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Seeing biodiversity through the farmer's eyes: A photovoice analysis in Story County, Iowa

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**Seeing biodiversity through the farmer's eyes:
A photovoice analysis in Story County, Iowa**

by

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A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

Co-majors: Sociology, Sustainable Agriculture

Program of Study Committee:
Cornelia Flora, Major Professor
Mary Wiedenhoft
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Iowa State University

Ames, Iowa

2013

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Dedicated to

Minha Mãe, Bia, meu Pai, Celso, e meu Irmão, Kevin

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ABSTRACT

The purpose of this study is to understand farmer's perceptions of biodiversity and how it relates to their sense of self. Biodiversity is a concept applied by scientists and policymakers to represent nature's richness, diversity, and its biological interdependence. However, current discussions of biodiversity do not consider farmer's understanding and relation to biodiversity. Sociology has a central role in decoding the human dimension of biodiversity and integrating different visions and voices for building future landscapes. This study utilizes grounded theory research methodology with eight cattlemen from the Story County Cattlemen Association in Iowa. Results reveal farmer's perceptions of biodiversity are constructed through their cattlemen self. Self in this context is not stable, but is layered, complex, and changing, as it is negotiated in social interactions. Understanding farmer's selves has implications for effective implementation of conservation strategies and alternative perspectives on land management.

CHAPTER 1. INTRODUCTION

Iowa is not traditionally known as a biodiversity “hot spot.” Much to the contrary, Iowa is associated with vast monocultural fields of corn or soy beans. Iowa has become a leading U.S. producer of corn, soybean, hogs, eggs, and ethanol with great environmental cost to the state’s natural prairies. Iowa ranks last in the nation in terms of remaining original vegetation, where less than 0.1% of the prairie remains today (Liebman et al. 2013). Before European settlement, most of the central U.S. was covered with prairies. Prairies are generally classified based on the height of the dominant grasses and include tallgrass, mixed-grass, and shortgrass prairies. In Iowa, more than 95% of all tallgrass prairies have been eliminated, primarily due to conversion of the land for agriculture. In contrast, approximately 40% of the shortgrass prairies remain because the land is too dry for non-irrigated agriculture, but suitable for livestock grazing (Jarchow and Liebman 2011). The depletion of natural prairies has a direct negative impact on biodiversity.

Biodiversity loss has become a global concern among scientists and conservationists. In Iowa, significant research has focused on increasing biodiversity on agricultural lands (Asbjornsen et al. 2013; Liebman et al. 2013). However, there is limited research on the sociological dimension of biodiversity, especially in the agricultural context. Currently in Iowa, the Iowa Wildlife Action Plan is the only state initiative focusing on biodiversity conservation. According to the project’s website:

The Iowa Wildlife Action Plan (IWAP) is a proactive plan designed to conserve all wildlife in Iowa before they become rare and more costly to protect. Developed by a coalition of scientists, sportsmen and women, conservationists, and members of the public, this plan can help us protect wildlife and the places they live for future generations. If the steps in the action plan are successfully carried out, Iowa will have

cleaner water and air—a healthy environment for people and wildlife (Iowa Wildlife Action Plan 2007).

Interestingly, farmers are not mentioned as part of the coalition of this project. Given that 85% of the land in Iowa is farmland (USDA 2007), it is paramount for farmers to be included in discussions about biodiversity conservation in Iowa. To begin these discussions, it is necessary to understand how farmers perceive and relate to biodiversity. This study attempts to understand the sociological dimensions of biodiversity by analyzing farmers' perceptions of biodiversity.

CHAPTER 2. PROBLEM STATEMENT

Biodiversity is socially, politically, and culturally constructed (Goldman and Schurman 2000; Machlis 1992; Oksanen and Pietarinen 2004; Sarkar 2005). The process of construction is continuous and dynamic, including multiple perceptions from scientific and non-scientific sources of knowledge for effective implementation of management practices. Recent studies, mainly in Europe, have recognized the importance of analyzing different perceptions of biodiversity. In Scotland, Fischer and Young (2007) explain the lack of scientific knowledge in members of the general public has been used to argue against public participation in decision-making and policy development in biodiversity conservation. They conducted a qualitative study of individuals' conceptions of biodiversity that challenges scientific knowledge as the only legitimate source of knowledge for decision-making. Their results suggest that independent from scientific terminology, participants (including tourists, local residents, mountaineers, foresters, birdwatchers, and agriculture students) expressed well-grounded and complex attitudes towards biodiversity management measures that corresponded to normative evaluations. In another study in Scotland, Young et al. (2013) directly address the benefits of different stakeholder involvement in biodiversity conservation. Results from three case studies show stakeholder involvement in the development and implementation of management plans can improve learning and increase trust among stakeholders. They conclude "these social outcomes could, in turn, impact on biodiversity outcomes in the long-term, for example by leading to a greater willingness on the part of land owners and managers to want to conserve biodiversity" (2013: 368).

In three case studies in France, Italy, and Hungary, Kelemen et al. (2011) conducted non-monetary assessments to explore how farmers relate and benefit from biodiversity. They find “biodiversity is not an independent, purely scientific concept for farmers, but is considered through their everyday life and farming practices” (2011: 8). They confirm it is important to explore and understand the attitudes and values farmers attach to biodiversity and to include their approach in scientific and policy discussions. In another study with farmers in Finland, Herzon and Mikk (2007) argue there is little research that explores farmer’s understanding of biodiversity. They affirm a farmer’s notion of biodiversity differs from narrow academic definitions. Not only are there competing conceptions of biodiversity in the scientific community, but these discrepancies can impair the acceptance of schemes targeted at biodiversity conservation. Their findings show a farmer’s understanding could provide alternative perspectives on land management.

In Western Mexico, Gerritsen’s (2012) case study examined farmer’s perspective on biodiversity in the Sierra de Manantlan Biosphere Reserve. He shows biodiversity is dependent upon farmers’ manipulation of their natural environment. However, the creation of protected areas in the Reserve causes an artificial separation of farming practices and biodiversity that disrupts the co-evolution of human and nature landscape patterns. The author warns that such segregation can negatively influence biodiversity composition and distribution in the medium- and long-term, unless special measures are taken. Furthermore, the inclusion of different sources of knowledge implies negotiation and trade-offs between all relevant stakeholders involved in land management. These new processes of negotiation can develop new strategies for policy formation, and alternative perspectives on biodiversity that are more consistent with the local context (Dudley et al. 2005).

In the United States, Stinner et al. (1997) found that farmers in Ohio, Missouri, Kansas, West Virginia, and Vermont rarely consider biodiversity in their management decisions. They suggest “if we wish to develop more forms of agriculture which protect biodiversity, we need to understand the perspectives of the people who manage agricultural lands” (1997: 200). In another study, Corselius et al. (2003) specifically analyze farmers’ perspectives on cropping systems diversification in Minnesota. The authors show farmers’ decisions determine the types of crops grown and the spatial configuration of these crops within a given cropping system, emphasizing the importance of understanding factors that affect such decisions. Through a survey, they identified “over half of the respondents agreed that farms should be ‘diversified’” (2003: 375). However, “over half of the respondents identified climatic limitations as a principal reason for not further diversifying their cropping systems. Sixty-five percent of farmers also identified a lack of markets and limiting infrastructure/institutional factors as obstacles to increase crop diversity on their farms” (2003: 375).

Diversity as a management strategy is inconsistent with industrial models. In general, the management of production-oriented systems focuses on specific species as opposed to species diversity. The composition of species is driven by economic and political incentives in the food system. The social constructions of biodiversity become clearer when analyzed through a farmers’ perspective, because farmers are directly influenced by economic and political factors that ultimately condition their perspectives.

Burton (2004) reveals an important component in farmer decisions that go beyond economic and political factors. When analyzing why farmers organize and manage their farms the way they do, he realizes there are deep social symbolic values that guide the farmer’s decisions. He explains:

The symbolic value of the farm production may also extend from its ability to display the farmer's connection with the land, of his/her concern for the nurturing role of the farmer. The farm landscape is not simply a workplace, but rather, as Leopold observed sixty years ago it is "the owner's portrait of himself". If one considers the reaction that could be expected to the prospect of destroying (or painting over) an old family portrait then it becomes relatively simple to understand why farmers are resistant to many of the suggested changes to the industry encouraged as part of the post-productivist modernization of agriculture (2004: 207).

When society encourages a farmer to change management behavior, Ahnström states the "farmer is implicitly offered a new identity, packaged with a new set of social norms" (2009: 64). Identity is constantly redefined through negotiations in participative experience. Thus, we constantly remake our self to fulfill our self-image, but also to fulfill the image we believe others have of us.

As part of investigating the nature of social interaction, symbolic interactionism is a philosophical approach that examines the empirical social world. Research questions from the symbolic interactionist perspective emphasize processes rather than structure, where the researcher considers not only the individual's point of view, but also the interactions by which points of view develop. Processes are significant because symbolic interactionists view human behavior as a dynamic process in which individuals are continuously defining and interpreting each other's acts (Benzies and Allen 2004). As they do that, they anticipate how others will interpret their acts. The person and the world cannot be understood in isolation because the 'self' is being continually developed through interaction with other human beings, thus becoming a product of social interaction, through an on-going process of participation in society. As a result, the concept of 'self' constructed through social interaction and the anticipation of responses to actions holds special relevance on how to explore the participants interpretation of their roles as community members. Theories such as identity, role- taking, context and negotiated order are

relatively recent contributions to the growing body of knowledge in symbolic interactionism (Jeon 2004).

In Boonstra et al. (2011), the authors utilize Frouws and Benvenuti's (1998) typology of social relations and patterns of interaction between actor and structural context to show that dominant sociocultural notions, or scripts about 'conserving nature' can reveal farmers' forms of resistance and reluctant compliance against the threats to their identity. They suggest farmers' perspectives of biodiversity tend to relate how they experience nature during farm work. The authors suggest experiences of nature are an essential part of their identity, and, therefore, constitute farmers' conceptualization of nature. O'Neill and Walsh (2000) provide similar arguments, showing that farmers' experience of the landscape is important because the characterization of the landscape as a worked landscape is central to their identity as members of an ongoing working community.

CHAPTER 3. METHODOLOGY

Biodiversity is a multi-dimensional concept that leads to different interpretations and conceptualizations. Given the agricultural context of this study, biodiversity can display alternative interpretations not traditionally operationalized in conservation biology. Through qualitative research, this study is oriented through grounded theory to better understand beef farmers' interpretations and perceptions of biodiversity. The product of a grounded theory study is to build substantive theory that emerges from or is "grounded" in the data. Therefore, theory is inductively derived from the phenomenon it represents. Quoting Strauss and Corbin (1990), Merriam (2002) states "one does not begin with a theory and then prove it, rather, one begins with an area of study and what is relevant to that area is allowed to emerge" (Merriam 2002: 142).

Through photovoice, the participants took part in conducting the research by providing photographic data they believed represented biodiversity on their farms. Through in-depth interviews complemented with farmers' photographs, this study aims to acquire a depth of understanding of how biodiversity is perceived among cattlemen in Story County, Iowa.

Initially, I chose to work with cattlemen because their operations are comparatively more diverse than monocultures. Since Iowa agriculture consists primarily of grain monocultures, cattlemen are more diverse because they manage for both grain and livestock. I assumed this type of agricultural operation would facilitate a dialogue on biodiversity. Through purposeful sampling, I searched for cattlemen associations in Iowa and found the Iowa Cattlemen's Association is headquartered in Ames. The Story County Cattlemen's Association (SCCA) is a chapter of the Iowa Cattlemen's Association (ICA). The ICA is an organization of 9,500 Iowa, beef-producing families and associated companies dedicated to developing Iowa's beef industry.

