

Differences in Organic and Conventional Agriculture Requirements

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Table of Contents

Section 1 Introduction	p. 5
Section 2 Background.....	p. 7
Section 3 Methodology and Research Design.....	p. 9
Section 4 Changes in Organic Certification Requirements.....	p. 11
Section 5 Changes in Conventional Regulations.....	p. 13
Federal Regulations	p. 13
California’s Regulations	p. 15
North Carolina’s Regulations	p. 17
Section 6 Perceptions of Organic Certification.....	p. 18
Section 7 Farmer Interview Analysis.....	p. 22
Section 8 Conclusion.....	p. 24
<i>Bibliography</i>	p. 26
<i>Appendix A: Perceptions of Organic Survey</i>	p. 31
<i>Appendix B: Farmer Interviews</i>	p. 36
<i>Appendix C: Details on Changes in Requirements</i>	p. 45

Abstract

As Americans increasingly produce and consume more organic foods, consumers' perceptions of organic requirements may inaccurately reflect the legal requirements. My first question was, **how do consumers' perceptions of organic fertilizer, pesticide, and livestock management requirements differ from the requirements written in the law?** My second question was, **how have the differences in requirements for the USDA organic certification and conventional agriculture changed in North Carolina and California since 1990?** While a majority of past research on the differences between organic and conventional production has focused on environmental impacts, this research is unique because it focuses on the differences in legal requirements as well as consumers' and producers' perceptions of those requirements, particularly for California and North Carolina.

To assess consumers' perceptions, I surveyed 560 Americans and found that the respondents overestimated the fertilizer, pesticide, and livestock management requirements for organic agriculture. To explore the second question, I focused on fertilizer, pesticide, and livestock management requirements in federal and state laws for organic and conventional agriculture, and I interviewed 22 farmers about their experiences with the two systems. Both my examinations of the law and the interviews showed significant variation in the differences between organic and conventional requirements across state and food product. Some farmers see few differences while others who see large differences believe organic agriculture is more ethical than conventional. There are also conventional farmers who argue that their practices are more sustainable than those of organic farmers and there are organic farmers who obtain the organic label in order to charge a higher price. In terms of the written law, USDA seems to have relaxed organic requirements in some cases, while both USDA and EPA have tightened requirements for conventional systems thereby diminishing at least some differences between organic and conventional requirements. I conclude that consumers should not assume all organic foods have the fewest environmental impacts and that all conventional foods have the most environmental impacts, and should instead do background research on particular products. Farmers should help consumers by making their production processes more salient. To more accurately highlight and reward environmentally sustainable farms, the government should continue decreasing organic certification costs for small-scale sustainable farms.

Section 1. Introduction

After the organic certification standards became effective in 2002, Dan Glickman, the Secretary of the US Department of Agriculture (USDA), made clear that the organic label does not imply a superior, healthier, or safer food product than a food without the organic label (Winter et. al 2006). However, as Americans become more conscious of their food's origins, they are increasingly producing and consuming more organic food products. The organic food industry is growing in value as sales totaled \$29.2 billion in 2011, which was a 9.4% increase over just one year (Laux 2011). Moreover, organic sales increased by about 20% per year from 1990 to 2006 (Winter et. al 2006). Although the USDA's Organic Certification program encourages sustainable farming and informs consumers of which products are organic, public perceptions of organic requirements may not accurately reflect the legal requirements. For instance, even though consumers often believe that farmers do not use any chemicals on certified organic products (Abrams et al. 2009), certified organic farms are allowed to use over 170 synthetic substances (Winter et. al 2006).

My preliminary question is, how do consumers' perceptions of organic fertilizer, pesticide, and livestock management requirements differ from the requirements written in the law? I predicted that people would underestimate at least some aspects of organic agriculture requirements. To test this hypothesis, I surveyed Americans about their knowledge of organic regulations. Results showed that they believe fewer synthetic fertilizers and pesticides are allowed than is permissible by the law. This investigation is important because it shows that consumers are not aware of the processes that go into producing the foods they eat, even if their intentions are to make healthy and environmentally sustainable choices. It is crucial that consumers know what they purchase so they can promote products that are beneficial to society and avoid those that are not. Without the knowledge of organic foods' backgrounds, consumers may continue to make choices that are not necessarily healthy or sustainable and hamper improvements in production processes.

Both organic and conventional agriculture requirements have changed since 1990, which may account for consumers' skewed perceptions. USDA establishes federal conventional requirements, and state agricultural departments create specific codes for their respective states. Since consumer perceptions of organic requirements are likely to be inaccurate, I deduce that consumer perceptions of how organic systems differ from conventional systems also diverge. The current scarcity of information on the actual differences led me to my main question: **how have the differences in requirements for the USDA organic certification and conventional agriculture changed in North Carolina and California since the passage of the Organic Food Productions Act of 1990?**

California and North Carolina are pertinent and contrasting case studies because California's government strongly supports the organic food industry, as it produces 36% of America's organic food sales (Laux 2011), while North Carolina's organic food sector is still small and growing.

Fertilizers, pesticides, and livestock management are the three variables I focus on in this paper, because they are the agricultural factors most apparent to consumers and their requirements are

accessible in both federal and state law codes. Many food labels in grocery stores and farmers' markets make claims to be fertilizer-free, pesticide-free, antibiotic-free, hormone-free, or free-range. A study by Whole Foods showed that 70% of those who bought organic food did so to avoid pesticides (Winter et. al 2006). Another study comparing organic and conventional systems lists fertilizer management as one of the factors that determine their differences in environmental impact (Meisterling et al. 2009). Moreover, fertilizer use and pesticide use are quantifiable and comparable, because consumers can estimate how many of each may be allowed or prohibited and producers can list how many they use (and how often). Livestock management is a qualitative variable that may be more subjective, but it provides information that consumers are likely to understand and visualize.

As amendments to regulations for these three variables show a trend towards exemptions and omissions for organic agriculture and towards tighter restrictions for conventional agriculture, the differences in conventional and organic requirements for pesticides, fertilizers, and livestock management may have diminished. This would mean that contrary to popular belief, organic agriculture may not always have fewer environmental impacts than conventional agriculture, at least in terms of fertilizers, pesticides, and livestock management. This analysis is important because it shows that consumers may think that organic farms use little or no pesticides and fertilizers to grow organic products even though that is not necessarily true.

To test the hypothesis that conventional requirements have gotten stricter and organic requirements have gotten looser, I researched federal and state laws, statutes, and codes regarding organic and conventional requirements. Since 1990, government agencies have amended these requirements in various ways. For instance, EPA often adds substances to the National List of Allowed and Prohibited substances for organic agriculture so the list is now longer than it was before. I also interviewed farmers to learn more about how the legal differences manifest themselves on the production end. When I asked how conventional requirements have changed since 1990, some conventional farmers said that they now require stricter documentation than before.

While a majority of past research on the differences between organic and conventional production has focused on environmental impacts, this research is unique because it focuses on the differences in legal requirements as well as consumers and producers' perceptions of those requirements, particularly for California and North Carolina. In order to understand the context behind these consumer perceptions, amendments, and interviews with farmers, the following section discusses various agricultural agencies and legislations, especially those related to pesticides, fertilizers, and livestock management.

Section 2. Background

Organic Certification Program

Congress passed the Organic Food Productions Act (OFPA) of 1990 to create a standard organic certification process for the nation. Rather than detailing the required and prohibited practices, this act focuses on the certification's framework and refers to national and state lists of prohibited and required practices so that the bill does not have to change when new scientific evidence on best practices emerge. OFPA also established the National Organic Standards Board, a group of 15 individuals, to determine permissible substances, help create standards for these substances, and advise the Secretary of Agriculture (Winter et. Al 2006).

The Code of Federal Regulations provides specific explanations of permissible processes under organic certification (National Organic Program 2010). The United States Code Annotated and the Federal Register list the certification's amendments since 1990 (Organic Food Productions Act 1990, National Organic Program 2007).

Organic production is most prevalent in California partially because non-governmental organizations and farmers started the organic food movement there in the 1960s. California was the first state to have a third party certification system with twelve regional systems by 1974. During the 1970s, USDA was still unreceptive to organic agriculture (Guthman 2004). As North Carolina's organic farming industry is still small, there has been little extensive research published about it.

Federal Agricultural Regulations

Unlike organic agriculture, conventional agriculture does not have a published list of allowed and prohibited chemicals. Instead, federal and state agricultural agencies approve them before they can enter the market. Once the agencies approve the chemicals and sometimes specify maximum levels of use, also known as tolerance levels, any conventional farmer or food producer can use them. Various legislations grant power to the Environmental Protection Agency (EPA) and USDA to regulate agriculture in different domains. For example, EPA regulates pesticide approval processes under the Federal Insecticide, Fungicide, and Rodenticide Act. EPA also enforces other regulations, such as Comprehensive Nutrient Management Plans for all animal feeding operations and Pollution Discharge Elimination System permits for some. USDA, on the other hand, oversees meat, poultry, and egg inspections, labeling, distribution and more. State agricultural departments have their own pesticide, fertilizer, and livestock handling requirements.

Agricultural Regulations in California

The California Department of Food and Agriculture (CDFA) is the state regulatory agency that creates and oversees most of the rules listed in the California Code of Regulations Title 3 on Food and Agriculture. CDFA also has its own Food and Agriculture Code with more details on requirements.

