Empathy Conditioned Conservation: "Walking-in-the-Shoes-of-Others" as a Conservation Farmer

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I. Introduction

Since the destruction and despair caused by the dust bowl of the 1930's, Americans and their government have taken a keen interest in natural resource conservation policy on agricultural land throughout the country. As a reflection of this, the farm bill of 1936 entitled the "Soil Conservation and Domestic Allotment Act" included for the first time provisions that provided payments and support to farmers willing to employ soil conservation measures on their farms (Cain and Lovejoy, 2004). While the main purpose of this bill was to provide financial support to impoverished farmers dealing with low commodity prices, the fact remains that natural resource conservation was starting to become an important issue for the American public.

Over time, conservation titles in the farm bill have evolved into legislation that not only protect soil from erosion, but they now include incentives for improving water quality and water quantity problems, provisions that prohibit draining wetlands for agricultural production, land retirement programs such as the Conservation Reserve Program (CRP), and working land programs like the Environmental Quality Incentives Program (EQIP). Expenditures for conservation measures have also significantly increased over time. For example, the United States Department of Agriculture (USDA) provided nearly 4.5 billion dollars for conservation programs in the farm bill for fiscal year 2005, compared to 500 million dollars for the 1983 fiscal year (ERS, 2007). It also appears this trend of increased conservation expenditures will continue, as the 2008 farm bill doubles the level of conservation funding under the previous farm bill. Of this new money, nearly two thirds is scheduled to be allocated to working land programs like EQIP (ERS, 2007).

While giving monetary payments to individual producers engaging in conservation activities is ultimately a policy decision, the underlying assumption for these payments is one borne out of traditional microeconomic theory. Specifically, microeconomics theory assumes that all producers are rational agents engaging in activities that will maximize profits. However, most conservation activities are not inherently profitable to the individual farmer; so, conservation payments are provided under the assumption that the only way to increase participation in conservation programs is to increase profits received by the individual farmer. In effect, conservation payments can be seen as incentives or “bribes” that should make conservation activity more attractive to the individual producer.

If the profit-maximization theory of standard microeconomics is correct in predicting individual farmer behavior, it would then be expected that the rapid expansion in government expenditures for conservation payments to individual producers would lead to great improvements in environmental quality throughout the country. Recent empirical evidence, though, is showing that this is not the case. For example, modeling of conservation behavior in the upper Mississippi River region indicated that increasing conservation payments at the individual producer level would produce minimal change in rates of soil erosion, nitrate leaching, and nitrate runoff in the area (Wu, Adams, Kling, and Tanaka, 2004). These authors concluded that conservation payments, which were modeled as an increase in profits to individual farmers, are not likely to be cost effective on their own for addressing pollution problems in the Mississippi River and the Gulf of Mexico.

Based on anecdotal evidence and empirical research, it appears that individual farmers are motivated to engage in (or not engage in) conservation strategies by a multitude of factors. While it is undeniable that profits do play a role in conservation decisions, the assumption that it plays the *only* role in economic decision making is highly contentious. For instance, work by Nowak and Korsching (1998) indicates that inadequacies in U.S. soil and water conservation policies can be attributed to a misunderstanding of the human dimension (sociological and psychological factors) of farmers, and not a lack of conservation expenditures. Work from Sen (1977) also concludes that individuals may ultimately make choices based on sympathy and commitment to others, even if the outcomes do not maximize a person's self-interest. He even writes that a person pursuing only selfish interests, as is modeled in microeconomics, is nothing more than a "rational fool" and a "social moron" (Sen, 1977). Even Adam Smith's *The Theory of Moral Sentiments* indicates that there are fundamental elements of human nature that transcend that of pursuing individual self-interest (Smith, 1790).

While it has long been realized that both financial and non-financial factors motivate farmer behavior, the conservation literature has been unable to evolve a settled and unified account of egoistic-financial and non-financial social motives that ultimately drive human behavior (Chouinard, Paterson, Wandschneider, and Ohler, 2008). However, it seems that the theoretical framework of metaeconomics (Lynne, 1999, 2006ab), which combines egoistic/hedonistic self-interest motivations with empathetic/sympathetic other-interest motivations into one coherent theory of human behavior, can provide new insights into farmer conservation behavior and human behavior, more generally. Therefore, this emerging framework was used to analyze tillage decisions in the context of a water quality conflict between upstream farmers and downstream water suppliers in the Blue River/Tuttle Creek Lake Watershed of Nebraska and Kansas.

The organization of this paper will proceed as follows. A brief review of the conservation literature, including papers that describe finanical motives, non-financial motives, and multiple-motive/multiple-utility for conservation adoption, is presented in Section II. Section III presents the theoretical framework used to analyze tillage decisions in the Blue

River/Tuttle Creek Lake Watershed. The empirical model is described in Section IV. Of particular interest are variables that measure financial capacity, capacity to empathize/sympathize, preferences for control over farming practices, and habitual tendencies. Section V presents the major findings of this study, and finally, Section VI provides concluding statements.

II. Review of Conservation Literature

Financial motives are the most widely cited account for conservation adoption on farms. These motives most generally include a desire for greater profits, but may also include other financial attributes including asset growth, risk reduction, and financial liquidity (Chouinard *et al*, 2008). For instance, a model used by Cary and Wilkinson (1997) hypothesized that five factors could explain the planting of trees and deep rooted grasses on farms and pastures in south eastern Australia. Of these factors, the idea that the conservation practice in question must be perceived as economically profitable before adoption will occur was of paramount importance. In the end, the authors concluded that, in general, "…the best way to increase the use of conservation practices to overcome land degradation…will be to ensure the practices are economically profitable" (Cary and Wilkinson, 1997, p. 20).

Several other writings attempt to estimate the cost responsiveness of a farmer's adoption of soil-conserving and/or runoff- reducing practices using data from surveys on stated preferences. For example, Lohr and Park (1995) attempt to determine the cost responsiveness of planting filter strips under the filter strip provision of the Conservation Reserve Program (CRP) for farmers in Michigan and Illinois. Using a contingent valuation (CV) framework, this study sought to evaluate whether a respondent would participate in the program and determine the percentage of eligible land that each willing participant would enroll in the program in response to a proposed payment. Results of the study indicated that the "payment" variable, which was defined as the per acre offer to farmers as inducement to join the filter strip program, had a positive and significant effect on the probability of a farmer joining the filter strip program.

Like the study conducted by Lohr and Park (1995), Cooper and Keim (1996) also use a CV framework in order to determine farmers' cost responsiveness to five different practices that protect water quality. Results indicated that incentive payment offers ranging between 35 and 65 dollars would be required to entice 50 percent of their sample to participate in the surveyed conservation practices.

The aforementioned studies find a significant degree of cost responsiveness and downward sloping demand for conservation practices. This suggests that subsidies for conservation technologies applied on working farmland are likely to yield substantial increases in the use of such practices. However, models of stated preferences do not always provide good predictors of *actual* behavior, making it desirable to validate the results with studies using revealed preference data. Lichtenberg (2004) uses such a study to analyze conservation decisions by farmers in Maryland. The analysis conducted by Lichtenberg uses survey data combined with information on standard unit costs of installing seven soil-conserving and/or runoff-reducing conservation practices as identified by a Maryland state cost-sharing program Latent demand models for each of the seven practices were developed and all exhibit a downward slope, suggesting that cost sharing could have a strong impact on the adoption of these conservation practices in Maryland.

