a bird list. She manages her land to ensure the wildlife have habitat, that the wood ducks have nesting boxes. She shares in the sacrifice of wildlife impacted, giving up acreage and yield to create habitat for them.

A study by Bromley (1985) on the impact of oil and gas activity on wildland environments reminded me that the impacts affect both human and non- humans who are not habituated to the high levels of noise and other effects:

> The rapid rate of resource development dictates that resource managers become familiar with the potential problems inherent in energy development and begin to implement guidelines to minimize adverse effects on the wildland environment

(Burger and Swensen 1977). One of the major problems associated with energy development concerns the potential effect of petroleum development activities on wildlife, especially those species dependent on a wildland environment. Construction of roads, drilling pads, and pipelines, the influx of people and machinery, and the development of construction summer and boom towns are but a few of the activities that create disruptions potentially threatening to wildlife not habituated to high levels, or the presence, of human activities.

The oiled duck was most likely contaminated in a reserve pit near the home of Phoebe, when it landed in an oil reserve pond or field waste pit. Phoebe described the event in our original interviews, saying "the ducks would land in these open pits because they look like big open areas of water." The illusion is supported by research. The U.S. Fish and Wildlife Service describes the lethality of such facilities which appears to wildlife as natural ponds (Ramirez, 2018; Stephenson, 1997). Ramirez wrote,

> Oil present in reserve pit fluids can trap and kill migratory birds and other wildlife… Bird and other wildlife mortality in reserve pits has been documented by the Service…The presence of visible sheens on wastewater ponds are just as deadly to birds that come in contact with them. A light sheen will coat the bird's feathers with a thin film of oil. Although a sheen of oil on the bird may not immediately immobilize the bird, it will compromise the feathers' ability to insulate the bird. Furthermore, the affected bird will ingest the oil when it preens its feathers and suffer chronic effects. The bird could suffer mortality depending on the severity of the chronic effects and the amount of oil ingested (p. 54-)

Stephenson (1997) expanded on the hazards to birds in proximity to oil waste

ponds and standing oil:

> Oil can be carried to nests, as well, killing offspring. If fracking wastewater, or any other chemicals such as corrosion inhibitors and surfactants, are placed into waste ponds, this can also pose a serious health risk to the birds, wrecking their feathers or exhausting the birds and thus posing hypothermia dangers (p. 121).

Phoebe's photos show her frustration with wildlife impacted by infrastructure (oil storage ponds) and operations (traffic, road building, dust, drainage impacts) she has little control over. Phoebe spoke much about how the transformation caused by the influx of oil industry activities and wishing "things could be the way it used to be."

Oil industry-induced impacts have taken a toll on a range of wildlife. All three participants have commented that fewer deer are seen; ostensibly they are avoiding roads, but there are vehicle collisions (see Figure X). The impact of oil and gas development on ungulate (hoofed mammals like deer and elk) distribution, habitat use, and behavior is documented (Hebblewhite 2008, Riley et al. 2012). Pronghorn antelope (Antilocapra americana) abundance in North Dakota was negatively impacted by increases in road and oil well density (Christie et al., 2015). Mule deer (Odocoileus hemionus) and elk (Cervus elaphus) have been documented shifting habitat use to areas away from energy development (Powell 2003, Sawyer et al. 2006). The increase in roads, and fragmentation of habitat that induces, can greatly increase the risk of death of white-tailed deer in heavily trafficked areas (Stewart et al. 2011). Figure 62 is my photograph of a dead deer photographed on that same Highway 23 in the Bakken region that Phoebe made one of her contest entries. In the image, the traffic is obvious.

Figure 32. White-tailed deer killed by vehicle strike. This deer was found on Hwy 23 in the study are during this research. Note the heavy truck traffic. Near Williston, North Dakota. Photograph © Bruce Farnsworth

Phoebe's photographs are very textural, with gritty blue haze and muddy, smudged out roadsides. There is black smoke and eroded landscapes with fracking water storage containers. Her pictures are the antithesis of the tourist image described by Kelsey (2002).

While her five images might seem only an episode of photographic political satire, they extend the stereotypical and sickly scenes of environmental devastation. The roadside image of truck tracks in the mud and what may be the stain of a rogue spilling of fracking wastewater she said, has the sickly colors of other scenes in recent history. Her

image of the wastewater spill at road side is shades of dirt, but with a sickly unfamiliar coloring, as if only possible with this paint is formulated with a mysterious mix of unknown chemicals. The mysterious blue-brown haze as she drives behind an oil services truck on the road to her home is frustrating.