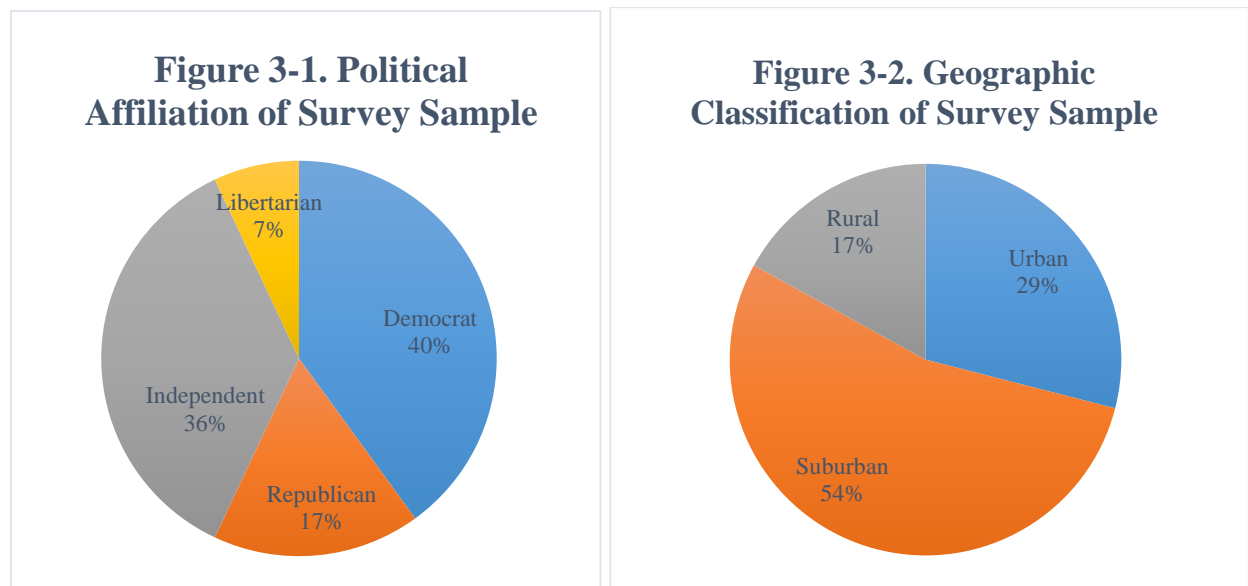
Agricultural Regulations in North Carolina

The North Carolina Department of Agriculture (NCDA) is the state regulatory agency that creates and oversees the requirements in the North Carolina Administrative Code, specifically Title 2 on Agriculture and Consumer Services. The North Carolina General Statute's Chapter 106 on agriculture also includes reporting requirements and penalties. Several laws in the 1970s established these requirements and NCDA has amended them since then. Some of these laws include the Pesticide Law of 1971, Commercial Fertilizer Law of 1977, Poultry Production Inspection Act of 1971, and Commercial Feed Law of 1973.

Section 3. Methodology and Research Design

Survey to Americans: Consumer Perceptions

To answer my preliminary questions on consumers' perceived differences in organic and conventional requirements, I created a survey for only U.S. respondents. I used Qualtrics to build the survey, published it on the Amazon Mechanical Turk website, and paid \$0.50 to the 560 individuals who responded. I asked participants to categorize which restrictions they believe are required by both the USDA organic certification and conventional farming regulations. The median age of the sample of 560 participants was 31. The highest education level for 43% of the sample was a bachelor's degree, some college or university for 23%, and high school for 13%. The median income range was \$40,000 to \$49,999. See figures below for more details, Section 6 for results and Appendix A for the full list of questions.



Federal and State Laws

To discern the changing differences in requirements for organically grown and conventionally grown food in 1990, I investigated how the original federal organic requirements in the Organic Food Productions Act (OFPA) of 1990 and Title 7 of the Code of Federal Regulations in 1990 have changed over time. I studied federal agricultural acts and the Environmental Protection Agency's role in other conventional regulations, particularly pesticides. I paid attention to the changes in requirements over time. I investigated North Carolina and California's state codes and agriculture department regulations and how they changed over time as well. Lastly, I compared the organic requirements to the federal conventional regulations and state regulations.

Interviews with Farmers: Differences on the Field

To study manifestations of the differences in organic and conventional requirements and how they have changed since 1990, I interviewed farmers in California and North Carolina about their experiences complying with the two types of food production processes in the 1990s. I contacted a total of 275 farmers from both states first by finding the counties with the largest number of farms. For both California and North Carolina, I chose counties with about one thousand farms or more. I categorized these counties into geographic regions for each state and randomly chose two counties from each region. I collected farm names and phone numbers from the Yellow Pages website and re-ordered each county's farm list using a random number generator. I called the farmers starting from those at the top of the list. Many of them did not answer, so I left a message, but only one or two returned those calls. I found that most of the farms from that list were conventional farmers. I decided to use the USDA's list of organic farms to find farmers in my regions of interest. I re-ordered those lists with a random number generator and contacted these farms in that order as well.

I interviewed 22 farmers, nine from California and 13 from North Carolina. Of the 22 farms, 11 were certified organic, ten were not, and one has both organic and conventional products. Two interviews were in-person and the rest were via phone or email.

To investigate the farmers' perceived differences of conventional and organic requirements, I asked them whether or not they use particular sustainable agriculture techniques, what challenges they face to meet organic or conventional regulations, and how they prioritize various factors in their business plans. See Appendix B for full list of questions and Section 7 for detailed information on the different types of farms as well as analysis on their responses.

Section 4. Changes in Organic Certification Requirements

Allowed and Prohibited Chemicals (as fertilizers, pesticides, herbicides, ingredients)

The Organic Food Productions Act of 1990 established a National List of Allowed and Prohibited Substances for organic agriculture. It states that synthetic substances necessary for production are allowed in organic production as long as they are not harmful to human health. Other allowed substances must come from certain synthetic ingredients and may not be inerts of toxicological concern, as determined by EPA. In 2005, the definition of allowed substances required only one or the other characteristic rather than both, there by becoming more relaxed (Organic Food Productions Act, 7 U.S.C.A.).

Between 2003 and 2013, amendments to the National List also added about 88 synthetic substances to the list of allowed substances, but removed only two. Of the new allowable substances, about one fourth of them are permissible only under certain conditions. Currently, the list allows 62 substances in the production of organic crops, 41 for organic livestock, as well as 139 additional substances that are in EPA’s list of “Inerts of Minimal Concern” and roughly 1900 substances on EPA’s list of “Inerts of Unknown Toxicity.” There are also 40 non-organic substances that are allowed as ingredients in foods labeled as “organic,” and 50 in foods labeled as “made with organic ingredients,” (Organic Food Productions Act Provisions, 2013). See Appendix C for a chronological list of amendments to the National List. Figure 4-1 highlights some of those changes.

Figure 4-1: Changes in Allowed and Prohibited Chemicals under Organic Certification

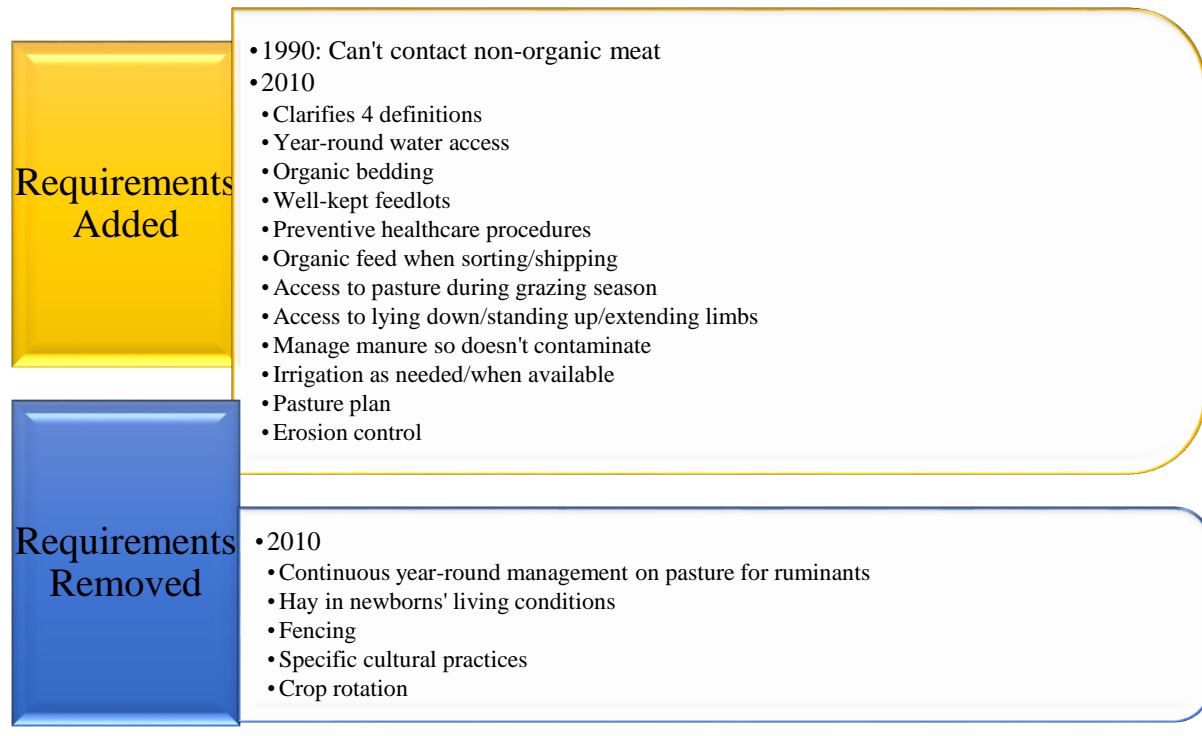
<p>Policy Changes</p>	<ul style="list-style-type: none"> • 1990: Organic Food Productions Act • 2000: National Organic Program under USDA • 2000: National List of Allowed and Prohibited Substances created • 2003: Clarifies that some synthetic substances allowed in some cases • 2005: Nat'l List can include substances if necessary and not harmful to health • 2007: Adds the Animal Medicinal Drug Use Clarification Act of 1994
<p>Prohibited Chemicals</p>	<ul style="list-style-type: none"> • 1990: Fertilizers with synthetic ingredients or commercially blended fertilizers with particular materials • 1990: synthetic ingredients, sulfites, nitrates, nitrites, non-organic ingredients • 2012: removes 1 synthetic substance from allowed list
<p>Allowed Chemicals</p>	<ul style="list-style-type: none"> • 2003: 9 synthetic substances in some cases (6 with conditions) • 2005: 3 synthetic substances (only until 2008) • 2006: 14 synthetic substance (10 with conditions) • 2007: color ingredients and processing aids from 27 non-organic agricultural products (2 with conditions), 10 drugs with conditions • 2010: 5 synthetic substances with conditions • 2012: 8 synthetic substances with conditions