Their main commitment is to connect producers to resources that will help their beef businesses grow. Aside from Story County, there are 97 active county organizations involved in a wide variety of activities throughout the year. These activities include identifying regulatory issues that can either help or hinder Iowa cattle farmers: taking part in promotional activities, such as grilling beef products at local events; and educational efforts for producers and youth, such as sponsoring market outlook meetings or scholarship opportunities (Wellman 2012).

I became a member of SCCA to gain better access to information regarding the industry and to find active farmers in Story County. I was invited to attend a board meeting to directly connect with farmers and discuss the possibilities of their participation in this study. My first meeting was in March 2012. As the only young Latina woman in the meeting room, I felt very out of place. To add to my discomfort, as I was introducing myself to the farmers, they were surprised to learn I was in the Graduate Program of Sustainable Agriculture, and requested a presentation on sustainable agriculture. What followed was a lively discussion about sustainability, complete with questions and concerns. I answered concerns as best as I could, and maintained that as a representative of the sustainable agriculture community, I did not wish to impose a right or wrong way of farming. My concern was to facilitate communication and access information between the scientific and the farming communities. In addition, I shared that my undergraduate background was in agricultural operations management, making the point that I have experience on both sides of the farming industry. Through our discussions on sustainability, I presented the issue of biodiversity.

Citing some of the information from the literature review (Dudley et al. 2005), my initial approach was to present the difficulty of conceptualizing biodiversity to farmers. More importantly, I stressed the need to incorporate their perceptions of biodiversity into how we

operationalize biodiversity in policies. I emphasized the inclusion of different sources of knowledge implies negotiation and trade-offs between all relevant stakeholders involved in land management, and, more importantly, this process of negotiation can develop new strategies for policy formation, and alternative perspectives on biodiversity more consistent within the local context. Given that nearly 85% of the land in Iowa is farmland (USDA 2007), I explained their views and relationships to biodiversity are essential to formulate conservation policies consistent with local needs.

After our discussion, they were enthusiastic and willing to work with me. From the March board meeting, I collected contact information from ten farmers. At the time, I did not have a specific description or research question to provide the participants, so I arranged to contact each farmer individually to further discuss their participation in the study. Within the following weeks, I collected the necessary literature materials, and gathered relevant resources to narrow my research questions. By May 14, 2012, I had IRB approval and contacted each farmer to begin interviews. I contacted each farmer initially though email, but only received one response. After a few weeks without any additional responses, I called the farmer who responded to my email, and asked him for advice on the best approach to reach the other farmers. He advised me to attend the next board meeting later in the month and meet them personally. I followed his advice and attended the meeting. This time, I had a clearer description of my research and specific instructions for their participation. During the May board meeting, I passed around another contact sheet for interested participants and recruited two more members. Four members declined to participate. Thus, a total of eight participants were directly contacted to participate in this study.

Selecting Respondents

All participants were white males between the ages of 23-55. Not all participants were full-time farmers. Four participants depended on full-time positions outside the farm for income. Six were current SCCA board members, except for two farmers who had recently joined the association (Table 1). Farm size varied from a few hundred to a few thousand acres. Herd size varied considerably from 20 to 5,200 head (Table 2). It is important to note each farmer took advantage of different market opportunities in the cattle industry not represented in Table 2. For example, aside from cow-calf and feeders, John also raised cattle for heifer development (300 head) and breeding stock (25 head). For this study, I will only focus on the differences between cow-calf and feed lot operations because they are most prevalent among all participants.

In all operations, feed for the cattle came from their grain operations and dried distillers' grain (ethanol by-products). Table 3 describes each farmer's grain operation in terms of crops/acre. In addition, some farmers were involved in different markets for grain operations; two farmers raised custom seed corn and soy beans for seed companies. Note, Mike is not listed in Table 3, because he did not manage the grain portion of the farm; the farm was co-managed with family members.

Table 1: Participants Demographics

	Farmer's Name*	Full-time Farmer	Age Over 30	SCA Board Member
1.	Greg	No	Yes	Yes
2.	Paul	Yes	Yes	Yes
3.	Peter	No	No	No
4.	Alex	Yes	No	No
5.	David	Yes	No	Yes
6.	Chris	No	Yes	Yes
7.	Mike	No	No	Yes
8.	John	Yes	No	Yes

*All farmers' names are pseudonyms to protect their identities.

Table 2: Description of Cattle Operations

Farmer Participants			Cattle Operation	
			Cow-Calf	Feeder
1.	Greg	Acres	360	
		Head	125	320
2.	Paul	Acres		
		Head		500-700
3.	Peter	Acres	70	
		Head	70 pairs*	
4.	Alex	Acres	130	
		Head	100 pairs	
5.	David	Acres		
		Head		5200
6.	Chris	Acres	30	
		Head	30 pairs	
7.	Mike	Acres	140	
		Head	150	
8.	John	Acres	200	
		Head	100	80-90

*Cow and calf.

Table 3: Description of Grain Operations

Farmer Participant		Grain Operations			
		Corn (acres)	Soybeans (acres)	Alfalfa (acres)	Winter Rye (acres)
1.	Greg	600	200		600 (double cropped on corn acres)
2.	Paul	1000	350		140 (double cropping with soybean acres)
3.	Peter	900	300		
4.	Alex	1000	800	10	
5.	David	3000	2000		
6.	Chris	60	60		
7.	John	900		100	

Data Collection

All data were collected through in-depth interviews, photovoice, and informal focus groups during board meetings. All interviews were digitally recorded with the participant's permission and later transcribed. In-depth interviews were structured into two separate interviews (Table 4). Interviews ranged from one hour to three hours and were completed between the months of June and November 2012.

Table 4: Research Process

Research Process	Data Collected
1. Initial Interview	Transcripts and observation notes
2. Photovoice	Photographs, transcripts, and observation notes

The first interview was arranged to better understand each individual's farm and his adopted management practices. During this informal process, farmers had the opportunity to tell me their farming history. Most interviews were conducted outdoors and seven out of eight interviews were conducted in their vehicles, as they drove me around their property. This was a

very interactive process, where farmers were comfortable in their environment and very eager to show and explain their operations. In addition to general questions about their farming practices, they were also asked about their relationship to biodiversity and nature. These questions prepared farmers to partake in the photovoice portion of the study (refer to Appendix C and D for questionnaires). For photovoice, farmers were asked to take between 10-20 pictures of what they considered biodiverse on their farms. Following a recommendation from D'Adamo's thesis (2010), I provided basic information to the farmers about biodiversity to avoid excessive open ended-interpretations and to avoid intimidation that might result from the participants working outside their comfort zones. I suggested biodiversity can be thought of encompassing all species of plants, animals, and microorganisms in the ecosystems that compose a landscape. It is an umbrella term for the degree of nature's variety, including both the number and frequency of ecosystems, species or genes in a given assemblage. All farmers received the same explanation and instructions for photovoice and were asked to take pictures with any device easily accessible to them.

Before meeting for the photovoice interview, I asked the farmers to send me their pictures so I could have them printed. Once the pictures were printed, we met for the second interview. This interview consisted of five questions, encouraging the farmers to be expansive in their responses to help me understand what they wished to convey through the image. The farmers were also encouraged to share old pictures from their farm, but instead, all took original pictures. Submissions ranged from five to 33 pictures, and portrayed a rich variety of perspectives. The farmers were very pleased with the quality of the pictures and enjoyed going through them and explaining each image. Farmers who submitted over ten pictures preferred to organize them into categories, since some of the pictures depicted similar processes. All

interviews were conducted indoors, ranging from 45 minutes to two hours. Pictures were printed with a thick white frame around the image to allow space for writing notes. Writing on the picture was helpful to describe and capture the interactive process of the farmer's explanations for each picture and to provide transparency to data collection. The farmers were asked to title each picture to facilitate identification during interview transcriptions (refer to Appendix E for all picture submissions).

Photovoice Process

Photovoice can engage participants in the research process, allowing for deeper reflections, critical dialogue, and knowledge production (Neill et al. 2011). It was an important complement to this study, because it allowed for multiple points of reflection. The photographic image provided an alternative form of expression that might not have been captured through traditional interviews, much less a survey. The option to express themselves beyond verbal communication was especially helpful to participants who were not comfortable in an interview setting. Most importantly, talking about their own pictures allowed the participant to take control of the construction of meaning. Greider and Garkovich (1994) further discuss this approach as they explore the social construction of the environment, stating “the postmodernist critique of traditional social sciences is concerned that deterministic theories tend to ignore socially-constructed symbols and meanings that create nature and the environment and the processes through which these symbols and meanings are negotiated, renegotiated, and imposed on other groups through the use of power” (Greider and Garkovich 1994: 5).

Taking pictures of biodiversity allowed farmers to engage in the research process by reflecting and building on the meaning of biodiversity related to their context. These reflections

were expressed during the in-depth interviews. When explaining to Greg the photovoice portion of the research, he sat back to project possible images. As he looked around he said:

“Now I guess just sitting here and looking, there are birds everywhere. Now, if we didn’t have as much livestock, we wouldn’t have all these birds.”

Later in the same interview, he expressed this process allowed him to think deeply about his farm:

“But if it wasn’t there [trees], I would miss it. Like all the trees. If that wasn’t there, it would be harder, we would have less cattle. I guess I never thought that deep!”

In another interview, Chris revealed he was attentive to the process, as I had missed including one of his pictures. When we were finished with the photovoice interview, he immediately noticed there was a picture missing. So, I asked him to explain the picture as he showed it to me on his phone:

“Ok. Well, it’s a feed wagon. It allows us to mix silage and other roughages together to make it more palatable for them to eat. [...] Yeah, I was kinda wanting to show you because it allows us to mix the different feeds together.”

However, photovoice did not prove to be as an effective tool to engage other farmers. When asked to clarify one of the pictures, Peter confessed:

“I guess I don’t know where I was coming from with this one, taking pictures just to take pictures? I don’t know, maybe I was thinking weeds were an issue?”

The importance of photovoice in this study lies in its possibility to reveal and affirm themes in our conversations that would otherwise not have been apparent. Through photovoice, farmers saw an opportunity to reaffirm their notions of sustainability. During David’s interview, it is clear he was aware that other images might be more appropriate for the assignment. Before I

introduced the basic information on biodiversity I presented to all the farmers, David already suspected his pictures might not fit the assignment:

“Ok, and of course, the pictures that I take I feel are important because there is something that we are trying to manage. Like weeds we are trying to manage, disease or insects, or like germination and stand, how thick it is planted, those are things we try to manage. Whereas, I don’t know if there is something that you want me to take pictures of that really we don’t care about, but is probably out there.”

From this observation, he reveals that biodiversity in his farm is only relevant when there is interaction with labor. Furthermore, he suspected the goal of the research was to have pictures of a diverse variety of species.

“[...] I feel like there is this sentiment that having more species within a given area is better. I mean, is that the goal, or is it not related?”

This is significant because it shows David is aware of a dominant perception of biodiversity, but that it does not apply to his experiences, and will not be included in his pictures.