While the conservation literature appears to be dominated by work citing financial motives as the primary driver of the adoption of conservation practices, a considerable amount of work shows that other, non-financial factors can play a role in the conservation decision made by farmers. For example, a study of Missouri farmers conducted by Ervin and Ervin (1982) indicates that personal factors attributed to the individual farmer may have a substantial impact on the number of adopted conservation practices. In fact, the authors note that the two most important variables in explaining the number of conservation practices employed on an individual farm were "…either personal characteristics or related to personal characteristics: education and perception of the degree of erosion problem" (Ervin and Ervin, 1982, p. 286). Their findings also suggest that governmental assistance to farm operators in erosion prone areas should possibly vary depending upon operator characteristics.

Similarly, a study of the Central Platte River Valley of Nebraska conducted by Supalla (2003) suggests that the best way to convince producers of irrigated agriculture to use conservation practices that protect water quality is through expanded educational programs. In this study, Supalla notes that producers in the area have developed a stewardship ethic and are willing to forego profits in order to use best management practices (BMPs) that enhance water quality in the region. In fact, it was discovered through an attitudinal survey that 85 percent of producers in the region were willing to voluntarily accept lower net returns in exchange for reduced groundwater pollution (Supalla *et al.*, 1995, cited in Supalla, 2003, p. 96). Therefore, it appears that a lack of knowledge concerning BMPs, not income, may be the deciding factor in the decision to adopt conservation technologies along the Central Platte River Valley. Thus, policy instruments that stress education may be more likely to increase conservation technology adoption rates than policies that stress financial incentives or direct regulation.

In addition to human capital studies that stress general farmer characteristics like age and education levels, several other studies have analyzed the importance of farmer values and attitudes when making a decision regarding the adoption of conservation practices. Wallace and

Clearfield (1997) examined the reasons why producers adopt stewardship practices and determined that many voluntarily install conservation practices on their land because it is the "right thing to do." They also indicated that many farmers and ranchers see private ownership not as a right to do what they please with the land, but as a right to be stewards of the land. Also, the researchers showed that, even when facing difficulties, many agricultural producers have maintained an attitude and ethic that treats farming and ranching as "*a way of life*," and not a venture to maximize profits (Wallace and Clearfield, 1997, p. 4).

Maybery, Crase, and Gullifer (2005) also show the importance that values and attitudes can have in shaping conservation behavior. Survey responses from farmers in New South Wales, Australia showed that producers in this region had three distinct values in regard to their farming operations: economic, conservation, and lifestyle. Also of importance was the fact that a clear separation existed between economic and conservation values, as well as economic and lifestyle values. This suggests that "…ideologically different policy approaches may have separate pathways of influence within landholder decision making" (p 68). Therefore, it can be reasonably inferred that those with strong conservation goals and weak economic goals are unlikely to respond to financial incentives as motives to engage in conservation practices. Conversely, those with weak conservation values are not likely to buy into volunteer conservation practices that will sacrifice profit. Yet, this study still shows that financial motives alone cannot entirely predict participation in conservation programs in this region.

As evidenced from the studies cited above, it is clear that farmers can be motivated to adopt conservation practices by both financial and personal/attitudinal considerations that are not directly related to profit or financial capacity considerations. However, as shown by Chouinard et al. (2008), the literature has largely stepped around using a systematic integration of these two types of goals to describe conservation behavior, either by assuming that only maximum profits and/or minimum costs matter, or by adding social and stewardship factors in an ad hoc way. However, a recent subset of the conservation literature has started to use such an integrated approach in an attempt to substantively explain a wide variety of conservation behaviors.

Lynne, Shonkwiler, and Rola (1988) were among the first researchers to use a multiple-motive framework and apply it to an analysis of conservation decision-making. They collected attitudinal data, as well as context variable data including income and farm terrain, from farmers in the panhandle of Florida. Results from the study showed that attitudes toward conservation, perception of environmental problems, farm ownership, current profitability, income per effort, and risk were all important in predicting the effort of conservation adoption in the region.

As an evolution to multiple-motive studies like that cited above, Lynne (1995) developed a new behavioral economic model in which a farmer (or person in general) is proposed to pursue multiple-utilities or multiple interests. Taking cues from Sen (1977) and Etzioni (1986), Lynne proposed that individuals pursue not only a self-interest utility as modeled in microeconomics, but also a shared other-interest utility rooted in social norms and the ideas of sympathy, meta-ranking, and commitment (Sen, 1977). He labels each of these utilities as “I” and “We” utilities, respecitvely. It was hypothesized that the addition of the “We” utility to conventional economic models could greatly improve the explanatory power of studies intended to describe farmer conservation behavior.

Over time, the multiple-utility model proposed by Lynne has been refined and given the name “metaeconomics” (Lynne, 1999, 2006a). The metaeconomic model has been tested in several different settings. Lynne (1995) used this model in an attempt to detail the adoption of irrigation technologies that improve water use efficiency by strawberry growers in Florida;

Lynne and Casey (1998) and Casey and Lynne (1999) test the model in order to understand the adoption of drip irrigation technology by Florida tomato farmers; and Sautter, Ovchinnikova, Kruse, and Lynne (2008) use the meateconomic framework to explain the adoption of conservation tillage in portions of Nebraska. The theory has been applied in areas oustide of the conservation literature as well, suggesting that it may be applicable in describing many different types of behavior. For instance, Artikov and Lynne (2005) use metaeconomics to elucidate farmers' use of weather information, and Kalinowski, Lynne, and Johnson (2006) use the theory to explain recycling behavior by citizens in Nebraska. In all of the examples cited above, empirical results indicate the presence of joint self-interest ("I") and shared other-interest ("We") utilities or interests, together forming an internalized own-interest. Also, as hypothesized, the predictive capacity of the behaviroal models significantly improved with the inclusion of variables that served as proxies for a shared other-interested utility.

While Lynne was the first to propose the theory of metaeconomics, other researchers have begun to use the idea in recent research. For instance, Chouinard et al (2008) relies heavily upon the works of Lynne and his various co-authors to show that some farmers in the Pacific Northwest are willing to trade profits for stewardhsip activities. In this work, the authors propose that farmers pursue multiple utility, which they label as ego-utility and stewardship utility, and must reconcile these competing utilities when making conservation choices. Results from this study provided some empirical evidence that supports the existince of multiple utility in farmers, as the contingent valuation survey found a median willingness to pay (WTP) of $4.52/acre for stewardship practices in the sample area.

Work similar to that conducted by Chouinard et al. (2008) was developed by Bishop, Shumway, and Wandschneider (2009). In this research, as with that of Lynne and Chouinard et al, the authors theorized that the pursuit of joint and multiple utility (private and social) impacted the decision to use anaerobic digesters on dairy farms in the Pacific Northwest. Again, as with previous work in the multiple-utility/multiple-motive realm, the empirical survey used in this research confirmed the presence of both egoistic/financial motives and social motives when considering the decision to use anaerobic digesters. The authors also conclude that models that attempt to integrate both financial and non-financial motives into one coherent theory may work best when attempting to explain conservation behavior exhibited by farmers.

Intriguingly, the theory of choice behavior presented by Lynne and his various co-authors, Chouinard et al. (2008), and Bishop et al (2009) has been somewhat validated by research from neuroscientists and evolutionary biologists. In other words, there may acutally be a biological (physical) basis to multiple motives in humans. Cory (2006a, 2006b), who appropriately updated the work of evolutionary neuroscientist MacLean (1990), developed the theory of the human triune brain. In this research, it is documented that the human brain has evolved into a three level *joint and interdependent*, modular structure. The three levels are named the reptilian complex, the paleomammalian (or "old mammalian") complex, and the neocortex.

