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Encouraging soil health practices: The influence of identity, norms, and language on soil health behaviors of Iowa farmers

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Encouraging soil health practices: The influence of identity, norms, and language on soil health behaviors of Iowa farmers

by

Denise Coberley

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

Major: Journalism and Mass Communication

Program of Study Committee:
Dara Wald, Major Professor
Elena Cotos
Michael Dahlstrom

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2020

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DEDICATION

For my husband Mark, my daughter Mackenzie, and my son Beau who have been my inspiration and ultimate support. This belongs to all of us.

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ABSTRACT

This study explored the influence of norms, identity, and language on the adoption and implementation of soil health behaviors by Iowa farmers. Utilizing the Theory of Normative Social Behavior (TNSB), the relationships between the mechanisms of TNSB- descriptive norms, injunctive norms, outcome expectations, and identity - and soil health behaviors such as intent and adoption were analyzed using results from the 2015 Iowa Rural Life and Farm Poll. Three specific identities - farmer as steward, farmer as businessman, and farmer as productivist - were studied to determine the direct and moderating role of these identities on intent and adoption of soil health behaviors.

Using regression analysis, I found that there were strong predictive and interactive relationships between the TNSB mechanisms and farmers' soil health intentions and behaviors. Identity and outcome expectations had the strongest effect on soil health behavioral intentions and adoptions.

This study also looked at the publications indicated by Iowa farmers as trustworthy and influential in conservation decisions to determine how the mechanisms of TNSB may be communicated to farmers. A corpus analysis revealed patterns of linguistic features that may be connected to outcome expectations as well as possible priming of autonomy and choice which are important self-concepts of farmers.

Future research should develop and field surveys focused on Iowa farmers' soil health behaviors. Specific survey items (found in Appendix B) could be used to further test the mechanisms of TNSB related to farmer intentions and behavior. Finally, further linguistic analysis of conservation publications could be conducted to determine how these mechanisms may be primed in other conservation contexts.

CHAPTER 1. INTRODUCTION

In 1847, the Agricultural Society of Rutland County in Vermont hosted U.S. Congressman George Perkins Marsh. In his speech, Marsh spoke of the importance of understanding how human actions impact the land, water, and forests. He went on to say that “though man cannot at his pleasure command the rain and the sunshine, the wind and frost and snow, yet it is certain that climate itself has in many instances been gradually changed and ameliorated or deteriorated by human action” (“Address Delivered Before the Agricultural Society of Rutland County, Sept. 30, 1847,”; pg. 11). Marsh’s speech marked the beginning of the organized conservation movement in the United States, including the push towards more conservation-minded agricultural practices.

Since Marsh’s speech, agriculture has changed in ways that no one could have predicted. From simple plowshares working small homesteads of less than 200 acres (Agriculture Then and Now, n.d.) to GPS-guided tractors and planters working 1000 plus acreages. Today over 380 million acres of land in the United States are used for cropland (How Is Land in the United States Used? A Focus on Agricultural Land. n.d.). However, despite the importance of soil and water in agriculture, the proliferation of agricultural land in the U.S. has not always been associated with positive outcomes for these natural resources. The Dust Bowl in the U.S. was partially blamed on this proliferation as increased amounts of land were turned into row crops during the early 1900’s (Natural Resources Conservation Service, n.d.).

Edward Faulkner, an agronomist, also known as the father of no-till farming (Farooq & Siddique, 2015), described how disastrous the outcomes of farmers' use of the plow were in his book “Plowman’s Folly”(1943).

“We have equipped our farmers with a greater tonnage of machinery per man than any other nation. Our agricultural population has proceeded to use that machinery to the end of destroying the soil in less time than any other people has been known to do in recorded history,” (pg. 5).

Faulkner’s writings, 100 years after Marsh’s seminal speech, helped to raise awareness about the impact of farming practices on soil health. To address concerns about soil health and conservation practices the Soil Conservation Act, was passed in April of 1935, establishing the Soil Conservation Service (SCS), the predecessor to the modern Natural Resources Conservation Service (NRCS). The SCS provided on-farm demonstrations of practices to prevent soil erosion. It’s formation also allowed the U.S. government to install other soil and water conservation measures throughout the 40s and 50s, including an increase in the number of soil conservation districts (local resource management units for the NRCS), support for the Agricultural Conservation Program to increase the power of the conservation districts, and the Watershed Protection and Flood Control Act (Natural Resources Conservation Service. n.d.).

Conservation regulations along with an ever-expanding Farm Bill have contributed to tensions between governmental agencies, soil and water conservation districts, and farmers and rural landowners. Indeed, farmers have expressed concerns about the overarching role of governmental agencies on farm policy and federal regulations encouraging and mandating conservation practices on their farms. When asked about agencies’ policies related to conservation and water quality farmers’ responses highlight this tension: - “If it's to help us [the farmers] get better, then maybe it's all right. If they're going to use it to put restrictions on me as a landowner... um, I don't know,” (Zimmerman et al., 2019; pg. 3804). Conservation-oriented regulations have generated concerns about government oversight: “It was like some big brother

was looking over my shoulder the whole time.’’ (Reimer & Prokopy, 2014; pg. 326). Economic impacts or costs associated with conservation practices are another frequent concern for farmers: - “As much as I like the conservation aspect of it, it doesn’t fit in the economics with the other side of it.’’ (Reimer & Prokopy, 2014; pg. 327)

This tension could help to explain farmers’ reluctance to adopt additional conservation practices including no-till and cover crops, two of the most effective and scientifically supported soil and water conservation practices. Of the 19 Iowa State Extension Field days offered in 2019, 11 were focused on “crops and soil,” which included no-till and low-till topics and one on “cover crops.” Yet less than one third of all farmland in Iowa practices no-till and only 3.9% of Iowa acres were planted to cover crops in 2017 (Rundquist, 2019), even with a constant stream of messages and programs directed toward these soil and water protection measures.

Reluctance to adopt conservation practices by farmers is not isolated to Iowa. The adoption rates of cover crops and no-till practices have been slow across much of the United States (Adusumilli & Wang, 2018; Floress et al., 2017; Hallberg, 2011). At first glance, the aforementioned quotes and low adoption rates seems to suggest widespread negativity among farmers about conservation practices. However, there are also many farmers willing to adopt conservation action.

The success of the Science-based Trials of Rowcrops Integrated with Prairie Strips project (STRIPS) is one example of how science-based conservation practices have the potential to generate support among farmers. The collaborative project between 25 Iowa farmers and researchers at Iowa State University has led to reduced erosion, improved water quality, and

increased trust in scientific information (Arbuckle, 2019; Grudens-Schuck et al., 2017). To date there are 66 collaborative projects and 621 acres have been replanted as prairie protecting 5557 acres of farmland (STRIPS, n.d.).

There is also evidence of support for conservation in prominent ag-related publications such as *The Spokesman* published by the Iowa Farm Bureau, and in *Iowa Farmer Today*. Headlines from recent op-eds include, “Conservation practice adoption spikes with soybean farmers,” and “A conservation mindset grows strong in Iowa.” These headlines suggest that most farmers do have a positive attitude towards conservation practices or as Iowa Agricultural Secretary Mike Naig put it: “Iowa farmers are progressive, always looking for ways to improve,” he said, “It’s no different in conservation and water quality” (Steimel, 2018). The question is then why is widespread adoption of no-till, low-till, and installation of cover crops still lagging?

Farming identities and social norms are two potential antecedents of conservation behavior that may help to explain why “despite much talk of an increasing ‘conservationist’ component to farming—farmers’ self-concepts are still dominated by production-oriented identities,” (Burton & Wilson 2006, pg. 95). Schema theory provides a theoretical framework for this research by describing how demographics, values, and beliefs of an audience influence behavior and decision-making. Schema theory was first described by Frederic Bartlett (Bartlett & Burt, 1933) as an experimental psychology theory. The premise of this theory is that people process new information based on previously organized patterns of knowledge that have developed over time. Schema theory suggests that messages that prime strongly developed schema are more likely to influence audience behavior and decision-making. Thus, encouraging farmers to adopt conservation measures may be difficult if recruitment messages or outreach fail to connect with the farmer’s strongly developed schema or identity.

Previous scholarship has highlighted three identity types that farmers use to describe themselves (Comito et al., 2013): stewards of the land, businessmen, and hero. Comito et al, (2013) suggests that these identities may not be exclusive and may actually create conflict as farmers struggle to align their view of their role as stewards of the land with the businessman who need to make a living.

Previous work has also suggested that audience identity is an important predictor of the acceptance of conservation messages and the adoption, or lack of adoption, of conservation practices (Burton & Wilson, 2006; Chekima et al., 2016; Comito et al., 2013; Fielding et al., 2012; Floress et al., 2017; Saunders, 2008). “Once a choice becomes identity linked, it is automatized. It feels identity-syntonic, it feels right, and does not require further reflection” (Oyserman et al., 2012; pg. 93). Alternatively, a message that conflicts with a farmer’s existing identity may be perceived as a threat, resulting in identity-protective behavior and contributing to the rejection of the conservation message. For example, if the cost of planting cover crops or removing land from agricultural production does not align with their perceived role as a businessman, farmers may not be willing to adopt these practices.

Another important identity to consider in messaging is the importance of autonomy in decision-making by farmers (Alho, 2015; Stock & Forney, 2014). Again, if that identity of autonomy feels threatened or is not primed by the message, it may be ignored or rejected.

The theory of normative social behavior (TNSB) may help to explain where the disconnect between support for conservation and actual adoption may occur. TNSB proposes that norms, or how an individual perceives engagement in certain behaviors (such as drinking or

smoking) by their peer group, influences an individual's own decisions to engage or not engage in that behavior (Rimal & Lapinski, 2015). Thus, norms that are held as part of an identity within a group are likely to influence an individual's behavior and decisions.

While the TNSB has been explored in the context of college students drinking behavior (Carciooppolo & Jensen, 2012) and adult smokers' behavior (Byron et al., 2016), fewer studies have focused on conservation behavior in the context of farmers' identities or social norms.

The first objective of this research was to explore how farmers' perceptions of their peers' conservation behaviors might influence their own conservation practices, specifically related to soil health. Using the Iowa Rural Life and Farm Poll (IRLFP) data from Spring of 2015, I explored how farmers' normative beliefs, identities, and perceived expectations are associated with farmer adoption of soil conservation practices. In addition to these measures, the 2015 IRLFP assessed farmers' awareness of and adoption of soil health practices including actual adoption, an increase in the adoption of specific soil health practices, or willingness to learn about these practices. Additional details about the measures used to test these associations are available in Chapter 3.

Government agencies such as the DNR, agricultural groups such as the Practical Farmers of Iowa, and nonprofits who are working to improve water quality, sustainability, and carbon levels in the atmosphere have a need for effective conservation messaging. The USDA has several pages of their website dedicated to soil health, including 'Soil Health Theater,' and 'Soil Health Management' which gives details about specific practices related to soil health. To date, there remain important questions about how effective these messages are, how well they reach their intended audience, and how persuasive messages about soil health might align with audience knowledge, attitudes, beliefs, and behavior.

The second objective of this research is to explore how the language used to describe farmers conservation and soil health practices by trusted agricultural sources may align or prime farmer identities or self-concepts. By looking at linguistic features of publications from sources farmers trust, this work will also enhance current understanding of how existing messages surrounding soil health conservation are framed as well as how scientific information including scientific uncertainty is transferred from research to practice. The linguistic features studied included frequency of the use of “soil health” as well as identifying grammatical features such as modal verb usage and verb choice in relation to discussions of conservation practices. The purpose of these linguistic features is further explained in Chapter 4.

Together, the results of this thesis are expected to provide important information that could help agricultural and conservation-oriented organizations identify messages that align with farming identities and norms and might encourage the adoption of soil health conservation practices.

In the following section, I provide further background on schema theory, as an overarching theoretical framework, and the theory of normative social behavior as it has been applied to decision-making behavior and group identity. In addition, I provide a brief review of previous research exploring the effectiveness of environmental messages in conservation and agricultural contexts.

CHAPTER 2. LITERATURE REVIEW

Schema Theory

Bartlett & Burt (1933) first proposed schema theory as an experimental psychology theory. They believed that the processing of new information was influenced by frameworks built over time through experiences and acquired knowledge. Bartlett used the term schemata or schemas to describe these frameworks. Broadly, the theory suggests that messages are more likely to influence behavior and decisions-making when they align with an individual's strongly developed schema. While most of Bartlett's work was grounded within the domain of cognitive processing of memory, he argued that the theory could be applied to almost all mental processing.