Phoebe submitted her images to the tourism contest, and the response was that some situations have been unfortunate, but that that "oil development can also be positioned as an attraction like other energy production facilities such as major gas plant and dam, mines and other installations." Her satirical images were an idea of her own, though this general strategy has a long history in art.

With the decline of print journalism due to advertising following target online mechanisms (Google and Facebook ads) and the ubiquitous nature of digital images today, outlets have turned to more user-submitted content (Kaiser, 2012). This has promoted a rise in citizen journalism. Courtney C. Radsch (2013) defines citizen journalism as:

> an alternative and activist form of news gathering and reporting that functions outside mainstream media institutions, often as a response to shortcomings in the professional journalistic field, that uses similar journalistic practices but is driven by different objectives and ideals and relies on alternative sources of legitimacy than traditional or mainstream journalism. (p. 159).

Phoebe knew was the outset that her attempts to enter her images in the tourism photo contest, and ostensibly see them published among a cadre of contest winners, were futile from the onset. Phoebe chose images that were both cathartic and documentary in nature for her. She used tragic and ironic humor in her tourism series, conveying labels

of beauty to images of death, destruction and despair. Perhaps this is a coping strategy. Each of the images is simple in its composition, yet detached, mysterious and elusive. In the scene of the hazy sky, there is just a wash of color and a veil of atmosphere. The duck is placed at center so it is not avoided. The picture stays like the residue of crude oil. The hapless bird flew into a pool of dirty waste oil. There is no going around it. The viewer must confront this. The bird is shiny in the reflection of the camera's flash, even more brilliant in its depiction of how man is impacting nature on the Bakken. When Phoebe saw my images, the panorama of the homestead, the pictures of the slumping barn, and the scene of her holding the historic image, she wrote[?] "I just had a chance to look over the photos. Amazing is too mild and too overused, so I won't use that word. They are superbly sad. Thank you for all of them."

Most of Cody's and Phoebe's images explored several channels of toxicity (air pollution and release of poisonous H_2S via flaring, spills of oil and wastewater), economic impacts, loss of autonomy, privacy and livelihood, and aesthetic changes in the environment (loss of darkness and quiet). Their emphasis on impacts, paralleled his concerns for out-migration of generational families and increasingly fixed changes to the social landscape of the rural farm country. Just as Bennet and Dearden (2013) found "the impacts of environmental or ecological change can also be felt in the social sphere of the community's life and vice-versa," so too Cody found that landowners in his community were selling off their land once the children left the nest so that they could leave the intensity of the oil development in the region and retire in a more peaceful setting. And, just as these authors found that "social changers were seen to have environmental implications", Cody found that, with the out-flux of established families, there were

fewer homesteader families determined to negotiate firmly with the oil companies to ensure lands were protected for future generations.

Research Question 3

The final research question of this study is to determine how these findings might contribute to the conceptual development of curricula that is responsive to local/rural needs for environmental and industrial science education?

The photographs offered by the participants can assist curriculum—both for informal community learning as well as formal learning in education institutions—in many ways, by showing impacts, changes over time, before/after sets and otherwise invoking as much an aesthetic response as well as a biological or technical response to the issues that may be the basis for the development of teaching strategies, lessons, field seminars and curriculum.

Farmers and ranchers, as a cultural group living and leasing on the Bakken oilfields, have attained great literacy in the areas of land management, oil policy, oilfield rules, construction and remediation, contracts and law. But this knowledge has been hard won. It has been gained from decades of experience. Now, they want to share what they know. Cody's education prepared him well for certain aspects of managing the mineral rights of his property, but in other ways he was unprepared. These findings reveal both the complexity and the intensity of oil field development and pressures on the landowners. In addition to the most visible impacts, there are a myriad of lesser known ones; they may be indirect or induced by oil and gas development in the region.

These findings make it very clear that there is great need for curricula that is responsive to local/rural needs for environmental and industrial science education, and

the textual and photographic findings of this study may potentially contribute to its development. Participants' answers regarding their educational backgrounds, the extent of oil and gas industry-related expertise and literacy they had achieved, and their suggestions on what learning is needed by their counterparts in agricultural communities all forms the basis for answering this question.

In my conversations with Cody, and all the study participants, I noticed an incongruence between their high school education—namely their science education—and the demands placed on them in today's oil boom and the new knowledge that would seem to require. During phase one interviews, all three participants stated they didn't get the knowledge or skillsets needed to deal more effectively with the oil and gas industry.

Hotaling (2013) commented that in society, the obligations to ensure that the less fortunate members of society are protected from decreased quality of life from fracking are acknowledged in environmental laws and policies. We must urge regulatory agencies to take responsibility and also accept help from reliable non-governmental organizations so that human rights can be protected.

