Spare and Share as Applied to Land Management Practices of Farmers in the Rice County Area

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ABSTRACT

Spare or Share is a theory that has gained traction in the ecological field, balancing the needs of food production and biodiversity on working landscapes. However, as a theory, it ignores other social and cultural factors that may shape land policy decisions. This study asks how farmers relate to spare or share theory in a rural midwestern agricultural context. We interviewed farmers to ask them about their management practices that fall under spare or share, as well as the reasons for adopting the practices. While spare or share focuses solely on the objectives of the land's productive capacity and biodiversity, we found that farmers' objectives were more complex. Conservation theories such as spare or share should better reflect landscapes where small-scale, individual management decisions are informed by factors such as economic considerations, long-term fertility, and the notion of family legacy. This requires adapting the core assumptions of the theory to reflect the priorities of the farmers and other land users who interact with it.

INTRODUCTION

Over half of the land area in the United States is devoted to agriculture in some form. This holds true for Minnesota, one of the leading agricultural producers in the nation. There are over one hundred thousand farmers in Minnesota alone (USDA). Collectively, they control a massive portion of the land area of the state. Each of these farmers make hundreds of decisions annually on how to manage their acres, whether they control forty or four thousand. With so much land in the hands of private farmers, their land use decisions have far-reaching implications on the ecological health of the country.

Through our project, we hope to better understand how farmers of all varieties conceptualize these management decisions. We will be using the "spare or share" framework to investigate these practices. Spare or Share is a theoretical lens which seeks to understand the

division of natural and working lands with respect to food productivity and biodiversity and health of the native systems (Pimental et. al). “Spare” refers to the practice of intensive agriculture on an area of land which, in theory, allows for the conservation of land elsewhere, while “share” seeks to integrate the two - utilizing a system of agriculture that combines the interests of production and conservation. This framework is popular in ecological circles, but it is not without controversy. Spare or Share has been criticized for ignoring the effects of any variables other than biodiversity and food production (Jiren et. al). While similar studies have been done to study farmer opinions on related topics such as BMPs, spare or share goes beyond specific agricultural practices, and as such encompasses a wider range of land management philosophies. In short, the spare or share theory does not take into account the complex decision-making process of small-scale, individual farmers. We hope to better quantify these processes, thereby critiquing and improving the theory.

LITERATURE REVIEW

Spare or Share: a Theory and a Debate

In a human-dominated Earth, the importance of biodiversity in providing for the long-term health of the ecosystem is often overlooked (Pimentel et.al). Biodiversity, or the number of species in an area and their prevalence, is a common way of measuring ecological health (Walker). Biodiversity exists everywhere, even in cultivated, logged, or otherwise developed land, so wise management strategies are imperative for both maintaining output and lessening impacts on local biota (Pimentel et.al). Spare or share is a framework developed to model this crucial issue of managing land for human use while maintaining biodiversity. Sharing can be thought of as wildlife-friendly land use management; sparing entails intensive use of some areas

and setting aside others for the sole use of wild biota (Green et.al). Each model has benefits and drawbacks. Sharing man-made landscapes with other species can lead to large increases in biodiversity, as the majority of land on earth is managed by humans for extractive uses (Pimentel et.al). However in the agricultural context sharing strategies typically precipitate lower crop yields (Green et.al). Though the main benefit of sparing is intensifying production in some areas in order to decrease the overall amount of land used, long-term studies have shown that demand for agricultural land does not necessarily decrease when higher yields are achieved (Rudel et.al). Naturally, each option in this binary framework has advocates and detractors. Some argue for sparing due to improved species richness (Egan and Mortensen) or increased carbon capture (Williams et.al). Others advocate for sharing to create landscapes where humans and nature can thrive together in a more harmonious and connected way (Kremen and Merelender). The effectiveness of either strategy depends on the individual factors of each area where it is implemented; neither strategy is empirically more effective than the other (Jiren et.al).

This binary of Spare/Share has been seen by some researchers as shallow and problematic. Contemporary land use studies of tropical forests find that sparing or sharing by themselves produce less product and have less biodiversity than a mixed system of both (Runting et.al). Similarly, agricultural spare or share studies argue against an either/or approach, but rather improving management strategies of high-use farmlands to make them more hospitable to species while simultaneously providing corridors to undeveloped areas that species need (Grass et.al). In effect, both output and biodiversity can be maximised by implementing parts of both strategies (Grass et.al). However, some still see problems with the inherent framework behind spare or share. The framework does not see the land as a continuous entity, thus it struggles to describe land that is fragmented, or comprised of discrete ecological units effectively isolated

from one another due to human development. Furthermore the fundamental assumption that increased yields enables sharing practices is flawed due to the simple economic benefits that increased yields on increased amounts of land can bring (Phalan).