Axelrod (1973) added to the understanding of schema theory as it related to cognitive processing. He developed a model which suggested there were distinct cognitive paths an individual follows each time new information related to a concept was introduced. As a new message is received the cognitive path will first determine if there is a previous interpretation of the information. If there is, the process will then analyze how the new information fits into the previous interpretations of similar information. These previous interpretations or paths for various concepts and ideas are built over time. The paths are based on relevant experiences and previous knowledge about the concept or idea that helps define and categorize the new information. If the new information is familiar or similar to a well-established path or schema, the individual processes it and may either add the new information to the previous schema or modify the schema in some way. If the new information does not fit into any previous schema or is in opposition to it, then the information is dismissed usually by downplaying the credibility of the source of the information without any modification to the strongly held schema.

Further evidence of the power of schema on cognitive processing was suggested by Anderson (1977). He proposed that schema provided slots for information along certain themes. While schema are abstract frameworks, the slots are specific terms and ideas that fit into that framework. Anderson's previous work focused on reading information. He proposed that as a student reads, the brain wants to file new terms and ideas into existing slots in the framework.

Similar to the shape game where children try to fit stars, squares, and circles into openings cut out on a board, if a term or idea doesn't "fit" any previous schema, it won't be filed. According to Anderson, filling the slots helped the student interpret the information and access the knowledge, just as finding the right opening helps children recognize shapes and develop gross motor skills.

Anderson looked at both the context of the readings as well as the words used. His results indicate words that fit into students' existing schemata are remembered at a higher level on multiple choice tests. This process also influenced how the student interpreted the meaning of the reading. Students were interpreting the entire reading as either positive or negative, or important or not important based on whether a few specific terms fit or did not fit into their existing schemata. This supported his hypothesis "that at a very early stage in processing, high-level schemata can cause a person to give one interpretation to a passage without even considering other possible interpretations," (Anderson, 1977, pgs. 370-371).

Schema theory studies have expanded to include other specific schemas within groups and within society as a whole. A proposed gender schema by Bem (1981), suggested that the development of a societal schema of male and female limits the ability of different social groups to accept and even define alternates to a dichotomous sex identity. The gender schema was measured by asking participants to categorize a group of words as masculine or feminine and by

their semantic role or part of speech. Overall, the results showed that participants were more consistent in categorizing words by gender than grouping words based on meaning.

Dixon (2006) used a slightly broader definition of schema to look at how skin tone impacted the perceived culpability of a suspect in a crime news story. The conceptual definition of schema used by Dixon was that schema were the average representations in a social group of an idea or belief. Dixon used a series of experiments where subjects grouped as heavy news viewers and light news viewers were asked to watch a crime story for the purpose of memory recall of the information. He found that when participants viewed a crime story with a suspect whose guilt was ambiguous, heavy news viewers were more likely to label suspects with darker skin tone as culpable. When the suspect's guilt was unambiguous, there was no effect of skin tone on perceived culpability.

Attitudes towards conservation have also been studied through the lens of schema theory. Burton & Wilson (2006) used schema theory to conceptualize schemas to define self or self-identity for farmers. They argue that while conservation practices have been introduced to farmers to improve the land, these practices are often disconnected from farmers' primary self-concept or identity as a producer of food. As agricultural systems changed to incorporate conservation practices that improve land management, farmers are asked to change their primary identity. Yet the primary productivist identity of most farmers focuses on maximizing yields and increased profitability. In addition, the authors suggested that farmers do not have many strongly held schema aligned with conservation. Burton & Wilson argue that without a change in a farmers' higher-level identity, conservation messages and efforts to encourage the adoption of conservation practices are likely to be dismissed or rejected by farmers with strongly held schema focused primarily on profits and productivity.

While schema theory provides a general framework for understanding the relationship between messaging, identity, and conservation behavior, the lack of specific and distinguishable constructs limits its operationalization. It is also difficult to measure all the possible schema that may be primed or provoked by conservation messaging to farmers. Thus, this research also draws on the theory of normative social behavior which builds on the principles of schema theory while defining distinguishable and measurable constructs of social groups that influence behavior and decision-making processes.

The Theory of Normative Social Behavior

The theory of normative social behavior (TNSB) was first proposed in 2003 by Rimal & Real. This theory draws on previous work on the influence of perceived normative beliefs on behavior (Cialdini et al., 1990; Ajzen & Fishbein, 1980; Haines, 1996; Perkins & Berkowitz, 1986). While schema theory looks at broad mental models built over time that influence information processing, TNSB looks at how expressed beliefs about group norms, identities, and expectations influence choices related to specific behaviors. TNSB assumes “that descriptive norms (people’s perceptions about the prevalence of a behavior) affect individuals’ own behaviors through interactions with three normative mechanisms: injunctive norms, outcome expectations, and group identity,” (Rimal & Real, 2005, pg. 391).

Descriptive norms are the behaviors an individual perceives as acceptable or common within a group (Rimal & Lapinski, 2015). Descriptive norms influence individual decisions when one’s perceptions of others’ actions are interpreted as socially desirable. These perceptions strongly determine what an individual sees as the “right thing” to do. In a 2005 study, Rimal & Real used the theory of normative social behavior to assess how college students’ perceived norms about drinking influenced their own decision to engage in drinking. The study found the

perceived descriptive norm that excessive drinking was common and socially acceptable among college students increased the intention of incoming freshmen to drink.

Injunctive norms, on the other hand, relate more to how an individual thinks they will be perceived by a social group for choosing to engage or not engage in a certain behavior (Rimal & Lapinski, 2015). These norms influence behavior indirectly through an association with an individual's motivation to be accepted or included in their desired peer group. Similar to subjective norms, the context and type of interaction is also important in influencing which behavior choice is made. In the aforementioned study by Rimal & Real (2005), the authors found that injunctive norms (such as approval of peers for drinking or disapproval of authority figures), acted as moderating factors in a student's decision to drink.

The perceived benefits or consequences for engaging in a certain behavior are defined by Rimal & Real (2003) as outcome expectations. Rimal & Lapinski (2015) further refined the definition to include perceived social and individual benefits and consequences. The benefits may relate to immediate improvements in social standing or long-term importance of being part of the desired peer group. The consequences can include social sanctions as well as legal penalties (Byron et al., 2016).

The final key construct in TNSB is group identity. While more difficult to define, Rimal & Real (2003, 2005) and Rimal & Lapinski (2015) define group identity as the characteristics and values that an individual perceives as important to belonging to a specific group. Rimal & Lapinski (2015) point out that what an individual perceives as an important component of a particular group's identity may not actually be part of the collective, documented group ideology or behavior. But the individual's perception of the group's collective identity has a stronger influence than any documented characteristics of that group.

Carcioppolo & Jensen (2012) replicated the application of TNSB to college drinking. They built a model using survey results from incoming freshmen on their beliefs surrounding drinking in college. It looked at how intention to drink in college was influenced by the perception of how often college students drink (descriptive norms). The authors then investigated the moderating effects of the mechanisms of perceived social acceptance (injunctive norms), perceived benefits of college drinking (outcome expectations), and aspiration to behave like other college students (identity) on how often an individual college student stated they would drink. The authors found a direct effect between descriptive norms and behavior and a moderating effect on behavior of three main mechanisms: injunctive norms, outcome expectations, and identity.

While this theory has been applied in the context of college students drinking (Carcioppolo & Jensen, 2012; Rimal & Real, 2005) and adult smoking (Byron et al., 2016), this is one of the first studies to apply it to farmers' adoption of conservation behavior. Previous work has suggested that a farmer's identity is important in understanding of adoption or lack of adoption of conservation practices. This study will expand the application of the TNSB, testing whether descriptive norms (measured as farmers perceptions of patterns of behavior within their peer group) affect farmer adoption of conservations practices through interactions with three normative mechanisms: injunctive norms, outcome expectations, and group identity. In Chapter 3, I provide detailed information about each of the measures used in this study.

CHAPTER 3. SURVEY ANALYSIS

Applying the TNSB to Farmers' Soil Health Practices

To understand how the Theory of Normative Social Behavior (TNSB) and its constructs apply to farmers' conservation behavior, specifically behaviors related to soil health, it is important to first identify how each of the components of TNSB might be defined in this context. Several studies into the influence of descriptive norms on environmental behaviors define descriptive norms as perceived prevalent behavior (Bissing-Olson et al., 2016; Richetin et al., 2016; Smith et al., 2012). Lapinski, Rimal, DeVries, & Lee (2007) showed that perceived behavior of "other households" in relation to water conservation had a strong influence on personal decisions about water conservation. For my study, descriptive norms are defined as the farmers' perceptions of the patterns of behavior surrounding soil health within their peer group.

Following previous work applying TNSB, the following hypotheses will be tested:

H1: Descriptive norms are associated with farmers' soil health behaviors including intent and adoption.

Injunctive norms have been described as perceived approval or disapproval of certain environmental or conservation behaviors (Bertoldo & Castro, 2016; Bhanot, 2018; Smith et al., 2012). Gockeritz et al (2010) explored the effect of injunctive norms on energy conservation behavior and found that strong injunctive norm beliefs (perceived approval of energy conservation behaviors) increased the effect of descriptive norms on energy conservation behaviors. Witzling et al. (2019) found that information from social media was less strongly associated with injunctive norms for those individuals who regularly frequented farmers' markets compared to non-farmers' market shoppers, suggesting that social media use and descriptive norms may interact with injunctive norms to influence behavior. Based on these

studies, I define injunctive norms as the perceptions of peers' acceptance of or adoption of conservation behaviors promoting soil health and treat it as a potential moderator of the relationship between descriptive norms and soil health behavior.

Outcome expectations are real or perceived benefits associated with the adoption of a particular behavior (Farrow et al., 2017). In the context of this study, outcome expectations are defined as perceptions of the farmers of the benefits associated with adopting or not adopting soil health practices. These may include perceived tangible benefits to the self, such as tax breaks, increased land productivity, and benefits to others, including the farming community, the environment, or wildlife. Following the TNSB, in this study, outcome expectations are treated as another potential moderator of the relationship between descriptive norms and conservation behavior.

The role of group or social identity in conservation behavior is often described in terms of ingroup versus outgroup (Brick et al., 2017; Lede et al., 2019; Reese, 2016). Lede et al (2019) showed how language related to ingroup such as the use of the word "fellow" to describe other people was effective in increasing the perception of ingroup norms. Framing language that aligns with important ingroup conservation identities may lead to more effective messaging about conservation behavior.

Previous scholarship has highlighted three identity types that farmers have used to describe themselves (Comito et al., 2013). The first identity described by Comito et al. (2013) is as a steward of the land. This identity defines the role of the farmer as a caretaker who works to preserve the land for future generations. The second identity is farmer as a businessman who

must make decisions that provides food and money for his/her family and creates opportunities to grow their business. The third farmer identity is the role of hero. The hero must fulfill his/her duty to “feed the world.”

There has been limited research in the application of TNSB to conservation behavior, particularly related to attitudes about conservation practices (Lapinski et al., 2017; Niemiec et al., 2020). However, previous work grounded in the theory of social identity suggests that there is reason to believe that farmers’ identities are associated with specific attitudes about conservation and farmers’ willingness to engage in conservation practices and behaviors. More importantly these factors may interact with normative mechanisms and outcome expectations in ways that have important implications on farmers’ willingness to adopt conservation practices. Similar to Carcioppolo & Jensen’s (2012) model of TNSB, I test the following hypotheses:

H2: Injunctive norms, outcome expectations and farmer identity are associated with farmers’ soil health behaviors including intent and adoption.

H3: Injunctive norms, outcome expectations, and farmer identity will moderate the association between descriptive norms and soil health behavior.

A recent meta-analysis by Rimal & Lapinski (2015) noted that the stronger the group identity, the stronger the moderating effect on the influence of descriptive norms on behavior.