Livestock Management

In 2010, USDA amended many requirements for organic livestock management. While some were short additions or clarifications of relevant terminology, others were measures that addressed the livestock's living conditions. Of those changes, some made the requirements stricter and others made them more lenient. The new stricter requirements include controlling erosion in outdoor access areas, managing manure to prevent soil and water conservation, and increasing access to water, organic bedding, well-drained yards and feedlots that prevent waste runoff and provide cows with outdoor access. Some changes called for enhancement of existing requirements, such as preventative healthcare, approvals for changes in the comprehensive pasture plan from the certifying agent, and the prohibition of some types of confinement (National Organic Program, 2010).

Changes in the 2010 amendment that made organic certification more lenient include the removal of certain requirements, such as the mandate for year-round pasture management for cattle (as long as there is no regular temporary confinement), fences, specific cultural practices that would ensure sufficient pasture, and crop rotation to maintain soil fertility. Other measures added exceptions for temporary denial of outdoor access and additional circumstances under which animals can be temporarily confined (National Organic Program, 2010). See Appendix C for a list of changes to the organic requirements regarding livestock management. Figure 4-2 highlights some of those changes.

Figure 4-2: Changes in Livestock Management Requirements under Organic Certification



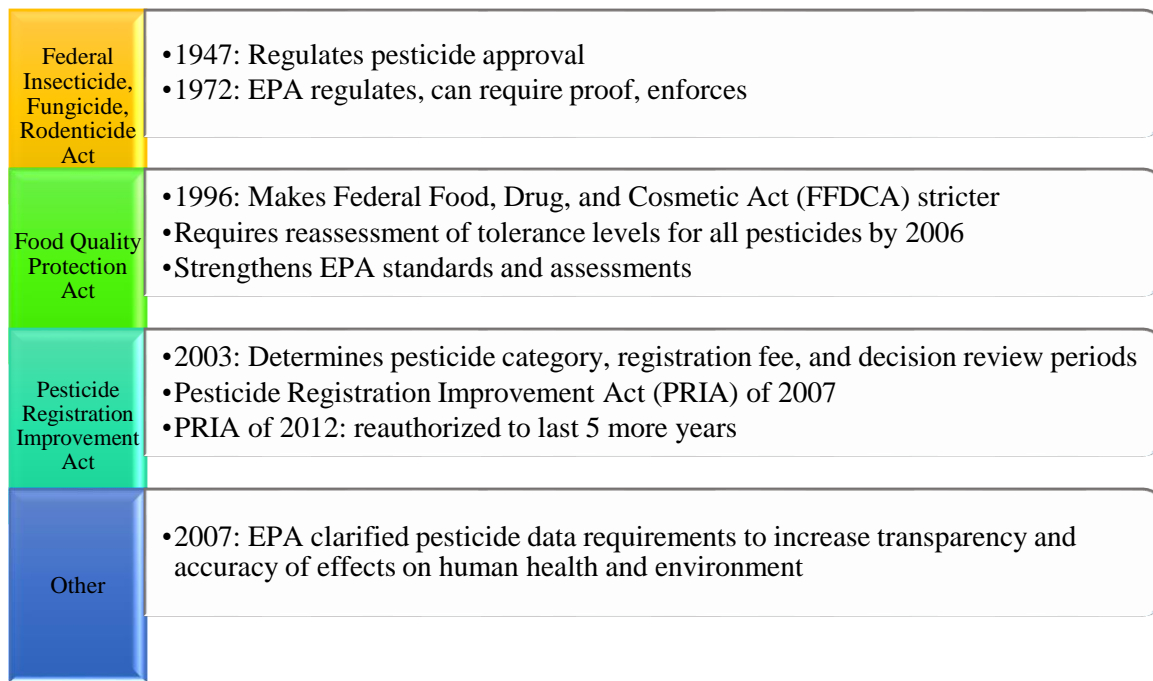
Section 5. Changes in Conventional Regulations

Federal Regulations

Pesticides

In 1947, Congress passed the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as the first primary federal law to regulate the pesticide approval process. FIFRA requires that the EPA's pesticide approval process depends on the pesticides' effects on the environment and human health. Congress amended it several times since then, especially with the Federal Environmental Pesticide Control Act (FEPCA) of 1972 and the Food Quality Protection Act (FQPA) of 1996. As the FQPA tightens the Food, Drug, and Cosmetic Act's (FFDCA) evaluation of pesticide usage on crops, it toughens the pesticide approval process. FQPA also strengthens EPA's pesticide testing measures to reflect real-life situations and to facilitate relationships with stakeholders and the public. See Table 3 in Appendix C for a more detailed list of FQPA's achievements. Figure 5-1 highlights some of those changes.

Figure 5-1: Changes in the Pesticide Registration Process for Conventional Agriculture

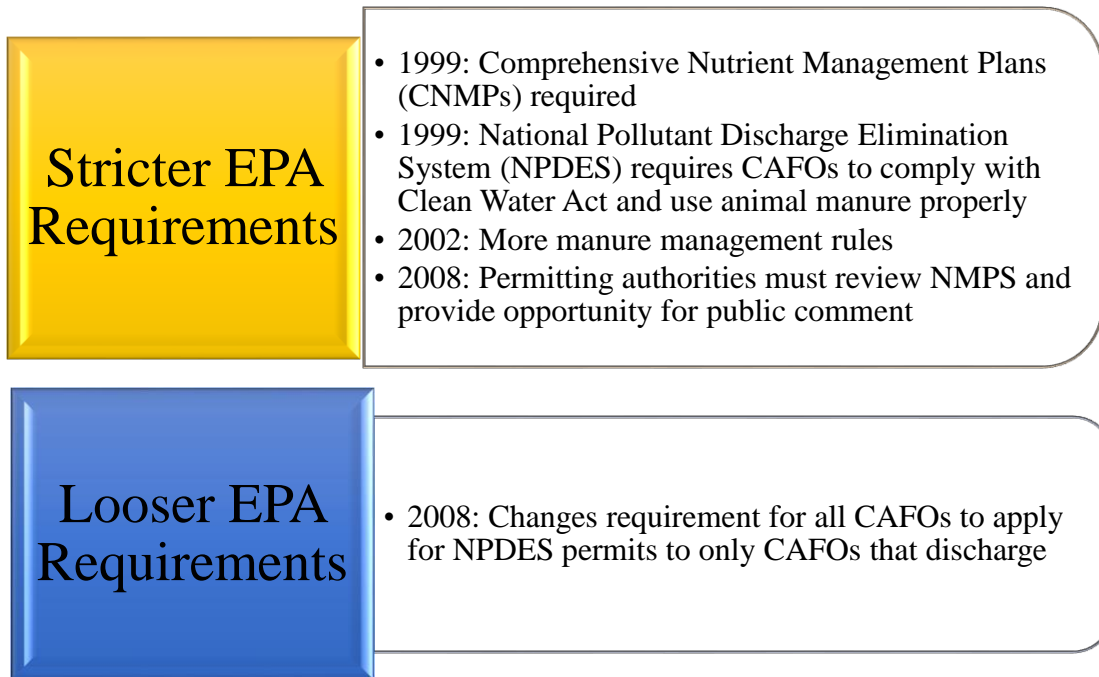


Livestock Management

In 1999, the EPA began to require all animal feeding operations to create Comprehensive Nutrient Management Plans (CNMPs) (U.S. EPA 2014). It also requires them to manage water and animal manure so they do not affect water quality and public health (U.S. EPA 2003). In 2002, the EPA tightened manure restrictions and mandated more inspections on water quality (U.S. EPA 2012). In 2008, the EPA dropped the National Pollutant Discharge Elimination

System permit requirement for all CAFOs and instead require it for CAFOs that discharge or propose to discharge pollutants. It also mandated a public comment period for CNMPs. Lastly, it relaxed requirements on how CAFOs should fulfill their no discharge requirement (U.S. EPA 2008). See Figure 5-2 below for a summary of changes and Table 4 in Appendix C for a detailed list with references.