As noted by Bishop et al (2009), researchers have developed a multitude of models to represent how the pro-social components of behavior are woven into the triune brain structure. However, for the purposes of this research, there is no need to resolve the competing models dealing with brain structure. Rather, it is more important to acknowledge that two brain systems exist, —"a system effectuating egoistic behavior (moslty self-regarding motivation) and a system of pro-social or other-regarding motivation which causes a person to empathize or 'walk in another's shoes'" (Bishop et al, 2009). In other words, the pro-social system has facilitated the development of internalized, shared motives. The dual motives in the brain invoke both complementary and competitive neural processes, but these activities are always interconnected and ultimately resolved. In empirical measurement of neural activity, the dual motives of the brain have different neural firing patterns, but the systems communicate throught the neocortex, and both connect to the higher, hedonic reward centers of the brain (Fehr and Camerer, 2007; cited in Bishop et al, 2009).

Based upon the work from behavioral economists and neuroscientists, it appears reasonable to hypothesize that egoistic-financial and social-moral factors can influence conservation decisions made by farmers. It is the contention herein that models that integrate selfish and social motivations into one coherent behavioral theory may ultimately provide a better model for explaining conservation adoption on farms than models proposed by standard microeconomic theory.

III. Theoretical Framework

Metaeconomics, as first proposed by Lynne (1999), is a theory in behavioral economics that looks to transcend the traditional framework of standard microeconomics (Lynne, 2006a, 2006b). Traditional microeconomic theory assumes that an individual pursues only one interest, which is ultimately derived from pursuing selfish and hedonistic tendencies. Conversely, metaeconomics, which uses a framework similar to that introduced by Etzioni (1986), proposes a dual-motive, dual-utility model of the individual. Specifically, metaeconomics proposes that an individual jointly pursues both an egoistic-hedonistic based self-interest utility/tendency and an empathy-sympathy based other-interest utility/tendency, with the latter being shared with others. Importantly, these dual interests are viewed as *non-separable and are jointly internalized within the own-interest of an individual* (Sautter, Ovchinnikova, Kruse, and Lynne, 2008).

The essence of the metaeconomic framework (and the embedded theory that the human brain is as described by Cory (2006a and 2006b)) is presented in Figure 1. Careful inspection of the figure reveals several major differences from the traditional microeconomic production model. First, note that there are two sets of isoquants that represent both the egoistic-hedonistic self-interest (I_G) and the empathetic-sympathetic shared other-interest (I_M). Also note the absolute overlap of the dual self-interest and shared other-interest isoquants. The intersection of both interests at every point in the space is represented at points A, B, and C. This overlap of the dual interests represents the foundation of the metaeconomic model. In the context of the farming community, traditional profit-bearing outputs like corn and soybeans are represented in the I_G isocurves, whereas shared, more community based outputs like less chemical and sediment loadings to nearby water sources, enhancement of ecosystems, and long-term farm sustainability are represented in the I_M isocurves.

Figure 1 also demonstrates that, due to the jointness and non-separability of the dual interests, a farmer is unable to pick a certain level of self-interest without simultaneously choosing a level of shared other-interest. Yet, the tendency within the conservation literature is to treat the choice behavior of farmers as separable independent effects involving mere tradeoffs (Sautter *et al,* 2008). Thus, the two interests are implicitly modeled as separate components in the literature, and not like the interrelated paths 0G and 0M.

A farmer that pursues path 0G, or, in the extreme case the vertical axis, is described as *Homo economicus,* and is assumed to have his or her behavior arise only out of self-interested tendencies. In contrast to a farmer that pursues only self-interest, though, metaeconomics proposes that a farmer may also wish to pursue the shared other-interest on expansion path 0M. A person that pursues this path can be characterized as *Homo sociologicus*, akin to the nature of human behavior presumed in standard sociology. A farmer portrayed in this fashion is assumed to be motivated in their behavior by empathetic-sympathetic tendencies such as roles in the farming community, interdependence and identifying with place and others, and community norms and traditions. Pursuing these community oriented tendencies would again maximize outcomes (i.e. maximize profit and the utility it can buy), but it is maximized in the other-interest domain by achieving shared community oriented goals at point C. By settling upon point C in the space, a farmer uses many conservation techniques and will use relatively small amounts of industrial inputs. Control over farming processes is also desired less at this point. Also, drawing upon philosophy, we find that farmers maximizing the shared other-interest are choosing to buy more completely into a conservation ethic, which is all about "feeling with" or being "in sympathy with" (Solomon, 2007, p. 64) other conservation farmers and downstream water users valuing higher quality water. Without first identifying with and walking in the same space as others, though, a shared conservation ethic could not evolve.

As noted, the conservation literature assumes that the self-interest and shared other-interest tendencies are considered independently by the individual decision maker. Metaeconomics, meanwhile, proffers that both dispositions must be considered jointly and simultaneously when making a decision. Instead of choosing to maximize either the self-interest or shared other-interest tendency, metaeconomics posits that the individual strives to integrate both interests on path 0Z in order to make a choice that satisfies both domains and provides peace of mind to the decision maker. This is represented by point B in the space. At point B, the conflict between the self-interest and shared other-interest within the individual has been resolved and integrated into an *own*-interest that considers both the self and others.

Closer examination of point B also leads one to recognize that metaeconomics allows for the individual farmer to engage in self-sacrifice in both domains of interest. At this point, we find that the farmer has settled upon the intersection of I_G^2, I_M^2, and the budget/capital constraint R^oR^o. Yet, if a farmer intended to maximize while acting on the self-interest tendency or other-interest tendency, he or she would orient themselves to the intersection of the budget constraint with either isoquant I_G^3 or I_M^3, respectively. By locating at point B, farmers are choosing to give up a little in both domains. This is to say, the producer may give up some profit in order to install conservation measures on their farms and do the right thing for the environment, yet they also give up some of the outcomes from pursuing less in the way of shared other-interest in order to earn enough profit to remain viable. Thus, point B becomes a type of "satisficing" choice for the farmer, and as noted, provides a certain peace of mind. We have a kind of *Homo satisficicus* state of being on path 0Z. Intriguingly, recent empirical evidence has shown that farmers engage in exactly this type of decision-making process. In their study of farmers in the Pacific Northwest, Chouinard et al (2008) found that producers, on average, are willing to give up $4.52 per acre in order to invest in conservation on farms. This money represents a sacrifice in what the authors called the ego-utility (self-interest) domain. However, these farmers are also sacrificing in the social-utility (shared other-interest) domain in order to make their farming operations profitable. So, we find a type of satisficing choice has been made.

Not only does metaeconomics make the role of self-sacrifice explicit when describing choice behavior, it also describes how control and self-control play an important role in decision making. For example, a farmer moving along path 0G will likely use intensive tillage practices on crop acres in order to help facilitate deeper root penetration, help maintain soil fertility, and destroy weeds. In contrast, a person moving along path 0M is much more willing to use reduced or conservation tillage systems on his or her farm and to give more control to the natural ecological system. A farmer on this path is also more likely to give in to more control coming out of regulations, or other kinds of external controls (i.e. landlords). Thus, we find that a farmer on path 0M may integrate the need for less control over his or her farm processes with the desire to give more control to the shared other-interest (Sautter *et al*, 2008). This integration results in the farmer helping to eliminate soil erosion while also buying into a conservation or sustainability ethic.

It follows that making the role and need for self-control explicit is also an important feature of metaeconomics. Farmers that are on the satisficing path 0Z will be tempted by both inward desires and outside influences to move back to path 0G and maximize the egoistic-hedonistic interest, or they may ultimately succumb to social and community norms and the conservation ethic exhibited by path 0M and attempt to maximize the empathetic-sympathetic interest. So, self-control is needed by the individual in order to act independently and with courage in order to achieve satisfactory outcomes in the two parts of the individual's *own*-interest as demonstrated by path 0Z. Thus, as noted by Sautter *et al* (2008), "the preference for control and the ability to take control also temper the self-interest in moving toward path 0Z."