Farmers have been shown to have a strong collective identity (Groth & Curtis, 2017; Warren et al., 2016). Morton et al. (2017) found that the collective identity of “good farmer” influenced how farmers perceived recent changes in weather patterns and how willing they were to implement land management, soil management, and water management strategies. Compared to farmers with a productivist identity, the stronger a farmer’s conservation identity the more likely he is to adopt climate adaptation and conservation practices (Morton et al., 2017). In a

2019 study, Lequin et al. proposed a framework for studying how proposed conservation behaviors, which are identity reinforcing or identity undermining may interact with the profitability of conservation behaviors to influence the adoption of conservation practices. Given extant research, there is reason to believe that farmers' identities are associated with specific attitudes about conservation and farmers' willingness to engage in conservation practices and behaviors. Using farmer identities as a tool to develop targeted conservation messaging may be one way to improve message effectiveness and encourage greater rates of conservation adoption. Drawing on previous research, the following hypotheses will be tested.

H4: The identity mechanism will produce a stronger moderating effect on descriptive norms than any other mechanism.

H5: Stewardship identity will have a stronger, positive relationship to adoption of soil health practices than other identities.

Previous scholarship has suggested that demographic variables may also impact environmental attitudes and behavior, though some seem to have a greater effect than others. Age has been shown to have a low or even negligible effect on general environmental attitudes and behavior but a stronger effect on specific actions (Hertel et al., 2013). A 2003 meta-analysis conducted by Diamantopoulos et al. identified a strong negative relationship between pro-environmental attitudes and age. There have been several studies that look at the influence of age and gender on the effectiveness of conservation messages within the context of ecotourism (Ballantyne et al., 2009; Lyngdoh et al., 2017; Peake et al., 2009). These studies suggest that there is a measurable influence of age and other demographic factors on how participants react to conservation messages in the context of ecotourism, though these factors were evaluated in association with pre-existing environmental values and conservation attitudes.

Education levels and political ideologies have been shown to have strong effects on environmental attitudes and behaviors. The relationship between education level and pro-environmental attitudes and behaviors has been shown in several studies to be a strong, positive relationship (Boeve-de Pauw, 2011; Casaló & Escario, 2018; McMillan et al., 1997). A meta-analysis of 69 studies found a significant association between political ideology - conservative vs liberal - and pro-environmental attitudes and behaviors, with liberals more likely to express positive attitudes (Cruz, 2017). Given the potential for these variables to influence norms, outcome expectations, farmer identity, and behavior, and in keeping with previous studies, demographic variables were included as potential control variables that might influence individuals' responses to conservation messages (Bhate & Lawler, 1997; Chekima et al., 2016; De Oliver, 1999; Fisher et al., 2012; Holland et al., 2019; Liang et al., 2017; March et al., 2013).

Methods

Participants

The data used in this study is from the 2015 Iowa Farm and Rural Life poll. The IRLFP has been surveying farmers and landowners in Iowa since 1982 (Iowa Farm and Rural Life Poll, n.d.). Each year approximately the same 2000 participants are mailed the survey. While the questions vary every year, they generally focus on agricultural topics. In the spring of 2015, the Farm Poll assessed farmers' awareness and adoption of soil health practices. This survey was sent out in February of 2015 to 2,093 Iowa farmers. A 55% response rate resulted in 1159 usable results (N=1159). The average age of the participants was 65 years old and over 90% were male. The majority did not have a college degree and identified as moderate or conservative.

Variables

The questionnaire included 24 questions and measured 226 variables. However, for this thesis, I am focused only on the questions that are related to TNSB. Using the TNSB as the framework and the operational definitions previously described, 19 survey questions were identified that measure descriptive norms, injunctive norms, outcome expectations, identity, intentions, and adoption. The full wording and response ranges for Likert scales are included in Appendix A.

Descriptive Norms Two items were used to create the scaled measure of descriptive norms. “Compared to other farmers, I tend to use more innovative management practices and strategies.” “I place more emphasis on soil and water conservation than most farmers.”

Injunctive Norms. Two items were used to create the scaled measure of injunctive norms based on neighborhood expectations and possible embarrassment caused by observable problems on their farm.

Outcome Expectations. Items included the following examples: “Tax benefits for conservation expenses,” “Protect the land for the next generation,” and “Improve wildlife habitat.”

Farmer Identity. Three items were selected that measured each of the identities previously discussed - steward, businessman, and productivist. The three items were used individually as independent variables.

Soil Health Behavior. Intentions to adopt soil health behavior were measured by participants’ willingness to learn more about soil health, “*I would like to learn more about how to improve soil health.*” Actual adoption was measured using a single item that asked farmers to report whether “*In the last couple of years, I have taken steps to improve the health of the soils I*

farm.” The final dependent variable, increased behavior, was based on an item asking participants if they had recently decreased or increased soil health practices on their land.

Control variables. Age, ideology, and education level were included as demographic variables in this study. Gender was excluded as over 90% of participants were male. Age was recorded as an open-ended item. Ideology was measured on a 5-point Likert scale (Very Liberal = 1, Liberal = 2, Middle-of-the-Road = 3, Conservative = 4, Very Conservative = 5). Education level was a 6 point scale based on the highest level of education completed (Less than high school = 1, High school graduate (or equivalent) = 2, Some college, no degree = 3, Bachelor’s degree = 4, Some graduate school = 5, Graduate or professional degree = 6).

Analysis

Descriptive statistics of the demographic variables were determined using the statistical software R version 3.6.2 (2019-12-12). This included the mean, median, and standard deviation. A missing data analysis was completed on the identified variables and cases with missing data were removed, leaving a final N = 726. Demographic factors are included in the Table 3.1.

Table 3.1 *Descriptive Statistics of Demographics of IRLFP*

Demographic Variable	Mean	Median	SD
Level of Education	3.18	3.00	1.29
Age	64.99	65	10.72
Gender	1.08	1.00	.27
Ideology	3.52	4	.864

A series of Cronbach alpha calculations were run to determine if independent variables with multiple items could be combined into a single scale. According to Gliem & Gliem (2003) scaled multi-item variables from Likert-like surveys are a more reliable method for measuring variables than single survey items.

The results of the Cronbach alpha tests were analyzed using the .70 cutoff first suggested by Nunnally (1978) and reconfirmed through a meta-analysis by Peterson (1994) for preliminary research. Cronbach results suggested reliable scales for each of the items. Thus, composite items for each of the scales were created by adding each item together and dividing by the number of items in the scale: Descriptive norms (Range 1-5; M = 3.12, SD = .80), injunctive norms (Range 1-5; M = 2.58, SD = 1.07), and outcome expectations (Range 1-5; M = 3.59, SD = 0.73) (see Table 3.2).

Table 3.2: *Mean and Cronbach Scores for Scaled Items*

Survey Items with Likert Scales	Mean (SD)	Cronbach alpha
Descriptive Norms:	3.13 (0.80)	0.70
SCALE: Strongly Disagree - 1 Disagree - 2 Uncertain - 3 Agree - 4 Strongly Agree - 5		
- Compared to other farmers, I tend to use more innovative management practices and strategies.	2.94 (.951)	
- I place more emphasis on soil and water conservation than most farmers.	3.30 (.913)	
Injunctive Norms	2.58 (1.07)	.73
: (Factors important in making decisions about incorporating conservation practices)		
SCALE: Not at All Important-1 Slightly Important-2 Moderately Important-3 Important-4		
Very Important-5	2.34 (1.19)	
- Neighborhood expectations.	2.36 (1.17)	
- Because it's the right thing to do		
Outcome Expectations: (Factors important in making decisions about incorporating conservation practices)	3.59 (0.73)	.88
SCALE: Not at All Important-1 Slightly Important-2 Moderately Important-3 Important-4		
Very Important-5	3.50 (1.11)	
- Increase long-term profitability	2.77 (1.21)	
- Tax benefits of conservation expenses	3.02 (1.19)	
- Prepare for programs that reward conservation behavior	4.01 (.948)	
- Protect my investment in the land	4.16 (.938)	
- Protect the land for the next generation	4.06 (.948)	
- Avoid polluting streams, rivers and lakes	3.47 (1.12)	
- Improve wildlife habitat	3.82 (.918)	
- Maintain or improve soil health	3.46 (1.04)	
- Reduce the environmental impact of my farming activities		

The three identity items and three items used to represent the dependent variables for soil health behaviors were not modified prior to analysis. 75.8% of the respondents indicated that they agreed or strongly agreed with the statement that they had taken steps to improve soil health in the last couple of years (adoption behavior DV; Range = 1-5; M = 3.77, SD = 0.77). A majority (69.2%) of the respondents agreed or strongly agreed with the statement that they

would like to learn more about how to improve soil health (intent behavior DV; Range = 1-5; M = 3.70, SD = 0.78). For the final DV of increased behavior, 58% of the respondents indicated they had made a moderate to major increase in practices to improve soil health (Range = 1-6; M = 4.52, SD = 0.93). Fewer than half (46.2%) of respondents indicated that their stewardship ethics had a strong or very strong influence on decisions about changing practices on their farms (steward identity IV; Range = 1-5; M = 3.25, SD = 1.16) while 41.9% indicated that economics had a strong or very strong influence on those decisions (businessman identity IV; Range = 1-5; M = 3.16, SD = 1.15). For the final IV identity of productivist, 72.9% of participants indicated that maintaining or enhancing productivity was important or very important in their decisions to incorporate conservation practices on their farms (Range = 1-5; M = 3.89, SD = 0.95).

The scale for descriptive norms questions used a Likert scale of 1-5 from Strongly disagree to Strongly Agree. The injunctive norm questions and outcome expectation questions used a Likert scale of 1-5 from Not at all important to Very Important. A series of bivariate correlations were run to determine the association between the independent variables (norms, outcome expectations, and identity), control variables, and the three dependent soil health behaviors - behavioral intentions, adoption behavior, and increased behavior. (Table 3.3).

A regression analysis was performed with statistical software R version 3.6.2 (2019-12-12) for each dependent variable. Using the Anova () function, 17 models per dependent variable were built for a total of 51 models. These models were analyzed relationships between independent and dependent variables using both simple linear regression of demographics and scaled items and regression with interactions based on TNSB moderating mechanisms (injunctive norms, outcome expectations, and identity) on descriptive norms.

Table 3.3: *Bivariate Correlations for IVs, Control Variables, and DVs*

	Intent Behavior	Adoption Behavior	Increase Behavior	Age	Education	Ideology	Descriptive Norms	Injunctive Norms	Outcome Expectations	Identity-Steward	Identity-Businessman	Identity-Productivist
Intent Behavior	1.00											
Adoption Behavior	0.259***	1.00										
Increase Behavior	0.284***	0.303***	1.00									
Age	-0.03	-0.12***	-0.05	1.00								
Education	0.08*	-0.05	0.00	-0.12***	1.00							
Ideology	-0.03	0.03	0.03	-0.05***	-0.09***	1.00						
Descriptive Norms	0.15***	0.31***	0.39***	-0.02***	0.11***	-0.01	1.00					
Injunctive Norms	0.11***	0.16***	0.13***	-0.05	-0.16***	0.01	0.11***	1.00				
Outcome Expectations	0.19***	0.21***	0.14***	-0.05	0.07	0.01	0.2***	0.47***	1.00			
Identity-Steward	0.22***	0.32***	0.4***	-0.06	0.04	-0.01	0.43***	0.14***	0.46***	1.00		
Identity-Businessman	0.22***	0.21***	0.33***	-0.09*	0.004	0.04	0.28***	0.21***	0.37***	0.66***	1.00	
Identity-Productivist	0.14***	0.24***	0.33***	-0.084*	0.02	0.04	0.3***	0.38***	0.72***	0.35***	0.34	1.00

Significance Levels: . $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Results

Significant bivariate correlations between each dependent variable and descriptive norms (all $p < .001$), suggest support for hypothesis 1. Bivariate correlations also suggest that injunctive norms, outcome expectations, and identity are significantly correlated to all DV's (hypothesis 2).

The blocks of the regression models for each dependent variable were added in the same sequence. The first block was demographic variables, the second block added in descriptive norms, and the final 3 blocks added each of the moderating mechanisms (injunctive norms, outcome expectations, and identity) individually and with descriptive norms.

Adoption behavior (DV) The demographic items were statistically significant in the model with adoption behavior (DV) accounting for 1.9% of the variance of the outcome variable,

with age being the only highly significant factor ($p < .001$). The change in R^2 from the inclusion of the scaled descriptive norm variable was significant for all additive models as well as the interactive models (See Table 3.4).