Figure 5-2: Changes in Livestock Management Requirements under Federal Law

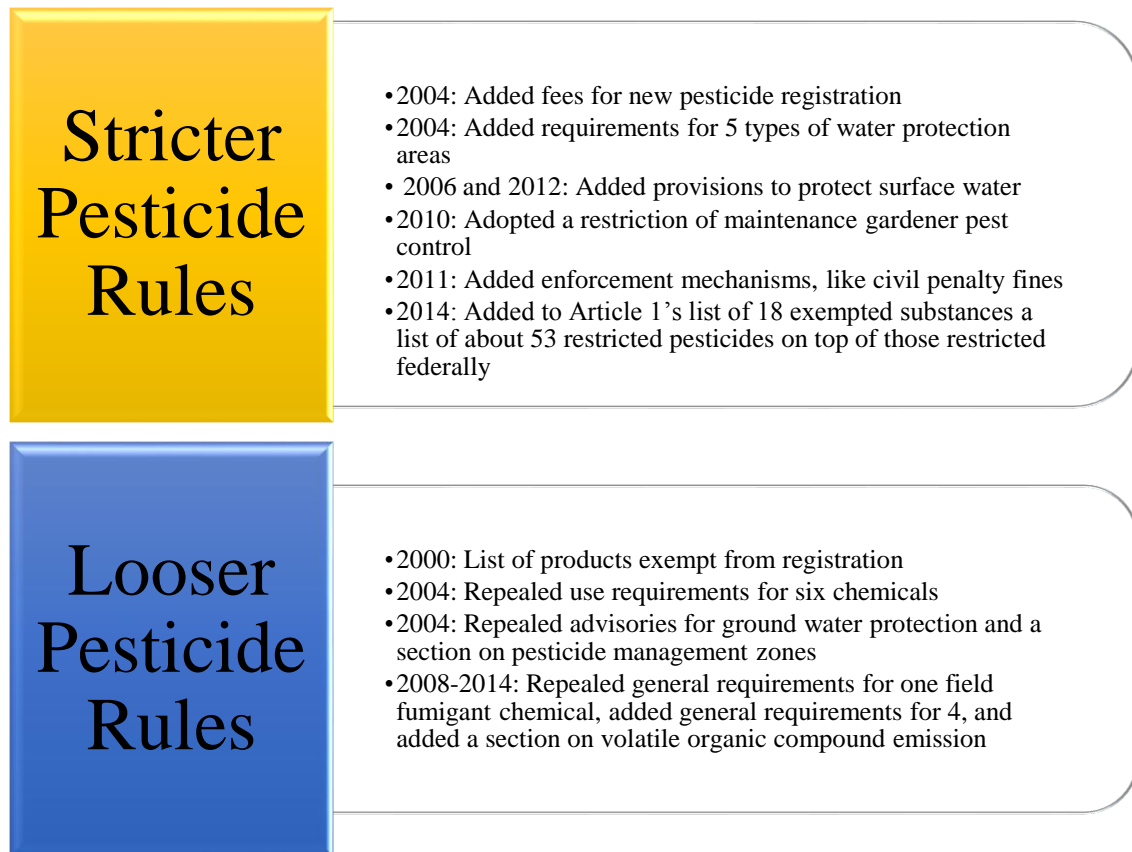


California's Regulations

Pesticides

Since 1962, the California Code of Regulations (CCR) states that the director of agriculture cannot adopt regulations on pesticides that would cause “significant adverse environmental impact” (CCR Section 6116). Commissioners must consult public agencies concerned with health, pollution, and wildlife as well as County Farm Advisors to understand current pest conditions and how they impact the environment (CCR Section 6122). In 1990, California's Food and Agricultural Code (CA FAC) expanded the agricultural department's focus on pesticide residue compared to the 1988 level. It prioritized pesticides of greatest health concern especially on groups who may be sensitive to such residues (CA FAC Section 12535). See Figure 5-3 below for a summary of changes and Table 5 in Appendix C for a detailed list with references.

Figure 5-3: Changes in Pesticide Regulations in California



Fertilizers

CDFA has a Fertilizer Materials Inspection Program in its Inspection Services Division which inspects and regulates fertilizers. It carries out the stipulations in Division 4 of Title 3 of the CCR

which lists concentration limits of about seven elements included as fertilizing materials (CCR Section 2302). See Figure 5-4 below for a summary of changes and Table 6 in Appendix C for a detailed list with references.

Figure 5-4: Changes in Fertilizer Regulations in California

Stricter Label and Registration Requirements	<ul style="list-style-type: none"> •1982: Warning required when more than 0.1% boron or 0.001% molybdeneum •1991: Establishes labeling requirements, must list phosphoric acid content, requires registration of fertilizers (and other inputs) and tonnage reporting •2002: Must guarantee that certain fertilizers do not exceed standards for arsenic, cadmium and lead; requires listing the amounts of 9 different elements except for 17 types of products; Lists limits for seven elements and recyclable material •2010: Adds reporting requirements for ingredients •2012: Limits use of the statement “State of CA Approved”
Looser Label and Registration Requirements	<ul style="list-style-type: none"> •1991: Experimental use of noncommercial fertilizer is exempt from licensing

Livestock Management

The CCR discusses regulations regarding milk products, disease control, livestock identification, meat and poultry inspection, and other animal biologics (CCR Sections 400-1301.3). It also states to follow the US Code of Federal Regulation’s stipulations on humane slaughter of livestock (CCR Section 906). Since 1979, the CCR has stipulated safe transportation of livestock on the farm and access to water and feed in holding pens. Since 1967, the CA FAC has also included standards on humane methods of slaughter, such as carbon dioxide chambers, captive bolt stunners, gunshot, and electric current (CA FAC Section 19501).

In 1956, CDFA had added specific procedures for humane slaughter of poultry, like requirements for handling and the humane methods of slaughter which include gas chambers, stunning, electric currents, neck dislocation, cervical dislocation, severing of the carotid artery, and decapitation (CCR Sections 1246.1-1246.12).

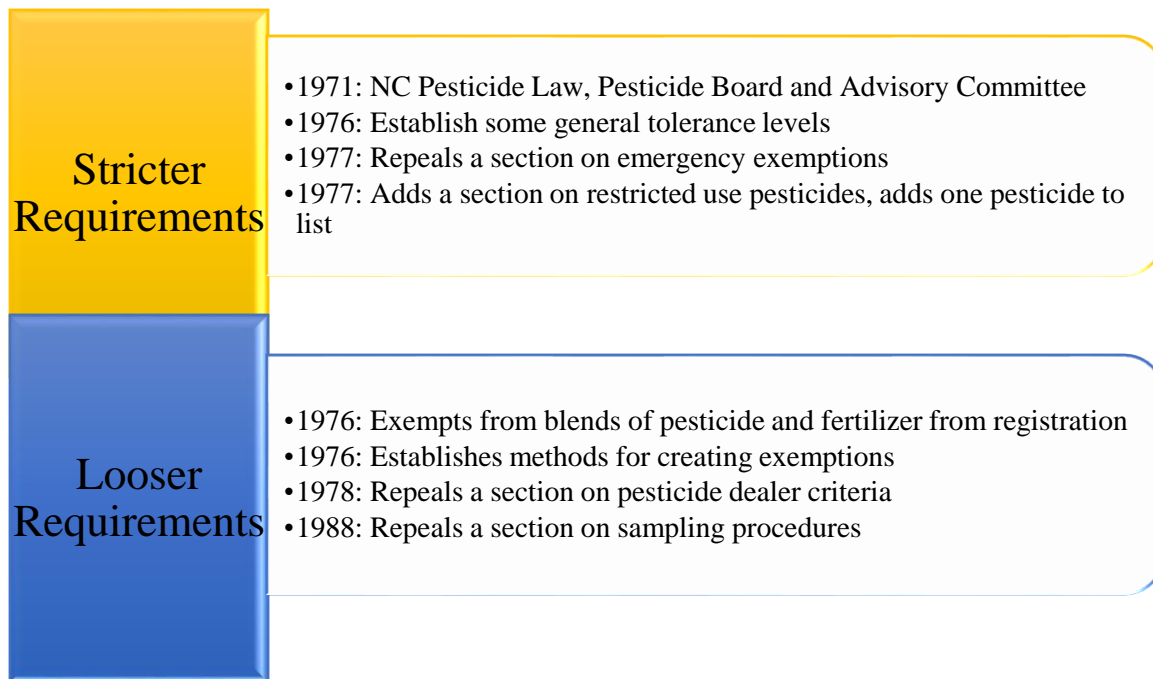
There has also been a subchapter on commercial animal feed since 1973 with requirements and tolerance levels of pesticide residue, fluorine, heavy metals, and other substances (CCR Sections 2700-2708). In 1982, CDFA added tolerance levels for drugs in animal feed and made some amendments to those levels in 1991. See Table 7 in Appendix C for details on these changes.