Finally, it is important to note that metaeconomics posits that the isoquant sets I_G and I_M as well as the expansion paths 0G and 0M tend to be in the subconscious of the individual and are not often considered. While paths 0G and 0M may frame the space that cognitive and conscious individual thought occurs within, the paths themselves come to be through "instinct" or intuition (Kahneman, 2003). It is also likely that even 0Z, once cognitively considered, may become part of an individual's intuition. This is especially true if the decision to be made is one that occurs on a routine basis. In fact, this is a major theme woven throughout a recent piece written by McCown (2005). In his writing, McCown, who is building upon the idea of phenomenology in decision making submitted by Schutz and Luckmann (1973), notes that "in normal *routine* activity, commitments are made, and action is taken *without conscious deliberation*" (p. 22, emphasis added); so, commitments to the shared interest represented in 0M lead to tempering the pursuit of self-interest 0G, leading to routine on path 0Z.

IV. Empirical Model

The ultimate goal of this research is to use the information and insights gained in order to promote increased usage of conservation measures in the Blue River/Tuttle Creek Lake watershed that enhance water quality in the Lake and watershed. For this reason, models that are probabilistic in nature are best suited to analyze conservation behavior in the study area. In other words, we seek to understand how changes in independent variables impact the probablility of adopting conservation technologies on working farms, with particular attention being focused on the individual farmer's decision regarding tillage strategies. Therefore, models of the logit variety are used to test conservation behavior in the four county target area.

Four logit models of the following functional forms are used to test the metaeconomic theory presented in Section III:

(1) $$\Pr(0, X_1) = \beta_0 + \beta_1(R_i) + \beta_2(N_i) + \varepsilon_i$$

(2) $$\Pr(0, X1) = \beta_0 + \beta_1(R_i) + \beta_2(N_i) + \beta_3(I_{Gi} * I_{Mi}) + \varepsilon_i$$

(3) $$\Pr(0, X1) = \beta_0 + \beta_1(R_i) + \beta_2(N_i) + \beta_3(I_{Mi} * I_{Gi}) + \beta_4(H_i) + \varepsilon_i$$

(4) $$\Pr(0, X1) = \beta_0 + \beta_1(R_i) + \beta_2(N_i) + \beta_3(I_{Mi} * I_{Gi}) + \beta_4(H_i) + \beta 5(I_{Gi} * V_i) + \varepsilon_i$$

where R_i = the income (as a proxy for financial and capital capacity) of the i^{th} farmer; N_i = the physical characteristics of the i^{th} farmer's crop land; I_{Gi} = proxy for self-interest of the i^{th} farmer; I_{Mi} = proxy for the shared other-interest of the i^{th} farmer; H_i = proxy for habitual tendencies of the i^{th} farmer; and V_i = proxy for preference for control by i^{th} farmer. Notice that equation (1) represents the standard empirical derived demand equation given in standard production microeconomics, whereas equation (2) represents the empirical derived demand equation offered by metaeconomic theory. Equations (3) and (4) build upon the metaeconomic model by adding important variables that account for habitual tendencies and preferences for control exhibited by the individual farmer.

<u>*Description of Study Area*</u>

The Blue River/Tuttle Creek Lake watershed covers a large portion of southcentral and southeast Nebraska, as well as northeast Kansas (See Figure 2). However, the use of natural resource assesment maps and empirical surface water quality data allowed physical scientists from the University of Nebraska-Lincoln to identify a critical four county area of nonpoint source runoff that may impact Tuttle Creek Lake near the Nebraska-Kansas border (Shea *et al*, 2006). This critical area includes Jefferson and Gage counties in Nebraska, as well as Washington and Marshall counties in Kansas. Therefore, efforts to promote behavioral modification involving conservation measures on farms has been targeted to this four county area.

While the physical characteristics of the land in the watershed contribute to water quality issues in region, the current institutional situation in the watershed also contributes to water quality problems in the region. The historical presumption in the watershed has been that farmers upstream of Tuttle Creek Lake have the right to allow chemicals and sediments to runoff and deposit into rivers and streams. Traditionally, upstream farmers have not been obligated to be concerned with downstream water users' rights to clean water. Both state laws and the Federal Clean Water Act put the burden of cleaning contaminated water on those that are currently using the water, unless the water users can definitively show which entities are creating the water pollution; and since agricultural runoff is a non-point source of pollution, those downstream of Tuttle Creek Lake can not show precisely who is causing the poor water quality in the Lake.

In recent years, the current institutions in the Tuttle Creek Waterhed have been called into question by downstream water users (instutions are defined as working rules, norms, traditions, and property relations; see Bromley, 2008). Thus, irritation has started to build within and between the upstream agricultural producers and downstream water users of the region. The questioning and evolution of the institutional makeup of the watershed has been brought on for several reasons, including the desire for clean water for recreational purposes, general concern for plants and animals that use the water in the region, and aesthetics. However, of paramount concern to downstream water users is the quality and quantity of potable water sources in the region. As noted earlier, outflow from Tuttle Creek Lake helps to provide water flow to the Kansas River. Shea *et al* (2006) note that approximately 50 percent of the flow in the Kansas River can be directly attributed to supplies from Tuttle Creek Lake. This is important to note, as the Kansas River provides drinking water to major population centers in northeast Kansas, including Kansas City, Topeka, and Lawrence. Therefore, polluted water from Tuttle Creek Lake is infiltrating the Kansas River and jeopardizing the quality of the water supply for these areas in northeast Kansas.

Water quantity is also of concern to the region due to the fact that cities in northeast Kansas are growing rapidly. Margaret Stafford of the Topeka Capital-Journal (2003) reported that the population of Johnson County, Kansas had grown by 27 percent between 1990 and 2000, and that the city of Olathe alone had grown by 47 percent (nearly 30,000 people). Obviously, this rapid population expansion has strained the ability of municipalities to provide water to their citizens. As the population and demand for water continues to grow in the region, Tuttle Creek Lake will become an ever more important source for water supply. However, as cited earlier, the capacity for the reservoir to hold water has been reduced due to siltation. Therefore, practices upstream that contribute to soil erosion and siltation are now looked upon in a negative light by water suppliers downstream. So, given the interaction between the physical land characteristics and the social arrangements among the people in the watershed, a study that focuses on behavioral change that improves water quality in the region was deemed appropriate.

Data Collection

Data for this research was collected via a mail survey instrument, and the procedure for administering the survey followed the basic "Dillman (2000) survey method."[1] A total of 4,191 surveys were mailed to known farm operators in the four county target area of the watershed. Names and addresses of operators were obtained from farm operator lists maintained by the local county offices of the Farm Service Agency, U.S. Department of Agriculture. According to the FSA, the population of the four county area consists of 3,731 total operators. In the original survey mailing, operators were offered $40 to complete the survey. A subsequent mailing of the survey commenced a few weeks after the first mailing was complete. This mailing included a random subsample of 460 non-respondents of the original 3,731 operators. This time, respondents were offered $80 for their completed questionairres. Overall, the response rate from the 3,731 operators was 17.1 percent (639 survey responses). Due to missing responses on the proposed dependent variables, 498 surveys were used for statistical analysis.

While a survey response rate of 17.1 percent is not out of line with other similar research (see Chouinard et al (2008)), some may choose to argue that the response is too low to make

[1] A copy of the survey instrument and raw data collected for this research is available upon request.

generalizations about the farming population in the four county target area. However, there is evidence to suggest that the survey response rate may in fact be larger than 17.1 percent. First, the survey created was intended to be administered to farm *operators* in the target area, as the operators are the individuals most likely to be in the field making conservation decisions. However, the primary investigators listed on the cover page of the administered survey received several phone calls and e-mail correspondences from individuals that had received the survey that do not participate in day-to-day farming operations. Thus, this antecdotal evidence suggests that both operators as well as owners/landlords may have received the survey. The potential exists that the FSA farm operator lists obtained were not properly maintained and oversampling may have occurred.