The addition of descriptive norms accounted for 11.1% more variance ($p < .001$) than the model with the demographic items alone. Each addition of a TNSB mechanism as an independent variable increased the variance. All independent variables were significantly associated with adoption behavior ($p < .001$) except for the identity of businessman which was only slightly significant ($p = .05$).

Table 3.4 Regression Analysis Adoption Behavior DV

Predictor Variables	Beta	Block ΔR^2	Total R^2	p-value
Block 1: Demographics			0.019	0.003**
Age	-0.13***			
Education	-0.06			
Ideology	0.016			
Block 2: Descriptive	0.167	0.111	0.13	<.001***
Block 3				
3a: Injunctive	0.144	0.02	0.039	<.001***
3ai: + (Descriptive)	0.103(0.321)	0.101	0.14	0.001**
3aii: x (Descriptive)	0.313(0.442)	0.003	0.143	<.001***
3b: Outcome Expectations	0.345	0.085	0.137	<.001***
3bi: + (Descriptive)	0.256(0.24)	0.053	0.19	<.001***
3bii: x (Descriptive)	0.279(0.270)	-0.004	0.186	<.001***
Block 4: Identity - Steward	0.315	0.099	0.118	<.001***
4a: + (Descriptive)	0.212(0.244)	0.048	0.166	<.001***
4ai: x (Descriptive)	0.03 (0.116)	0.003	0.169	<.001***
Block 5: Identity - Businessman	0.203	0.041	0.06	0.05 .
5a: + (Descriptive)	0.119(0.301)	0.083	0.143	<.001***
5ai: x (Descriptive)	-0.319(-0.01)	0.016	0.159	<.001***
Block 6: Identity - Productivist	0.229	0.052	0.071	<.001***
6a: + (Descriptive)	0.143(0.292)	0.077	0.148	<.001***
6ai: x (Descriptive)	0.175(0.328)	0.000	0.148	<.001***

The TNSB mechanisms as moderating variables with descriptive norms were also significant ($p < .001$) with most variables increasing in the strength of the relationship between adoption behavior and descriptive norms. The models that included descriptive norms with

outcome expectations and the identity of steward as IV's, accounted for the largest explanation of variance - 19% and 16% respectively.

Intent Behavior (DV) Demographics only accounted for .7% of variance in behavioral intentions. Compared to the previous model, intention to learn more about soil health had a weaker relationship to descriptive norms as well as the other TNSB mechanisms. However, when these mechanisms were included as moderating variables interacting with descriptive norms, all three mechanisms - injunctive norms, outcome expectations, and identity - showed a doubling or more of the R^2 . The largest jump in explanation of variance in the interactive models occurred with the two identities of steward and businessman. These interactions accounted for 18.4% and 15.9% of the variance, respectively.

Increased Behavior (DV) Demographics only accounted for .3% of the variance in farmers' reported increase in soil health practices. While education was a significant predictor in the demographics only model, the overall model was not significant.

The hypothesized independent variables were significantly associated with increased adoption. The models that included identity as well as outcome expectations had the largest explanation of increased adoption of soil health practices.

Each model showed a change in R^2 that was significant for each of the TNSB mechanisms when added as IV's as well as moderating variables with descriptive norms, thus hypothesis 3 is also supported. The interaction between identity and descriptive norms showed some of the most significant changes in R^2 for all DV's; however, the interaction between outcome expectations and descriptive norms was also a significant predictor and potential mediator. Thus, hypothesis 4 is partially supported.

Table 3.5: Regression Analysis Results for Intent Behavior (DV)

Predictor Variables	Beta	Block ΔR^2	Total R ²	p-value
Block 1: Demographics			0.007	0.148
Age	-0.023			
Education	0.074			
Ideology	-0.026			
Block 2: Descriptive	0.167	0.029	0.036	<.001***
Block 3				
3a: Injunctive	0.140	0.019	0.026	<.001***
3ai: + (Descriptive)	0.120(0.151)	0.023	0.049	0.001**
3aii: x (Descriptive)	0.345(0.435)	0.059	0.108	<.001***
3b: Outcome Expectations	0.293	0.085	0.092	<.001***
3bi: + (Descriptive)	0.268(0.067)	0.004	0.096	<.001***
3bii: x (Descriptive)	0.366(0.371)	0.053	0.149	<.001***
Block 4: Identity - Steward	0.221	0.049	0.056	<.001***
4a: + (Descriptive)	0.183(0.088)	0.055	0.062	<.001***
4ai: x (Descriptive)	0.532(0.31)	0.122	0.184	<.001***
Block 5: Identity - Businessman	0.14	0.020	0.027	<.001***
5a: + (Descriptive)	0.101(0.138)	0.037	0.044	<.001***
5ai: x (Descriptive)	0.27(0.234)	0.115	0.159	<.001***
Block 6: Identity - Productivist	0.265	0.070	0.077	<.001***
6a: + (Descriptive)	0.236(0.097)	0.008	0.085	<.001***
6ai: x (Descriptive)	0.495(0.495)	0.076	0.161	<.001***

Table 3.6: Regression Analysis Results For Increased Behavior (DV)

Predictor Variables	Beta	Block ΔR^2	Total R ²	p-value
Block 1: Demographics			0.003	0.583
Age	-0.045			
Education	-0.003*			
Ideology	0.023			
Block 2: Descriptive	0.305	0.091	0.094	<.001***
Block 3				
3a: Injunctive	0.135	0.017	0.020	0.005**
3ai: + (Descriptive)	0.097(0.292)	0.083	0.103	<.001***
3aii: x (Descriptive)	0.441(0.335)	-0.047	0.056	<.001***
3b: Outcome Expectations	0.329	0.106	0.109	<.001***
3bi: + (Descriptive)	0.249(0.212)	0.144	0.147	<.001***
3bii: x (Descriptive)	0.442(0.305)	-0.046	0.099	<.001***
Block 4: Identity - Steward	0.396	0.156	0.159	<.001***
4a: + (Descriptive)	0.325(0.165)	0.022	0.181	<.001***
4ai: x (Descriptive)	0.389(0.232)	-0.115	0.066	<.001***
Block 5: Identity - Businessman	0.329	0.107	0.11	<.001***
5a: + (Descriptive)	0.265(0.23)	0.156	0.159	<.001***
5ai: x (Descriptive)	0.17(0.187)	-0.114	0.045	<.001***
Block 6: Identity - Productivist	0.326	0.105	0.108	<.001***
6a: + (Descriptive)	0.258(0.228)	0.047	0.155	<.001***
6ai: x (Descriptive)	0.397(0.277)	0.067	0.088	<.001***

Interactive models for all DV's, revealed evidence of significant direct and moderating effects. The moderating effect of injunctive norms, outcome expectations, and identity was strongest with the DV of increased behavior. The relationship between the independent variables for identity was significant for all three identities for the all dependent variables, however, the largest explanation of variance occurred in the models that included the steward identity, 11.8% and 15.9% respectively. Therefore, hypothesis 5 is supported.

Discussion

As in previous studies relating to TNSB, this study finds support for a significant association between descriptive norms and behavior. Descriptive norms were more significant predictors of adoption behavior, behavioral intentions, and increased behavior. The independent variables in this model predicted more variance than the demographic model alone. These findings highlight the importance of understanding how farmers perceive other farmer's actions regarding the adoption of soil health and conservation practices.

Despite the significant association between descriptive norms and behavior, this variable never accounted for more than 13% of total variance in soil health behaviors. This is in contrast to previous results by Rimal & Real (2005) which showed descriptive norms accounting for approximately 28% of total variance in intention to drink and Carcioppolo & Jensen (2012) which showed descriptive norms for this behavior accounting for almost 50% of the total variance. The observed smaller magnitude of the effect of this model may indicate that concerns about peers' actions are less important among farmers. It may also suggest that there are other variables (e.g., news coverage, government subsidies) that may have a more substantial impact on farmers' conservation behaviors. Because this work is based on secondary data analysis, the

questions used to measure descriptive norms were not originally designed for this purpose. Thus, it is also possible that the survey items used here were not as reliable in measuring descriptive norms as previous studies.

According to TNSB, injunctive norms, outcome expectations, and identity should moderate or influence the strength of the effect of descriptive norms on dependent variables. The overall moderating effect of each of these mechanisms in the regression models did improve the ability to predict the effect of descriptive norms on adoption behavior, behavioral intentions, and increased behavior. Thus, these findings, suggest that normative measures and positive outcome expectations could be important factors to test in future educational campaigns designed to increase farmer adoption of soil health practices and other conservation behaviors.

This study also suggests that the role of farmer identity should be explored in future studies about farmer adoption of conservation practices. Identity had the strongest moderating impact on descriptive norms for all DV's. The effect was especially strong in predicting how much a farmer had increased or decreased their soil health practices in the past. The identity measures used here assessed farmer as steward, farmer as businessman, and farmer as productivist. Future research could advance this effort by developing, validating, and assessing a more comprehensive scale of farmer identities, considering any interactions between these identities in decisions about adoption of soil health practices.

CHAPTER 4. CORPORA ANALYSIS

Connecting Language to the Theory of Normative Social Behavior

Words may illicit judgement in the reader, even if that was not the intent of the writer (Bednarek, 2006). One promising avenue to understand how words prime specific judgements of the reader or listener is to explore the linguistic feature of collocation: the increased frequency of certain words that occur together more often than by chance. Understanding how words occur together to build meaning was first proposed by John Sinclair (1991). His work in developing methods for searching for lexical or word patterns to determine possible semantic meaning led to developments in multiple disciplines including linguistics and communication.

Fairclough (2003) built on Sinclair's work and declared that language and social interactions are inseparable. He argued that language choices and how they create meaning within texts can influence how ideologies are perpetuated through society. Specific word patterns and phrases could drive specific ideas or even mental models, contributing to common or popular use among the public. This idea aligns with Rimal & Lapinski's work (2015) which reviewed previous studies on TNSB and concluded that "norms are dynamic, shaped, and understood through communication processes" (pg. 394). Thus, norms, identities, outcome expectations, and conservation behaviors are also likely influenced by specific word patterns and phrases used by groups or organizations. Lexical patterns, the frequency and categories of specific words and phrases, used in conservation messages are likely communicated to farmers on multiple levels: farmers talking with peers, seed/input providers, extension agents, and farmers reading about conservation in trusted news/media outlets.

The role of trust in information sources is strongly associated with farmers' adoption of ag-related practices. Farmer trust in information sources increased the adoption of mastitis (a

disease in the udders of milk cows) reducing practices (Jansen et al, 2010). Stuart et al, (2018) explored the relationship between nitrogen-fertilizer application decisions by farmers and trust in suppliers and found a strong connection between trust in suppliers and their influence on farmers' decisions about nitrogen application. Thus, understanding both who the trusted sources of information about conservation are and how environmental messages are framed and conveyed through different linguistic features may identify possible pathways to enhance existing messages and target messages that align with farmers' existing schema and identities.

Audience trust in key sources of environmental information also influences how environmental messages are received (Brewer & Ley, 2013; Malka et al., 2009; Mase et al., 2015). Mase et. al., (2015) looked specifically at water quality and watershed information and found that trusted sources were also sources that were most familiar to the agricultural respondents to the survey. They also found that University extension and NRCS were the most familiar and trusted by farmers in the states of Illinois, Indiana, Michigan, Wisconsin, and Minnesota. More recently, Hunt & Wald (2020) reported that perceived scientific trustworthiness and perceptions of scientific goodwill predicted public beliefs about the safety of GM foods.

The aim of this study is to determine if there are common linguistic features used in trusted and influential media sources (as identified by farmers) that provide conservation information to farmers. This study will analyze the frequency of a popular conservation term "soil health", how this term is described, and how it co-occurs with farmer identity. The frequency and use of modal verbs in extension publication and the use of the verbs "cause" and "produce" in relation to positive or negative valence will also be explored. By understanding the

linguistic choices of information sources that have had a proven positive influence on a specific audience, a possible framework could be developed and replicated in other types of scientific communication.

Understanding how the language used in conservation messaging intersects with farmers' identity and understanding of the science may provide valuable pathways for enhancing the effectiveness of conservation messages. In particular, identifying the associations between farmers identities and the adoption of conservation practices would allow farming-focused conservation groups, NGOs, and agencies to produce messages that are more likely to appeal to a specific target audience.