One of the most critical shortcomings of this model is its lack of consideration of the social and cultural beliefs of the humans who implement the model or live on lands where the model is used to make land use decisions. (Fischer et.al). In a framework that analyzes trade-offs between production and biodiversity, no room has been made for the other variables that affect the landscape (Fischer et.al). This is true of both the scientists and policymakers who create land use policy based on spare or share, as well as the local shareholders, or the direct users of the land who are affected by policy. Spare or share does not take into consideration the variety of beliefs of both implementers and shareholders that affect the land-- it assumes that the only two objectives of any land use policy are biodiversity and conservation. Even within these two variables, spare or share is biased about what the balance between human and nature should look like, as the foundation of the theory itself could be considered as fundamentally biocentric (Fischer et.al). Though spare or share is just a framework which cannot be expected to match up with real world practices, addressing the shortcomings of spare or share is essential to improving the function of the theory.

Farmer Values

Spare or share framework reduces conversations around conservation to a simple trade-off between food production and biodiversity. This ignores the opinions and values of those living and working on the landscapes in question. Therefore, in order to fully address this discrepancy, the ways in which spare or share framework relates to the values and opinions of those enacting the framework must be taken into account. Spare or share's implementers are

ultimately the farmers that work the land. Implementation of agricultural conservation laws have precipitated research on farmers' reactions to practices that we, for our purposes, consider spare or share. In Europe, where share practices are relatively prevalent, behavioral psychology studies have found that certain personality traits such as openness to change and moral concern could increase the likelihood of such policies being implemented by an individual landowner (Dessart et.al). More qualitative studies in the midwestern United States have found that farmers who see themselves as stewards were more likely to adopt water conservation practices (Reimer et. al). These studies look at farmers who have proactively adopted elective farming practices, however many conservation practices are mandated by policy; farmers don't have a choice in the matter. However, many choose to engage with these practices without regulatory prodding.

When it comes to agricultural conservation, known as "best management practices" (EPA), Midwestern farmers land use values are informed by attitudes of stewardship towards the land, a responsibility to provide food for society, and need to turn a profit (Yoshida et. al). These values are complex, and sometimes contradict the specific conservation practices advocated in spare or share contexts. In Rice County, Minnesota, some farmers opposed a recent buffer strip law, deriding it as poor implementation by a incompetant and sluggish government (Goldman et.al). Another Rice County study looked at the Conservation Reserve Program (CRP), finding that CRP's conflicted with the farmer's ideals of having productive working land, and that farmers generally disliked governmental approach to conservation regulation (Gruver et. al). The values held by farmers in the American Midwest, while having throughlines such as those identified by Yoshida et. al, are complex and varied. While farmers do support many conservation practices, certain conservation policies chafe at some core beliefs. Therefore, it is

clear that these policies generally do not take into account the values of the farmers expected to implement them. At the very least, there is room to improve.

Synthesis and Summary

Though past studies have studied how individual ecological practices are perceived by farmers, there have been no studies that attempt to determine to what extent the farmer's views correspond to the spare or share framework. This is a difficult endeavor, because Spare or Share goes beyond the legal definitions of CRPs or BMPs. There is no one way to practice sparing or sharing--conservation practices can vary as much as the perceptions that shape them. For example, lands can be managed simply to evoke feelings of nostalgia, as a way to protect rural and traditional ways of living (Seaman). Other practices could still be informed by the need to turn a profit, but in novel ways. Farmers around the nation manage land to preserve whitetail deer for the purpose of hunting (Wewitt), which can provide a surprising amount of profit for the owner if they lease the land to hunters (Baen). This particular practice, though driven by economic desire, has greatly increased whitetail populations in the United States (Wewitt). It is clear that the spare or share framework could be applied to such management decisions. Farmers who put a piece of land into an easement to protect the rural quality of the land are engaging in the ideals of sparing just as surely as one who manages his crops and woodlots for deer engages in sharing. It is clear that what previous studies have analyzed in terms of conservation practices does not fully address the possibilities that the spare or share framework can encapsulate. Additionally, farmers do not directly engage with the perspective implicit in spare or share. It is worth studying both the character of these perceptions, as well as the incidental consequences for spare or share that they precipitate.

QUESTION

Spare or share may include a large array of land use practices that vary based on geographic location. Therefore it is crucial for our study to determine what land use practices exist in our study area, and define how they fit into spare or share. We will describe the interface between our framework and reality. We aim to further connect the concrete methods of farmers, however they arise, to the more abstract debate of spare or share in an effort to both understand stakeholders, and to critically engage the theory of spare or share itself.

Engagement with conservation practices will most likely be in part or largely incidental. Getting at the alternative causality for employing conservation practices is crucial for improving the viability of the framework. Therefore, we will address why Rice County farmers engage with conservation, and if those reasons are consistent with the values implicit in the spare or share theory.

The constituent questions are presented as such: Firstly, how do farmers manage their land; how do those management decisions fit (or not) into the spare or share framework; what are the stakeholder values that drive these decisions; and how can the spare or share framework be adapted to better reflect or link up with these values? To summarize, we want to find out what the farmers do that could be considered sparing or sharing, as well as determine why they are doing those practices. In each case, practices and values will be compared to those described by the spare or share theory in order to describe alternative causal forces shaping the land that spare or share does not consider.