There is other evidence to suggest that oversampling may have occurred. As noted, FSA operator lists indicated that there were 3,731 operators located in the four county target area in the watershed. Yet, according to the National Agricultural Statistics Service (NASS) census for 2002, there is only a total of 3,184 farms in the four county target region. Therefore, if it is assumed that each farm has one principal operator, oversampling by nearly 550 individuals occurred in the sample. If we remove these 550 surveys from the overall sample, the survey response rate is 20 percent.

Description of Variables Used

Dependent Variable:

The dependent variable in this study was named no01, and is a binary (0,1) variable used to explain the adoption of conservation tillage in the logit analyses. The variable was created from answers reported in Questions 2a and 2b of the administered survey instrument. Questions 2a and 2b use a matrix format in order to ascertain the number of acres under various types of tillage regimes. Respondents reported the number of acres under conventional tillage (less than 15 percent crop residue), reduced tillage (15 percent to 30 percent crop residue), and conservation tillage/no-till (greater than 30 percent crop residue) cropping schemes. Those respondents that use any amount of conservation tillage/no-till received a score of 1 for the no01 variable, and those that use no conservation tillage/no-till received a score of 0.

Independent Variables:

Income/Financial Capacity (R_i)

Income data from farmers in the Blue River/Tuttle Creek Lake watershed was collected and is an important component in both microeconomic and metaeconomic derived demand models. The variable, named income2_1, was collected via Question 33 in the administered survey instrument. This question asked respondents to choose a category that best described their total income from both *gross* farm sales and other farm/conservation payments, again, as noted, to indicate the financial or capital capacity of the farm. Responses were scaled such that the final income variable is reported in thousand of dollars. Also, missing income values were treated with mean substitution.

Soil Slope (N_i)

The physical context of the land in production is thought to be an important determinant in the adoption of conservation technologies. In the case of tillage strategies, the most important physical factor appears to be soil slope (i.e. land steepness). For this reason, soil slopes are estimated in the four county critical area of the Blue River/Tuttle Creek Lake watershed.

In order to compute soil slope, individual survey respondents were asked to mark an “X” on a county map in order to indicate the *general location* of the respondent’s principal farm. Then, geographic latitude and longitude coordinates of the principal farms were determined by using the computer program 3-D Topoquads. Once the geograpic coordinates were obtained, this information was then utilized in Geographic Information Systems (GIS) software in order to obtain information regarding soil slope on a particular respondent's principal farm.

Other-Interest*Self-Interest (I_{Mi}*I_{Gi})

The other-interest*self-interest independent variable is the core variable of the empirical metaeconomic model. As previously indicated, it is theorized that humans rely upon *joint, non-separable* shared other-interest tendencies and self-interest tendencies when making economic decisions. For this reason, other-interest and self-interest indepenent variables can not be modeled separately. Thus, it has been decided that proxies for an individual's shared other-interest and self-interest tendencies will be multiplied such that both proxies are taken into account when creating a single independent variable.

Three proxies were used to measure a survey respondent's orientation toward a shared other-interest: empathy, measured with portions of the Davis (1980) Empathy Scale (Question 22 of survey); sympathy, measured with a scale created by the authors (Question 23 of survey); and empathy/others, measured with a scale created by using the Theory of Planned Behavior (Ajzen, 1991) (Question 19 of the survey). The need for three different shared other-interest proxies is due to the fact that other-interest dispositions in humans are thought to evolve. For example, psychologists and neuroscientists like Decety, Michalska, and Akitsuki (2008) have shown with functional Magnetic Resonance Imaging (fMRI) that the programming for empathy has been "hard-wired" into the brain circuitry of normal functioning children. Their results are consistent with previous fMRI studies involving adults. Thus, it appears that the ability to empathize with other humans is an innate characteristic possessed by normal humans. Therefore, it is also proposed in this paper that all humans have the ability to project themselves into the perceived mental state of others (i.e. "walk in the shoes of others").

While empathy is defined as the ability to project oneself into the mental state of others, sympathy is defined in a much different manner. While most relate sympathy to feelings of compassion, this paper defines sympathy in much the same way as it is defined by the philosopher Solomon (2007): a human's ability to sympathize is characterized as the ability to buy into a specific group ethic. So, we find that humans can indeed become "in sympathy with" particular groups and buy into specific group ethics. This is achieved through the use of empathy. Individuals can project themselves into the state of mind of specific groups and choose to become in sympathy with the group in question if the group ethic and goals align with the individual's goals. So, we find that the key to becoming in sympathy with particular groups is the act of empathy. In other words, empathy can move an individual towards sympathy. However, it should be noted that the act of empathizing does not automatically lend itself to sympathy. Becoming in sympathy with a group is still an individual choice that can be accepted or rejected, but empathizing does provide important information to the individual that aids in the decision making process. So, in terms of the research at hand, it is proposed that all inhabitants in the four county target area have the ability to empathize (albeit some have a greater capacity than others), but it is unlikely that all inhabitants have become in sympathy with various groups that use the Blue River watershed and Tuttle Creek Lake.

While the acts of empathizing and sympathizing occur strictly within the individual, it cannot be denied that the opinions and lobbying of other human beings can in fact influence an individual's decision making process. Therefore, the empathy/others variable was created in order to assess which specific individuals and groups can influence farmer conservation behavior. Influence from three groups was tested: family members, farm entities (i.e. seed suppliers, machinery dealers, etc.), and downstream water users. These variables constitute the final other-interest proxy used in testing the metaeconomic theory in the study area.

While three proxies were needed to evaluate the evolution of shared other-interests of farmers in our sample, only one proxy was needed to assess a farmer's orientation toward self-interest tendencies. The proxy used for this study was the selfism scale created by Phares and Erskine (1984). This scale has been tested routinely in psychological disciplines, and it has been deemed as reliable in assessing narcissistic (selfish) tendencies within individuals. This scale was administered through Question 24 of the survey instrument.

Once the final shared other-interest and self-interest variables were computed, the final other-interest*self-interest (I_{Mi}*I_{Gi}) metaeconomic independent variables could be created. In order to create these variables, the results from the selfism scale were reversed such that the two multiplicants would be of the same magnitude and direction. Then, the results from each other-interest proxy were multiplied by the results of the self-interest proxy. The result was five independent variables that could be used in three separate tests of metaeconomic theory (test of empathy, test of sympathy, test of empathy/others.

Habit (R_i)

Metaeconomics suggests that most farmers making operating decisions run largely on emotion or sub-conscious feelings about farming strategies that have worked in the past. Intriguingly, this assertion is supported by empirical research conducted by Kahneman (2003). In his work, Kahneman determined that humans in general rely on "intuition" or emotion in their decision making processes. In fact, he determined that "effortless thought is the norm" in the everyday lives of humans. So, based on this empirical contribution to the behavioral economic and psychological economic literature, it seems prudent to add a measure of habit to the empirical metaeconomic model.

In metaeconomic terms, if someone is on a path 0Z, it is more likely that path will be maintained through time. In effect, it is proposed that consciously cognitive, rational calculation and consideration of using more conservation tillage happening at some earlier time simply leads to underlying, less than cognitive feelings reflected in habitual tendencies. These internalized past decisions then guide decisions made today (Sautter *et. al*, 2008). Thus, we find that once farmers put into practice a new technology, they become rather reluctant to switch back to practices used in the past.

Habitual tendencies in relation to conservation tillage strategies were measured in the four county target area by asking the following question: *Is the percentage of your farm under conservation tillage/no-till less, the same, or more than 3 years ago?* Responses were recorded on a seven-point Likert scale.