A comprehensive study by a group of researchers in Australia (Kidd et al., 2019) found that over a third of case studies of previous public conservation messaging campaigns only summarized the campaign. There were no conclusions or methodology included to determine the effect of the messaging. This same study concluded that this lack of evaluation along with missing or incomplete (not fully realized) theoretical frameworks and no indicated target audience in a majority of the studies pointed to a critical gap in the understanding of effective conservation messaging. My research will attempt to partially fill this gap by exploring connections between different linguistic features and the priming of farmer identity and self-concepts.

In 2016, an experimental study looked at how the use of specific language or linguistic features impacted how people assessed blame (Hart, 2016). Hart was able to show that specific linguistic features increased the likelihood that participants would assess blame to specific parties involved. The basis of the experiment was a news story detailing a fictional political protest where police and protestors became involved in a direct confrontation. The participants

answered a few demographic questions on an online survey, and then were presented one of four versions of the protest story. Once they had finished the story, they were asked to answer a few questions about both parties involved - police and protestors - without the benefit of being able to go back and look at the story.

The researcher found that participants who read the report that used linguistic features framing the interaction through different verb choices such as “attacked” versus “clashed” to describe the interaction between the protestors and police. When the linguistic features including a verb choice that framed the interaction as a one-sided event, participants were much more likely to place blame for the side framed as the initiator. Participants who read the report that framed the interaction as a reciprocal event - where neither party was labeled as the initiator - were much more likely to place blame for the interaction on both police and protestors. Thus, minor changes in the lexical patterns and choice of verbs appeared to influence participants view of the entire story.

The ability of specific linguistic choices (such as the choice of verbs) to influence blame assessment in conservation messaging especially messages targeting farmers, has not been widely explored.

While soil health is the primary focus of this thesis, water quality issues are closely related and have become a key topic of discussion conservation messages to agricultural communities. This is due to growing evidence that farming practices are a main contributing factor to water quality issues (Unger et al., 2010). Since a 2000 research study pointed to Midwest farm run-off as the main source of nitrates leading to the dead zone in the Gulf of Mexico (Goolsby, 2000), farmers have come under scrutiny for the types of water management practices they employ. There is also evidence that farmers feel like they are taking the most of

the blame for the water quality issues facing the U.S (Smithers et al., 2005). Thus, farmer frustration with messaging that contains a blame frame (about soil health or water quality) may be contributing to the lack of farmer engagement in conservation behaviors.

Exploring soil health messaging, which has been received more positively overall by farmers, and how different linguistic features are used to discuss the causes of soil health issues and the effects of soil health practices could provide insight in how to frame and discuss other conservation practices like water quality. This study will also explore how these features align with identities and norms associated with farmers self-concepts.

Collocates and TNSB

Previous scholarship has shown how perceived descriptive norms can be defined and measured through the use of collocates - words that frequently occur together. Bullinaria & Levy (2007) developed a methodology that produced reliable results for semantic or word meaning through co-occurrence frequencies. The study of common co-occurrence of words is similar to processes that children use to learn the meaning of new words. Words with similar meaning tend to occur within the same context. This natural co-occurrence helps children infer what a new word means based on the previous knowledge of the other words in the same context.

Bullinaria & Levy (2007) focused on the mental representations (semantics) a learner gained from natural language co-occurrences. But a similar approach could be used to explore the co-occurrence of the key constructs of TNSB including descriptive norms, injunctive norms, group identities, and outcome expectations.

An example of defining descriptive norms through collocations was explored by Baker in 2012. He conducted a large-scale study of news stories that referenced Muslims or the religion of Islam. Baker quantified the perceived descriptive norm in journalism that Muslims or groups

affiliated with the religion of Islam held extreme beliefs and that this bias was reflected in the news stories about these groups. He measured the frequency of extreme belief words such as *radical* or *extremist* in collocation with words associated with Muslims or Islam in a news corpus comprised of 200,000 news articles from the British National Press. He showed that the frequency of the extreme belief words such as “radical” or “extremist” occurring as collocates with variations of the names for Muslims or Islam was not higher than other descriptive terms. While the general consensus in journalism, according to Baker (2012), was that there was an extreme belief bias in reporting about Muslims and Islamists (a perceived descriptive norm), there was no evidence that this bias was reflected in the popular press.

This same analysis may be applied to conservation messaging in extension publications. No matter the focus of conservation messages - water quality, endangered species, or land use - the use of certain words or objects that prime or appeal to a certain identity or perceived norm within the audience have become commonplace. For example, “Clean”, “healthy”, “safe”, are common words in water quality messaging (Owen et al., 1999). While these words may appeal to existing conservation-oriented audiences - those with pre-existing or strong conservation or environmental identities - those same words may be interpreted or evaluated differently by audiences with identities or perceived norms oriented to economic or production values. Words that connect a farmer’s identity to the message, such as the phrase “increased yield” for a farmer with a strong productivity identity, may increase the effectiveness of the message especially if they perceive that the behavior of other farmers is to keep increasing productivity.

One impact of terminology on attitude or behaviors is through frequent use. An increase in the frequency of words has been shown to influence attitudes towards language (Wagner & Hesson, 2014) and the mere exposure effect theory predicts that an increase in frequency to

certain stimuli, including linguistic cues, increases awareness, including linguistic cues (Fang et al., 2007; Harmon-Jones & Allen, 2001). In order to understand if the terminology used in extension publications have had an impact on a specific behavior or may be priming a specific identity, the frequency of words such as “soil health” must also be examined.

Another important aspect in transferring science information to the public is making the information relatable to the target audience. Social identity can influence attitudes about learning science (Brown, 2006; Brown et al., 2005; Feinstein, 2011). These studies show that science information that connects with identities related to gender and socio-economic factors, increases the likelihood of a positive attitude towards science information. While previous studies focused on student science literacy, limited scholarship has explored identity in adult attitudes towards science, beyond political identity. I am not aware of scholarship that has explored farmer identity as a driver of farmer adoption of soil health practices, despite evidence presented in the previous chapter that identity is an important factor in farmer willingness to learn about and adopt conservation practices.

In this pilot study, the possible influence of the term “soil health” in conservation messages as well as terminology that may prime possible farmers’ identities will be measured by analyzing frequencies of specific vocabulary related to recognized farmer identities. As described in previous chapters, the three main identities of farmers are steward, businessman, and productivist. The following research question about frequency and identity will be explored:

RQ1: What is the frequency of use of the term “soil health” and collocates associated with farmer identity - steward, businessman, productivist - that occur in extension publications about soil health?

Semantic Prosody and TNSB

Words can develop a perceived positive or negative valence through common and long-term co-occurrences or repetition in multiple types of registers, such as fiction, news, and academic writing. The effect of this repetition on perceived valence of words is termed semantic prosody. Semantic prosody creates an underlying association of certain words to certain ideas or concepts, both positive and negative (Sinclair, 1991).

Hauser & Schwarz (2016) tested the influence of semantic prosody on judgement and decision-making. The results of their research showed that the verbs “cause” and “produce” carried different valences although their meaning was functionally the same. For example, Hauser & Schwarz showed that the verb “cause” is often followed by a negative outcome or result, while the verb “produce” was more often followed by a positive outcome or result. The audience’s perceptions were primed by these verbs to pre-evaluate the outcome that followed as positive or negative. This effect was stronger when the concept being discussed was vague or included new information.

Conservation messaging surrounding “stewardship” could be an example of an ambiguous concept. The concept of “stewardship” can be related to natural resources such as soil or land stewardship, but the term is also used in other contexts related to business and public policy (Burger, 2002; Chiu, 2013; O’Connell, 2007; Worrell & Appleby, 2000). Within agriculture “stewardship” is used differently and can have multiple meanings often tied to personal or group beliefs about soil and water (Shepherd & Martin, 2009). This lack of universal meaning may prime different beliefs about descriptive norms, injunctive norms, personal identity, or outcome expectations in the audience than what was intended. If the language of a conservation message primes certain descriptive norms (perceived or real), or if

these norms occur in association with other positive or negative terms, such as “steward” or “productivity” it may influence how a farmer evaluates the content of the message. Before message testing can be done, it is important to identify pre-existing descriptive norms and collocates used by sources of news and information that farmers trust. Thus, understanding how language specific frames may regularly be associated with different farmer identities, conservation practices, or outcome expectations may help in developing targeted messages.

An important aspect of extension communication is creating a positive environment for adoption of practices, while also conveying a sense of responsibility for adoption of conservation practices. This study will use the framework of semantic prosody as described in previously in this chapter to explore the use of the two verbs “cause” - which has a more negative valence - and “produce” - which has a more positive valence - in messaging targeting Iowa farmers as well as how the use of these verbs may play a role in framing blame in relation to environmental issues.

RQ2: How are the verbs “cause” and “produce” used in explanation of conservation practices in Iowa farmer influential and trusted sources of information?

Modal Verb Use in Framing

The interpretation of scientific gaps and limitations of research is the role of the science communicator, especially when they are providing scientific information that might influence others’ behaviors related to health or conservation. Effectively communicating this uncertainty may play a role in the audience’s trust in the scientific information as well as the impact that information will have on their behavior.

Previous research has explored the linguistic feature of “hedging” including the use of modal verbs as a common approach used by academic or scientific writers to address scientific

uncertainty (Biber, 2006; Hyland, 1996, 1998; Markkanen & Schröder, 1997). Hyland (1996) pointed out several purposes for the use of hedging in academic writing: (1) to temper any sense of overconfidence, (2) to improve the discussion of precision of results or methods, or (3) to protect against professional consequences of possible mistakes in research.

The use of modal verbs (auxiliary verbs used to express logical or personal meaning) such as “may”, “could”, and “will” is also helpful in characterizing scientific uncertainty. Even when there is ample evidence for a more assertive tone in writing about claims or deductions, scientists often used modals as hedgers to identify possible gaps or limitations in scope and validity of the research (Hyland 1996, 1998).

Scientific uncertainty can sway decisions by either increasing or decreasing the perceived importance of certain factors (Fischhoff & Davis, 2014). For example, the specific linguistic choices a public health extension expert makes while expressing their interpretation of the uncertainty surrounding research about the causes and consequences of a new swine flu epidemic could greatly influence farmers responses to the outbreak.

Clear communication about the probability of risk, predicted outcomes, or variability is important in providing the right degree of urgency, but the modal verbs used by scientists to communicate this probability may create a different interpretation by the audience. Fischhoff & Davis (2014) discussed how the use of common words such as “room”, “safe sex”, or “unemployed” (pg. 13665) may prime different interpretations by the public than intended by scientists who wrote the information. While Fischhoff & Davis (2014) do not discuss modals specifically, the same logic could be applied. Modals such as *may*, *could*, or *should* have implied meaning, but that implied meaning may not be the same for the public, for journalists, for extension personnel, for science communicators, or for scientists. The use of hedging words or

modal verbs (i.e., will, should, could, etc.) may also play a role in how farmers perceive conservation messages including the likelihood of a positive outcome or the importance of their role in that outcome.

The linguistic features of academic writing, including the use of modal verbs in hedging, have been analyzed in multiple linguistic studies (Biber et al., 2014; Hinkel, 2009; Hyland, 1998). Collocation has also been evaluated for its use in different registers such as news and academic writing (Ädel & Erman, 2012; Biber & Barbieri, 2007; Byrd & Coxhead, 2010). Yet previous work has largely ignored these linguistic features in science or conservation-related communication from university extension and conservation agencies including governmental and NGO's. While scientific research is often published in peer-reviewed journals, farmers are more likely to read about conservation science through extension publications and mass media outlets (news). This is especially true for Iowa farmers who have listed Iowa State Extension as one of their most trusted and influential sources according to multiple Rural Life and Farm Polls (Arbuckle, 2015, 2016, & 2017).

Exploring how the different categories of modal verbs are used in university extension publications about conservation practices might be valuable in understanding how conservation messages are perceived among Iowa's farmers. Comparing modal verb usage of extension conservation messages to academic writing and news sources, may also shed light on differences in source communication strategies. Finally, this comparison may help to identify possible communication gaps between farmers and academic researchers

The categories of modal verbs explored in this study, described by Conrad et al, (2002) were permission/ability, obligation/necessity, and volition/prediction. Permission/ability modal verbs are often used to describe personal permission for action, possibility of action, or an

agent's ability to perform an action. Obligation/necessity modal verbs are often used to imply a requirement for the agent to perform an action or increase the urgency for the agent to perform the action. The final category of modal verbs, volition/prediction, are most often used to describe the likelihood of an action occurring. This study aims to answer the following research questions related to use of modal verbs in university extension writing:

RQ3: How does the frequency and category of modal verbs in university extension publications compare to academic writing and news writing?