Limitations, discussion, and recommendations

One of my main concerns during the data collection process was keeping farmers interested and motivated. I struggled to find a balance between being persistent and annoying. The original interview schedule was designed to allow farmers a two-week window between the first and the second interview to take pictures. However, once the harvesting season began in October, those farmers who had not taken pictures could not send anything until after harvest. During this process I had minimal contact with the farmers. I believe this distance jeopardized some of their commitment to the project. During this time, I attempted to remain in contact by attending more meetings, even visiting their farm to experience the harvest. Nonetheless, I

believe it impacted the quality of the interpretation of the pictures, in terms of their engagement with the process. Given the time limitations of this research, I established a deadline at the end of November, and as a result, two farmers were unable to submit pictures.

One way to increase effectiveness of engagement is to have a stricter schedule for picture submission that does not exceed a month after the initial contact. It is important to take advantage of the momentum from the initial interview and remain persistent during the time farmers are taking pictures by checking on their progress. Another possibility is to have at least two separate sessions of photovoice. This can potentially avoid participants taking all the pictures at one time; thus, keeping farmers engaged in the process for a longer period of time.

Another limitation of this study is the consideration that farmers will only select pictures motivated by self-interest that portray a positive representation of their practices. Since biodiversity is outside of the farmer's frame of reference, they will attempt to construct a biodiversity based on the expectations they believe I hold, only to complete the assignment. As a result, the selection process will most likely weigh on personal values, which might not coincide with environmental values that are relevant to a functioning biodiversity. Therefore, photovoice may not be an appropriate methodology for directly impacting public policy. Instead, photovoice is helpful as an initial stage to understand people's views and concerns on relevant issues for public policy. Photovoice allows for multiple points of reflection that go beyond just the process of taking pictures, which are revealed during the photovoice interview. The conversations about the pictures enriched the data and will be further discussed in the results.

Data Analysis

A total of 14 interviews were conducted—eight initial interviews and six photovoice interviews, as two participants did not submit pictures in time (Table 5). All pictures were original and mostly taken with their camera phones. Only two out of the six participants used a digital camera. In the original methodology, the first interview was designed as an informal introduction between the farmer and me. The questionnaire included general questions about their farming practices and a brief introduction to biodiversity to initiate ideas for pictures. Therefore, only the photovoice interviews were to be coded. However, the conversations from the initial interview were very insightful and provided an important foundation for the themes discussed in the photovoice interview. As a result, both interviews were transcribed and manually coded for each participant. The themes that arose from both conversations reinforced the farmer’s perspective and ensured validity. Table 6 describes the development of the themes during the coding process.

Table 5: Interview Process

	Farmer’s Name	Completed Initial Interview	Completed Photovoice
1.	Greg	Yes	Yes
2.	Paul	Yes	Yes
3.	Peter	Yes	Yes
4.	Alex	Yes	Yes
5.	David	Yes	Yes
6.	Chris	Yes	Yes
7.	Mike	Yes	No
8.	John	Yes	No

Data analysis process

Open Coding

After conducting all of the interviews, I began to develop themes by analyzing one interview at a time, adding themes as they appeared in each interview. My initial approach was to analyze themes that emerged from each individual picture. However, as I moved to interviews with more than 30 pictures, this method showed inappropriate, as each farmer had a particular way of showing and explaining his pictures. Therefore, I continued by analyzing emergent themes in the overall interviews and not specific pictures. After all interviews had been open-coded, I organized the quotes from all interviews into their corresponding categories.

Axial Coding

Before organizing the quotes, I color coded each quote according to the farmer's operation, feedlot (red), cow-calf (green), and both (blue). The colors helped me identify significant patterns with farmer's operations and their corresponding categories. As I was organizing each quote into its corresponding theme, there were clear connections between themes, which were combined to reflect a more concise view shared by all of the farmers

The original Theme 4 (independent nature), seeing nature as separate from the farm, was not relevant to all farmers, and was incorporated into Theme 1 to explain farmer's relationship with nature. Theme 5 (correct biodiversity) depicted farmer's concerns with describing a correct definition of biodiversity; however, this was also not applicable to all farmers, so it is discussed separately. Theme 1 combines all categories that express the farmer's relationships with nature.

There was also a lot of overlap between themes 6 and 8, related to the farmer's self. To crystalize each theme, Theme 6 was designated to focus only on analyzing the construction of

the cattlemen's self and Theme 8 was incorporated into the methodology, explaining the farmer's reflections about the process of taking pictures for photovoice.

Table 6: Coding Analysis

Coding Process	Themes
Open	Theme 1: Negative Nature Theme 2: Sustainable Cycle (Positive Nature) Theme 3: Money Drives Everything Theme 4: Independent Nature Theme 5: Correct Biodiversity Theme 6: Cattlemen Self Theme 7: Farmers vs. Environmentalists Theme 8: Self-reflection Theme 9: Biotechnology Theme 10: Diverse Management
Axial	Theme 1: Farmer Relationship with Nature (combined themes 1, 2 and 4) Theme 3: Money Drives Everything Theme 6: Cattlemen Self Theme 7: Farmers vs. Environmentalists Theme 8: Self-reflection (moved to methodology) Theme 10: Diverse Management <ul style="list-style-type: none"> - Natural Diversity - Enterprise Diversity
Selective	Core theme: Theme 6: Cattlemen Self Supporting theme: Theme 10: Diverse Management <ul style="list-style-type: none"> - Natural Diversity - Enterprise Diversity

Selective Coding

Cattlemen's Self: Analyzes the social processes that construct the farmer's description of self, related to the farmer's history and adaptation to economic and environmental changes. From their self, diversity was described in terms of natural and enterprise diversities. Natural diversity

describes the farmer's relationship to nature, distinguishing between planned and associated biodiversity. Associated incorporates independent elements of nature and planned is what the farmer is able to control and manage. In planned biodiversity their notion of sustainability is developed, as they describe cycles of nutritional diversity. Finally, enterprise diversity analyzes management decisions.

Validity

I maintained internal validity through face validity and triangulation. According to Merriam (2002), sociologist Norman Denzin developed an extended discussion of triangulation, identifying four types—multiple investigators, multiple theories, multiple sources of data, and multiple methods—to confirm emerging findings. For this study, multiple investigators and multiple sources of data were accomplished through photovoice. Photovoice helped provide a complex analysis of meaning that complemented and affirmed the interviews' findings. Peer review was also accomplished through discussions and feedback with POS committee members, which helped guide the research.

External validity in qualitative research is not concerned with broader generalizations, therefore, the results of this study are limited to Story County, Iowa. The respondents were selected to understand the depth of their particular context. In other words, their selection was aimed to promote thinking of context-bound extrapolations instead of generalizations. "Rather than abstract universals arrived at through statistical analysis, what we have in qualitative research are concrete universals" (Merriam 2002: 28). Generalizability for this study will be determined by a case-to-case transfer as it applies to the reader's context.

Ethical and Personal Considerations

As a student in sustainable agriculture, I am immediately stereotyped to hold certain beliefs about farming, natural resource conservation and management. During my first encounter with the livestock farmers, this realization was clear by their attitudes and discussions. During the meetings, they were purposefully discussing sustainable practices and how they are dealing with environmental issues. Therefore, this could have affected their intentions, and ultimately prevented a spontaneous and honest interpretation of biodiversity.

Through the lens of symbolic interactionism, “when an individual appears in the presence of others, there will usually be some reason for him to mobilize his activity so that it will convey an impression to others which it is in his interest to convey.” (Goffman 1959: 3-4) Therefore as a researcher, it is my role to discern the information that is relevant to answering the question at hand. In order to increase validity of responses, I presented my undergraduate training in agricultural operations management to establish a common interest and legitimize my knowledge in agriculture. In addition, I always maintained a neutral position towards their views. Although they were interested in my views and opinions, I never revealed a strong position. Instead, I was interested in recreating the image of the “scientist”, emphasizing I did not have all the correct answers, and that for this study, their views are just as valuable as any scientist. This approach reveals my side of symbolic interactionism, where I was acting based on the idea I believed they held of a scientist.

Moreover, another important factor in relation to how they viewed me is my ethnicity. Not only am I an ‘outsider’, I am a foreigner, and therefore unfamiliar with their cultures. This could have prevented me from understanding certain cultural customs and meanings that could

be easily interpreted by an American, especially a native Iowan. However, this turned out to be an opportunity for us to learn from each other's cultures. During the board meeting of my initial encounter, aside from having discussions on sustainability, they were extremely interested in learning more about Brazil, especially Brazilian agriculture. This curiosity remained throughout individual interviews. In general, they made an effort to carefully explain processes related to their farm and farming culture. No information was ever taken for granted, and I felt very comfortable to engage in dialogue and ask as many questions as needed.

CHAPTER 4. RESULTS

Cattlemen's Self

Cattlemen's selves were the first theme to emerge from my conversations with the farmers. After in depth analysis, it emerged as the basis for understanding how farmers view themselves and how their reality informs their perceptions of biodiversity. From my first encounter at the board meeting in March 2012, it was clear this group of farmers viewed themselves as different from other farmers in Iowa. Although most cattlemen grew grain and oil seed (corn and soybean) as their main source of income, they maintained a separate identity from grain farmers. These distinctions were based on the heavier labor requirements to manage livestock. They explained that raising livestock requires careful attention and a lot more physical labor year round, unlike grain farming, which is only active a few months out of the year. It was common place to joke around about grain farmers being "lazy" because they didn't work year round.

Greg: "Grain farmers are lazy, because they don't have to chore every day, and in the winter, they don't do a goddamn thing. Where we are out there, hauling manure and feeding the animals."

David: "Livestock is a lot of work. And they [grain farmers] don't want to be stuck everyday with the farm. But, we feel it's a great compliment because we can diversify our farm. We can feed our crop if we need to, or if we can sell it for more, we will do that."

As a result of being distinct from grain farmers, the cattlemen assured me I had picked a good group of farmers to talk about biodiversity, because of their diverse operations. They also mentioned it would be more difficult to have an open conversation about farming practices with grain farmers because they are constantly competing with one another. The cattlemen stated they

are more open with each other to share advice and experiences. They are also diverse within themselves, ranging from feedlot operations to cow-calf or a combination of both.

Tony: “You have a wide diversity of farmers on this table that have different production methods. But, we are also involved in other industries.”

John: “Like Tony was saying, you are probably gonna get a better definition of biodiversity with cattlemen.”

From my observations, manual labor forces a closer interaction with the production system that builds the cattlemen’s self. Despite the additional labor, their commitment to livestock production is a labor of love.

CO: “So why did you choose to be in livestock?”

Peter: “Because I grew up around cattle, I’ve loved it forever, and they kinda pulled me into it. [...] Yeah, it’s a lot more work, but it’s a lot more fun. My favorite in the spring time is seeing calves on ground, out in the pasture or what not.”

Chris: “Oh yeah, it’s fun. You bet. When they are selling good, you never have enough, but then when it’s snowing and it’s raining and its muddy, and you are fighting the weather, then it’s too many. But yeah, it’s good and it’s bad.

Tony: “We do it because we love it.”

CO: “So what makes you want to keep the cattle? Is that your priority?”

Mike: “Well, it’s more than a hobby, but it’s a passion I guess you can say.”

Understanding the cattle farmer’s self is foundational to contextualize this study. As suggested earlier, their reality as cattlemen is built on the intensive manual labor required for their work, but it is also constantly developing as they adapt to changes in their environment. These changes are part of the history of their farm and essential to unpacking the complexity of their reality. The majority of the farmers mentioned the dramatic economic shift, as a result of the farm crisis in the 1980s that crashed livestock farming and jeopardized the profitability of diversified farms.