Self-Interest*Control (I_{Gi}*I_{Vi})

As noted earlier, meateconomic theory proposes that a farmer's preferences for and perceptions of control over his or her farming operations can make a large impact upon conservation technologies used on individual farms. For this reason, farmers in the four county target area of the Blue River/Tuttle Creek Lake watershed were asked to respond to several line items that assess a person's views in regard to control over specific farm processes.

Question 15 of the composed survey instrument administers the control scale. The scale assesses three types of control: control over daily farming operations, control that others can exert over farming decisions, and control over nature.

Respondents were basically asked to mark an "X" on a continuum that measured whether he or she perceives *complete* control over conservation practices and their consequences or if he or she feels that they have *no* control over conservation practices and their consequences. This is very similar in nature to the idea of autonomous versus heteronomous control presented by Angyal (1967), in which autonomous control is represented as internal self-control and heteronomous control is represented as control exerted upon the individual by others or the environment in which the individual resides. It is hypothesized, then, that those who feel that they can use conservation tillage strategies and still maintain a great amount of autonomous control over farming processes will be more likely to use conservation tillage on individual farms. In contrast, those that believe using conservation tillage technologies reduce a farmer's autonomous control over farming processes will be less likely to use conservation tillage strategies.

V. Results

Summary descriptive statistics for all variables used in the logit models of conservation tillage adoption in the watershed are provided in Tables 1 through 5. Inspection of the tables presented provides some interesting insights into the psychological makeup of the respondents in the four county target area. First, notice that the final selfism scale (Table 1) indicates that self-interest tendencies are in fact present within farmers in the watershed. However, the mean score of the scale (3.29) is much less than might be predicted using the standard framing of the problem of adoption using traditional microeconomics. In fact, a microeconomics frame would suggest that the mean score of the selfism scale would be much closer to six or seven, and, being exactly true to the theory, everyone would need to answer seven. Instead, the final selfism score shows that respondents are actually closer to *selfless*, rather than selfish.

In addition to selfish tendencies being present within respondents in the watershed, survey results also indicate that shared other-interest tendencies in the form of empathy and sympathy also exist within the region (Table 2). Intriguingly, a comparison of the mean results of self-interest tendencies and shared other-interest tendencies in the watershed actually show that shared other-interest tendencies occur at a greater magnitude than self-interest tendencies. This finding places traditional, microeconomic based renditions of farmer behavior in question.

Closer inspection of Table 2 also provides some critical information regarding metaeconomic theory. Previously, it was noted that metaeconomics theorizes that all individuals are born with an innate ability to empathize with other individuals. The ability to empathize, then, can ultimately lead an individual to become "in sympathy with" the ethic and goals of a particular group of people. It was carefully noted, though, that the ability to empathize does not necessarily lead to sympathy.

Information given in Table 2 shows that this idea may in fact be plausible. The mean score of the final empathy scale is 5.06 units. Given that empathy was measured with a seven-point Likert scale, it is obvious that respondents clearly have the ability to empathize with other individuals. Comparing the empathy scale with the scale that measures sympathy, though, indicates that there is a great amount of variability in the respondents' ability to sympathize with groups that use Tuttle Creek Lake. First, the mean score of the sympathy scale was 4.73 units, a result that is lower than the mean score of the final empathy scale. Second, and more importantly, the standard deviation of the sympathy scale was 1.088 units. This result is higher than the standard deviation of the empathy scale, which produced a result of 0.807 units. Based upon these numbers, then, we can reasonably speculate that all respondents in the four county target area have the ability to empathize (albeit at different capacities), whereas not all respondents have become in sympathy with the ideals and goals of other users downstream that rely upon Tuttle Creek Lake.

Tables 6 through 8 provide the logit test results used to understand tillage decisions in the four county critical area of the Blue River/Tuttle Creek Lake watershed. In all three models presented, the column labeled “Role of Capital” is representative of equation (1) and represents the standard microeconomic empirical derived demand function; the column labeled “Adding Tempered Self” is representative of equation (2) and represents the most basic metaeconomic empirical derived demand function; the column labeled “Adding Habitual Tendency” is representative of equation (3) and adds the aforementioned habit variable to the metaeconomic derived demand function; and finally, the column labeled “Adding Selfism Reinforced Control” is representative of equation (4) and adds the three previously mentioned control variables to the metaeconomic derived demand function.

Examination of the results from all three models provides some very intriguing insights into what motivates the conservation tillage adoption decision among farmers in the four county target area above Tuttle Creek Lake. First, take note of the results presented in the column labeled “Role of Capital” in all three logit models. This is the empirical derived demand model described in microeconomic-based production economics. As microeconomics would suggest, we find that income (i.e. financial capacity) is a significant variable that helps to explain a farmer’s decision to adopt no-till and conservation tillage technologies. The chi-square statistic for this model also shows the overall model to be significant in explaining tillage behavior. While the model is significant, though, it should be noted that the coefficient on the income variable indicates that an increase in income actually has a very small impact on a farmer’s tillage decision. In fact, a one thousand dollar increase in gross income only increases the odds of a farmer adopting no-till and conservation tillage strategies by 0.06 percent (i.e. less than one percent). Also note that the microeconomic model does a poor job of predicting which respondents do not use no-till and conservation tillage technologies.

While the microeconomic model predicts conservation tillage behavior reasonably well, it does not compare favorably to the empirical derived demand model proffered by metaeconomic theory. In fact, we find that regardless of the shared other-interest proxy used (empathy, sympathy, or empathy/others), the metaeconomic derived demand model predicts conservation tillage behavior much better than the microeconomic-based derived demand model.

The basic metaeconomic derived demand model is presented in Tables 6, 7, and 8 under the column labeled "Adding Tempered Self." Notice that in all three tables, the income variable remains significant, just as in the microeconomics model. Yet, we also find that the metaeconomic variables (self-interest*shared other-interest) contribute significantly to understanding farmer tillage behavior. In Table 6, we find that the empathy*selfism variable is a significant predictor when attempting to understand tillage behavior in the watershed. The chi-square (block) statistic also shows that adding the tempered self-interest variable improves the overall model fit. Also, we find that the R-square statistic increased from 0.10 to 0.159.

Table 7, which presents the results of the metaeconomic derived demand model that uses sympathy as a proxy for an individual's shared other-interest tendency, tells much the same story as the results provided in Table 6. Again, income is a significant variable in the individual tillage decision. However, like the model that uses empathy as a proxy, the sympathy*selfism variable is also a significant factor in predicting the tillage decision. Finally, we again see that the chi-square (block) statistic indicates that the addition of the sympathy*selfism variable improves overall model fit, and the Nagelkerke R-Square statistic increases from 0.10 to 0.12.

Finally, Table 8 presents the metaeconomic derived demand model when the empathy/others variables are used as proxies for an individual's shared other-interest tendency. Yet again, we find that this model tells much the same story as the models presented in Tables 6 and 7. Again, income is a significant variable in the tillage decision, but the farm entity*selfism coefficient is also significant. Somewhat surprisingly, though, this model shows that both other lake users and family members do not appear to impact the conservation tillage decision in farmers residing above Tuttle Creek Lake. Despite these surprising results, the metaeconomic model presented in Table 7 still yields a better fitting model than the standard production economics derived demand model. This is evidenced by the significant chi-square (block) statistic and an increase in the Nagelkerke R-square statistic from 0.10 to 0.185.

The results presented in Tables 6, 7, and 8 show that the metaeconomic derived demand model yields a better description of what motivates tillage behavior in the watershed than the microeconomics model. However, it is theorized that the basic metaeconomic model can be further refined and improved by adding variables that account for individual habitual tendencies and preferences for control. The columns labeled "Adding Habitual Tendency" and "Adding Selfism Reinforced Control" provide the results when proxies for these two phenomena are added to the metaeconomic model.