METHODS

Intro

Our study area consists of farms distributed throughout Rice, Dakota, and Goodhue Counties of Minnesota. There are some attributes of Rice County that make it a very suitable study area for our project. According to Minnesota state papers and USDA data, agriculture is the chief land use in Rice County (USDA). More than half of all agricultural land in the County is devoted to corn and soybeans (USDA). The demographic makeup of its farmers are similar to those throughout the midwest, which is to say generally over 55 and white (Peterson). These demographic and land use factors paint Rice County as a typical agricultural midwestern County.

Our study question calls for qualitative research, as we aim to understand our subjects' thoughts and beliefs. The nature of beliefs manifesting in real-world management practices requires a methodology which can contextualize these complexities. Furthermore, this study analyzes whether general principles of spare or share, namely concerns about food production and biodiversity, are consistent with the facts of how farmers view their land. This requires an inductive approach where data about farmers is collected, commonalities are identified and categorized, and conclusions are drawn based on data. These conclusions will be contrasted to the base understandings of spare or share.

We base our methods on four ethnographic studies that deal with questions of attitudes and belief systems of American farmers by Reimeir et. al, Yoshida et.al, Gruver et.al, and Dombrovski et.al. One of the distinctive features of the ethnographic approach is establishing a dialogue with the ethnographic subjects. Studies by Reimeir et.al and Yoshida et.al use mixed-methods research, namely surveys and semi-formal interviews. Our research constraints will not permit mailing out surveys; however a smaller number of face-to-face interviews coupled with in-depth analysis is a much more conducive to a relatively short term study. This particular method was utilized by Gruver et. al and Dombrovski et. al, who both used around ten semi-

structured interviews of Rice County farmers to aid in qualitative analysis of contemporary environmental policies. For the format and set questions within the interviews, see Appendix A.

The ethnographic nature of this study prevents us from generalizing to a large population, however we will be able to generalize our findings to the concept of spare or share theory. We aim to ascribe how well the proposed motive tenets of spare or share actually motivate our subjects. This is the crux of our project, and where we draw most of our validity. Furthermore, the lack of randomization of samples and the specific location restricts the external validity of our findings.

Interviews

Our primary source is a list of farmers residing in Rice County. All reside in the Nerstrand-Dennison-Northfield area. The subjects were chosen through a combination of several prior relationships we and our advisors have in the area. A comprehensive list of farms and farmers of various demographics was compiled based on interaction with past research. Additional farmers were added on recommendation by subjects. This list of farmers can be understood as a convenience sample, as they have proven to be reliable sources of information for similar projects. As a result of this sampling, our findings could not by any means be applied to larger populations of farmers. However, this point is not very pertinent to purposes of an ethnographic study. Our goal is to understand the motivations, beliefs, and opinions of those in our study area, not to define a phenomenon across all of Middle America.

Semi-formal interviews have often been used in similar studies by Goldman et al, Yoshida et. al, Gruver et. al, and Reimer et. al to understand farmer attitudes. The more personal

nature of an interview can potentially yield more rich, in depth data than surveys. Furthermore, while we have established the problem of dissonance between spare or share theory and farmer attitudes, we did not fully know the extent or nature of actual attitudes. Interviews prevent such unforeseen problems with open-ended questions and the option to further pursue unexpected responses. Questions of land use practices and the reasons behind them were developed in order to obtain a sense of conservation practices of the land and the attitudes that informed their adoption. The semi-formal interview was developed and approved by the IRB.

The interviews themselves were generally conducted at the homes of our subjects; this allows the interviewees to remain at ease, as well as provide more information that may not be available at a neutral location. For instance, many of our subjects showed us detailed maps and figures concerning the land use of their farms; this is invaluable to us as researchers. A standard interview lasted about forty-five minutes, and ranged from production details to marginal land use (for the questions and format of the interview, see appendix).

Analysis

Interview questions focused on two areas, land use and attitudes. Land uses were quantified and coded from interviews as either spare practices or share practices, using the definitional framework as laid out by Green et.al. We defined “sharing” land use as a number of EPA-defined Best Management Practices (BMPs) including cover crops, perennial cropping, insectories, and buffer strips. These particular BMPs were chosen due to their mention in literature of Spare or Share literature by Grass et.al, Fargione et. al, Egan et. al, Jordan et. al, and

Phalan, and based on recommendations by David Hougen-Eitzman, a faculty member and local farmer who is familiar with area practices. In general, sharing can be understood as practices which increase biodiversity in the field itself, or have positive impacts on biodiversity downstream.