After high school, Trackfinder attended one year of college. I asked him what he studied in high school and college that he later realized was useful in handling oil related matters. I asked him to think about English and legal matters…

> The meaning of what they're getting across is a perception of what they want you to believe. It doesn't necessarily mean it's the legal, the legal way that the rights are going to be granted to the people.

Trackfinder also expressed how important an understanding of psychology is to the farmer or rancher in communication with the oil companies. Trackfinder said, "There

are so many avenues, environmental, mathematical. And there's also the psychological effects, the psychological implications of their dealings with the people. And a lot of people don't see it. ,I do," He expanded on the importance of understanding psychology,

> The psychology of the oil leasers… they make the people believe that, unless you sign the paperwork they put in front of you, you're not gonna get paid or they'll never have to pay you, and they still have right to come on your property anytime to do whatever they feel like doing because they have a lease, and the lease grants them exclusive right to your property….and, now there's a number of organizations, especially the farmer's union, that's now taking a stance … they see that the rights should belong to the land owner, because the land owner is the… the steward of the land, and how can you take the stewardship away from the person who's paying and overseeing the land? … It's the way the industry tries to present that they can just do whatever they wanna do, they give you a couple days' notice, and they wanna put a location on your land, they can because they have the lease for the mineral rights, and the mineral rights, they claim, takes precedence over the surface rights. And… I don't believe that is correct. … And when you look at the law for North Dakota, when you pay your taxes for three years, you have exclusive rights to everything. Your minerals, too.

As farmers who grew up on their land, they were prepared well for certain aspects of managing industry activity on their property, but in other ways they were unprepared. Cody graduated from North Dakota State University in Fargo with a degree in agricultural science and a minor in animal science. Among the coursework was agricultural business and ag law, business. as well as his pre-vet courses in livestock

management. Reflecting on his interaction with the oil industry today, he finds certain courses most relevant. He believes that the agronomy classes are important in terms of understanding the effects of fracking wastewater (aka saltwater) on the soil. He also mentioned soil science and agronomy as he learned how crops grow—and which crops and weeds grow in different types of soils.

When I asked Phoebe, what are the activities associated with oil and gas operations or hydraulic fracturing that you would have liked to learn about earlier, she replied, "everything from the building of the site to becoming a producing well and beyond." I asked her to describe any environmental or science education that is needed in her community, and she indicated a concern for bias in the delivery of such material, said she thinks "there should be more education on what is being put into our environment and the problems or consequences associated with these actions."

I asked Phoebe if there are any other topics that might be useful for young people to learn about or may be included in high school curriculum so that these youths are more informed about the oil and gas industry, and she said,

> I think you could probably have geology, a little better understanding of some of the things they say that they are doing. I suppose chemistry, but I never did take that so. You get into the chemical compounds and everything. Also, probably some sort of water classes. I don't know if they have ecology classes 'round here much but that would probably be helpful…

I wanted to know who should be the target audience for such education. She believes it should be for "everyone," from teachers, students, landowners and mineral owners to oil workers.

Cody said the university needs a class to "help people in this part of the state to deal with oil industry and the legal aspects of it, the negotiation aspects. That's something that wasn't really offered or really nobody thought about …when I was going to school." He said he had some agricultural law, but "they weren't really geared toward oil and gas, of course, they were more environmental."

All of the participants were the youngest siblings when they were called upon to run the farm. Given the nature of farming, which is hard work and can lead to injuries, such oil and gas curriculum may need to be delivered as early as middle school. Trackfinder reflected in phase one on his own personal experience that, when teenagers assume a management role on the farm, as he did in seventh grade, their school attendance may decline, which indicates that curriculum should be prepared in kits that can be taken to the farm or ranch. Cody recounted how he was called upon to manage the family farm in 7th grade, when his father fell ill. Trackfinder had to step in at 7th grade because his father was injured. Phoebe also managed the farm as the youngest sibling.

Through their many years exposed to the oil industry, the participants have learned both the pros and the cons. They realized that the industry can facilitate new income and, at the same time, curtail traditions and limit livelihood. Certainly, the pressure to drill on private land is higher when the price of a barrel is good, such as now. What these ranchers/farmers-turned-industry insiders can teach is valuable.