Greg: “[...] there was a big thing in the 70s, 80s, and 90s, where people went from a little bit of livestock, and some ground to all ground and then some livestock. So what happened to us, we got butted out of getting more land, so we concentrated on more cattle.”

Paul: “I can remember the decision to get out of pigs. The decision was, do I build a building that keeps the pigs in confinement as opposed to non-confinement where they gotta run out on the dirt?”

Paul clearly expresses the struggle that many farmers in Iowa were going through in response to the industrialization of raising hogs. Farmers were challenged by the new competition in the hog industry and were forced to decide whether to invest in the industry or to get out. During one of the interviews, John’s son commented, “it seems like it was a lot simpler back then, as far as not having as much competition.” Since most of the cattlemen were already involved in both hogs and cattle, they decided to specialize in cattle to survive in farming. They have since become established livestock producers with the knowledge, infrastructure, and experience that allows them to compete in the market.

Greg: “Yeah, because mainly the grain farmers here, I shouldn’t say it, but most of them rent the ground. And they have just started doing that when we were getting butted out. So they got a more ball rolling of getting more acres, getting more ground. They’re rolling faster than we are. But if they wanted to stop and switch to cattle, there is no way they can compete with us, because we are already established.”

As land prices have increased, it has become an extremely complex factor that goes beyond the scope of this study. Nevertheless, it has directly impacted farmer’s decisions on land management, and increased the construction of confined animal feeding operations (CAFOs) as an attractive option to expand economically, without additional acreage.

John: “[...] we’ve got some elderly landlords that own this ground, and when their kids get it, they will want to sell it. We can’t afford to buy it. So we are gonna start losing those tillable acres. So our main goal is to expand in cattle, because that can be done on our ground that we own, and nobody can take that away from us.”

Aside from land accessibility, one of the most important changes in the industry is in feeding patterns. As corn prices skyrocketed with the introduction of ethanol plants, it is no longer financially viable to feed corn to cattle. Instead, cheaper by-products, such as distillers' grains, became available at the ethanol plants, as a high energy, alternative feed source.

Paul: "It's always changing, and that is a risk that cattle feeders in the past, wouldn't have been willing to take, and not even sure if you could do it without risking performance. Because the way we used to feed cattle, is we chopped silage. Everybody did it the same. You chopped a bunch of corn silage, it sat there, you fed your cattle the corn silage, and you supplement it with corn. Basically you fed corn, all corn. And we would feed all our corn and that is what we fed."

John: "My dad fed cattle his whole life, and he probably never changed the way he fed them his whole life. Ground ear corn, hay, and protein."

Chris: "In the old days, you can get guys like my dad, my mom, alfalfa and corn, that was the only way to do it."

As farmers shared their farming backgrounds, it became clear that changes in the market drive management decisions and design the agricultural landscape. At the same time, although the market was the justification to continue in cattle farming, it was consistent with their passion and dedication for the cattle industry. This common ground is a strong foundation to build and fortify their cattlemen's self. Within sociology, an individual's self-meaning drives how individuals act. In a general sense, behavior is how an individual expresses his/her self in a particular role and/or social setting. Thus, individuals have multiple selves, based on their social networks and the positions they occupy in each setting, which may be activated by the social context (McGuire et al. 2012). Paul explicitly conveyed the notion of multiple selves when asked to describe himself as a farmer:

"One of the first questions you asked me was what do I call myself, right? And what do I call myself? And you know, do I call myself a cattle feeder, do I call myself a farmer?"

And, all those things in my mind are way too limiting. I don't want to be just any of those. I am very proud of all of them.”

The SCCA is the space for this exchange of knowledge to develop and support each other in the industry. Most participants were board members of the SCCA and described their participation as an opportunity to be active in the community and to network with other farmers. The space created through the SCCA is important to foster the cattlemen's self as it is transformed through the ethanol industry and the challenges of their generation.

John: “[...] we are cattle guys, I mean there is a difference. You go out and start talking to some grain farmers. They wouldn't want anything to do with what we do. But the group of people that you met, we are all cattle guys.”

As the cattlemen's self was identified, it became clear their construction of biodiversity was built from their social self. Although each farmer had a unique interpretation of biodiversity, they were linked through their social self. Biodiversity was described in three general categories—natural, enterprise, and nutritional diversity.

Natural Diversity

For all of the initial interviews, I introduced Zimmerer's (2010) concept of associated and planned biodiversity to facilitate each farmer's understanding of biodiversity in the agricultural context. In agriculture, planned biodiversity is a common approach for managing natural resources and purposefully integrating different species to create a functionally diverse system. Concepts of genetic resources and agro diversity emphasized the planned subcomponent of biological diversity in agriculture. Associated biological diversity consists of indirect organisms, including pollinators, weeds, soil organisms, pests, and disease pathogens as well as natural enemies attracted to a managed system. Farmers did not specifically refer to this concept when

explaining their pictures, but did present clear examples of each. For this study, associated and planned biodiversity are both under natural diversity, where planned is controlling or managing nature, and associated is unmanaged nature, what is unpredictable and independent from the farm. Associated biodiversity was mostly depicted as negative nature, such as wildlife or weeds:



Figure 2: Deer Damage

Greg: “We don’t like wildlife... I don’t like deer because I hit them with a vehicle... They are overpopulated a little bit, they don’t compete with grass, but they are a pain in the ass. They would also spread disease between farms if there was a disease problem. [...] Yeah, I could care less about wildlife. It has no effect on my farm.” (Figure 3)



Figure 1: Weed Issues

Peter: “I can’t think of anything that weeds are good for. They take up nutrients, they take sunlight, they impact your corn, because they are taking nutrients and sunlight, and not letting your plant to grow fully.” (Figure 2)



Figure 3: Wind Damage

As part of associated biodiversity, farmers understood nature as an independent entity. For this section, I predicted that nature, in terms of biodiversity, would be seen as separate from the farm, because it is not managed. However, through the interviews, it was clear nature is much larger than biodiversity and cannot be separated from the farm. This revelation was apparent as Peter described the weather as nature in one of the pictures.

Peter: “Yeah, I mean, that is not a very good biodiversity

explanation.”

CO: “So do you think this doesn’t show biodiversity?”

Peter: “No, I think it does, because it is wind, I mean wind comes along with everything that we do. It’s just something we can’t control.” (Figure 4)

Greg also included another perspective on weather:

“Nature is rain, we need rain right now. Now three years ago, we had way too much rain. So basically, it all depends on your crops, because we depend on our crops to feed the cattle. So you are always battling nature for the crops in order to have enough feed, valuable feed for the livestock.”

Including weather as a part of nature makes it clear that natural processes are those factors the farmer cannot control. When talking about the Japanese beetle infestation in the fields (Figure 5), Peter says:



Figure 4: Peach Tree

“That’s a natural deal, we had no control, I mean if you wanted to go through and plant that field two weeks earlier, might not have had that problem, because it would have been pollinated, and it might have not been blown over. [...] Yeah, there is nothing you can do. You can’t prevent them. It’s just, they are either gonna have a problem with them, or you’re not. Some people, ten miles away had no problems. There are just spots, just kinda like everything else this year, you just didn’t know.”

For planned biodiversity, they perceived the farming of both cattle and grain as complementary systems that create a sustainable cycle. All farmers seemed to agree they managed a closed system in their farm that connects the livestock and grain operations:

Greg: “I have to have the plants to feed the animals. And the animals produce some of the fertilizer back to the plant, so you got your cycle, and they have to go with each other.”

Similarly, Alex shared:

“[...] everything gets fed back to the cattle. The corn, the soybeans, I guess we use some soy whole pellets which is a by-product from processing soy beans so all that stuff is all by-products from crop production from feeding cattle.”

When talking about cover crops, Paul recognizes a functioning cycle that helps construct his conception of biodiversity.

“It’s all part of one big continuous circle. To me, this whole thing with biodiversity, I get to utilize everything that’s there. And now with this cover crop, I am utilizing everything. [...] I need all these tools to do it. It’s just another tool.”

On the same topic, when asked about his definition of biodiversity, Mike related biodiversity to the cycle of his farm:

“[...] we raise crops and livestock that make fertilizer and we take that back out to the field and that helps build the soil, which holds moisture, which is good and holds nutrients. I guess that is my only definition that I can think of.”

The distribution of nutrients in the farm cycle is a critical management decision that helps form the perceptions of biodiversity. However, nutritional management decisions have changed over time and have become more complex since their father’s generation. The expansion of the ethanol industry led to an increased demand for corn and an increase in the supply of by-products from the ethanol production processes. Parallel to the expansion of biofuel production, high global commodity prices, and poor weather conditions in some major crop producing areas have drastically changed the livestock feeding industry (Matthews and McConnell 2009). When asked about the changes in feed, John confirms the impact of the ethanol industry:

“The rations, the type of feed and what is available and what is economical because things change so fast. And part of that came because of the ethanol plants and the by-products from them. From corn going from 3 to 6 dollars, you had to find something that was less expensive to feed.”

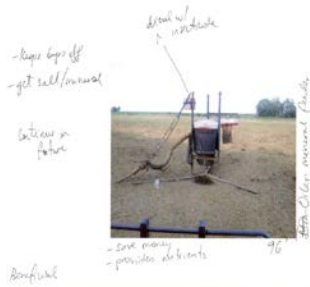
According to a USDA report (Matthews and McConnell 2009: 2), “co-products from ethanol, sweeteners, syrup, and grain-based oil production have been used as livestock feed for many years, but only recently have become a more widespread economic alternative for coping with high prices for feedstuffs such as corn, soybean meal, and urea.” As a result of substituting corn by-products for corn, Paul explains:

“Nowadays, you’re mixing and matching and buying this and doing that, and you are changing things and you are balancing. Now you need a nutritionist [...] Now I decide, I’m not gonna chop silage anymore, I’m gonna make phone calls, and I’m gonna have trucks, deliver my feed every week. [...] Do I have the confidence that I can make phone calls and get feed delivered? I mean, now it’s a no brainer, I know I can do that. But that was the first fear I had to overcome. To not just have my feed on my farm, from my own farm produce. Now I am willing to take advantage of price, price advantages to buy feed and sell my corn at a higher price.”

Feeding has become a complex management decision. According to Magdoff et al. (1997: 54), “one of the main factors influencing farm decisions affecting nutrient flows is perceived economic benefits of particular management options.” The farmers in this study showed an awareness of nutrient flows in their systems. David was especially knowledgeable about the importance of nutrients in management decisions, implying nutrients are themselves a management tool for increasing yields:

“[...] we are finding our micronutrients are low, and micronutrients are so difficult to apply because they are such little rate, you can’t get it spread thin enough, and if you put too much on, you will sterilize the soil, can’t do it, so it’s almost easier to use a foliar spray with micro [nutrients]. Now if we had \$3 corn, it would not pay to do that, no one cares. But when you have \$6 or even \$7 now, you can do a lot of things to increase yield because it pays for itself. So the price of corn makes a big difference on management decisions. The amount of nitrogen, potassium also influenced by price of corn. So the higher the price, the more willing we are to feed the crop better, the better the diet [the corn] gets.”

In another interview, Chris included a mineral feeder (for his cattle) as one of the pictures to represent biodiversity in his farm. His reasoning confirms David's insight on nutrients as a management tool for improvement (Figure 6):



“Well, it’s saving me money. It costs me money, but it’s also saving me money. Because it provides nutrients and it keeps bugs away. It costs you to put it out there, but it really costs you if you don’t have it.”