For our purposes, we did not consider BMPs to be sparing, as the land is still being managed with agriculture in mind. Any non-cultivation use of tillable land was coded as sparing: non-tillable land cannot be put into cultivation, but it was coded as sparing if that land is managed in some other way that increases biodiversity. While we ultimately defined sparing as "any land not in cultivation", we also asked additional questions to help clarify the nature of that land spared. While we have developed these questions in this practice-first format, we wanted to exploit the form of an interview in accounting for unknown problems. Most conservation minded agricultural practices can fit into the share-spare continuum as long as it is determined they increase the biodiversity of the land they are implemented on (Pimentel et.al). Therefore, in order to get at any other significant practices, we included more general questions about how farmers protect or preserve specific features of the landscape such as soil or water. This land-use first inquiries help offset the preconceived notions we have, warranted or not, inherent in our questions about land usage.

Past studies by Goldman et.al and Gruver et.al have suggested that farmers do care about preserving land features; however the farmers made no mention of biodiversity. Therefore we did not explicitly ask about biodiversity in either sparing and sharing questions.

It is important to remember that these sets of values are simply what we expected to see. Open ended value questions, and an analysis where expectations are matched against self-

reported values provided a deep level of understanding of how farmers conceptualize these issues without the constraints that come with the use of a pre-coded analytical theory.

We coded the responses based on expectations as laid out by similar studies, such as Reimeir et.al, Yoshida et.al, Gruver et. al, and Dombrovski et. al, who all have identified values that provide a useful basis for our key value terms. These key terms are the following: stewardship conceptions of land, provider mentality towards the public, economic profit, and long-term environmental health as potential factors that inform a farmer's decision-making process.

The reported values, and the spare or share practices they are associated with were used to make claims about what might make an individual stakeholder adopt particular practices, as well as explain why they have chosen their current ones.

RESULTS

Introduction

Seven interviews were conducted, each lasting approximately an hour. All farmers were from Dakota or Rice counties. Five of the subjects were conventional row-crop farmers who grew corn and soybeans; two were organic farmers who utilized a multi-crop system. All conventional farmers had been farming for the majority of their lives, with farming being a part of their family. All subjects both owned and rented their farmland. Acreage varied between 70 and 8,000 acres, with the majority of farmland being rented in most cases. Most farmers were male and over 50 years of age. For conventional farmers, a corn-soybean or corn-corn-soybean rotation was employed. Every farmer engaged in practices associated with spare or share to some

extent. The most common share practices involved soil retention, which notably includes cover crops. Sparing occured on marginal, unused farmland. Despite these practices, biodiversity was not explicitly mentioned by any subject and no subject had heard of spare or share theory. Instead we found that farmers thought about practices considered spare or share in terms of sustainability, which comprises three interrelated values: economics, fertility, and legacy.

Economic

Farming is a business, and one that requires an extensive amount of specialized knowledge and skill sets. Farmers, as business people, are primarily motivated by making a living, for themselves and their families. This, in short, is economic sustainability: the ability to make a farm profitable enough to sustain its own existence into the foreseeable future. Each of our interviewees were strongly motivated by making a living, one farmer saying, “we do what we can, but we have to make a profit.” All management practices had to be economically viable. This was related strongly to the adoption of best management practices, which was seen as having direct consequences on profitability.

Farming is a famously difficult business to undertake. Subject to market shifts, international competition, disease, weather events, and more, most farmers, while relatively comfortable, work under the constant threat of “the bad year.” One of the vegetable farmers we interviewed said “I’m just waiting for the hailstorm that destroys my farm.” For all farmers, conventional and unconventional, the necessity of producing every year puts them in economic uncertainty.

This uncertainty must be minimized if the farm is to remain economically sustainable. This is something all of our interviewees understood. Every farmer we talked to was looking for ways to optimize their operation. This took different forms on different farms, though there

seemed to be consensus that lowering input costs was the most effective. In one discussion about fertilizer use, a farmer was using incredibly detailed soil information (on the scale of square meters) to precisely apply the correct amount of fertilizer; this prevented overapplication, which has benefits to both downstream communities and the bottom line of the farm. This bottom line mentality is the overarching concern of the farmers we interviewed. They wanted to be good stewards, but economics must come first, or there would be no farm to steward. They were all extremely motivated to learn all they could about new agronomic technologies and practices that would help them secure a profitable yield. However, as one farmer put it, "they can't expect us to overhaul our whole operation in a [growing] season or two." This inability to experiment was largely due to the tight margins farms operate under. Most farmers we interviewed, when adopting a new practice, would test it on a smaller field, then increase the acreage if they saw success. This risk minimization allows them to experiment and try new things without compromising their economic viability. If found to be viable, in that it improved yields, reduced input costs, or was environmentally beneficial without negatively affecting the first two conditions, it generally was folded into the management practices of the farm.

Specialization is one trend that many of the farmers recognized as a way to improve the profitability of farms. For instance, one organic vegetable farmer we interviewed is moving towards a more specialized model, where he would have about five main crops (with some more minor plots), as opposed to the current model of a relatively equal planting of many crops. In his words, "...I like the idea of five or six crops, one to three acres of each, growing for wholesale markets, investing in tools and machines that allow me to do it more efficiently with less labor, lower cost of production…" This same specialization of crop type happened within memory of many of the conventional farmers we interviewed. Many of our interviewees described how their

fathers (and the farms around them) either dropped the livestock business and became row croppers or vice versa. This occurred throughout the area, one farmer recalled “this was the tenth dairy farm coming down the road [highway 19], now there are zero.”