Early on in my conversations with Cody, he mentioned that other farmers, members of his local community, have sold their land without any real knowledge of the component mineral rights and legal language. He said that training in the legal and land

planning aspects of the industry are also needed. For the landowner making his or her first contact with a prospective lease, the work can be daunting. McCarthy (2012), in a study on the Marcellus shale formation of Pennsylvania, found that landowners would be better prepared to address the leasing process if more information sessions were held across fracking-intensive areas. While there is no substitute for a professional lawyer familiar with oil field rules when overlooking a lease agreement, then any resources that can be gathered—such as those collected by McCarthy—may be a valuable resource. Photographs in the hands of landowners can be very effective communication tools. Berman of Jerolmack and Berman (2013) is an active documentary photographer and the images in their study persist in exhibits and local community settings.

Reflections on the Photographic Interventions

Reflecting on how the photography-based interventions in this research were used to elicit local storytelling and historical narratives that contributed to our understanding of fracking communities, they did this first by giving agency and voice to the participants. They are documentary in nature and testament to impacts of oil and gas exploration, but their use in this study is not to be interpreted as an argument against fracking per se. These images are not to be dismissed as research-based propaganda with an agenda to disparage the oil and gas industry.

The photographs shared by the participants were not laid out in a systematic fashion—either geographically or temporally—adequate to prosecute any industry operation. Rather, the photographs show a range of experiences. In fact, Cody speaks of good relations and valuable income in collaborations with the oil industry. This is qualitative social research, not an editorial piece. As such, the over-arching goal is to

record the lived experience of the participants in their own words—and images.

Congruent with the notions above, some critics of this research (or its subject matter) may suggest that the participants should not speak about images and criticizing the industry in the same breath. Many of the images shared by the participants in phase two of the work were taken by an uncle or were taken years ago in another generation. As such, others may contend that the images don't reflect the participants actual or true experience; that revisiting a homestead 100 years later has no bearing in the reporting and doesn't accurately portray the performance of the oil companies or indicate their actual compliance today. Cody may have answered this insinuation best when he said, without prompting from me, as he gathered images for phase two work and told me,

> I'm sure I've got newer pictures… I just don't take that many anymore because why? You're so used to it. You did it over the years and years and years. You just don't do it anymore because you know what they look like.

There is no attempt at sensationalism here and the authorship or the date of the images is not essential either. The most important aspect of the photographs is that they were meaningful to the participants and chosen by them.

The photographic interventions helped the participants to tell their stories, giving them an audience to share their concerns. The photography-based interventions helped to elicit local stories and historical narratives in several ways. The participants felt I was truly interested in them by allowing them to choose the images, the intervention and the narrative. This approach, giving agency to the participants, was key in this study of a marginalized community, where ideas of oppression and loss of agency were prominent.

I believe that the images shared by the participants enhanced their access to, and

participation in, this investigation and that their interpretations of the images have increased the richness of this work by supplementing the text-based interviews with visuals chosen by them. The interventions engaged the participants and elicit deeply personal and authentic narratives. All of the participants responded by reflecting and selecting images in the interventions that took us back in time, sometimes establishing start points, timelines and references to the historical sweep of generations of involvement and their lived experience with the oil and gas industry in western North Dakota.

Implications

I assert that high school science education is needed in contracting, negotiating and psychology, with a comprehensive overview of the environmental impacts, and training in land monitoring. According to a U.S. Geological Society fact sheet (USGS, 2013), from 2008 to 2013, approximately 450 million barrels of oil have been produced from the Bakken and Three Forks formations in the U.S. which only represent some 6% of the USGS estimate. The advance of harvesting techniques included the recent construction of the controversial "Dakota Access Pipeline" which circumvented the transportation bottleneck of train transport. Therefore, there is still an enormous amount of oil can be produced from the Bakken and Three Fork formations and the demands on the farming and ranching community of western North Dakota and, similarly, all rural fracking communities, continues—and may for decades to come. Thus, continuing community and landowner education will remain a critical component of maintaining social, financial, and environmental stability and sustainability.

Industrial science education must improve in fracking communities

Many high schools in the U.S. have updated science instruction to reflect the digital age and careers in digital and information technology. Classes in technical and architectural drawing (including CAD) are available at some high schools as drawing is the language of engineering. Some programs allow students to make models, even with 3D printers. Schools have introduced content in coding, with students creating maze-based games and programming Lego robots and 3D printers.