Methods

Corpora

The timeline was limited to publications published between in January of 2000 and December of 2014. The rationale for the start of the timeline was based on a simple frequency search of COCA - The Corpus of Contemporary American English (Davies, 2008-) - an online billion-word corpus of English language sources that is regularly updated with new sources from academic, newspaper, fiction, and media sources. The first multiple hit for the term "soil health" occurred in 2001. The ending of the timeline at 2014 was based on the survey date for the 2015 Rural Life and Farm Poll.

The extension corpora for this study were compiled based on the trusted sources of information Iowa farmers identified in the Rural Life and Farm poll (Arbuckle, 2016; Arbuckle, 2017; Arbuckle et al., 2015) - Iowa State University Extension, United States Department of Agriculture/Natural Resources Conservation Service, and the Iowa Department of Agriculture and Land Stewardship (IDALS). The Academic corpus was compiled from sources contained within COCA (Davies, 2008).

From each of the above sources, a keyword search for “conservation practices” was conducted using the online publication databases. All publications that fit the timeline and were free of charge and downloadable were included in the Total Extension Corpus. The final set of articles were organized chronologically so that frequency results for the term “soil health” were in in order from the earliest publication to latest.

The Total Extension corpus contained 275 articles and 322,226 words. The Academic corpus compiled from COCA (Davies, 2008 -) contained 1000 articles and 4,794, 974 words and the Newspaper corpus also compiled from COCA (Davies, 2008 -) contained 1000 articles and 1,618,325 words. Details about all corpora are included in table 4.1. The Total Extension corpus was subset into an ISU Extension corpus for further study of modal verb categories and frequencies.

Table 4.1 *Description of Corpora*

Source	Number of articles	Total Words
Total Extension	275	322,226
- ISU Extension	- 126	- 270,050
- USDA/NRCS	- 145	- 49,253
- IDALS	- 4	- 2,923
Academic (COCA)	1000	4,794,974
Newspapers (COCA)	1000	1,618,325

Analysis

A series of searches were conducted on the each of the corpora including the subset corpus of ISU Extension using AntConc (Anthony, 2019) The searches were designed utilizing the framework of semantic prosody, collocation, and frequency analysis. To address RQ1 and RQ2, an analysis using AntConc (Anthony, 2019) was conducted on the Total Extension corpus.

First a frequency was determined for the term “soil health” using the concordance plot function. Next, a collocation analysis was conducted for “soil health” to determine possible collocates relating to identity based on the top collocates for the terms “steward”, “business”, and “produce” including all cases of each work (See Appendix C). A concordance analysis was conducted again using AntConc for all cases of the verbs “cause” and “produce”. All results were downloaded to excel.

The concordance results for the verbs “cause” and “produce” plus all cases of each verb were coded for the following: occurrence of modal verb to determine how scientific uncertainty, urgency, or autonomy might be transferred to the action. The grammatical use of the verb was also coded to determine if “cause” or “produce” were the main verb of action in the sentence. This would provide context for the outcome connected to the action. The agent connected to the outcome was also identified if known and the contextual valence of the agent as positive, neutral, or negative. The outcome was coded as positive, neutral, or negative if known to determine the collocation of the verbs “cause” and “produce” to positive or negative outcomes. An overall valence of each result was determined based on the final context of the concordance. A “?” was used to denote if valence of the agent, outcome, or overall assumed valence of statement was neutral or unknown. The coding scheme modalverb_VerbPhrase_Who (if known), positive, negative, or neutral (if known), Agent_Outcome (positive, negative, or neutral if known)_Valence is illustrated below:

“...in the world. Incredibly proficient, it can produce more than 20,000 lbs/acre of above ground...”

CODED: can_mainVP_PosAgent-> more than 20,000 lbs/acre?Out_Pos

“...the veins remain green. Severe deficiencies will cause leaf margins to curl. Magnesium quantities in...”

CODED:will_mainVP_deficienciesNegAgent -> marginsNegOut(tocurl)_Neg

Intra-coder reliability was also measured using a variation of the strategy suggested first by Helmstadter (1964) and later expanded on by Krippendorff (1980) and Hollnagel (1993). A first coding and second coding analysis was conducted approximately 4 weeks apart. The first coding included all results of concordance, the second coding consisted of every third result. The similarity of results was compared using the following formula: number of codes for each concordance that were the same in both the first and second coding/the total number of codes from the second coding. The resulting intra-coder reliability coefficient was determined to be .92.

A final search was to determine the frequency of modal verbs using the classification of modal verbs previously described - permission/ability, obligation/necessity, and volition/prediction. Only single word modal verbs were used in the search to limit results and to simplify the comparison of frequencies. The following search combinations of each category were used: search 1) permission/ability search included the modal verbs “can”, “could”, “may”, and “might”; search 2 included the modal verbs “must” and “should”; search 3 included the modal verbs “will”, “would”, and “shall”. For comparison, the same series of searches were conducted for both the Academic corpus and the Newspaper corpus.

Results

The first step in analysis was to normalize all frequency results using the formula: number of hits for each specific word or phrase/total word count for the corpus x 100,000 (based on the size of the smallest corpus). This normalization process is based on the recommendations of Gries (2010). This normalization allows for a direct comparison of frequencies even though the corpora may be of different sizes.

Regarding the first part of RQ1, the frequency analysis of the chronological corpus showed a jump in frequency of the term “soil health”, especially from 2012 to 2014. The term was used a total of 85 times, however 80 hits occurred in articles from 2012 to 2014 accounting for 94% of the hits. Based on these results, hypothesis 1 is supported. (Figure 4.1).

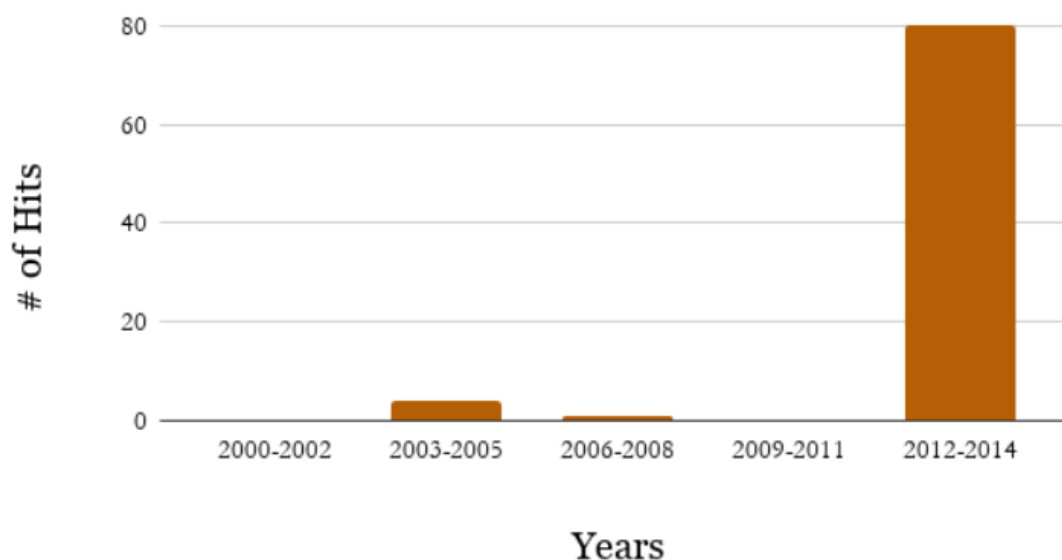


Figure 4.1 Frequency of “soil health” from 2000 to 2014 in Total Extension Corpus

Collocation search results from the Total Extension corpus were analyzed to look at the second part of RQ. They were compared to lists of the top collocation results from COCA for each of the identities attributed to farmers: steward, businessman, and productivist (productivity) (See appendix C). There are several examples of collocates that relate to the concept of steward/stewardship, none of the collocates identified for productivist or businessman occur (at least once in every 10,000 words) with the term “soil health”.

In Table 4.3 the results of the collocates study provide little evidence of the use of collocates related to the farmer identities previously discussed in this study. The collocates “quality” and “improving” have high t-values and MI scores suggesting a strong relationship between the occurrence of these words with the term “soil health”. However, these words do not

provide enough context to connect them to the identity of steward or productivist. It is interesting though that “improving” which has the highest T-value as well as MI score, is most often found preceding “soil health” suggesting a possible framing use of this word when discussing “soil health”.

Table 4.2 *Collocates for “soil health” Associated with Identity*

Identity	Collocate	Normalized Frequency (per 10,000)	T-Value	MI Score
Steward	- quality	.71	3.35	1.73
	-conservation	.31	-0.57	-0.24
Businessman	NA	NA	NA	
Productivist	-improving	.5	3.77	4.12
	-improve	.5	3.49	2.97

Regarding RQ2, the initial case search for the verb “cause” and “produce” returned hits that included both used as nouns. These results were removed. The case search for “produce” also returned hits that included “producer/producers” and the use of “produced” as an adjective. These results were also removed. The total hits for the verb “cause” (all cases) was 147 and 166 for “produce” (all cases).

A careful coding of the agent and action for each case was conducted as well as the type of verb phrase and use of modal verbs. Figure 4.2 details the results of the valence exploration. Similar to the Hauser & Schwarz (2016) study, there is a much higher incidence of negative outcomes associated with the verb “cause” as compared to the use of “produce” in the Total Extension corpus.

In addition, there was evidence of a consistent pattern for the use of farmer-based agents and the verb “produce”. Farmer as agent of the outcome occurred 11 times with the verb

“produce” and its cases but farmer as the agent of the outcome did not occur once with the verb “cause” or its cases. In each occurrence of a farmer-based agent with the verb “produce” the outcome was either positive or neutral.

Modal verb usage analysis revealed that modal verbs occurred 54 times with the verb “cause” and its cases, with “can” occurring 26 of those times. The verb “produce” and its cases plus a modal verb occurred 19 times with “can” occurring 5 times and “will” occurring 7.

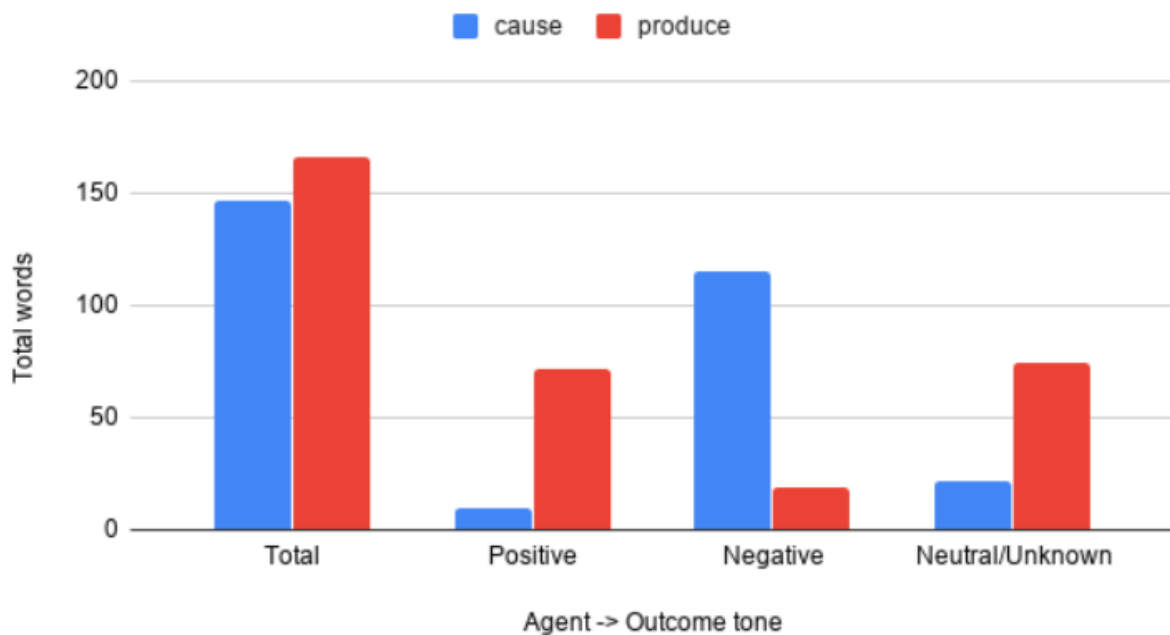


Figure 4.2: Valence Analysis of “cause” & “produce” in Total Extension Corpus

Regarding RQ3, the exploration of frequency of modal verbs in the ISU Extension corpus and comparison of categorical frequency of modal verbs in all three registers shows a higher frequency of permission/ability modal verbs compared to both obligation/necessity and volition/prediction. Figure 4.2 also shows that overall ISU Extension publications have the highest frequency of permission/ability but are similar to the frequency in the Academic corpus for volition/prediction modal verbs. The frequency of obligation/necessity modal verbs in the ISU extension corpus lies between the Academic and Newspaper corpora.