This, as we will discuss later, is an element of legacy, and some farmers seemed to want to return to the more diverse method of yesteryear, one saying “My dad was a cover cropper, he just didn’t know it.” This was not a universal mentality, but unease about the future of farming in some respect was ubiquitous.

Each of the farmers that had undergone this specialization in recent years cited shifting markets as the main driver. One farmer said “We got away from small grains when the guy I would normally sell them to sold off his herd [of sheep].” He went on to say that it was increasingly difficult to find a small market for any crop anymore, as economies of scale were too domineering.

This pressure to streamline informs many of the practices in which the farmers engage. Many of these influence the monoculture archetype of corn and soybeans, such as long crop rows, two year rotations, and mechanical tillage. However, if modifications to these practices make economic sense (and come without large risk), the farmers we interviewed seemed willing to change. The practice of cover cropping, which we will discuss further in the following section, is one such instance of an economic shift toward sharing. This practice at once diversifies the species of plants being grown and improves the diversity of the soil microbiome; this, in theory, improves soil health and yields.

Most of the spared lands of the farmers we spoke to were marginal, meaning they were unable to make a profit by growing a crop. Either the fertility of the soil was so poor that the crop yielded would not be worth the inputs it required, or it was on highly erodible land that was

not worth tilling. The farmers had various uses for this land, though it wasn't conventionally cropped. Some found these spaces useful for fostering desired species, such as pheasant and deer. Still others used their uncropped land to foster insectories, where beneficial insects could thrive. While largely incidental, these marginal lands provided services to the farmers.

Figure 1. A tractor plants in a field with high stubble. This is an example of a soil retention strategy. PC Interviewee.

Fertility

Farmers were extremely invested in the health of their soil; this is to be expected, the healthier the soil, the more robust and reliable the crop. Also present in the desire for healthy land and soil is the idea of sustainability, that the land will remain healthy into the future. This idea of fertility, though interrelated with economics, was a driver of the adoption of best management practices. There were many ways farmers went about maintaining and improving their soil, but they form a few main categories: organic matter increases and earthworks.

Organic matter increases improve the quality of the soil itself. This practice, in theory, improves soil structure and biology (in this case referring to beneficial microorganisms) while reducing erosion, as there is more time in which the soil has roots holding it down. Many of the farmers we interviewed mentioned cover-cropping, or seeding fields with plants other than the intended crop, with some putting their entire operation into cover crops. Others used the practice to a lesser extent, but made strides to increase this, and some did not use cover crops at all. “We had about fifteen percent of our fields in cover crops this season, and we’re planning on adding them into our entire operation in the next few seasons,” one farmer said. For those that did, they applauded the noticeable improvement of soil structure; a field that has been cover cropped is more permeable and better-able to absorb precipitation. One farmer said, “what I’ve observed and what I’ve seen is definitely the water filtration rates. I’m just amazed at how much water the soil has taken in and distributed.” This reduces runoff and erosion. Direct yield increases were less clear, as it is difficult to tell what a yield *would* have been had a management decision not been made, but many farmers felt that yields were impacted positively. A few farmers were interested in the microbiology of the soil, a fact that has interesting implications for the biodiversity tenet of spare or share, one farmer said, “The soil likes having different roots,

different species of plants growing. It stimulates soil biology… you can see the difference in our crops, you can see the difference in the soil." This species-specific conceptualization is freighted with biological terminology; though it is not clear this farmer is driven by biodiversity, it is obvious he, and most likely other farmers, are thinking in terms of biology and ecology.

A more established management tool to improve soil retention is the placement of earthworks (drainage ditches, sediment basins, tiling, terraces, etc.). While they do little to improve the quality of the soil, when done correctly, they are effective at keeping soil on the fields, "it would take thirty years of good management to do the same thing [in reference to sediment basin]." This is something that every farmer considered vital to a successful farm. Each farm we visited (with the exception of one small scale organic farm) constructed some form of earthwork. It is not abundantly clear if earthworks can be defined as share, as they, unlike organic matter improvements, do not directly contribute to biodiversity. Despite this, many farmers referenced how earthworks prevent sediment from polluting waterways. Furthermore, the way some of the features of these earthworks, such as retention ponds, were managed in ways that can be considered sparing. However, the management of such features was not driven by fertility, but rather other, cultural factors that we went on to define as legacy.

Figure 2. Cover crops being sprayed before planting. PC Interviewee.

Legacy

An important aspect of sustainability was the notion of legacy. All respondents said that they wanted to leave the land in a better state than they found it. Many of the sharing strategies that were used for fertility or economic purposes were put in these terms. Cultural ideas also drove the management of the non-farmed acres. Often, farmers said that they planned to pass on their land to children or family members who would continue the "tradition" of farming. The ideal of legacy consists of a complex mix of values, including familial tradition, nostalgia, and the continuation of farming within the family.