The money's available for curriculum and some oil money in North Dakota has trickled over to schools. In Watford City, the hub of oil development for bustling McKenzie county, North Dakota, a new $54 million high school was built, complete with a $20,000 truck driving simulator funded by oil company donations (Brady, 2018). A truck simulator will help feed the demand for truck drivers to carry wastewater, but it does not reflect the lived experience of the participants and my findings on needed education. I recommend that high schools teach…

The curriculum has not changed substantially across the three boom-bust cycles in North Dakota. Trackfinder also told me his 7th grade history book was removed from his classroom because of its treatment on the topic of oil development. This suggests that it was frowned upon to criticize the status quo or the industry that is bringing money. Trackfinder went so far as to suggest that,

> maybe we should've had more early education into that… but then again, we give that to the industry and the state and they don't wanna—they don't want the average person to be able to get into that kind of a field of understanding because it's harder to take advantage of people that are educated.

At the secondary level, Project Lead the Way provides curriculum that allows students to obtain pre-engineering education as early as 9th grade (Project Lead the Way, 2019). Courses include Introduction to Engineering Design, Principles of Engineering, Civil Engineering and Architecture and Environmental Sustainability (shown below) but there is still a need for course content accessible to high school in impacts, remediation, mitigation.

> Environmental Sustainability (1 year) In Environmental Sustainability, students investigate and design solutions in response to real-world challenges related to clean and abundant drinking water, food supply issues, and renewable energy. Applying their knowledge through hands-on activities and simulations, students research and design potential solutions to these true-to-life challenges (p.).

In Washington state, education for sustainability is mandatory and required by law (Wheeler, 2012). Instruction in conservation, natural resources, and the environment shall be provided at all grade levels in an interdisciplinary manner via science, social studies, humanities, and other appropriate areas "with an emphasis on solving the problems of human adaptation to the environment."

Phoebe had thoughts on how such curriculum should be delivered:

> I think there should be more education on what is being put into our environment and the problems or consequences associated with these actions. This should not be education presented by or sponsored by oil companies or the Petroleum Council… I know the Petroleum Council, this past summer, they were taking teachers from across the state on tours through the oil patch and they would, you know, give them classes ahead of time and then take them on the tour and show

them what they wanted to show them. I just felt like nobody else is having a say and they were turning them towards how they wanted it to appear.

There is a shortage of qualified engineers in technology and industry in the United States willing to work in rural areas, and ideally, there could be more recruiting from rural and farm areas living with fracking so that these individuals become engineers who understand the farm/ranch livelihood and importance of water, soil, area and wildlife as a shared resource and heritage. However, I suspect the lack of rural responsiveness in engineers may be more an artifact of the profit motive of industry and the lack of state agency enforcement on existing zoning codes and regulations.

Brookfield (2017, 58) described the value of Freirean thought in designing curriculum for rural fracking communities whose members' values and experiences are likely to be similar of the concerns of the participants in study.

Within the context of preservation, Cody referred much to heritage value and maintaining his father's values for the land, however there may be more to the generational concept at play here. Cody related that some of the early landowners have moved away, coming back just to lease oil company rights to their land in a way that does not protect open space long-term. Might those families still ranching and farming and/or raising children in this livelihood, like Cody, have a greater sense of obligation to the land. Cody wants to see the land protected for his children—and by his children—if they continue as the next generation of agriculture on his land. Jerolmack and Berman (2016) may have presented an alternative analysis to the same dynamic. They wrote,

> The advent of fracking has forced the inherent tension between these self- and group-oriented proclivities to bubble to the surface in rural Pennsylvania. The

> tradition in many of these locales is to "live and let live" and resolve any disputes that arise through "informal norms of neighborliness" rather than through appeals to legal entitlements (Ellickson 1991: viii). However, the spillover effects of individuals' choice to lease their land (the "live" in "live and let live") can affect their neighbors' and communities' quality of life to such a degree that it contravenes the folkway of letting others live. As a result, both communalism and individual autonomy / property rights can be infringed by personal land-use decisions.

The ranchers and farmers should be part of such curricula. O'Neill (2012) drew from personal experience as a native Wyoming resident watching natural gas fracking transform his home and insights honed from the discourse highlighted by the documentary *Gasland* and, so, he created a curriculum unit for students.

Any curriculum must be woven with strands of social and environmental justice. The participants spoke of being ignored and abandonment. The state has not enforced regulations and fines for health and safety and landowners are left without a voice on regional and broad landscape decisions and regulations.