North Carolina's Regulations

Pesticides

The North Carolina Pesticide Law of 1971 created and established authority for the North Carolina Pesticide Board and its consultation group, the Pesticide Advisory Committee. More specific pesticide regulations are in the North Carolina Administrative Code including tolerance levels, as well as a process to apply for exemptions (02 NCAC 09L Sections .0101 - .2203). From 1977 to 1988, North Carolina repealed four sections and added two sections regarding pesticide registration and sampling. There is little information available on the changes after 1990. See Figure 5-5 below for a summary of changes and see Table 8 in Appendix C for more details.

Figure 5-5: Changes in Pesticide Regulations in North Carolina



Fertilizers

The North Carolina Commercial Fertilizer Law of 1977 lists tolerance levels for eight fertilizer ingredients in accordance with the North Carolina General Statute as well as reporting requirements and penalties for exceeding the limits (NC GS Section 106-665). In 1985, the NC Department of Agriculture (NCDA) included specific fertilizer regulations in the NCAC. It lists tolerance levels for chlorine and boron, and minimum amounts of 13 elements above which require reporting in fertilizer registration applications (NCAC 48B Sections .0102 - .0121).

Livestock Management

The North Carolina Compulsory Meat Inspection Law of 1962 states that the acceptable humane slaughter methods for red meat are single blows, gunshots or other rapid and effective means like electricity or chemical substances, as well as the methods prescribed by Jewish and other religious faiths (NC GS Section 106-549.17). The Poultry Production Inspection Act of 1971 condemns the sale of adulterated products and lists various ways the poultry could be defined as adulterated. For instance, it characterizes poultry that dies in a way other than slaughter and poultry prepared under unsanitary conditions as adulterated. It also includes provisions on labels and penalties for noncompliance (NC GS Sections 106-549.49 – 106-549.69).

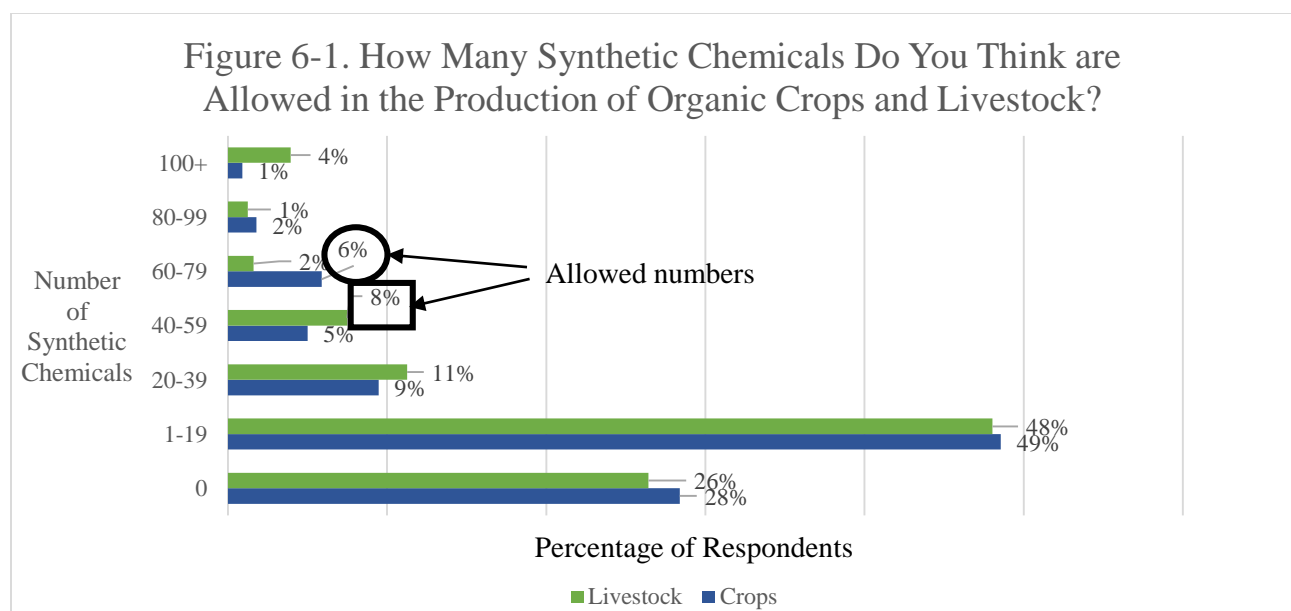
The North Carolina Commercial Feed Law of 1973 lists registration, labeling, and inspection requirements as well as definitions of adulterated feed. The definitions mostly refer to the Federal Food, Drug and Cosmetic Act. It also lists tolerance levels for ingredients such as animal drugs and antibiotics. (NC GS Sections 106-284.30 – 106-284.46).

Section 6. Perceptions of Organic Certification

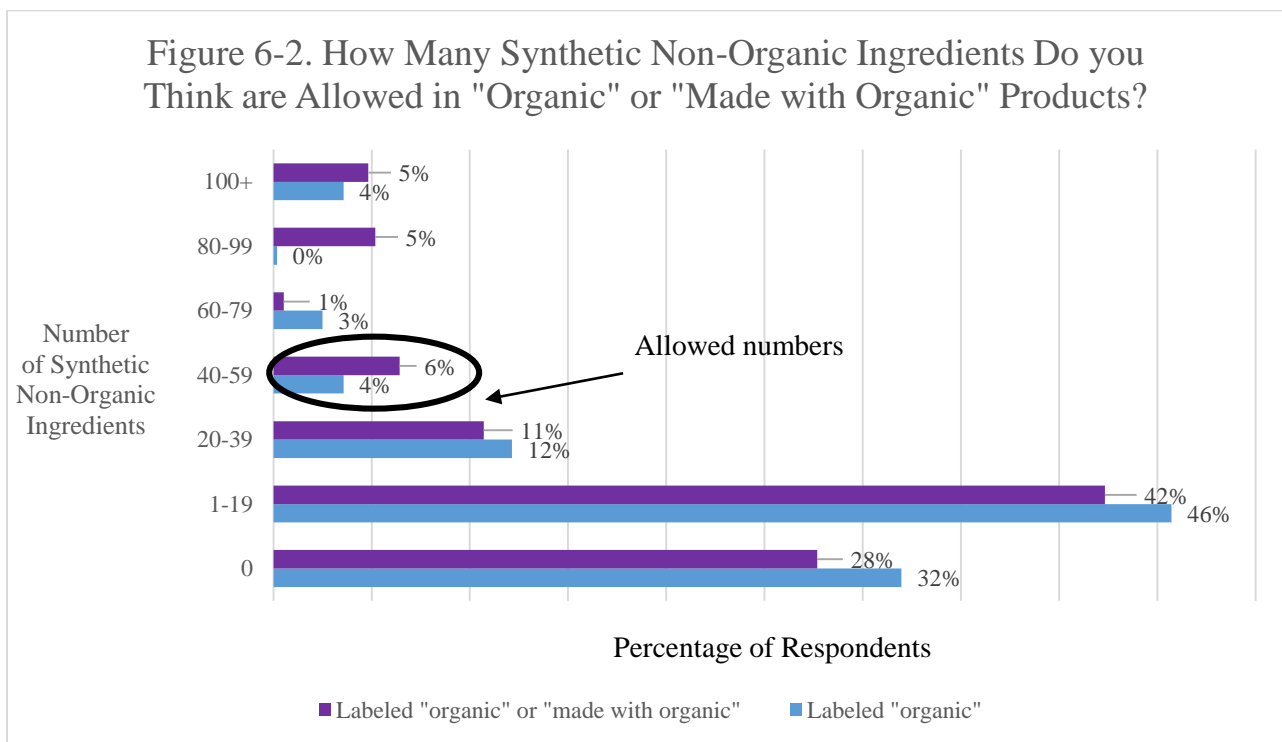
In terms of public perception of organic requirements, individuals are not confident in their understanding of the organic requirements (Abrams et al. 2009) and this may have resulted from changes in the list of prohibited and approved practices. They are unaware of potential holes in the requirements that could have negative environmental impacts. For instance, inspectors of organic farms rarely monitor their products' exposure to pesticides or genetic engineering, and even if there are traces of genetic engineering, there is no limit for how much is permissible (Friedland 2005).

Through a survey about which farming practices are required or prohibited and how many synthetic chemicals are allowed under the organic certification, the 560 participants were largely unaware of both. See the methodologies section for details on the demographics of the survey sample. The sample population significantly underestimated the number of allowed chemicals. When given 12 farming practices and asked to select the ones that they think are required for USDA organic certification, respondents answered correctly 56 percent of the time. They designated the non-required methods more accurately (answered correctly 84 percent of the time) than they did the required practices (answered correctly only 28 percent of the time). When asked which practices they think are prohibited under the organic certification, they answered correctly 52 percent of the time. They designated the non-prohibited methods more accurately (80 percent) than they did the prohibited methods (25 percent).

There are about 62 synthetic substances allowed in the production of USDA certified organic crops according to the National List of Allowed and Prohibited Substances, but only six percent answered the correct range of 60-79, circled in the figure below, and 91 percent underestimated the number of substances. Similarly, for the number of synthetic substances permissible in certified organic livestock production, only eight percent answered the correct range of 40-59, enclosed by a square in the figure below, and 85 percent underestimated. See Figure 6-1 for the distribution of respondents' answers to the multiple choice questions.