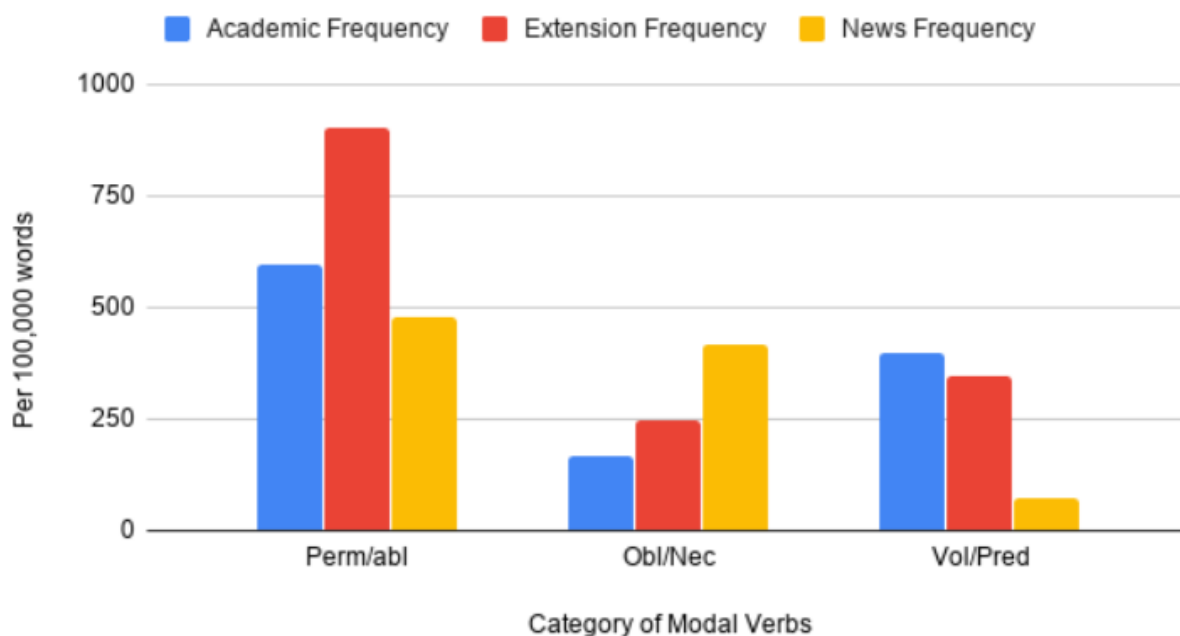


Figure 4.3: Comparison of Categorical Frequencies of Modal Verbs

Reporting individual frequencies in Figure 4.4 provides evidence to suggest that the terms “can” and “may” are contributing to the observed differences in the permission/ability modal verb category in Figure 4.1. There is some evidence that certain modal verbs in the ISU extension publications are used at the same rate as the Academic and Newspaper corpora. For example, the frequency of “must” is similar to the Academic corpus, while the frequency of “will” is more similar to the Newspaper. But there are larger differences in frequencies for “can”, “may”, “should”, and “would”, between ISU Extension and the other corpora. The possible purpose of these differences is explored in the Discussion section of this chapter.

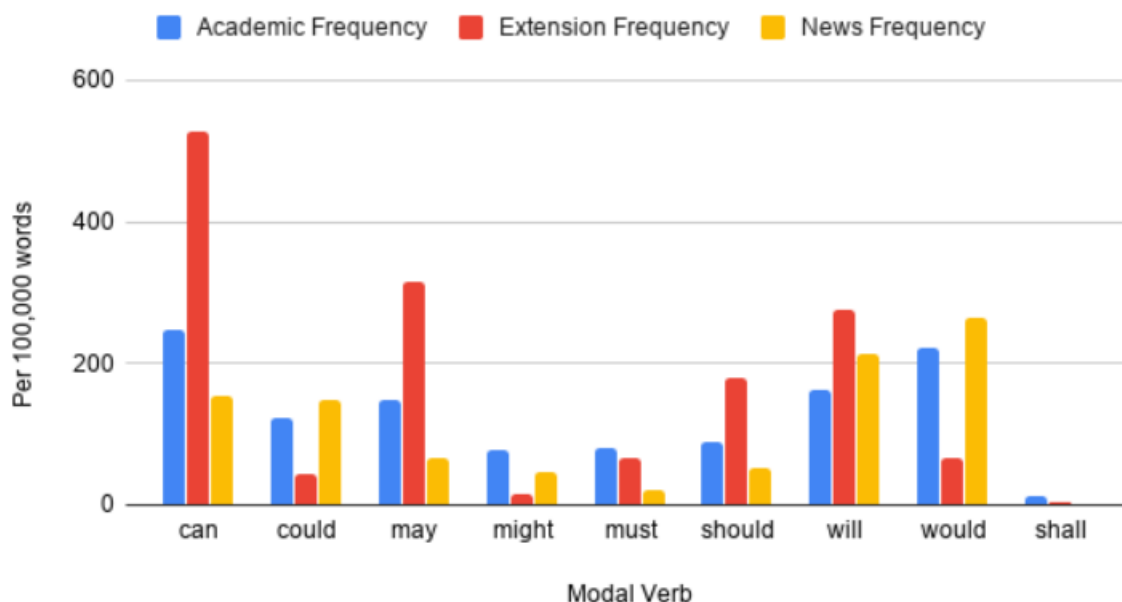


Figure 4.4: Comparison of Single Modal Verb Frequencies

Discussion

The exploration of the corpora in this study revealed several linguistic patterns of interest. Results indicate an overall increase in the frequency of the term “soil health” by extension sources including Iowa State University, the NRCS, and IDALS.) Therefore, it is possible that increased media coverage about soil health has contributed to increased farmer attention to soil health as well as interest in the adoption of soil health practices. Additional research would be needed to confirm the association between exposure to stories about soil health, increased awareness of soil health, and adoption intentions or behaviors.

While this study did not provide evidence of any collocation patterns associated with farmer identities, the other linguistic features I identified suggest there are linguistic trends in ISU Extension publications an (e.g. IDALS and NRCS) that align may with farming identities and may prime normative mechanisms.

For example, ISU Extension corpus had higher frequencies of permission/ability modal verbs specifically “can” and “may”. Previous work has highlighted that farmers have a strong connection to their land (Gosling & Williams, 2010; Quinn & Halfacre, 2014; Ryan et al., 2003) as well as identities that strongly align to autonomy.

Alho (2015) and Stock & Forney (2014) explored the role of autonomy in the self-concept of farmers in decision making. Participants’ ability or perception of their ability to make their own choices and be self-sufficient were important in maintaining their identity as a farmer. Therefore, the high frequency of permission/ability modal verbs in University Extension conservation materials may prime this perception in Iowa farmers and possibly increase the effectiveness of the message. Using the modal verbs “can” or “may” in a statement about a soil health practice for example, might prime a sense of empowerment - the farmer can do this practice - or a sense of ownership - a farmer may decide which soil health practice to implement. The results from the coding did show that can was used often with the verb “cause” and may imply not only a sense that the negative outcome is a result of the agent described, or it may prime a sense of control that farmers who use the conservation practices suggested can prevent the outcomes.

The observed use of the verbs “cause” and “produce” in this study was similar to results reported in a study of semantic prosody by Hauser & Schwarz (2016). The verb “cause” was most frequently used when the outcome that was negative or out of the farmers control while the verb “produce” was used with the positive outcomes of conservation practices or those in which the farmer is directly involved in. The different use of “produce” and “cause” may also align with different farmer identities. When the outcomes are tied to economic benefits such as

“increased yields” or “profitable yield increase” for example, the use of the verb “produce” may prime the productivist identity - a dominant identity among Iowa’s farmers. This may increase the effectiveness of the information and by reflecting a farmer’s existing values, the approach may increase the farmer’s comfort with or trust in the source. Thus, future research could explore how messages tying conservation practices to terms like “profitability” or “productivity” might appeal to farmers with a strong productivist or businessman identities.

When looked at individually, each linguistic feature shows interesting patterns within the corpora explored in this study. However, a clearer picture emerges when these features are looked at from a framing or priming perspective. The overall interpretation of a farmer of the information provided by these sources maybe influenced, even subconsciously, by the lack of use of the verb “cause” when the farmer is the agent of the outcome. By not assigning blame to the farmer as the cause, the overall valence of the information is positive.

Based on interviews and listening sessions as well as other surveys, there is a perception among farmers that the public now see farming practices as the main cause of water quality problems. (Comito et al., 2013; Dutcher et al., 2004; Greiner et al., 2009; McGuire et al., 2013). Several op-eds in midwestern newspapers lament the portrayal of farmers in news stories concerning water quality (Anderson, 2016; Lesicko, 2019; Menke, 2019). Farming is both a practice, a source of employment, and a way of life. Thus, farmers are likely to feel attacked on multiple fronts when they read messages that suggest farmers are the “cause” of soil health or water quality problems.

Blame can decrease feelings of trust, as well as support for collaboration to address large-scale conservation problems (Stern, 2018). Farmers are critical stakeholders in any future efforts to increase the implementation of agricultural practices that conserve natural resources; thus

messaging and engagement must be inclusive and designed to promote and build trust. If the messaging assigns blame to farmers for conservation issues such as water quality or soil health, it may create distrust or frustration on the part of farmers.

This issue of blame has been at the heart of the controversies in Iowa related to ag-run off, the DSM Water Works controversy, and erosion issues. The language that frames these issues is often negative. However, if progress is to be made, more positively framed messages as well as messages that suggest that farmers “may” adoption conservation action implying autonomy and ownership in the decision-making process might be more appealing to farmers who are resistant to regulation or punitive approaches. More importantly, farmers may be more receptive and trusting of the information presented and make decisions that positively influence soil health.

CHAPTER 5. CONCLUSION

Discussion

How conservation information is presented will impact how science or environmental messaging influences readers' attitudes and behaviors. Identifying specific linguistic features used by sources that have been identified as trustworthy and influential by farmers, may identify important science communication strategies or frames that could be leveraged by other groups interested in building trust and positive relationships with agricultural stakeholders.

My findings add to previous literature suggesting that how words intersect, influence, and align with an individual's norms, identities, and expectations may influence the acceptance of environmental information and willingness to implement conservation actions.

This study also highlights important gaps in our understanding of the role of farmer identity in conservation behavior. Comito's et al., (2013) listening sessions suggested that one of the most influential factors in decisions made by farmers about conservation practices was how the farmer defined themselves. It was the interactions of the different identities - steward, businessman, or productivist - that could help explain why farmers felt strongly about preserving soil and water but might make decisions that only helped their bottom line. It was not a lack of concern for soil health or water quality, but the strength of the identity as a businessman or productivist that influenced the final decision. Survey results presented in Chapter 3 supported these findings. Identity was a critical moderator of the relationship between descriptive norms and the adoption of conservation practices.

This study also identified strong relationships between the other normative mechanisms of the Theory of Normative Social Behavior and soil health behavior among farmers. These relationships and interactions of descriptive norms, injunctive norms, and outcome expectations

with intent and adoption of soil health practices could be important to consider when developing soil health and other conservation messaging. My results suggest that along with identity, the perception of benefits to self-and/or others (outcome expectations) had the strongest effect on farmers' soil health behaviors.

Considering the homogeneity of Iowa farmers as a group, the importance of understanding how self-identification and social norms influence decisions on conservation behavior is vital to increasing adoption of these behaviors. This study has suggested that there is a relationship between how farmers perceive the conservation behaviors of other farmers, the perceived benefits and/or consequences of conservation behaviors, and how farmers define themselves within the identity of "farmer" and adopt soil health behaviors. If the overall goal of conservation messaging is to increase adoption and improve behavior, developing messages based on these factors could increase their effectiveness. Thus, it is my recommendation that future research explore the potential benefits and pitfalls of targeting messages to farmers based on identity and social norms.