Peter also showed concern for nutrients lost to weeds:

“Oh yeah, that is a major deal, because every weed is taking nutrients away

Figure 5: Mineral Feeder from your crops. That is the main thing right off the start.”

Nutrient management is an important component of the planned biodiversity of the farm. The understanding of a nutrient cycle allowed them to recognize the complexity of their farms, and through this recognition, they justified their sustainability. They believed these systems were environmentally and economically complementary, forming their conception of sustainability. During some interviews, biodiversity and sustainability were used interchangeably.

Tony: “We think we are sustainable because we are doing the best that we can, by using all the resources that we have.”

Greg: “Sustainability I believe is your corn stalks and your corn, and you are putting it all back together. And you’re not mining the ground, striping it off, throwing it away, so you are recycling. [...] Farmers think more about sustainability.” (as opposed to biodiversity)

David: “As far as biodiversity goes, we actually reduced our carbon foot print of the crop ground because of our cattle yard. It’s sustainable. Not only can we feed our own crop, but we can out two year fertilizer program, just from the manure.”

Paul: “To me we are thinking about things completely...because we got this little segment of people that want to think certain ways, and it’s more of a ... if you really think about how we are doing things. I mean we are trying to utilize everything that is there, and that’s what makes us sustainable. Because you are taking advantage of the

knowledge and the things that we have available to us that we are learning, and we are using those.”

Chris: “Yeah, I was kinda wanting to show you [referring to picture] because it allows us to mix the different feeds together which in turn feeds the cattle, continues their nourishment, their nutrients, their growth, their sustainability.”

Distinct differences arose in the interpretation of nature between feed lot and cow-calf farmers. Farmers who operated feed lots were more management focused, and did not want to rely on nature for the safety and well-being of their animals. Cow-calf farmers were more open to allowing nature take its course. The following quotes clearly represent these differences as farmers describe the importance of shelter to protect their cattle:



Paul (Feedlot farmer): “In some respects, people would show a picture of cattle on a pasture, just grazing on a pasture, and say that is biodiversity. And in my opinion, it would be just the opposite. **Because, you are relying on nature and the animal to fend for itself, you know.** It’s just no more than a deer, no more than anything else, you just fend for yourself and you are on your own. And with this [barn] I’m trying to help the animal, I am trying to... I’m taking away all its stress.” (Figure 7)

Figure 6: Shelter



Greg (Cow-Calf farmer): “So that pasture with all the trees around it, in the winter all the cattle will huddle up in the corner of the trees. And you should see how protected they are. They stay a lot warmer, and that’s all nature right there. In the winter, your primary winds are from the North, so you got pockets in the pasture, up into those trees, so they eat here, and then they go back in there. So, I would say that is biodiversity! **That is totally depending on nature for shelter, or a form of shelter.**” (Figure 8)

Figure 7: Shade

Another distinct difference between feedlot and cow-calf farmers was in their attitude towards environmentalists, conservationists, and the general environmental movement. Feedlot operators were particularly hostile to environmentalists, while cow-calf operators revealed compliance and understanding of environmental regulations. Aside from the interviews and the board meetings, I had the opportunity to participate in one of the tours given by Tony, the largest feedlot farmer in the study. Tony did not personally participate in the study, as he volunteered his son, David, to represent the farm in the interviews. Therefore, since this was such a large and complex operation, it was helpful to learn more about the farm through the tour. During the tour, he explained the necessary changes in infrastructure to accommodate for environmental regulations.

“Everybody today wants to hear that you are natural, so we are just trying to figure out ways in Iowa, I mean you see how flat it is around here, you gotta see what happens when we get 4 or 5 inches of rain, because there is no place for it to go. So we work very hard here, and this is an approved system by the EPA and DNR to offer this to cattle producers [...] I was here first, my family was here first, this feed lot was here first, but they [conservationists] don’t care, so we are just trying to figure out how can we fit in our community.”

Following the tour, he gave a power point presentation with more background on the farm and future goals. In the presentation he spoke of environmentalists as a challenge to his production:

“We look at the environment, the environmental, and the environmentalists. This is our biggest challenge as farmers, as companies like yours, dealing in chemicals, dealing with GMOs and all the new stuff that is going on.”

When describing the challenges environmentalists pose, he shared a newspaper clipping from California:

“Now our environmentalists. My son sent me this clipping from the SF newspaper, it says, “Note to all hunters, to all of our hunters who kill animals for food, shame on you, you ought to go to the store and buy meat that was made there, where no animals were

harmed.” That’s what we are fighting with right now, I mean the people that don’t understand where animal production is, where crop production and what it takes to do crop production and animal husbandry. I mean this is what we are up against people, and this is all over the world, and they don’t understand today, so how do we can get them here on this farm, and show them that that’s not how it is.”

On another interview with a feedlot farmer, Paul expressed a similar sentiment of threat and victimization. His problem with environmentalism is that it is completely based on emotion and nostalgia. He is worried environmentalists want to push farming back to how it was, and by doing so are impeding the progress of agriculture.

“Yeah, they want to save old farm buildings from being torn down because they don’t like what farms are turning into. Well, if you are out here working with them and doing things, I can’t do anything with that. I can’t go backwards to what it used to be. You know, it’s kinda frustrating because they kinda make us feel like we are doing something wrong when we tear something down, to put up something that we can use.”

At the same time he is worried about these threats. There is also a feeling of victimization caused by this conflict:

“Yeah, I just want all the answers for all the questions to be asked, as opposed to just thinking the way we are doing now is wrong.”

According to Clayton and Opatow (2003), environmental conflicts make competing social environmental identities more visible, foster in-group bias and stereotyping, and can exacerbate destructive conflict (2003: 252). The farmer’s hostility towards environmentalists can be explained through their cattlemen’s self. Self in this context is not stable, but is layered, complex, and changing as it is negotiated in social interactions and conflicts. Thus, nature-oriented activities, whether it is through farming or conservation, can elicit strong social connections that take on intensified meaning in environmental conflicts between those who want to interact with nature in one way and those who want to interact in another way.

Towards the end of Greg's interview, he was excited to tell me about a recent case on a proposed hog confinement near Hickory Grove Park that Story County Conservation was filing against. As a result of strong public opposition, the plans for the confinement were withdrawn.

The park was near his farm, so he drove me to the location and shared his frustration:

“Just when that happens, it's just a fucking huge blow to me as a livestock farmer. Because, I'm like uh! They won! It's a competition. Farmers use the environment to make money, but we don't like environmentalists, because they prevent us from making money. They do! They don't want us to make money off of the environment.”

An additional reason for intergroup conflict—beyond competition for real resources— is social competition, which was clearly depicted in Greg's quote. When faced with decisions about resource allocation, groups prefer seemingly irrational outcomes that maximize differences between themselves and opposing groups, rather than an outcome that maximizes the benefits to their own group. This occurs because groups assess their collective self-worth by comparing themselves with other groups. Thus, social competition helps explain why conflicts over land can be so difficult to resolve (Clayton and Opatow 2003: 267).

Given the same topic, cow-calf farmers were less threatened and judgmental toward environmentalists, and had fewer questions and concerns about regulations.

John: “And with the laws, and this kind of where you get in with your dealing with the DNR and the conservationists, they don't like the open lots, because we are susceptible to the rain washing the manure down to the creek and into the lake, so that is why we are gonna put up a building, so all the manure can be contained.”

Mike: “[...] farmers are environmentalist too, I mean I suppose they think about soil, erosion, water quality protections and things like that. I don't get involved in too much of that, but I know some farmers that do buffer strips along rivers and streams, and they do a lot of terracing to keep the soil in place.”

Alex's sentiment was especially interesting because his wife is a soil scientist for NRCS. He is a lot more exposed to information regarding environmental regulations, and in turn, more willing to cooperate:

“Well, she's on the other side of the fence. She is working for the government, regulating the farmer, and I can see for both directions. I mean, farmers shouldn't... we should watch what we do, and make sure we don't affect other people.”

Enterprise Diversity

Through the cattlemen's self, they view having diverse enterprises as an economic advantage that minimizes risk against the unpredictability of nature. This category did not significantly vary between cow-calf and feedlot farmers. All agreed their decisions were based on the largest profit return and limited by the resources available on the farm. As most farmers are limited by tillable acres, through cattle they are able to expand economically without more land. Some accomplished this through feedlots and others utilized land unsuitable for crops or pasture. Enterprise diversity is an expression of their cattlemen's self because it shows how they have adapted their context to changes in the industry.

Three of the cattle farmers interviewed were trying out cover crops; two for the first time. Interestingly, as we discussed cover crops, they made sure to tell me it was not for environmental reasons, but for profit. They had the same attitude when justifying CRP grounds on the farm.

Greg: “I would say the markets drive everything, and money is everything. That is CRP, if we didn't get money off of CRP we wouldn't do it. It's all money, and that is a government subsidy, the CRP. Money drives everything. Look at the grain farmers; they put as much crop close to the road as possible...”

Paul provided clear examples of enterprise diversity, but was cautious explaining his views, as there was an underlying expectation that his idea of biodiversity did not coincide with my own.

When asked to talk about biodiversity on his farm, he responded:

“The first thing that comes into my mind are my buildings, being able to diversify, and having more groups of cattle and being able to take advantage of different markets throughout the year. Now that is a form of biodiversity to me. It has nothing to do with my land, although, because I get to do that, I get to have more manure available to put on my crop ground at different times. One of the things that I am thinking about doing that would kind of go in line with biodiversity in my mind, am not doing it because of being biodiverse, I am doing it mainly because I think it is going to make me more profit, in that I am going to aerial seed into standing corn, a rye grass that will start to grow this fall, will be available next spring right away. I will harvest it in late spring and then plant soybeans to that ground.”

Further in the interview, he confesses he is trying to understand my perception of biodiversity, suggesting his perception would be different than mine:

“I keep thinking of how you are thinking of biodiversity and to me biodiversity is the ability to feed livestock in Iowa, as opposed to ... that’s what it gives me, the ability to, feed cattle the most efficient way in Iowa. Because if I was in Kansas, Oklahoma, or Texas, I wouldn’t need buildings, because of the climate. Their humidity is low, so they don’t need shelter. In Iowa we have to create climate or control climate. You have to be most efficient.”

Moreover, biodiversity can be seen as a market strategy to utilize the most natural capital available in the farm. All the farmers mentioned diversity in terms of utilizing plants with different growing periods to access nutrients and markets at different times of the year.

Mike: “Well, yeah you have cool season grasses, and then you have legumes, mostly in the pastures and you want that variety for different seasons of the year. Like the cool season grasses come on early in the spring, and in the summer the legumes will take over because they like the warmer weather better. So you always want a diversity of plants on your pasture.”

Chris: “Yeah, because certain grasses will peak at certain times of the year. So, if you just have one that peaks, that’s it. You have nothing for later. So, you are better off having two different types of grasses in there.”

As I discussed biodiversity in the interview with David, he provided a unique perspective connecting both natural and enterprise categories. David revealed diversity was a necessity as agriculture is a survival business. Since agriculture depends upon the unpredictability of nature, farmers must have a different approach for business, which constructs their selves as farmers.

“Yeah, but don’t feel like monoculture is bad, because it’s not monoculture. This crop is beans today, but its corn next, we are not planting beans after beans. You can’t do that. The only thing we do that is with commercial corn, and even then you can only do that for ten years before you need to put beans. The reason we don’t grow crops other than corn and beans is because there is no insurance or government support. So if you were to have drought, you could go belly up with that. Well I’m sorry, but farming is a survival business. It’s not like a school or a corporation or something where every year you can pretty much calculate growth or decline. It is a survival business. I mean if we have a drought, it can take us out of business. So the mindset is different, we are controlled by something we can’t control, weather.”