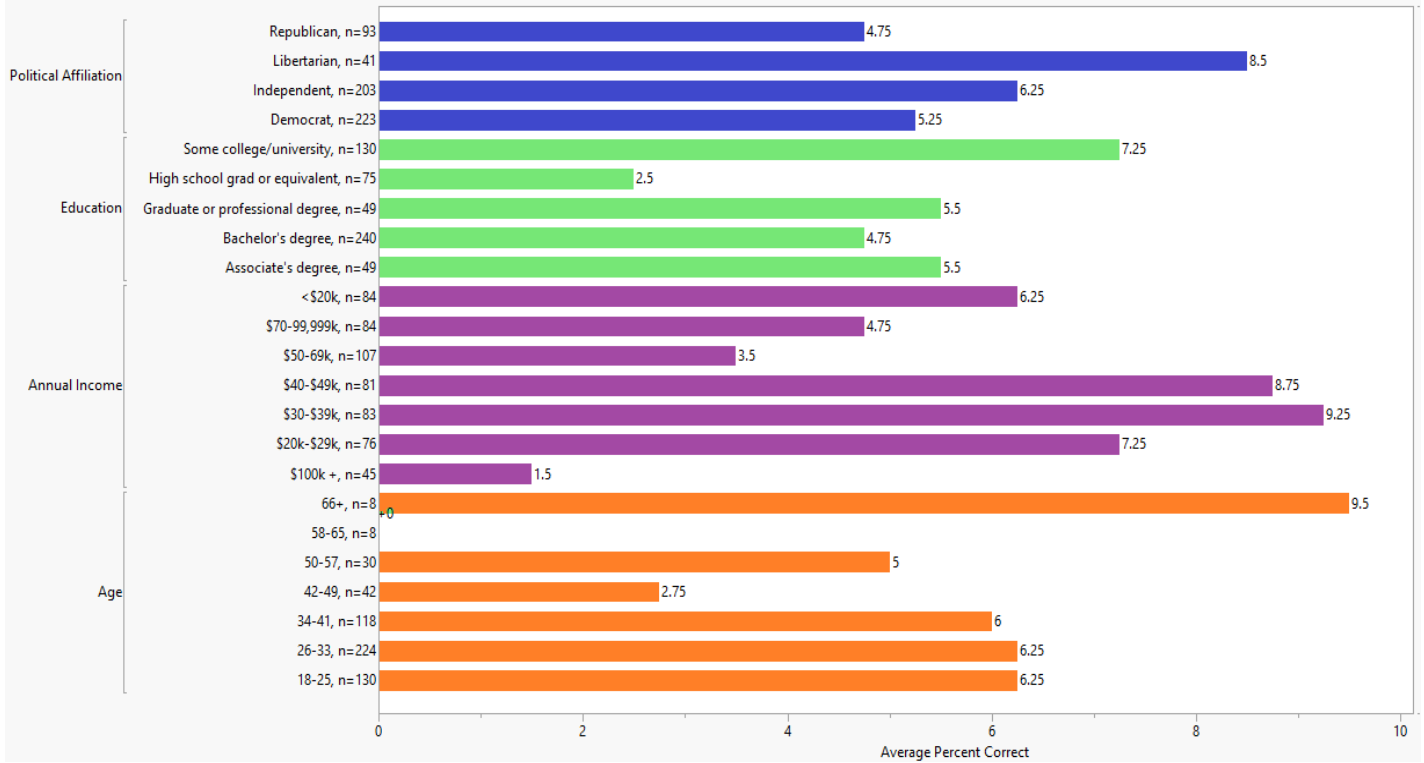
The National List of synthetic substances allowed for use in organic crop and livestock production also includes the chemicals on EPA List 4, called “Inerts of Minimal Concern.” When asked how many chemicals they think are in this list that are not already listed in USDA’s National List, 92 percent said below 100, and seven percent correctly said over 100. For products labeled as “organic,” there are 50 synthetic nonorganic substances that can be included as an ingredient. When asked about the length of this list only 4 percent answered the correct range, circled below, and 90 percent underestimated. There are 40 non-synthetic nonorganic ingredients allowed in a product labeled as “organic” or “made with organic ingredients,” but only six percent answered in the correct range, circled below, and 86 percent underestimated. See Figure 6-2 for the distribution of respondents’ answers.



There are no significant differences in age, education, income, and political affiliation among those who answered correctly and incorrectly. See Figure 6-3 for the average percent of respondents in each demographic category who correctly answered the questions about how many synthetic substances are allowed under the organic certification. Only about nine percent or fewer respondents from each of these demographic categories answered correctly.

The 560 respondents to this survey have highly inaccurate perceptions of the farming practices required or prohibited under organic certification and they vastly underestimate the numbers of synthetic chemicals and ingredients allowed in organic agriculture. Although I did not use representative sampling methods to obtain this sample, a more representative sample is not likely to have had more accurate perceptions, because accuracy did not correlate with socio-economic and other demographic characteristics like age or sex.

Figure 6-3. Percentage of Respondents with Correct Perceptions of Synthetic Substances Allowed in Organic Agriculture

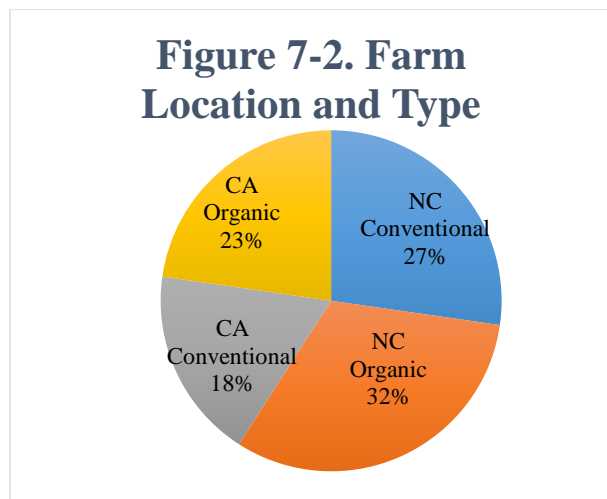
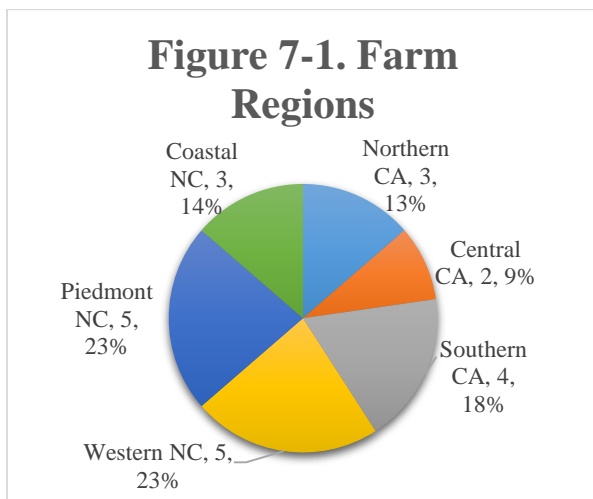


The misconceptions of organic agriculture detailed by this survey may have resulted from changes in the list of prohibited and approved practices. For instance, the list of acceptable pesticides may have increased over the years, but people perceive organic food to have little or no pesticides and overestimate the current differences between organically grown and conventionally grown foods.

Section 7. Farmer Interview Analysis

Out of the 275 farmers I contacted via phone or email or both, 22 were willing to answer the interview questions. The lack of response may be indicative of the farmers' busy schedules away from their phones and computers, discomfort, or skepticism of where their responses will go. This small sample size cannot yield significant conclusions as to American farmers' perceptions of the differences between organic and conventional requirements, but these responses are nonetheless informative. As mentioned previously, nine farmers were from California and 13 from North Carolina. There were 11 certified organic farms, and one has both organic and conventional products. Five of the organic farms were in California and seven were in North Carolina. Fourteen were small family farms, with annual sales less than \$250,000 or with fewer than five employees, one was a very large family farm with sales of about \$500,000, and five were nonfamily farms or companies with over 30 employees. The majorities of both conventional and organic farms were small family farms. The small farms' sales ranged from \$30,000 to \$178,000 and most of their costs were about equal to their sales.

See Figure 7-1 for a breakdown of the farmers' regions and Figure 7-2 for the distribution of organic and conventional farmers in each state.



The most common roadblocks farmers mentioned for becoming certified organic were the high costs of inputs and certification. I spoke with a few farmers who do not have the organic certification but use sustainable methods required under the certification. For instance, six out of the nine conventional farmers minimize soil erosion, seven of them consciously try to improve and maintain the soil's health, and six of them rotate their crops. Many conventional farmers also practice other sustainable methods not required by the organic certification. Six of them use animal manure, green manure, or compost and seven of them plant resistant and tolerant crop varieties to minimize the risk of disease. There are also certified organic farms that use conventional farming methods. Seven out of the 11 organic farmers I spoke to use some kind of pesticide or fungicide.

Moreover, some certified organic farms had priorities similar to those of conventional farms. For instance, the majority of both organic and conventional farmers listed economic or financial concerns as first priorities with environmental and ethical concerns second.

One major difference was that USDA-accredited organic certification inspectors visit organic farms at least once a year, whereas federal or state inspectors do not visit conventional farms regularly or often. Another difference is that a majority of organic farmers were not as aware of the changes in conventional regulations, like higher costs, additional restrictions, and additional documentation as conventional farmers were. Most organic farmers did, however, notice the higher costs, additional restrictions, and additional documentation associated with organic regulations.