Inspection of the tables reveals that adding individual habitual tendencies does in fact improve the basic metaeconomic derived demand model, regardless of which shared other-interest proxy is used. In all three cases, the habit variable coefficients are significant and in the hypothesized positive direction. In addition to this, the income and shared other-interest variables all remain significant in all three models. The addition of a habit variable also substantially improves the model fit of the metaeconomic derived demand model. All three chi-square (block) statistics are significant, and in all three instances we find considerable increases in the Nagelkerke R-square statistics. This suggests that subconscious feelings about tillage decisions made in the past play a great part in tillage decisions that are made today or in the future.

Finally, we also find that the control variables presented in the columns labeled “Adding Selfism Reinforced Control” also help to refine and improve the basic metaeconomic derived demand model. Regardless of the shared other-interest proxy used, the selfism*farm control variable becomes a significant predictor when attempting to understand tillage behavior. The variable is also in the hypothesized negative direction. Again, as when adding the habit variable, the addition of the selfism reinforced control variables contributes significantly to the overall model fit, as evidenced by the significant chi-square (block) statistic in all three cases. The Nagelkerke R-square statistics also increase with the addition of the control variables to the metaeconomic model. It should be noted, though, that only the selfism*farm control variable is significant in the model. This indicates that an individual’s preferences for control over nature and attitudes toward control exerted on their farms by others are not important in the tillage adoption decision.

In sum, the results presented in Tables 6, 7, and 8 indicate that the refined metaeconomic model that includes habitual tendencies and preferences for control is vastly superior at predicting tillage behavior in the Blue River/Tuttle Creek Lake watershed than the standard microeconomics model. This metaeconomic model gives the largest Nagelkerke R-square statistics, best overall model fit, and yields the greatest percentage of correct 0,1 dependent variable predictions. Thus, our results suggest that new economic models that account for the psychological dispositions described should be created in order to truly understand the conservation adoption decision made by farmers.

VI. Conclusions

This study was very unique in nature. This research could be classified as an economic study, and includes all the elements one would expect to find in an empirical study using derived demand theory as presented in microeconomic-based production economics. However, the research conducted also sought to go beyond and transcend (the notion of "meta") the traditional economic framework, and thus metaeconomic theory (which includes elements from psychology, sociology, and other social sciences) was also used to test the motivations for farmer conservation behavior.

The results produced from the research are also very unique in nature. For instance, the results indicate that a farmer's income/financial capacity is an important factor in the conservation tillage adoption decision faced by farmers in the Blue River/Tuttle Creek Lake watershed. This result makes intuitive sense, as most conservation practices are not inherently profitable and there is some level of cost associated with purchasing new equipment that must be used in order to farm using conservation tillage strategies. What makes the result truly remarkable, though, is that increases in income/financial capacity, in an absolute sense, actually have a very small (albeit significant) impact upon the conservation tillage decision. This result is completely counter to the idea that substantial increases in income are needed in order to induce farmers to engage in conservation tillage activities.

In addition to the findings concerning the role of income in farmer tillage behavior, other psychological variables included in this research make the results distinctive and somewhat ground breaking. Most prominent in this research is the fact that both self-interest tendencies and shared other-interest tendencies play a role in the conservation tillage adoption decision made by farmers in the Blue River/Tuttle Creek Lake watershed. This result is similar in nature to the results found in the studies conducted by Chouinard et al (2008) and Bishop et al (2009). All three works have found empirical evidence that both self-interest (financial) motives and shared other-interest motives impact the conservation adoption decision.

Logit models created with survey data collected in the region show the importance of the self-interest and shared other-interest interaction. In all models, the shared other-interest*self-interest variable proved to be significant when attempting to predict conservation adoption in the watershed. Since the selfism scale was ultimately reversed when creating this interaction variable, the result is really a measure of how a person is oriented towards the shared other-interest in farming. The results ultimately show that those farmers who are less selfish in nature are likely currently using conservation tillage practices and are much more likely to continue using the technology in the future.

In addition to the results concerning the shared other-interest*self-interest interaction, the survey data compiled and models created also indicated that a farmer's preferences regarding autonomous and heteronomous control are also very important factors in the conservation tillage adoption decision. The logit model considers three different exploratory control variables: control over farm processes, control exerted by others, and preferences for control over nature. The results of the logit models consistently show that farm control is a significant variable. This result shows that if a person believes that they can use conservation tillage techniques and still keep complete autonomous control over their farm, they will be more likely to use conservation techniques. However, if a farmer perceives a loss of control over their farm by using conservation tillage, the odds of conservation tillage adoption significantly deteriorate.

Finally, this research also concluded that a farmer's habitual tendencies play a major role in the tillage adoption decision. So, it appears that those that have used conservation tillage strategies in the past are much more likely to continue using it in the future. However, it must be cautioned that the opposite situation may also apply. This is to say, if a farmer has not been convinced of the benefits of using conservation tillage techniques and continues to use intensive tillage technologies, he or she is more likely to rely on subconscious feelings and intuition and continue to use intensive tillage practices. In terms of policy, then, it seems imperative to jointly build unity with cause and enhance financial incentives in order to help convince intensive tillage farmers of the benefits of conservation tillage technologies. Once these intensive tillage users have converted to conservation tillage techniques, they will then be much more likely to continue using the technology.

The results from this study indicate that a single over-arching conservation policy administered on a volunteer basis is not likely to be successful in reducing agricultural non-point surface water pollution. This conclusion can be drawn because our survey results show that farmers are very heterogeneous in their psychological and economic motivations. This is starkly different than the homogenous *Homo economicus* assumed in standard economic theory.

The results show that farmers vary in the degree to which they act on self-interest and shared other-interest tendencies. Those that are more self-interested in nature are most likely influenced by mainly profit considerations. Therefore, financial incentive programs may help encourage these farmers to engage in conservation practices. However, by only targeting these self-interested individuals through the use of financial instruments, a large subset of the farming population that is largely influenced by a psychological orientation toward the shared other-interest are most likely not going to participate in the incentive programs. These other-interested individuals are most likely to participate in programs that emphasize the aspect of farming that can help them identify with others. In other words, they enjoy a connection with others that comes from being identified as a "conservation farmer," and being in unity with other such producers.

While there are some in the farming community that are motivated to engage in conservation activities by the extremes of either self-interest or shared other-interest, our results show that most individual farmers will be motivated by a complex mix of self-interest and other-interest on the metaeconomic satisficing path 0Z. So, it appears that the best conservation policies are those that can emphasize both self- and other-interest.

Importantly, this study is another in a series of tests of metaeconomic theory, with similar results. Metaeconmic tests began in the late 1980's, and continue to this day. Intriguingly, these studies continue to find evidence of a substantive role for both the shared other-interest and control in an individual's decision making process. However, this testing needs to be expanded in order to further validate the generalizability of the model.

While there are indeed certain drawbacks to the metaeconomic research conducted in the Blue River/Tuttle Creek watershed, the fact remains that the results produced have provided some intriguing insights into potential motivators for farmers to utilize conservation tillage strategies in the region. It is our hope, then, that these results and future research can help to improve conservation policy in the United States. Hopefully, too, the improved policies can lead to the restoration of rivers, streams, and lakes to a more natural and clean state, and conflicts regarding water quality can be resolved.