Land use of the past was cited by nearly every farmer. Many grew up on a farm, and farmed for 40+ years. Some talked about their parents, while others talked about “forefathers” in a more general sense. One farmer specifically noted that his farm had started out by his father as a 160 acre plot, referencing the amount of land allotted by the homestead act of 1862. These forefathers were often reflected on positively. When asked about the reasoning behind maintaining certain areas as stands of trees, one respondent claimed that those areas had been specifically left alone by his forefathers, reflecting that it was “... amazing how smart our forefathers were when they came here to settle”. Referencing the actions of past farmers into the landscapes of the present is the core of tradition.

These conceptions of nostalgia seeped into spare practices. As noted in the fertility section, the only lands on the farms that could be considered spared were those where no crops could grow. However, this does not mean that these lands were not managed. One farmer maintained a small cabin on some eroded land. He reflected that his father had planted trees which were now in poor shape, and that he would need to plant more trees soon. He went on to talk about how that land was used for the family for recreation. Management strategies often involved planting trees that had been a part of pre-European settlement landscapes. These species were preferred by many farmers, with one subject saying “You don’t tear out maples and oaks, but boxelders gotta go.” One farmer managed the trees for a wood-burning stove. When asked why he preferred wood to other fuel sources, he said that “Cutting wood is my golf game.” Recreation came up occasionally, but almost always in terms of tradition, culture, and legacy. The wood-cutting farmer said of his planting strategies that “in 100 years, someone will have some good trees to log.” Similarly, water retention ponds were managed for recreational or aesthetic purposes. All farmers reported a wide array of animals inhabiting their non-tilled acres,

such as deer, pheasant, geese, birds of prey, and others. Though interaction with sparing was often incidental and occurred mainly on untillable or marginal land, these acres were still managed by farmers for recreation and nostalgia. These management strategies in many cases contributed to biodiversity.

Sharing practices were thought of by some as a continuation of traditional practices. A farmer who engaged in extensive cover cropping ironically noted that “my dad was a cover cropper, he just didn’t know it,” going on to venerate the agricultural practices of the past and express a desire for others to return to that tradition. While conceptions of past land use are heavily tinged with nostalgia, some farmers apparently connected their current land practices to those of the past.

Not every farmer was convinced that past practices were necessarily good. Nearly every participant mentioned that practices have “come a long way”, particularly when it came to soil conservation. More than one participant referenced declining use of the moldboard plow. When asked about the consolidation of farms, farmers were split between sadness that fewer people were farming, and ambivalence towards a seemingly inevitable problem. One farmer counted the number of small dairy farms that had been sold off since his childhood, calling the losses “a shame”. But when asked whether the trend was good or bad, he expressed stoicism, saying that consolidation was “the way it was” and that “you can’t fight city hall”. Another farmer acknowledged the trend, but noted that the now-consolidated farms were still run by families.

The idea of the family unit as the traditional owners of the land was referenced by all. For many ownership was seen as a direct line from their parents through them to their children. At many farms, family were closely involved in the everyday running of the farm; most of the various business cooperatives the respondents referenced consisted of family members and/or

neighbors. The few whose children were not directly a part of the business still "helped out" at harvest. For every respondent, familial ties were deeply rooted in the ownership and use of the land. Many farmers expressed a desire to pass their land to their children after retirement. One farmer said:

> "I want to keep that dirt on the farm. I come at that from not just an environmental standpoint, but a sustainability standpoint. I want my farm to be better than… when I started. And I want my kids to get it in better shape… the moldboard plow was around for years, and no one [knew] any better"

The idea of leaving the land "in better shape than I started" was echoed by nearly every respondent. For most farmers, sustainability means the ability to pass ownership of the farm down through generations. Soil health, profitability, and the conservation measures associated with spare or share were all phrased as a part of the desire for the long term endurance of this combination of family and landscapes.

Figure 3. Sediment basins and forests. PC Interviewee.

External Pressures and the Future

Threats to the farm were discussed at length by every participant. These external pressures are worth mentioning as they inform farmers' future management practices and play into conceptions of sustainability as legacy.

Weather events were discussed by every participant. Often, weather was cited as a cause of soil erosion. One participant talked about seeing "300 year" floods every few years. Not every

participant used the term "climate change", and many expressed differing opinions on whether the cause of the climate change was man-made or not. However, all reported taking more frequent weather extremes into consideration in long-term planning.

More than weather was the idea of threats from human sources. One farmer cited overregulation as an ongoing problem for his farm. Negative opinions on the recent buffer law were common among all farmers[1]. Many subjects cited market change as an ongoing problem. Some referenced the trade war between the US and China[2]. Others anticipated the problem of changing consumer preferences, such as the growing popularity of vegetarianism and veganism, or the rise of "fake meat". These consumer choices were seen as some as misguided activism. One farmer joked that "People are afraid of GMOs but will eat lab meat."