As we continue to analyze how enterprise diversity helps form the cattlemen’s self, the mentality of agriculture as a survival business is consistent among other farmers, regardless of type of operation, where money drives everything:

Greg: “[...] we always think of money, but we never think of nature helping us [...] I grew up thinking, and that is how my dad is, its money, to make money off of the land.”

Chris: “It gives us a farm income, you’re feeding, I don’t want to say you are feeding the world, but you are feeding a lot of people. The main thing is the income. Without that we don’t have nothing.”

Paul: “Farmers have changed because now there are more risks, to where before, farming was an entry level job just like any other. We are a business, we take more risk, and we want to get rewarded for that.”

However, Alex reveals that although money drives the decision, the land will ultimately limit the type of agriculture. It is at this point that a distinction arises between feedlot and cow-

calf farmers because the pasture in cow-calf operations limits economic expansion. When I asked why more farmers in Iowa weren't involved in cattle, Alex explained it is more demanding because of labor and added:

“Actually a lot of people are selling their cows right now because it's profitable enough to tear up pastures and plant corn. It's more profitable that way than it is to have cows.”

As a member of the SCCA, the cattlemen's self is confirmed through exchanging knowledge and experiences with other cattlemen.

Alex: “Yeah, like we went on a tour of the cattlemen's a couple of weeks ago, and a guy probably in his 60s said he has seen it before, where corn price went up, and everybody plowed pastures and sold the cows, and when corn went down they got the cows back and planted it back to grass. But he said that the damage that is done by planting row crops for a few years, you really don't get that back.”

Greg: “[...] we'll take the rough ground, where you will have more erosion, and put pasture there, and not row crop it. So see, that's better for that land. Oh shit, I can't make any money off of corn because of the erosion, but I can put cattle and make money. So again, its money, but at the same time you are trying to sustain the ground how it is to adapt to that.”

As members of an association, they create accountability on each other that impact their management decisions. As a result, they are less likely to sell their cows to plant corn.

CHAPTER 5. DISCUSSION AND CONCLUSION

The results of this study demonstrate biodiversity is a multifunctional concept expressed in different forms, depending on context. The agricultural context provides alternative interpretations of biodiversity described by farmers. Through the farmers' perceptions, it becomes clear that their construction of biodiversity is built from their self. Their self as cattlemen was evident from our first encounter and remained strong throughout every interview. Biodiversity, then, became a platform to discuss issues related to nature on the farm. Therefore, discussing nature as opposed to biodiversity is a more appropriate concept relatable to farmers. The relation to nature can be explained, as "nature is socially constructed through social interactions among members of a culture as they negotiate the meanings of nature and the environment" (Greider and Garkovich 1994: 5).

The photovoice methodology was helpful to reveal these meanings of nature. Even though the process of taking pictures was not effective with all of the farmers, photovoice was an innovative and creative component that provided multiple points of reflection during the interviews. The farm landscape carries multiple symbolic meanings that emanate from the values by which people define themselves. Every landscape is a symbolic environment that reflects self-definitions grounded in culture (Greider and Garkovich 1994). Through their pictures, farmers focused on the images to express their values and took control to create meaning by justifying the relevance of each picture. This process was especially helpful to guide and ease farmers, who were uncomfortable in an interview setting. The photo served as a medium to which farmers could still express their views, without feeling interrogated and forced to directly expose personal views. Others were less reserved about verbalizing their opinions and approached

photovoice as an opportunity to express their notions of sustainability. Sustainability and biodiversity were sometimes mentioned interchangeably, suggesting farmers perceived these concepts as part of a broader notion of environmentalism that confronts their social selves as farmers. In other words, “biodiversity” or “sustainability” was simply a place holder for terms that depicted a “green” initiative. These results suggest that the correct applicability of the term is irrelevant to the farmers, as they applied it in relation to their experiences.

According to the philosophical views in pragmatism and symbolic interactionism, the meaning of objects resides in the behavior directed toward them and not in the objects themselves. That is, knowledge is being continuously applied to new situations and is judged by its usefulness. Symbolic interactionism adds that it is the response of others to that judgment that determines the meaning given by an individual. Therefore, farmers do not refer to “biodiversity” as it is conceived in the scientific community, as the scientific community is not their “other” whose point of view they take when judging their own actions. Instead, biodiversity refers to a set of values and justifications that reflect the environmental utility of their farm and the point of view they take when evaluating their actions from other cattle farmers. The academic community does not have a monopoly on the stipulation of meanings and definitions. Meaning is determined by socially agreed-upon conventions of language use, and thus farmers’ colloquial connotations of the term are just as viable for the purpose of a grounded qualitative exploration; and are reinforced by groups formed of people with similar experiences which they attribute with similar meanings.

The cattlemen describe biodiversity in two broad categories—enterprise diversity and natural diversity. As part of enterprise diversity, they are involved in various industries to maintain economic sustainability. Through this involvement, the farmers believe they have

created a diverse operation that runs in a closed and self-sustaining cycle, and justify their notions of sustainability. Natural diversity is described as associated and planned. Associated biodiversity includes notions of nature as an independent entity with unpredictable forces. Planned biodiversity includes the parts of nature farmers were able to manage and control. In this section, there was a significant emphasis on cycles, suggesting farmers are aware of the importance of maintaining sustainable nutrient cycles in their farms. According to Magdoff (1997: 56), it is essential for farmers to manage nutrient patterns; “nutrient cycling must become a priority in farmer decision making before it can play a significant role in farm performance.” Finally, I predicted biotechnology would be prevalent in discussions about planned biodiversity, but it turned out to be insignificant in terms of frequency. However, it is worth mentioning, since it reflected perspectives of the youngest participants. Biotechnology, as an approach for management, was only mentioned among the youngest farmers:

Peter: “In the future, I guarantee on that one, they are coming out with stronger stock in genetics, better resistibility, better root strength.”

David: “Because we are trying to solve an issue here, so if we were to solve this issue without that ability to choose a different seed, we would have to do it through a different crop, insecticide. But we can keep the crop we want to grow because we have the option to grow a genetically-modified plant.”

The SCCA revealed to be a valuable space, where farmers are able to negotiate the meanings of nature through an exchange of knowledge and experiences. Generally speaking, the cattlemen’s relationship with nature is in constant conflict of acceptance and resistance. As Greg described, speaking for the group, “We don’t blame nature, because in one way nature helps us, and on the other hand it’s bad.” As they negotiate these meanings, SCCA is also a space to strengthen and maintain their identity, since it is constantly confronted with new decisions and challenges in the industry. Most notably, challenges to their self came from the environmentalist

identity. Environmentalists were perceived negatively, particularly by feedlot farmers, while cow-calf farmers were more neutral. Brian, a feedlot farmer, mentioned he feels like environmentalists are making up problems. Interestingly, he applied “we” differently from Greg’s use of the pronoun. Here, “we” seems to represent a broader collective that goes outside the cattlemen’s group.

“We are making up problems. In a way, we are making up that we are doing it wrong, that it’s being done wrong, because I would’ve never envisioned such a thing as “animal rights.” I would’ve never ever dreamt that up. As far as pollution, and water quality, air quality, those are all things that I can measure and try to improve. But animal rights? That’s an emotion, that just how do I combat that? How do I convince someone that says my animals aren’t “happy”? How do I do that?!”

I speculate he applied “we,” only as a formality for the interview process. At the end of his argument, it is clear he does not maintain “we” as the collective because he is “combating” opposing views, asking how he can convince others of his own views. Therefore, the issue here is not he believes “environmentalists” are making up problems, but farmers cannot relate to environmentalists’ problems. More importantly, not only do they not relate to these problems, but they are seen as causing the problems. Thus, they feel their self is constantly threatened, creating greater tensions between both groups. However, it is not just their identity that is threatened, but a whole way of life and community that is embodied in different landscapes (O’Neill and Walsh 2000). Therefore, “the fear is that the attempt to create a particular kind of conserved landscape is a threat to both a kind of community whose life depends on a particular mix of working activities – including quarrying and farming – and an identity as farmers” (2000: 286).

To avoid confrontations and conflicts of identity and selves, it will be important to create an overarching identity where sub-group identities are still preserved, and able to foster

productive discussions that do not threaten their individual identities (Clayton and Opatow 2003). Brechin et al. (2002) argue that most literature on biodiversity conservation frames the debate on a false dichotomy: pro-nature versus pro-people (conflicting selves). In contrast, it is important to establish a legitimate process by constructively working with people to achieve long-term nature protection. Since conservation is a human organizational process, the goal of biodiversity protection (pro-nature) depends on the strength and commitment of social actors (pro-people). Therefore, the creation of neutral spaces where identities do not impose a new set of social norms to opposing views is important to foster fruitful discussions for biodiversity conservation in the agricultural context. It is important for farmers to be recognized for their lived experience as farmers and feel they are included in discussions regarding biodiversity conservation.

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APPENDIX A. CONSENT FORM

**Consent form-Interviews
How do Farmers perceive Biodiversity?****A Photographic Analysis of Livestock Producers in Story County, Iowa**

Principal Investigator: Caroline Felix Oliveira

Department of Sociology

Graduate Student in Sustainable Agriculture, Iowa State University

You are invited to take part in a research project to study farmer's perceptions of biodiversity in Story County, Iowa. I believe your experiences are extremely valuable as to how we relate to the land, and are very relevant for environmental policy making. I hope that through the results of this project, we can integrate your visions to create better environmental policies that reflect the reality of the relevant stakeholders.

This research will consist of two parts. For the first part, I would like to visit your farm, and learn more about your operations through an informal interview. This should not take more than 45 minutes. During our first meeting, I will also ask you to partake in the photography portion of the research. For this I will provide a disposable camera, and ask you to take pictures of biodiversity on your farm. If you cannot take pictures, you are welcome to share personal photos. For the second part of this project, I will develop the pictures, and come back for a second interview. The interview will last approximately one hour, and we will analyze the pictures that you have taken together. I will ask you to pick 3 of your favorite pictures, that you think best represents the idea of biodiversity in your farm.

Your participation is voluntary. You are free to leave this process at any time you like.

With your permission, I would like to audio record the interview, which will be transcribed by me. No one else will listen to the recording. The recording will be destroyed at the end of 2012 and be assured that, if I keep the transcripts beyond that date, there will be no means of identifying the interviewees.

We anticipate no risks to you from participating in this study. Your name and contact information will never be attached to your data. If we publish information from your interview, your identity will remain confidential.

You are encouraged to ask questions at any time during this study. For more information,

contact Dr. Cornelia Flora (515- 294-1329, cflora@iastate.edu). If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, Office for Responsible Research, (515) 294-3115, 1138 Pearson Hall, Ames, IA 50011.

Thank you,

Caroline Felix Oliveira
Department of Sociology
Graduate Program in Sustainable Agriculture
Iowa State University, 403 A East Hall, Ames, Iowa 50011
cfo@iastate.edu

PARTICIPANT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

(Participant's Signature)

(Date)

APPENDIX B. INITIAL CONTACT

Initial contact- Email Script

Title: Request for ISU research participation

Dear (name of Iowa Cattlemen Association Member),

We met last March at the Iowa Cattlemen Association Board Meeting. It has taken me awhile to get back in touch with you guys, but I finally have all the information I need to start my research. Like I said at the meeting, I am a graduate student in Sociology and Sustainable Agriculture at ISU, and I am doing research for my master's thesis. My main purpose is to help the communication between farmers and scientists, so we can formulate policies that reflect the voices of everyone involved in agriculture.