Of the 11 conventional farmers, six are not considering to switch to organic farming, mainly because costs are too high. Two out of the three conventional farmers have considered switching for environmental or ethical reasons. Eight out of the 11 organic farmers mentioned environmental or ethical reasons as their top motivators for producing organically, and half of the four who cited economic and financial reasons first included environmental and ethical reasons in their top five reasons.

Six farmers (two conventional, three organic, one with organic and conventional products) said there are not many differences between organic and conventional agriculture. A few conventional farmers argued that their practices are just as, if not more, sustainable than organic practices. One conventional orange farmer in California explained that some natural pesticides and chemicals allowed under the organic label are more destructive than many prohibited synthetic chemicals. For instance, a natural pesticide called PyGanic comes from chrysanthemums, but it kills a variety of insects including some the farmer does not intend to kill. However, Baythroid, a synthetic pesticide, only kills his target insects. Another conventional produce farmer from California was part of the original organic movement in this 1970s, and he learned over the years that growing organically is not necessarily better than growing conventionally. He argues that environmental sustainability promotes flexibility and willingness to learn new techniques, but the organic guidelines do not encourage either, and therefore may not be significantly different from conventional requirements, in terms of environmental sustainability.

Section 8. Conclusion

Although organic food sales are growing, Americans greatly underestimate the organic certification's restrictions on pesticides, fertilizers, and livestock management. There are over one hundred synthetic substances on the National List of Allowed and Prohibited Substances permissible in organic agriculture. However, many Americans believe that only a few synthetic chemicals can be used.

The differences in organic and conventional requirements have changed in complex ways. USDA seems to have relaxed organic requirements since 1990, because it has incorporated more exemptions than restrictions into the Code of Federal Regulations. However, both USDA and EPA have tightened livestock management requirements for organic and conventional systems respectively.

Moreover, the significant variation among conventional agricultural codes in various states and for different foods show that the differences between organic and conventional agriculture requirements are not homogenous throughout the country or across all food products. Although the organic certification has increased the numbers of exempt substances and thereby seems more relaxed, conventional agricultural requirements and associated changes in different states are diverse. For instance, CDFR has added and removed roughly the same number of pesticide regulations and added many more fertilizer regulations than it removed. NCDA, on the other hand, has less conclusive information on pesticide, fertilizer, and livestock management requirements.

The difficulty in deciding how the differences between the requirements have changed shows that there is no conclusive answer. As USDA changes livestock management practices and the substances on the National List, federal and state agencies change requirements for conventional systems in different ways for different foods. Thus, the answer depends on the particular food's state of origin.

The interviews with farmers also showed great variation in opinions on the differences between conventional and organic requirements. A conventional orange farmer explained how some synthetic pesticides can be more beneficial for farm ecosystems than some natural pesticides allowed under the organic certification. An organic date farmer explained that there were not many differences between organic and conventional dates. Some farmers have the organic certification so they can charge higher prices while others are motivated by ethical concerns and environmental benefits. There are also conventional farmers who do not use fertilizers and pesticides but avoid the organic certification because it is too expensive to pay for the certification, the inputs, and the penalties on accidental violations.

These conclusions are limited in many ways. First, not all amendments to the organic, federal and state agriculture laws are available in explicit form. For many sections of the various codes, annotations state "amended" on a certain date, but do not show the pre-amendment language. Thus, I did not account for all changes in the requirements. I also did not account for the complex changes in enforcement. Moreover, I was limited in my background knowledge to fully

understand the legal and scientific terms throughout the codes. My judgments of the magnitudes in changes throughout the systems are also limited, because I do not know if every amendment changed the requirements by the same amounts. For instance, I measured the changes by counting the numbers of substances prohibited or exempt over time, without investigating these substances' magnitude of harm. These limitations also restrict the conclusions from the survey on perceptions of organic requirements, because I did not include all the organic agriculture requirements and exemptions.

An interviewer bias may have affected the farmers' answers during the interviews. They know that I am studying organic agriculture, so they may have over-emphasized their sustainable practices to give a socially acceptable answer.

Both the survey on Americans' perceptions and the interviews with farmers had selection bias in that those who responded may have had strong feelings for or against organic agriculture. As mentioned before, only 22 out of the 275 farmers I contacted agreed to answer my questions, which means that I cannot use their answers to make conclusions about most farmers with any statistical confidence.

Despite these complexities, I can conclude that more disclosure on food production processes, for both organic and conventional farms, would help consumers know which products were made with carefully managed pesticides and fertilizers. Instead of assuming all certified organic farms have the fewest environmental impacts and that all conventional farms have the most environmental impacts, individuals should do background research on the products they consume. This means internet searches on companies to see if they prioritize environmental and human health, as well as conversations with farmers and producers. Most grocery items are produced by large corporations and consumers cannot easily talk to someone who knows the products' supply chain, but at farmers' markets, consumers can learn from the farmers and farm workers directly. To make it easier to know how products sold in grocery stores were produced, food producers should allow public and private researchers to publish information on the environmental impacts of their production processes.

Although all farmers should provide this information, organic farmers have more of an obligation to do so, because most consumers overestimate the environmental sustainability of organic farms. Some farmers choose to adopt the organic certification to show their products are sustainably produced, and others adopt it because they know many consumers demand certified organic products and are willing to pay more for them. It is unfair to charge a higher price for organic products if organic farmers do not show consumers how their processes compare to conventional processes.

On the regulatory side, USDA should keep its strict requirements and continue to reduce the certification fee for small-scale environment-conscious farms. Many farmers who employ practices with the fewest environmental impacts are small-scale farms who cannot afford the certification or penalties for accidental violations, despite the cost-share programs already in place. Gradually, these changes can improve agricultural sustainability and consumers' knowledge of food production processes and associated environmental impacts.

Bibliography

- Abrams, K. M., Meyers, C. A., & Irani, T. A. (2009). Naturally confused: Consumers' perceptions of all-natural and organic pork products. *Agriculture and Human Values*, 27(3), 365.
- California Code of Regulations, Sections 400-6122 (1978).
- California Food and Agricultural Code, Sections 12535 – 19501 (1967).
- California department of food and agriculture: Regulations activities. (2014). Retrieved Feb, 2014, from <http://www.cdffa.ca.gov/Regulations.html>
- Federal Environmental Pesticide Control Act of 1972, 7 U.S.C. §136.
- Federal Insecticide, Fungicide, and Rodenticide Act of 1947, 7 U.S.C. §136.
- Food, Agriculture, Conservation, and Trade act, Title XXI (1990).
- Food Quality Protection Act of 1996, 7 U.S.C. §136.
- Friedland, M. T. (2005). You call THAT organic? -- the USDA's misleading food regulations. *NYU Environmental Law Journal*, 13(2), 379.
- Guthman, J. (2004). *Agrarian dreams: The paradox of organic farming in california* University of California Press.
- Laux, M. (2011). *Organic food trends profile*. Ames, Iowa: Agricultural Marketing Resource Center at Iowa State University.
- Meisterling, K., Samarasa, C., & Schweizera, V. (2009). Decisions to reduce greenhouse gases from agriculture and product transport: LCA case study of organic and conventional wheat. *Journal of Cleaner Production*, 17(2), 222.
- "National Organic Program," Final Rule with Request for Comments, 65 Federal Register (21 Dec 2000), pp. 80548-80684

- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances," Final Rule, 68 Federal Register (31 Oct 2003), pp. 61987 -61993.
- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances," Final Rule, 68 Federal Register (3 Nov 2003), pp. 62215 -62218.
- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock), " Final Rule, 70 Federal Register (21 Oct 2005), pp. 61217 – 61219.
- "National Organic Program-Revisions to Livestock Standards Based on Court Order (Harvey v. Johanns) and 2005 Amendment to the Organic Foods Production Act of 1990 (OFPA)," Final Rule, 71 Federal Register (10 Nov 2005), pp. 32803 -32807.
- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops and Processing)," Final Rule, 71 Federal Register (11 Sept 2006), pp. 53299 -53303.
- "National Organic Program-Submission of Petitions of Substances for Inclusion on or Removal From the National List of Substances Allowed and Prohibited in Organic Production and Handling," Notice of Guidelines on Procedures for Submitting National List Petitions, 72 Federal Register (18 Jan 2007), pp. 2167 -2170.
- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Processing)," Interim final rule with requests for comments, 72 Federal Register (27 June 2007), pp. 35137 -35141.
- "National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crop and Livestock)," Final Rule, 72 Federal Register (10 Dec 2007), pp.

69569 -69572.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Final Rule, 72 Federal Register (12 Dec 2007), pp. 70479 – 70486.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Final Rule, 73 Federal Register (18 Sept 2008), pp. 54057 – 54059.