Just as the participants' interactions and experiences with the oil and gas industry are diverse—particularly in their personal dealings with the agents of hydraulic fracturing—the curriculum that may develop should not only include an introduction to responsive engineering principles and practices, but also social justice education around fracking that addresses the marginalization of rural farming communities. Education framed in social justice may prepare rural youth in fracking communities for inequalities in wealth, power, agency and voice. This is an area where visual and documentary work

prevails. The participants spoke of a range of impacts that affected them personally--physically, emotionally and spiritually. Dust and gravel dumped on cropland, traffic dangers, death of wildlife, degradation of land, water and air quality: these are just a few of the impacts brought forth in this study of three cases. The participants spoke of not being invited into planning discussions, with no access to rail lines or grain silos to move their crops to market. They live with the fear of tractors falling in abandoned pipeline ditches and having their farm machinery damaged by buried oilfield debris. The participants lamented the loss of quiet, the loss of darkness and the loss of the rural. Greenwood and Smith (2008a, xiv) commented that,

> the process of formal education in schools and universities [in the US] is typically isolated from the reality of community life and neglected in the drive to meet content area standards in the classroom. from the immediate context of community life . . . overlooked in the push for each student to meet prescribed content area standards through decontextualized classroom instruction.

Ideally, using simulations, role-playing or scenario-based instruction, even the incorporation of actual photographs taken by ranchers and farmers, such a curriculum would bring the lived experiences of the landowners to bear on this curriculum—just as it is an expectation in this research— where youth may be asked to consider how the transformation of communities like their own—from farming to industrial—impact their friends, families and neighbors in environmental, economic and psychological terms. These farmers and ranchers are hosts to the oil and gas industry and, while willing, the participants have not been fully informed of the process. As such, they should not be

subjected to practices which affect their ability to farm and ranch. The photographic interventions can be supportive.

Such a curriculum should include elements of critical media literacy, whereby the images made by the landowners are juxtaposed with images in the popular media or those presented by the oil company landmen, the latter of which are images which may tend to avoid or minimize the actual impacts or experiences of the residents for whom the media outlets portend to report. Kellner and Share (2007) wrote:

> Critical media literacy expands the notion of literacy to include different forms of mass communication and popular culture as well as deepens the potential of education to critically analyze relationships between media and audiences, information and power. It involves cultivating skills in analyzing media codes and conventions, abilities to criticize stereotypes, dominant values, and ideologies, and competencies to interpret the multiple meanings and messages generated by media texts. Media literacy helps people to discriminate and evaluate media content, to critically dissect media forms, to investigate media effects and uses, to use media intelligently, and to construct alternative media (p. 4).

Impact of the findings on future research design

One of my contributions to qualitative research design are the use of these interventions as a responsive use of photography-based research methods in rural fracking communities. I set out with a two-phase protocol in which I anticipated distilling themes from Phase I interviews and presenting those to the participants to guide their selection of images. I let the participants choose the images and the intervention method in phase two. All of the research participants chose the prints they wanted to share,

sequenced them and placed them into groups as they saw fit. As the participants laid out photographs for me to view in their homes, they spoke contemporaneously about them, drawing from memory and sometimes handwritten captions written on the reverse. Beyond my general queries into their lived experience in Phase I, I did not suggest topics or impose any guidelines or criteria upon the participants for the pictures they might share in phase two of the research. Their knowledge overlaid on the images help to bring gaps in agricultural knowledge between the researcher and participants. In the end, the work of the photography served as artifacts to prompt memory and conversation, but they also provided opportunities to actively construct new meanings through the curation or creation of images.

All of the participants in this study are rather quiet individuals who don't normally seek the limelight. In fact, Phoebe stated explicitly that her decision to participate was based on the fact that she felt the work was important and that she would receive a pseudonym.

In western North Dakota, the press is quiet, too, but for various reasons. Speaking poorly of the oil industry vis-a-vis impacts, by local residents, is approached delicately and some prospective participants declined to participate for this reason. I detected this reluctance in conversations on my early reconnaissance trips and it is seen in newspaper and magazine articles in which local residents are questioned by the reporter about their opinions regarding the impacts of oil development or the demands placed on state budgets and infrastructure. The use of such phrases as "mixed feelings" (Brady, 2018) and other such terms of ambivalence are commonly seen. One of my participants made the claim—unverified by me--that the oil company purchased local newspapers.

Most of the long-hand reporting on social and educational aspects of fracking comes from visiting reporters of major out-of-state newspapers like the New York Times or the Washington Post, or from the contributions of local freelancers submitting articles into online blogs and wire feeds such as Inside Energy.org, InsideClimateChange.org and npr.org.

Perhaps my research, while not placed directly into circulation as print journalism would be, may become a form of public education for those who would upgrade the education to students in North Dakota and communities affected by oil and gas development. I hope the rich detail of the conversations; the anecdotes and the examples give readers a real sense of the people living on the Bakken. The ranchers and farmers appeared to have their attention divided between production of their land, support of their families, protection of their land, water and air as a generational resource, and the multiple obligations to communicate with, and monitor, the industry on their land.