As a member of the Story County's Cattlemen Association, I would like to focus on farmers that are members of the Cattlemen Association to better understand farming systems, and how cattlemen in story county farm. Having that said, I was hoping we could meet at your farm, so I can learn about your operations, and tell you more about my research. I would also like to ask you to partake in the photography portion of the research. For this, I will provide a disposable camera for you to take pictures of your farm. Once I get the pictures developed, I'd like to meet with you again, so we can talk about them. Please let me know if this is doable and something you would be interested in helping me with. I would truly appreciate it!

Please respond to this email, or call me at: (305)979-9295

I look forward to hearing from you!

Sincerely,

Caroline Oliveira

APPENDIX C. FIRST INTERVIEW QUESTIONS

Outline of questions for first visit

Thank you for having me at your farm! I am excited to be more involved with the cattlemen association, and learn more from each member about farming. There is only so much we can learn in the classroom and having the opportunity to come out here really helps me have put things into perspective.

Now let me begin by telling you about my research. I am finishing up the first of year of my masters in sociology and sustainable agriculture, and I have a bachelor's degree in agricultural operations management. My main purpose is to facilitate the communication between farmers and scientists, so we can formulate policies that reflect the voices of everyone that is involved in agriculture.

First I want to ask some basic questions about your operations:

1. What type of operation do you run? For how long?
 - a. Do you have a cow-calf operation?
 - b. Feeder cattle?
 - c. Has that mix changed over time?
 - d. What kind of crops do you grow?
 - i. Do you plant different species of this crop?
 - e. Have you always run this type of operation?
 - i. Do you have a family background in agriculture?
2. How many acres in crops?
3. How many acres in pasture?
4. How many head of what kind of livestock?
5. Are you able to grow your own feed?
 - a. What sorts of feed and fodder to you grow?
6. How long have you been working that type of operation?
7. What kind of changes do you plan to make in the future?
8. How much of your total income comes from the farm?
 - a. Do you work outside of your farm?
9. Have you worked with any third party groups, either private or public to help manage your farm?
10. What is your strategy for pasture management? How do you see it changing in the future?
11. What other aspects of your operation benefits from the presence of a diversity of plants?
12. Have you changed the breeds of cattle that you raise?
 - a. Are there particular breeds that you have found work best with your operation?

13. Do you have many different species of birds on your farm? Which do you enjoy the most? Which cause the most problems?
- a. Do you take any measures to prevent or maintain them?

The main portion of my project is to look at how farmers manage different plants and animals on the farm. Some people call this “biodiversity”. Biodiversity works at different levels, such as genes, species and ecosystems, making it more difficult to have a standard measure. One way to think of biodiversity, is that it is a concept that encompasses all species of plants, animals, and microorganisms and the ecosystems that make up a landscape. It is an umbrella term for the degree of nature’s variety, including both the number and frequency of ecosystems, species or genes in a given assemblage.

Now this can be something you did yourself, or something that just happens naturally on your property. I will ask you to take 20 pictures for about 2 weeks of what you see biodiverse on your farm, or what represents biodiversity on your farm. If you find this difficult, or if this is not the time of the year where you see this biodiversity, you are also welcome to share any pictures you have taken in the past that you think represents biodiversity on your farm. After the 2 weeks, we will set up another meeting, where we can talk about your pictures, and I will ask more specific question about biodiversity to understand how you relate to that concept.

APPENDIX D. PHOTOVOICE INTERVIEW QUESTIONS

Photovoice

First of all thank you so much for helping me with my research! I went ahead and printed (since they are likely to be electronic as well as from film) the pictures, so that we could go through and talk about them. Before we look at these pictures, was there a picture that you already had that you would like to include?

After we look them all over, including the ones you have added from your own albums, I will ask you to pick the best 3 that you think represents biodiversity in your farm, as represented by the diversity of plants, and animals, both domesticated and wild. The quality of the picture, or your skills as a photographer are not important!

- 1) Tell me about this picture and what it can tell me about your farm and how you manage it.
- 2) Do you manage this biodiversity or does it happen naturally?
- 3) Where is this in your farm?
 - a. Do you visit this place on your farm often?
- 4) Is the diversity of plants and animals shown in this picture beneficial or a problem to your operations?
- 5) What do you see on your farm in the future in terms of wild and cultivated diverse plants and animals?

APPENDIX E. PICTURE SUBMISSIONS

Greg's Pictures

Spring
water bugs

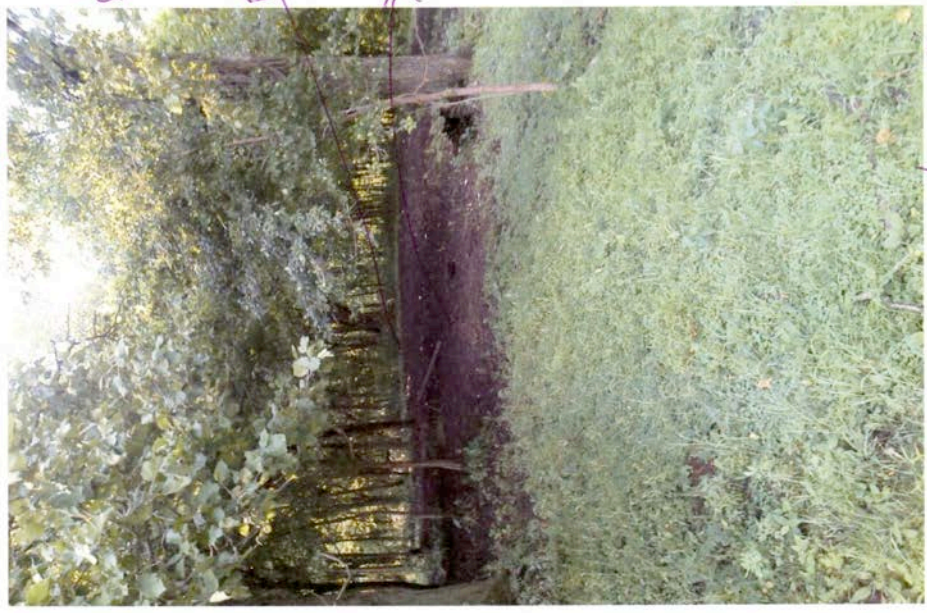


Beneficial bugs
fertilizer for food
low cycle

Spread up decomposing process

Beneficial
bugs biodegrade
manure faster } fertilizer
- eat manure 2 days

Shade
Keep them cool



Beneficial

Fence
Cows
stand
here

natural
barrier

60 acres summer / winter: wood
natural block
to cool--shelter keep them cool
- keeping cows healthy

problem

eroding
with
fence

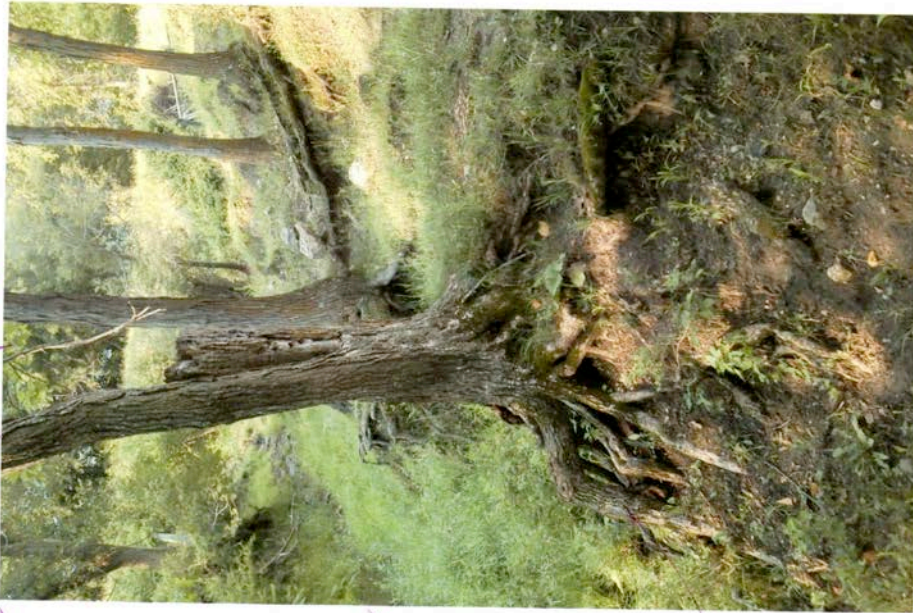


program
retention

2000
- till

60/70 years

feature



↙
creek
(winter)

↘
exposed
root
are
erosion
control

hold back

using nature
to solve
problem

protect
water
source



native getting in the way → problem
 - mause 60 acres

fly ear
 fly

Flies on face

control flies w/ preats
 - stress on cows

Paul's Pictures

part of cycle



manure spreader

Weather in IA
- too much heat and moisture



not available when

Ability to feed livestock
- feed cattle efficiently

Predict/rely on performance
reduce risk

(Added shelter to open lot)

- This is how it look for Indians

- ~~rest~~ managed restoration



Benefit (90%)

Problem (10%)

- has given up potential but has lost money before

- Government controlled opportunity because used to be a wasteful



Wet land

opportunity to store grain in fall
- convenient
- market opportunity



- feed or grain storage

Grain bin

more chances utilize land/time

Ingredients for hamburger, or steak



co-products
Feed storage

product from stock (more opportunity, choice)



←
feed

Round bales

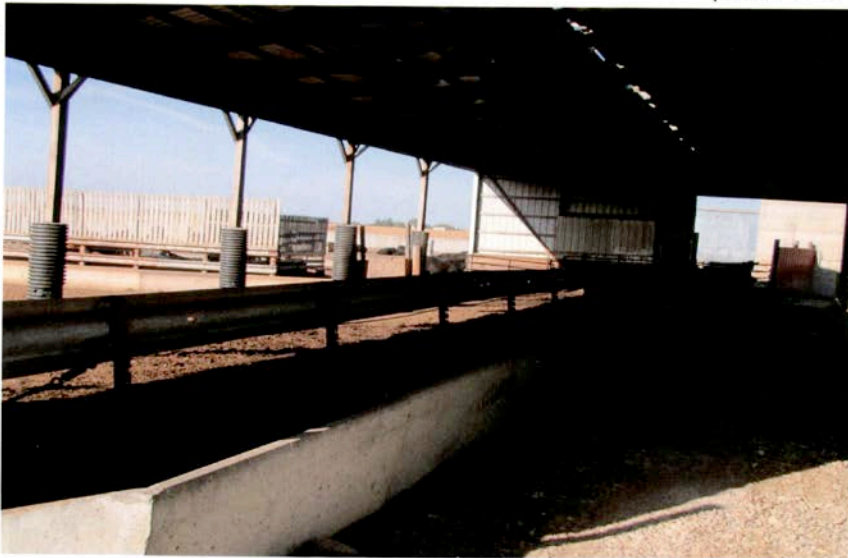
-corn is not ^{just} food, its an ingredient

Feed product
Silage

came from
cover
crop
field
(before
cover
crop)



manage
-benefit



mid 90s - 95?