Interestingly, the perceptions of non-farmers were talked about by almost every farmer, most of the time in a negative light. Farmers' decisions did not seem to be directly influenced by these public perceptions, however many felt public perceptions bled into misunderstandings about policy. Some participants felt as if they were being blamed for environmental issues. For some, this played a part in their land use practices. One farmer who was experimenting with putting in cover crops said, "I don't want to get blamed for a dead zone in the Gulf of Mexico." He connected that perception of farmers as polluters to a number of laws that imposed a severe burden on his operation. Misunderstandings arising from public perception seems to play a major part in farmer's anticipated problems for the future. Non-farmer attitudes influence policy and market forces that farmers see as harmful.

These external pressures fed into the idea that farming as an occupation was getting more difficult. All farmers talked about the difficulties of becoming a farmer; many of their children

[1] A 2015 Minnesota law that mandated buffer stips along lakes, rivers, and drainage ditches. See Goldman et.al

[2] Retaliatory Chinese tariffs on soy, a major export to China. Part of the ongoing US-China trade war. See Liu et. al

worked a “normal” 40 hour a week job in addition to working on a farm. One participant described the difficulties of young farmers, including holding down two jobs, working long hours, dealing with low crop prices, struggling to afford expensive equipment, and paying steep taxes on land they cannot get a crop to grow on. Though farmers seemed to be perceiving many future pressures, the prevailing attitude was one of resilience. All farmers talked about loving their profession despite the large amount of work involved. When asked how farmers of the future will deal with these outside problems, one farmer expressed optimism, saying “We’re a tough breed.”

DISCUSSION

Throughout our study we have struggled to categorize conservation practices exhibited by farmers as either spare or share. These categories refer to locality, but we found that borders between what is spared and what is shared are often blurred. For instance, the many untilled lands that we could consider spared are actually still managed and utilized (shared) by farmers. They manage spared lands in ways that could increase or decrease biodiversity. Furthermore, those spared lands were occasionally put into production, such as periodic logging. The lines are more blurred in productive land. Marginal habitat around fields provided shelter for a number of species such as pheasant. Ditches and waterways within fields provided more habitat, and often drained to ponds that support waterfowl. Should we consider the edge of a field a part of productive land shared with other species, or a discrete, shared entity? Sparing land and sharing land may be applicable in large-scale forest management practices as seen in Runting et. al, but we have seen that on the scale of land managed by our subjects, spare or share is inadequate in describing the regimes of land management. Practices could be put into spare or share

terminology, but as we have shown this is simply not intuitive for many of the types of practices observed.

These definitional issues with spare or share practices are intertwined with the problems of scale in spare or share theory. We have been treating farms as discrete entities that practice spare or share, which some literature (Egan et. al) does. Other literature deals with landscape-scale spare or share (Runting el. al). Many of these definitional problems are due to the small scale on which conservation practices are actually implemented. Applying spare or share at a landscape scale, as others have, lessens the problem of defining practices as spare or share. However, it is also less accurate, discounting the variation of conservation practices within individual plots. Classifying a piece of farmland that does not employ sharing practices as solely devoted to production does not take into account marginal lands, water retention strategies, and other practices that increase biodiversity within the productive landscape. Likewise, classifying a woodlot as land spared ignores the productive utility a farmer may derive from the lumber it provides. Applying spare or share at a smaller scale can take into account these nuances that affect the outcomes of production and biodiversity.

However, focusing on these two variables is also inaccurate. No farmer eschewed conservation practices because of conservation initiatives practices elsewhere-- their sustainability practices were directly tied to their own lands which benefited from them. Some farm lands focused on downstream effects in their conservation strategies, often quite literally, as water quality was a common concern among all participants.

There seems to be a fundamental disconnect between the values and objectives of ecologists vs that of farmers. Local shareholders engaged in many practices that could be considered part of the spare or share continuum, however the reasoning given by farmers for

undertaking these conservation measures were radically different than that of spare or share. First, the biodiversity versus production metric used by spare or share cannot describe the complex and interrelated desires that drive land management decisions. Production was the central concern for all farmers; however many conservation measures that directly or indirectly increase biodiversity were adopted by farmers for the explicit purpose of increasing fertility, and thereby production. This ties production to fertility (biodiversity) in a way that seems problematic to the dichotomy of the theory. Economics complicated this picture further, as many farmers limited adoption of spare-or-share practices due to the costs and risks associated with them. Our findings are consistent with Fischer's criticism that spare or share is cost-blind.

Apart from cost, farmers use a lot of the same language that spare or share does. Farmers told us about "habitat," "sustainability," and "conservation" but very rarely "biodiversity". The difference in the language of farmers and the language of spare or share is in the nuance and complexity of farmers' social and cultural values compared to the narrow, rigid view of spare or share. Farmers see much more in their lands than productive value and biodiversity. They see continuation of tradition, preservation of historical land use, a space where families work together to derive their living. Farmers are not the ecologists that spare or share assumes them to be. Their ecology includes human factors that do not have an apparent function in the theory. Spare or share is a good, straightforward model for ecologists; it is not very relevant for farmers. We would caution any entity that solely thinks of the land in terms of production and biodiversity when designing law or policy.