This study also explored how farmer identities might be primed through linguistic features used in conservation messages. Priming has been used widely in the field of communication and psychology. By priming a specific environmental identity, a set of values associated with that identity could also be primed. A study by Van der Werff et al. (2013) showed a connection between environmental identities and strongly held values. In relation to both energy-saving and general environmental identities, the stronger one associates with a specific identity, the stronger they hold the associated values. Related to this study, if certain values are primed, or if the mechanisms described by TNSB - descriptive norms, injunctive

norms, outcome expectations, and identity - are primed by the modal verbs such as “can” or “may”, or agents and outcomes associated with the verbs “cause” and “produce”, farmers may be more likely to adopt the behaviors described in the message.

It is possible that a single word within a message that primes an identity-affirming outcome for the individual may increase the likelihood the individual will view all the information within the message as positive and trustworthy. Likewise, a single word that primes an identity-undermining outcome or creates obligation for the individual could decrease the likelihood that the individual will view all the information as positive and trustworthy. The strong emotional reactions to certain words such as “climate change” and “vaccination” by certain groups could be explained by the identity priming that occurs with those words.

By exploring the linguistic patterns used by trusted sources of conservation information, this study provided an opportunity to take a deeper look at how specific sources might engage different agricultural stakeholders and provide some preliminary information about the kinds of conservation messages that might appeal to farmers. For example, frequent use of the verb “produce” with positive outcomes of farmer activity or of permission modal verbs in extension publications may highlight the importance of positive framing and the need for messaging that aligns with the dominant productivist orientation among Iowa farmers. This work provides some insight into important linguistic features that could be utilized in other conservation messaging and tested in future experimental efforts.

Limitations

One of the limitations of this study is the use of a secondary data set in the application of the Theory of Normative Social Behavior. The Rural Life and Farm Poll was not originally designed to test the theory of normative social behavior. While each mechanism was accounted

for in different survey items, the measures used here do not mimic the original measures developed to evaluate TNSB. This prevents a full exploration of how the mechanisms described by TNSB interact and possibly influence farmer adoption of conservation behaviors. Future research could include a survey that is built using original items based on previous studies focused on TNSB. To that end, I have provided a set of suggested survey items in Appendix B. These items enhance the items used in this study by providing multiple related items for developing a more appropriate scaled item which might be a more reliable measure (Gliem & Gliem, 2003) as well as using suggested wording from the previous TNSB studies discussed in Chapter Two and Three.

The aforementioned limitation could have contributed to the small effect sizes observed for the many of the models. Despite these small values, we did see significant increases in variance between many of the models. Small changes in explanations of variance in social science research can provide valuable insights (Itaoka, 2012; LaHuis et al., 2014). I believe that the significant findings reported in this study, even with imperfect measures, suggest that TNSB and particularly the role of descriptive norms and identity, could be useful in understanding adoption or rejection of soil health practices and other conservation behaviors by farmers.

The biggest limitation of the corpus analysis study is the availability of conservation-related publications. While the Total Extension corpus contained 275 articles, the articles were restricted to Iowa based agencies. This limits generalizations about conservation-related extension materials and messages targeting farmers outside of Iowa.

The other limitation is in comparing the ISU Extension corpus to the Academic and Newspaper corpora built using COCA (Davies, 2008 -). Again, few generalizations can be made based on the limitation of topic and source found in Iowa State University Agriculture Extension

database, and the fact that the Academic and Newspaper corpora are not strictly built on the topic of conservation. They are general corpora containing articles about multiple topics - scientific and otherwise.

The limitations of the corpus analysis study create opportunities for further research. This future research could analyze other extension publications identified as trustworthy and influential by other target audiences, expanding the generalizability of this work, particularly related to understanding how to effectively communicate scientific information to agricultural stakeholders.

While Iowa State University Extension publications have been identified by farmers as trustworthy and influential, few studies have measured how farmers perceive other news outlets. Thus, comparisons of linguistic features in news media as well as an exploration of farmers' perception of other news sources would be an important next step. This effort may identify important trends for creating other types of public messaging that relate to scientific research including topics such as health, public safety, and climate change. This same approach could also be used to improve the communication of scientific research in the news, though to date, corpus analysis has not been used widely in the field of journalism or mass communication.

It is important for scientists and agencies who are disseminating scientific information to know who their target audience is, and to understand who the target audience thinks they are. Despite the aforementioned limitations of this study, using the TNSB approach combined with the corpus analysis provides researchers and science communicators with a more comprehensive picture of how information, values, norms, and identity might interact in the processing of science information by farmers and how that processing might influence decision-making about conservation behaviors.

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Appendix A

IDENTIFIED 2015 IRLFP ITEMS & TNSB MECHANISMSDependent Variable 1 - Adoption Behavior

The concept of “soil health” has been a topic of discussion in the agricultural community in recent years. Soil health has been defined as “the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.” What are your thoughts about soil health?

- In the last couple of years, I have taken steps to improve the health of the soils I farm.

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

Dependent Variable 2 - Intent Behavior

The concept of “soil health” has been a topic of discussion in the agricultural community in recent years. Soil health has been defined as “the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.” What are your thoughts about soil health?

- I would like to learn more about how to improve soil health

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

Dependent Variable 3 - Increase in Soil Health Practices

As conditions and technologies change over time, farmers can adapt by making changes to their operations. Thinking about the last 10 years or so, how has your use of the following practices changed in your farm operation?

- Practices to improve soil health

Scale: (1) Not applicable (2) Major Decrease (3) Moderate Decrease (4) No Change (5) Moderate Increase (6) Major Increase

Descriptive Norms

1) *State and federal governments, land grant universities, farmer groups, and others have been promoting soil and water conservation practices for decades. Despite these long-term efforts, agriculture still has soil erosion and water quality impairment issues. Please indicate your agreement or disagreement with the following statements about potential reasons why that is.*

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

- a) Many farmers don't have the economic resources to adopt sufficient conservation practices.
- b) Farmers who are poor stewards of the land cause most of the soil erosion and water quality problems.
- c) Many farmers are not aware of water quality impact.

2) Please indicate your level of agreement with each of the following statements.

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

- a) Compared to other farmers, I tend to use more innovative management practices and strategies
- b) I place more emphasis on soil and water conservation than most farmers

Injunctive norms

1) The following are several statements regarding farming and farm policy. (Please circle the response for each that most closely matches your level of agreement or disagreement.)

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

- a) Sometimes I feel like I have little control over the profitability of my farm

2) The following are some factors related to decisions about soil and water conservation.

Thinking in general about the conservation practices that you have used in your farm operation over the years, please rate how important the following factors have been in decisions to incorporate conservation practices into your operation.

Scale: (1) Not at All Important (2) Slightly Important (3) Moderately Important (4) Important (5) Very Important

- a) Embarrassment about visible problems
- b) Because it is the right thing to do
- c) Neighborhood expectations

Outcome Expectations

1) The following are some factors related to decisions about soil and water conservation.

Thinking in general about the conservation practices that you have used in your farm operation over the years, please rate how important the following factors have been in decisions to incorporate conservation practices into your operation.

Scale: (1) Not at All Important (2) Slightly Important (3) Moderately Important (4) Important (5) Very Important

- a) Increase long-term profitability
- b) Tax benefits of conservation expenses
- c) Prepare for programs that reward conservation behavior
- d) Protect my investment in the land
- e) Protect the land for the next generation
- f) Avoid polluting streams, rivers and lakes
- g) Improve wildlife habitat
- h) Maintain or improve soil health
- i) Reduce the environmental impact of my farming activities

Farmer Identity

1) *The concept of “soil health” has been a topic of discussion in the agricultural community in recent years. Soil health has been defined as “the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.” What are your thoughts about soil health?*

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

a) I have noticed more discussion of soil health among fellow farmers in the last couple of years

2) *The following are several statements regarding farming and farm policy. (Please circle the response for each that most closely matches your level of agreement or disagreement).*

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

a) To make a living producing corn and soybeans, farmers have to continually increase acreage (productivist/feed the world)

3) *Thinking generally about the changes in your operation that you reported in the previous question, how much influence have the following had on your decisions to make those changes?*

Scale: (1) No Influence (2) Slight Influence (3) Moderate Influence (4) Strong Influence (5) Very Strong Influence

a) Economics (businessman)
b) My stewardship ethics (steward)

4) *The following are some factors related to decisions about soil and water conservation. Thinking in general about the conservation practices that you have used in your farm operation over the years, please rate how important the following factors have been in decisions to incorporate conservation practices into your operation.*

Scale: (1) Not at All Important (2) Slightly Important (3) Moderately Important (4) Important (5) Very Important

a) Maintain or enhance productivity (productivist)

5) *State and federal governments, land grant universities, farmer groups, and others have been promoting soil and water conservation practices for decades. Despite these long-term efforts, agriculture still has soil erosion and water quality impairment issues. Please indicate your agreement or disagreement with the following statements about potential reasons why that is.*

Scale: (1) Strongly Disagree (2) Disagree (3) Uncertain (4) Agree (5) Strongly Agree

a) Pressure to make profit margins makes it difficult to invest in conservation practices (productivist)

APPENDIX B

SUGGESTED SURVEY QUESTIONS FOR TNSB

Please indicate your level of agreement or disagreement with the following statements related to soil health practices on your farm.

*Demographic section here
(behavior)*

#. The use of soil health practices such as cover crops and no or low-till on my farm is important to me.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. I have increased the use of soil health practices such as cover crops and no or low-till on my farm over the past five years.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

(Descriptive norms)

#. Most farmers use soil health practices such as cover crops and no or low-till on their farm.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. Most farmers have increased their use of soil health practices such as cover crops and no or low-till over the past few years.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

Injunctive norms

#. Most farmers would encourage me to adopt or increase my level of soil health practices on my farm.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. Most farmers would encourage other farmers to adopt or increase their level of soil health practices on their farms.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

Outcome Expectations

#. The benefits of using soil health practices on my farm outweigh the costs such as time or financial burdens.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. Most farmers agree the benefits of using soil health practices on their farm outweighs the costs such as time or financial burdens.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. The use of soil health practices increases productivity and income on my farm.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

Identity

#. The need to protect and improve the soil on my farm has a strong influence on my decision to use soil health practices.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. The need to protect my source of income and improve my financial situation has a strong influence on my decision to use soil health practices.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

#. The need to produce higher yields and improve productivity of my farm has a strong influence on my decision to use soil health practices.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	6

APPENDIX C

COCA COLLOCATES LIST FOR FARMER IDENTITIES*(Results of COCA collocation searches for each of the terms associated with farmer identities)*Steward/Stewardship + cases

Nouns: land, shop, union, observatory, wine, earth, god, environment, council, forest, program, resource, product, responsibility

Verb: act, lecture, train, hand, appoint, race, wave, commend, promote, exercise, certify, encourage, foster, bless, practice, resource

Adj: good, chief, better, responsible, annual, environmental, faithful, royal, economic, marine, natural, financial, corporate, careful

Adv: potentially, ashore, formally, formerly, loudly, soundlessly, amiss, diligently

Business/Businessman + cases

Noun: owner, model, leader, card, partner, us, consumer, harvard, politician, lawyers, billionaire, romney, john, banker

Verb: mind, own, conduct, operate, finance, boom, thrive, cater, name, pose, trump, sentence, partner

Adj: small, successful, unfinished, profitable, legitimate, retail, risky, lucrative, american, wealthy, local, prominent, japanese, rich

Adv: usual, strictly, e.g., profitably, allegedly, illegally, unfairly, unsuccessfully, extraordinarily, hugely, moderately, narrowly

Productivity/Productive/Productivist + cases

Noun: growth, worker, gain, labor, increase, cost, level, quality, society, member, activity, citizen, capacity, economy

Verb: increase, improve, boost, reduce, enhance, rise, raise, measure, become, engage, counter, facilitate, divert, fulfill, foster, channel

Adj: high, low, increased, economic, agricultural, lost, increasing, total, healthy, happy, creative, efficient, positive, successful, counter, effective

Adv: significantly, greatly, e.g., dramatically, overall, thereby, positively, sharply, more, most, less, highly, economically, extremely, potentially, incredibly