⊗ First building for livestock shelter (after old barn)
- wanted to resemble a barn, but more modern
- old look is dysfunctional

Keep using it until it wears out and gets replaced

raise livestock as opposed to row crop

(Replacement barn)

Recycling

Pieces of machinery are just tools for cycle

Biodiversity
- every thing that is there
SUN



→ round bale wader

allows to care for livestock

- produce food off of corn stalk
- create food source

tractor loader

(Loader)

Beneficial



→ tractor

← planter

manage
- need to be updated by technology

→ row

Corn and soy bean planter

- row crop part of farm
- relates to livestock because it feeds



Grain bin

harvest, reapply manure,
more crops

- take advantage of corn field better
- more opportunities to utilize
more



← possible
biofuel

BEFORE
→ stock
is
opportunity
corn field

I'm not ^{just} a corn farmer, it's a piece of
my puzzle

Beneficial

harvest for silage
(planted cover crop to protect soil)

don't need that much
- help w/ nutrient runoff
- water quality



avoid monoculture

→ harvest for grain

year round
- seasons
- plants
- planting dates
- protecting/adding to soil

chopped silage

winter rye ~~cover~~ only worth it
(chopping for silage, then plant soybean)

better performance
- healthier

produce food efficiently
- cannot afford livestock to be stressed



→ tarp

Create control climate
- have to, to be efficient

(added shelter to open lot)

cycle that produces food
-mechanized is improved



→ feed wagon

→ used to be bucket

machine adds value

Wagon

Peter's Pictures

- carry disease
- un-washable natural
cause

problem



animals interact

prevent:
keep feed stuff clean

show pigs

Raccoon ~~is~~ not fully grown

- not too scared
- can't stop other animals

- hurt animals

- eat birds that carry disease
- mix in feed



- feed (water) using natural way
- feed building using natural way

Kittens
part of farm - control pests

take care of problems
- comparison
- uncertain trust
Future helpful
- being diverse

spraying fence row -> to keep weeds down



weed issues

no rain
grass lying

Pasture
July (late) -> eaten down

- everything can be out there

Beneficial/problem → depends



- where damage will be done → happy medium

Soybeans
- Save cost

- similar to trees

- not bad yet
- don't need sprayed

Wild flowers in the ditch

Beneficial



milk weeds ←

red clover or ←
wild flowers depends on eye

field

ditch

→ road

chance to grow
- benefits wildlife

- we don't spray ditches

Beetles



Another fruit

Weed Issues

⇒ water hemp

Problem



In worn field

- weeds are bad
- take nutrients, sunlight

- spray once for all year
 Depends on ground, timing.

- getting resistant
 Future: easier to manage

- Stronger stocks in genetics future
- Wind storm → knocked down corn

Problem



Wind damage

Natural

South of Ames on the way to farm

Wind comes along with everything we do that we do
July 26, 2012
- Wind → not good
- Too much is devastating
- can't get all corn, and volunteer

~~can't~~ can't prevent

Peach Tree

Japanese Beetles

had no choice had to spray



Mid July
- kill year

Problem

Tree in yard (peach tree) → killed
- watering and found it

Alex's Pictures

managed
Benefit
saved
in breeding

pick bulls with the carcass

- Always
changing
the
genetics

9/10 is
ideal age



Cattle

- cross bred -> better gaining

Problem -> eat everything

managed
in a way

Future: less



Deer

different animals

- Animals come in there for the creek

- keep weeds down
- not much managed

water attracts different

water is fine



Creek (2)

- no changes

Big size of cow herd

75 acres

- less money and time on it
- Breaks even



tree line along creek

Pasture 2

- natural

- different species of plants
- no changes

- natural prairie
- never been tilled

- little seeding



Pasture 1

- more native stuff don't eat

- more productive
- introduction of species

Beneficial

managed

- avoid planting same crop

3/4 years

Soy ←

alfalfa ←

ditch ←



→ round up ready alfalfa

different species of plants
- nitrogen fixing legumes



Problem

Everything covered in yellow



- Feed gluten
 - because DDG (dry distiller grain) birds ate
 - easier to stick to one plant
 -> wagon

Storage

Chris' Pictures

Beneficial
- get bigger or same

on ground not suitable for farming



calves

09-09-09 herd

- farm income
- feeding people

Benefit



grinder/mixer

- grind feed
- make it palatable
- get most nutrients out of corn

Benefit

- saves money

- prevents yield reduction



high clearance sprayer

- kills weeds that rob nutrients/moisture

Benefit

gain wagon



Farm machinery

- gets ground loose / soft

disc harrow

- deeps improves ground, saves

Benefit

Self-sustaining



heart and soul of operation

Skid loader

- multiple uses
- load feed, manure
- move bails

continue

- pulls heavy implements



4-wheel drive tractor

- Can provide service
- Generate benefits

machinery

cow-calf ~~operator~~ only



Creep feeder

provides easier feeding and handling

- keeps from buying feed
- greener → more nutrients

Main part of for cows in summer

- different peaks
- 2 diff. types of grasses



- rye
- buckwheat
- timothy
- orchard
- spray for weeds

Grazing

- continue

- interseeding
- fertilizer

- don't feed as much

Hay bale



Corn stocks

Feed is #1

- feed this, and supplement w/ ethanol by-products



- don't do distillers on cows
- birth defects
- multiple births

- multiple uses
- add as feed source

- bedding
- comfort/warmth

maintain through future



Wheat barn

- House livestock/shelter
- store feed/hay

- windbreak
- saves money, protect from weather

houses manure
in winter



East barn

- fix calves

Shelter ←

water ←

Ecological/Economic



water

- cost time money
- buy water
- still dry in future

- drought

Problem

Benefit

- rotation (soy)
- harvest silage
- corn to market
- corn stalks to bail
- feed
- bedding

Feature - beans



Corn field

- keeps bugs off
- get salt/mineral

continue in future

diesel w/ insecticide



Oiler mineral feeder

- save money
- provides nutrients

96'

Beneficial

- saves money on fertilizer

- prevent insect from incubating

nutrient cycling

manure

Benefit

Pasture/Manure

- scatter throug field during summer/spring

Beneficial

staying in hay for long 3-4 yrs

2 acres

- keep from losing money to grow other crop

run off

seeded w/ hay to reduce erosion, and feed livestock

Hay field

Benefit

→ protection



Silage

Feed source
- energy, protein
- nutrients

- cycle
- manure come from

Benefit

- another way to bring income

→ for higher



Around border

- make money, provide service

Feed hamburger helper



Bean stubble bails

- saving money from buying roughage

↓ helps stretch

corn next year, continuing rotation Benefit

income feed source

- keep ground from eroding
- crop rotation
- keeps bugs from forming



Bean field

- harvest beans, then income
- bail bean ~~stap~~ stubble → feed additive

David's Pictures

Biodiversity of insect population

- can eat any crop - hard to kill

- controlled through genetic trait
from moths → root worm



- worry about below and above ground

Insect biodiversity Problem

next big issue Insect cycles

Bugs

keep crop because can grow different ~~traits~~ traits

- decreases biodiversity

option to plant different seed or farming style

Super Nema
Calcium
Less yield potential



Issues:
- drought tolerance
- nematode
- root worm
- rooting depth
- stalk lodging
- root lodging
- hair roots

genetic traits

vs.

no genetic traits

- Beneficial: can solve problems w/ little yield potential loss

Root ball

natural form of controlling biodiversity

grass competitive

↑
need

Beneficial



weed control through light conservation

Forest on small scale

↓
shade

Corn is out competing weeds

Brace roots

- Bigger push for 20 inch (row) for weed control (narrow width)

Corn canopy

Problem in IA: wetland state

- need buffer strips / waterways
- to relieve excess moisture

- cheaper than tile
- filter basin

↑ allows for consistent management



must be segmented - creates gaps separate from crops
Diversity as management

Field Waterway

benefit intended (conservation)

Problem: disease can live in ditches / waterways

longer maturity / 20 inch → more sunlight

Fl / 1/2

can use soil



light
- capture angle
more sunlight
Stage V4
leaf angle (light interception)
20 inch corn

Biodiversity in cropping system
- corn/corn
- 20 inch
- high population
- defensive hybrid

- sunlight is wasted if it hits ground

- 1. Pioneer trait
- 2. Dekalb.

2 diff genetic traits (hybrids)

→ One trait not as effective

Need refuge to keep traits working




Refuge
- allows bugs to not create resistance

Split planter

managed → reduced risk of insect pressure and resistance
Problem → one trait works one doesn't

Corn: many end uses
- universal energy crop

Wind energy



ethanol

2 energy sources

- creating renewable fuel and energy

Wind energy

American energy

- Beneficial: free energy
- Cost: land

electricity must be consumed as

depends on commodity price
- research depends on commodity value

different crops

BASF Biodiversity research project



research on our backyard

- in different products and management

- diversify different issues

- close to farm

- intentionally causing issues to fix
- create solution

Beneficial

Test plot

cattle = profitable + sustainable in crop community

Brodiversity → reduce carbon foot print

land inefficient

500 acres → manure (only add nitrogen)

(2 years)



city
→ very efficient

- Iowa weather is extreme
- harder to manage cattle
- control environment

monoculture
- Beneficial

Birds eye view

Feedyard

- better quality of life

Brodiversity with housing

- cattle resistant to cold (not hot)
- roof shade when get
- cleaner life

Light

P, K, S → manure

mild yellowing (potassium not mobile)

W. Corn root worm beetle

sulfur nutrient deficiency


corn greenness

Leaf angle (straight)

nutrient biodiversity

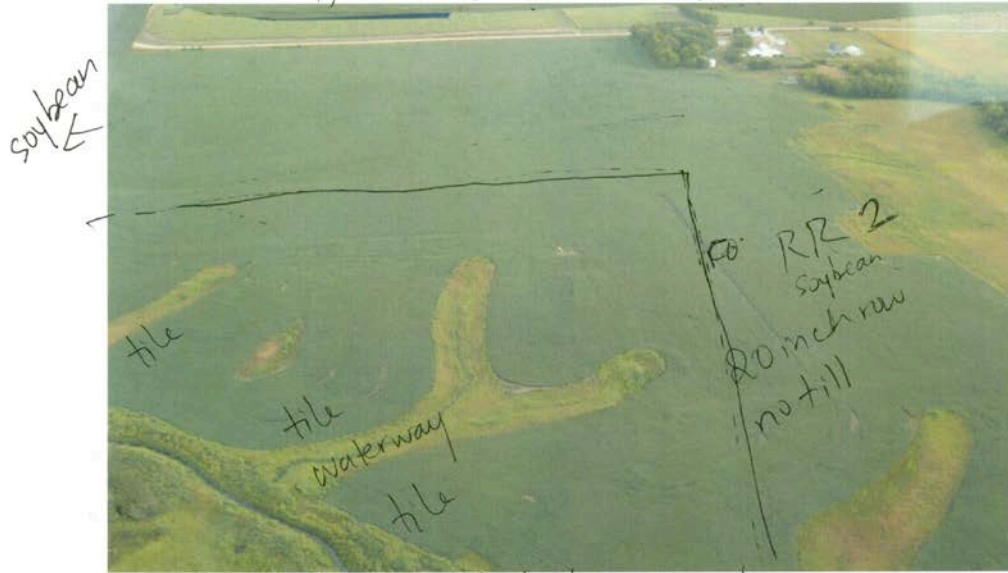
- nutrient symptoms

(outside) N is mobile P is purple (center) K is not



- used to be unproductive because of challenges (machinery)

- 1/2 pasture



- can grow crops where not before
- little tillage
- uses of ground are more diverse
- more profits

- mimics waterway

used to be hay ground

→ challenges (not any more)

Denny's bean field