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Table 1: Mean Results for Final Selfism*Empathy/Sympathy Variables

	N	Mean	Std. Deviation	Missing
selfemp	488	24.07	8.080	2.01%
self2symp	488	22.65	8.463	2.01%
slfuserinf	482	20.75	10.403	3.21%
slffarminf	483	21.92	7.923	3.01%
slffamilyinf	483	21.42	10.519	3.01%

Table 2: Mean Results for Final Selfism*Control Variables

	N	Mean	Std. Deviation	Missing
slffarm	479	15.64	5.627	3.82%
slfothers	478	19.34	6.776	4.02%
slfnat	478	23.60	10.007	4.02%

Table 3: Mean Results for Final Income Variable

	N	Mean	Std. Deviation	Missing
income2	475	158.91	211.413	4.62%

Table 4: Mean Results for Final Soil Slope Variable

	N	Mean	Std. Deviation	Missing
slope	498	3.11	0.648	0.00%

Table 5: Mean Results for Final Habit Variable

	N	Mean	Std. Deviation	Missing
notilchng	497	3.85	2.132	0.20%

Table 6: Logistic Estimation of No-Till Adoption Decision (Empathy Other-Interest Proxy)

Variable	Role of Capital	Adding Tempered Self	Adding Habitual Tendency	Adding Selfism Reinforced Control
Constant	1.005	-0.730	**-1.823**[c]	-1.078
Income	**0.006**[a]	**0.005**[a]	**0.004**[a]	**0.004**[a]
Slope	-0.033	0.016	0.038	0.008
Empathy*Selfism		**0.070**[a]	**0.066**[a]	**0.090**[a]
Habit			**0.383**[a]	**0.371**[a]
Selfism*Farm Control				**-0.089**[a]
Selfism*Other Control				0.013
Selfism*Nature Control				0.002
-2 Log Likelihood	442.134	422.482	384.954	374.016
$\chi 2$ (Block)	**31.474**[a]	**19.651**[a]	**37.529**[a]	**10.938**[b]
$\chi 2$ (Model)	**31.474**[a]	**51.125**[a]	**88.653**[a]	**99.592**[a]
Nagelkerke R2	.100	.159	.266	.295
Percentage Correct:				
0	0	2.2	23.1	28.6
1	100	99.8	96.8	95.8
Overall	81.7	81.9	83.3	83.5
Df	2	3	4	7

Note: [a] p<.01, [b] p<.02, [c] p<.05

Table 7: Logistic Estimation of No-Till Adoption Decision (Sympathy Other-Interest Proxy)

Variable	Role of Capital	Adding Tempered Self	Adding Habitual Tendency	Adding Selfism Reinforced Control
Constant	1.005	0.122	-1.157	-0.787
Income	**0.006**[a]	**0.006**[a]	**0.004**[a]	**0.004**[a]
Slope	-0.033	-0.012	0.004	-0.022
Sympathy*Selfism		**0.037**[b]	**0.041**[b]	**0.043**[c]
Habit			**0.401**[a]	**0.391**[a]
Selfism*Farm Control				**-0.082**[a]
Selfism*Other Control				0.035
Selfism*Nature Control				0.017
-2 Log Likelihood	442.134	435.479	393.881	384.343
$\chi 2$ (Block)	**31.474**[a]	**6.655**[b]	**41.598**[a]	**9.538**[c]
$\chi 2$ (Model)	**31.474**[a]	**38.129**[a]	**79.727**[a]	**89.624**[a]
Nagelkerke R2	.100	.120	.241	.267
Percentage Correct:				
0	0	0	16.5	22.0
1	100	100	96.1	96.8
Overall	81.7	81.7	81.5	83.1
Df	2	3	4	7

Note: [a] p<.01, [b] p<.02, [c] p<.05

Table 8: Logistic Estimation of No-Till Adoption Decision (Empathy/Others Other-Interest Proxy)

Variable	Role of Capital	Adding Tempered Self	Adding Habitual Tendency	Adding Selfism Reinforced Control
Constant	1.005	-0.734	**-1.894**[c]	-1.176
Income	**0.006**[a]	**0.005**[a]	**0.004**[a]	**0.004**[a]
Slope	-0.033	0.006	0.020	-0.022
Water User Empathy*Selfism		0.013	0.014	0.016
Farm Entity Empathy*Selfism		**0.090**[a]	**0.084**[a]	**0.093**[a]
Family Empathy*Selfism		-0.021	-0.016	-0.010
Habit			**0.381**[a]	**0.374**[a]
Selfism*Farm Control				**-0.094**[a]
Selfism*Other Control				0.022
Selfism*Nature Control				0.009
-2 Log Likelihood	442.134	413.540	376.536	365.692
$\chi 2$ (Block)	**31.474**[a]	**28.593**[a]	**37.005**[a]	**10.844**[b]
$\chi 2$ (Model)	**31.474**[a]	**60.067**[a]	**97.072**[a]	**107.916**[a]
Nagelkerke R2	.100	.185	.289	.317
Percentage Correct:				
0	0	6.6	22.0	27.5
1	100	99.3	96.3	96.3
Overall	81.7	82.3	82.7	83.7
Df	2	5	6	9

Note: [a] p<.01, [b] p<.02, [c] p<.05

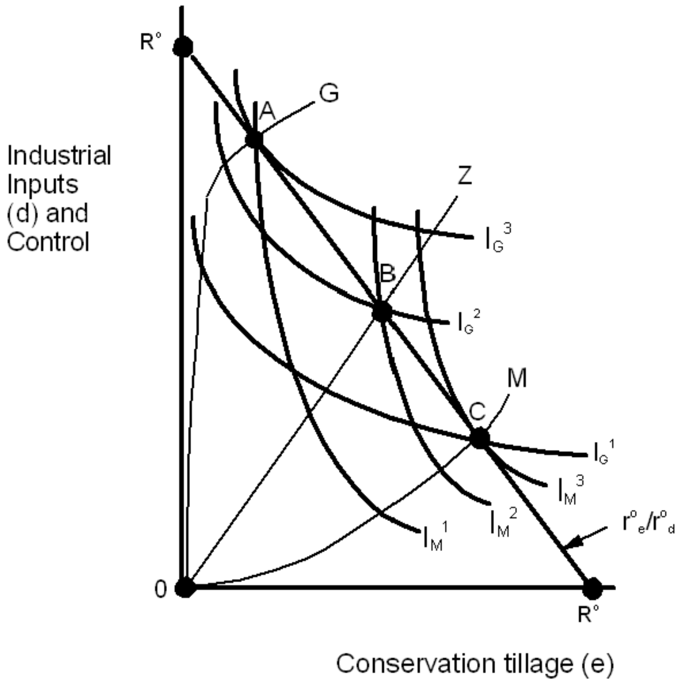

Figure 1. Joint Interests. Relationship between the farmer's pursuit of a joint self-interest (I_G) on path 0G and an internalized yet shared other-interest (I_M) on path 0M with the path 0Z showing sacrifice in both domains of interest.

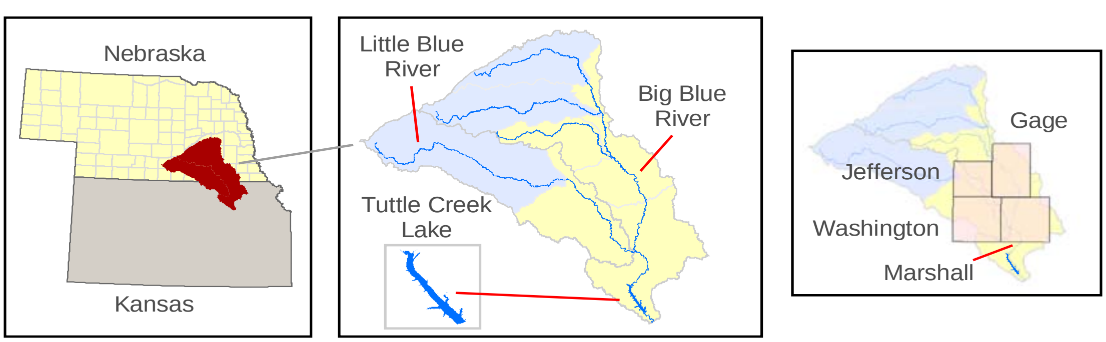

Figure 2. Blue River/Tuttle Creek Lake Watershed and four county critical area