The emergent question from our analysis is where ecologists and farmers should meet. Due to our sampling techniques we will not be able to generalize our findings to a broader population. Consequently, we cannot give a tidy answer to what drives farmer interaction with

conservation practices, or how those ideas could be used to improve spare or share theory. However, we can say that the methodology and analysis of our study shed light on a critical rift between the language of theory and the language of shareholders that should be investigated further. Replications of this study could be undertaken in different locations utilizing different sampling techniques to broaden our understanding of this difference in conservation language. Ecologists and policy makers are not farmers; successful implementation of conservation measures by policy requires sensitivity to the belief and values that farmers possess. Whether spare or share should be amended or discarded is beyond our scope.

As it stands, farmers often engage in more conservation practices than regulations dictate. This should also be taken into account when adopting new laws, especially as over-regulation was cited as a concern by a number of farmers. Similarly, Gruver et.al found that farmers disliked CRP programs as they found them to be at odds with some of their core values. Farmers interviewed by Goldman et.al saw the government's implementation of buffer strip laws as indifferent and ultimately ineffective. We found that most farmers do not explicitly care about biodiversity, but one of the basic components of the spare or share framework operates under the assumption that biodiversity is a consideration for landowners. In order to be effective, conservation ideas such as spare or share must be made to work in a landscape where management decisions are molded by more than the two simple variables of food production and biodiversity maintenance. This requires adapting the core assumptions of the theory to reflect the priorities of the farmers and other land users who interact with it.

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Appendix A: The Survey

Please note that this survey is a part of a semi-formal interview process; actual questions varied between participants.

Preface: Hello, we are conducting research on management practices of farmers in Rice County. We hope that, through this interview and others, to get an idea of how farms in your area conceptualize their land use. Our study does not aim to judge, or even recommend policy; we just want to understand the nature of your relationship with your land. Your cooperation and honesty are greatly appreciated. We will be asking about a number of practices, as well as your reasons for adopting said practices. We welcome any and all insight you can give us on this topic. Thank you for your time.

1. Demographics
    1. What is your name?
    2. How long have you been farming?
    3. Is this a family business/who do you farm with?
    4. How many acres is your property? How much do you own and how much do you rent?
    5. What are the characteristics of your property? What is grown, what is raised?
    6. Why do you grow/raise (previous response)

2. Land use general, biodiversity
    a. What does the crop rotation look like, if applicable
    b. Has this changed in your time farming? Do you expect it will in the future?
    c. What other species live on your land, plant or animal?
    d. What other species pass by your land?
    e. How do you interact with these species?

3. Share, or Best management practice history
    1. Have you in the past/are you currently employing any of the following practices: Cover Crops, Perennial Cropping, Insectories, buffer strips or other soil retention strategies? How are field borders managed?
        1. If so, why?
        2. If not, why?
    2. What do you do on your cropland to improve soil quality?
        1. Why is this important to you?
    3. What do you do to improve water quality?
        1. Why is this important to you?
    4. How do you reduce or remove pests?
        1. How do you feel about these pests? What should be done to these pests on a large scale?
    5. Would you consider any of those in the future?
        1. What are the factors that would influence adoption of those practices?

3. Spare, or Non-BMP questions
        1. Do you have land that is not in cultivation or pasture?
            1. Is that land tillable?
                a. If so, what is it used for? What lives on that land?
            2. Do you have a management plan for said land? What is it?
            3. Do you lease out that land? Do you derive other value from it?
            4. Would you ever put that land into pasture or cultivation?
            5. Do you manage any land specifically for aesthetic purposes?

        2. Do you hunt on your land? Do you Fish on your land? Do you allow others to hunt/Fish on your land?
            1. (If applicable) Where do the animals that you/others hunt live on your land? What do they eat? How do they use the land?
            2. (If no hunt) How do you feel about sport animals (defined as things people hunt). Do you feel this way about other species?

        a. (If applicable) If you don't like these animals, what should be done to them on a large scale?
    3. Are you a member of any sportsman organization such as Pheasants forever?
3. Do you participate in any easement programs of non-working land such as a CRP, or others?
    1. Why or why not
    2. Have you in the past?

4. Future Use
    1. Would you in the future increase or change the aforementioned practices to preserve soil and water?
    2. Would you in the future adopt practices such as buffer strips, cover crops, crop rotation, or insectories?
    3. Do you plan on handing over this farm to one of your children?
        i. Who do you see as the next generation of farmers?
        ii. What problems will they have to deal with?
    4. Over time, farms in America have become more consolidated. How do you perceive this general trend?
        i. How will this trend affect the next generation of farmers?
    5. Are there any non standard farming practices, such as organic farming or agroforestry you would consider?
        i. In what circumstances would you adopt said practices?