I was privileged to meet the participants in this research, learn about their lived experience and, perhaps, develop some new tools by which residents and the next generation can develop a more holistic education that prepares them to be stewards in the industrialized environment of western North Dakota, all while maintaining their livelihoods.

Concluding Thoughts

The participants illustrate the activism heart of rural communities hosting fracking. Their images show that "citizens are becoming aware of the need to take responsibility for mediating the impacts of globalization on local cultures and ecosystems" (Greenwood and Smith, 2008, p. xiv).

I assert there is a vital need for instructional content in the schools of fracking communities—at the middle school, high school and college levels. The participants made a compelling case in sharing their lived experiences in words and images that these communities who now find themselves embedded in an invasion of oil and gas operations need content in the subject areas of industrial science, math, writing, law, environmental justice and policy for grades middle school to university, to ensure that education is more responsive to the needs of youth and adults of rural farming and ranching communities who will grow up on their family land and become managers capable of monitoring, negotiating and leasing with the oil and gas industry on and near their lands.

The development of environmental education for adults and youth working on family ranches and farms is a critical and unaddressed need to help ensure that rural communities have the knowledge and skills needed to adequately monitor and address oil development in their vicinity as effective communicators, negotiators, documentarians, defenders of the public interest and the resources they seek to protect.

With this research, I hope that I have brought a humaneness and insight to the topic to dig into the lives of my research participants. In its use of photography, this work is situated on the borderline between the historical geography and environmental education and this has implications for geography and land use planning this is one of the first uses of photography of this nature and as a dissertation its needs to be disseminated to the widest audience possible because things are not right out on the Bakken.

This research may be useful to many disciplines of social and environmental sciences – its shows what is not reported in media outside of spills and drama, beyond the thumbnails that typify and also normalize. The participants' images move from the

public's highway view, gleaned at 60mph and careen back onto the land where the multiplicitous nuances of innumerable impacts have accumulate over a series of oil booms like a slow drip in which the participants tire from vigilance while becoming wiser in their determinations and steadier in their resilience.

It is my hope that this is a significant contribution to the literature of oil expiration and development not only in north dakota but in the Bakken region which extends from North Dakota and Montana into the Canadian provinces of Saskatchewan and Manitoba. This approach to the use of photography may be useful to those researching the lived experience of residents in the region of the Marcellus shale formation of Pennsylvania and other areas affected by the oil and gas industry. For these intensely private farmer-rancher participants, the images shared here —- coupled with the first-person historical narrative captured vividly in these findings —- are citizen journalism and documentary work given an outlet within the confidential space of educational research.

Their local knowledge, and spoken accounts tied to their own documentary visual narratives should be honored as a new metric for visual and ecological literacy in the holistic evaluation of petroleum impacts industry. Their self-teaching should be seen as a variant of informal/nonformal environmental education, which can become a conceptual framework for a more robust public education in fracking communities which is responsive to their needs for content on industry methods, physical/chemical science and social/environmental sciences.

APPENDICES

Appendix A
Participant Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

Title of Study:
Photography Methods to Understand Rural Resilience and Environmental Literary: The Example of Fracking in the Case Studies: Photography-based Methodologies for Community Education

Study Investigator: Bruce Farnsworth, M.A. (PhD student, EFR Department)

INVITATION
You are invited to participate in research because you may have opinions or knowledge about this theme. Your participation is voluntary. In the increasingly industrialized landscape of western North Dakota, your perspective as a landowners and custodians of lands passed generationally in your family is important. Approximately three to five individuals will take part in this study.

WHAT IS THE PURPOSE OF THE STUDY?
The purpose of this study is to examine how the medium of photography may provide local residents with methodologies that respond to their needs in environmental and community education, techniques which may be transferable to other rural communities in need. The researcher will use this information to write scholarly articles about the use of photographic images in conservation education.

WHAT WILL MY PARTICIPATION INVOLVE?
If you decide to participate in this study, you may be interviewed about your knowledge, experiences, working practices and opinions regarding environmental education in your community. These interviews typically last thirty (30) minutes to an hour. The study investigator may choose to observe you as you carry out your work related to your land in North Dakota. You may also be asked to participate is some activities that involve your use of photography, photographs or similar visual media. Your participation may last up to 20 hours in total, but this varies.

You will be asked if video images, photographs, or voice recordings can be made during the interview(s) and/or observation(s). Such recordings will be used only for writing down exactly what you say. Your name will remain secret when the findings are reported in academic publication. Audio and video tapes will be stored in a locked cabinet after use. Being recorded is voluntary. You may still participate without being recorded. Any other use of the audio and videotaped recordings will require your permission on terms to be negotiated.

WILL MY CONFIDENTIALITY BE PROTECTED?
Information learned from this study may be used in scientific journal articles, in presentations, or to train community workers or other researchers. None of these materials will identify you personally; you will be referred to by a pseudonym (made-up name). Interviews, notes, and any video or audio recordings will be stored
in a locked cabinet when not in use. Any information from the data that could identify you will be removed. In the event a paid typist is hired to transcribe the recordings, this person will be required to sign a confidentiality agreement.

ARE THERE ANY RISKS?
The risks involved with this study include possible loss of confidentiality. Though I take many steps to ensure secrecy, the identity of participants might accidentally become known. This may cause embarrassment or discomfort. Some questions I ask about your experiences and opinions might cause embarrassment or concern. You may choose not to answer such questions. Another drawback for you might include the amount of time spent participating in formal observations, interviews and discussions.

ARE THERE ANY BENEFITS?
No direct benefit is guaranteed to you from participating in this study. Your participation in this research, however, may benefit you or others in the future by helping us learn more the educational needs of farmers, ranchers and other landowners in your region.

WILL I BE PAID FOR PARTICIPATING IN THE STUDY?
No participants will receive pay for taking part in the study.

IF I DECIDE TO START THE STUDY, CAN I CHANGE MY MIND?
Your decision to participate in this research is entirely voluntary. You may choose not to participate. If you do decide to take part, you may change your mind at any time without penalty or loss of benefits that you had before the study. Your decision to participate or not in this study will not affect any relationship you might have with the investigator on this study. You may choose not to participate in certain observations or interviews, and you may skip any questions you do not want to answer.

WHAT IF I HAVE QUESTIONS?
If you have questions about this research in the future, please contact the researcher, Bruce Farnsworth, at (415) 320-4015. If you have questions regarding your rights as a research participant, or if you have any concerns or complaints about the research, you may contact the University of North Dakota Institutional Review Board (UND-IRB) at (701) 777-4279. Please call this number if you cannot reach the investigator by phone or E-mail, or if you wish to talk with someone else.

Authorization to participate in the research study:
I have read the information in this consent form, had any questions answered, and I voluntarily agree to participate in this study. I have received a copy of this consent form.

_____
Participant's Name (please print)

_____ _____
Signature of Participant Date

_____ _____
Signature of Investigator or Person Obtaining Consent Date

Appendix B
Sample Interview Protocol

Because of the diversity of the respondents and the semi-structured nature of the interviews, it was impossible to outline all of the specific questions I might ask. Each respondent was asked questions relevant to their own individual knowledge base or expertise, and my questions evolved as I learned more and pursued new directions in the research. I have noted some questions below that are representative of those that were presented in Phase 1 of the data collection.

I. Life history

Prompt: Can you tell me what you do?

Follow-up:

- How do you obtain the majority of your income? Please talk about your land and how it is used
- Have the sources for your income changed in recent years and, if so, can you explain briefly what brought about those changes?
- Do you currently lease your land for oil and gas industry activities? (If you do not lease your land, can you explain the reason or reasons?)

Prompt: Please tell me about your family history.

Follow-up:

- Did your father or any of your ancestors also farm or ranch?
- Can you briefly describe your community today?

Prompt: Please provide an overview of your education.

Follow-up:

- Tell me about your training or education in science.
- Tell me about your training or education in biology.
- Have you received training on oil and gas industry operations?

II. Local Environment

Prompt: Can you describe your land for me please?

Follow-up:

- How has your local environment changed in the last few years?
- What are some concerns you have today about your local environment?
- What are activities associated with oil and gas operations or hydraulic fracturing that you would have liked to learn about earlier?
- What should landowners/government/industry/non-North Dakotans do?
- How do you see your land in 20 years?

III. Environmental Education

Prompt: What might be the role of education?

Follow-up:

- What are the sources for your information about your local environment?
- Do you share what you learn with others? If so, with whom and by what means?
- Can you describe environmental or science education that is needed in your community?

- Who should be the audience for such education (who needs the education most)?

IV. Use of Photography

Prompt: Do you have any interest in photography, either recreationally, in your work, or as it relates to your livelihood or community today?

Follow-up:

- How do you use photographs or photography?
- Can you think of how photography might relate to your life here in North Dakota today?
- Might your personal attitudes about photography differ from others in your community?
- Do you prefer to make photographs or view them?
- How might photography relate to meeting the educational needs of your family/fellow ranchers/farmers/neighbors/community

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