"National Organic Program; Access to Pasture (Livestock)," Final Rule with Request for Comments, 75 Federal Register (17 Feb 2010), pp. 7153 -7195.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops)," Final Rule, 75 Federal Register (6 July 2010), pp. 38693 -38696.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Interim Rule with Request for Comments, 75 Federal Register (24 Aug 2010), pp. 51919 -51924.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops and Processing)," Final Rule, 75 Federal Register (13 Dec 2010), pp. 77521 -77524.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Final Rule, 76 Federal Register (14 March 2011), pp. 13501 – 13504.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops and Processing)," Final Rule, 77 Federal Register (14 Feb 2012), pp. 8089 -8092.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Final Rule, 77 Federal Register (15 May 2012), pp. 28472 – 28476.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops, Livestock and Processing)," Final Rule, 77 Federal Register (2 Aug 2012), pp. 45903 –45907.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Livestock)," Final Rule, 77 Federal Register (19 Sept 2012), pp. 57985 – 57990.

"National Organic Program; Periodic Residue Testing," Final Rule, 77 Federal Register (9 Nov 2012), pp. 67239 -67251.

"National Organic Program; Amendment to the National List of Allowed and Prohibited Substances (Crops and Processing)," Final Rule, 78 Federal Register (28 May 2013), pp. 31815 -31821.

North Carolina Administrative Code, Title 2, Chapter 09L, Sections .0101 - .2203.

North Carolina Administrative Code, Title 2, Chapter 48B, Sections .0102 - .0121.

North Carolina General Statutes, Chapter 106, Sections 284.30 – 665.

Organic Food Productions Act, 7 U.S.C.A. §§6508–6517.

Organic Food Productions Act Provisions, 7 C.F.R. § 205 (2001).

Organic Food Productions Act Provisions, 7 C.F.R. § 205 (2013).

Pesticide Registration Improvement Act of 2003, 7 U.S.C. § 136.

Pesticide Registration Improvement Act of 2007, 7 U.S.C. § 136.

Pesticide Registration Improvement Act of 2012, 7 U.S.C. § 136.

"Pesticides; Data Requirements for Conventional Chemicals," Final Rule, 72 Federal Register (26 Oct 2010), pp. 60934 -60988

Rules and regulations: Agricultural marketing service - national organic program, sunset review. (2007). *Federal Register*, 72(199), 58469.

U.S. Environmental Protection Agency. *Animal feeding operations archived publications* (2012). Washington, DC. Retrieved April/18, 2014, from http://cfpub.epa.gov/npdes/docs.cfm?view=archivedprog&program_id=7&sort=document_type_name

U.S. Environmental Protection Agency. *CAFO rule history*. (2014). Retrieved April/18, 2014, from <http://cfpub.epa.gov/npdes/afo/aforule.cfm>

U.S. Environmental Protection Agency. *Concentrated animal feeding operations final rule making fact sheet* (2008). Washington, DC: EPA Office of Wastewater Management. Retrieved April/18, 2014, from http://www.epa.gov/npdes/pubs/cafo_final_rule2008_fs.pdf

U.S. Environmental Protection Agency. *NPDES permit regulation and effluent limitations guidelines for concentrated animal feeding operations* (2003). Washington, DC; EPA Office of Water. Retrieved April/18, 2014, from http://www.epa.gov/npdes/pubs/cafo_short_factsheet.pdf

U.S. Environmental Protection Agency. *Programs and Regulatory Activities related to Animal feeding operations*. (2002). Fairfax, VA: Tetra Tech, Inc. Retrieved April/18, 2014, from <http://www.epa.gov/npdes/pubs/region4.pdf>

Appendix A: Perceptions of Organic Survey

Please answer these questions about the USDA organic certification requirements using only prior knowledge. The terms “conventional” and “non-organic” will be used interchangeably to describe crops and livestock that were produced under the regulations set by the USDA and the state department of agriculture. The term “organic” will be used to describe crops and livestock that were produced under the rules set by USDA’s organic certification.

1. Please select any farming practices you think are **required** for USDA organic certification [participants were randomly given 12 of the following statements]:
 - Raise pigs and poultry on pasture
 - Provide pigs and poultry access to outdoors
 - Provide livestock with organic feed
 - Allow access to pasture for all ruminant livestock during grazing season
 - Provide habitat for pollinators, insect predators, birds, and bats
 - Restore and/or protect natural areas
 - Control invasive species, especially those that threaten natural areas
 - Use wildlife-friendly practices to manage predation
 - Introduce beneficial organisms
 - Graze animals on rotation
 - Till minimally and limit the length of time soil remains bare
 - Ensure that pasture of a sufficient quality and quantity is available to be grazed throughout the grazing season
 - Ensure that ruminants are provided with an average of at least 30 percent of their dry matter intake from grazing throughout the grazing season.
 - Minimize erosion
 - Protect natural wetlands and riparian areas
 - Select diversity of forage varieties that are best adapted to your region to optimize the capture of solar energy
 - Use integrated pest management
 - Plant resistant and tolerant crop varieties to control plant disease and insect pests
 - Manage pasture to provide sufficient quality and quantity for the animals to graze throughout the grazing season.
 - Keep a description of all feeds (including pasture) and supplements for each type and class of animal.
 - Treat livestock with organic health care, which focuses on preventing illness
 - Accommodate the health and natural behavior of the animals in their living spaces
 - Provide ruminant livestock with access to pasture during the grazing season—at least 120 days of the year
 - Choose livestock species that are suited to the site-specific conditions of the farm and with natural resistance to prevalent diseases and parasites

- Manage manure in such a way that it doesn't contaminate crops, soil, or water and optimizes recycling of nutrients
- Follow specific handling procedures for handling manure
- Be inspected by USDA
- Be inspected by a certifier accredited by USDA
- Slaughter/process poultry at USDA-inspected facilities
- Slaughter/process beef, hogs, sheep, and goats at USDA-inspected facilities
- Provide appropriate, clean, dry bedding in livestock living conditions
- Maintain or improve the physical, chemical, and biological condition of the soil and minimize erosion
- Adopt specified soil improvement techniques like green manures, animal manures, compost
- For compost, ensure a certain carbon to nitrogen ratio and a specific temperature range
- Use organic seeds unless not commercially available.
- Rotate crops to maintain or build soil organic matter, control pests, manage/conserves nutrients, and protect against erosion
- Have no agricultural pesticides or polluting chemicals in irrigation water
- Store organic crops separately from conventional crops

2. Please select any farming practices you think are **prohibited** for USDA organic certification [participants were randomly given 12 of the following statements]:

- Continuous confinement of livestock
- Temporary confinement of livestock
- All synthetic or artificial commercial fertilizers
- All bio-solids (municipal waste and sewage sludge)
- All industrial byproducts
- All synthetic insecticides, fungicides, and miticides
- All heavy-metal herbicides and pesticides
- All soap-based herbicides
- All Micronutrient-based herbicides
- All synthetic wetting agents
- All nicotine sulfate and other tobacco products
- Livestock bred from conventional sources
- Animals that used to provide conventional dairy products can provide organic products after a year of organic management
- Artificial insemination
- Use of hormones to synchronize estrous cycles for breeding
- Antibiotics
- Genetically modified probiotics
- Synthetic growth or breeding hormones

- All conventional veterinary medications
- All parasitides
- Physical alterations (ie. For identification, prevent injury from fighting, improve product quality/marketability, for livestock health)
- All synthetic deworming agents
- Synthetic insecticidal ear tags
- Treated wood in organic production facilities when transitioning from conventional
- Synthetic vitamins and minerals in pig feed
- Mammal and poultry slaughter byproducts in pig feed
- Genetically modified vaccines
- Manures from conventional systems (i.e. livestock grown in confinement and fed genetically engineered foods) in the soil
- Manures with excessive levels of pesticides, heavy metals, or other contaminants, usually from industrial-scale feedlots
- Application of raw, non-composted livestock manure to food crops until after it's incorporated into the soil for at least a specified number of days
- Fertilizers
- Genetically engineered seeds
- Chlorine materials for disinfecting/sanitizing food contact surfaces
- Use lumber treated with arsenate or other prohibited materials for new installations or replacement purposes in contact with soil/livestock
- Mass trapping of insect pests
- Release of beneficial insects to control plant disease and insect pests
- For pest management, can use mechanical/physical practices (i.e. non-synthetic or natural materials) then biologicals/botanicals or synthetic substances in the National List if systems-based prevention doesn't work

3. How many synthetic substances do you think are **allowed** in the production of USDA certified organic **crops** according to the National List of Allowed and Prohibited Substances (multiple choice question in which participants must choose one answer)?

0, 1-19, 20-39, 40-59, 60-79, 80-99, 100+, or other

4. How many synthetic substances do you think are **allowed** in the production of USDA certified organic **livestock** according to the National List of Allowed and Prohibited Substances (multiple choice question in which participants must choose one answer)?

0, 1-19, 20-39, 40-59, 60-79, 80-99, 100+, or other

5. The National List of synthetic substances allowed for use in organic crop and livestock production also includes the chemicals on EPA List 4, called "Inerts of Minimal Concern." How many chemicals do you think are in this list that are not already listed in

USDA's National List (multiple choice question in which participants must choose one answer)?

0, 1-19, 20-39, 40-59, 60-79, 80-99, 100+, or other

6. How many synthetic nonorganic ingredients do you think are allowed in a product labeled as "organic" (multiple choice question in which participants must choose one answer)?

0, 1-19, 20-39, 40-59, 60-79, 80-99, 100+, or other

7. How many synthetic nonorganic ingredients do you think are allowed in a product labeled as "organic" or "made with organic ingredients" (multiple choice question in which participants must choose one answer)?

0, 1-19, 20-39, 40-59, 60-79, 80-99, 100+, or other

Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you ***Strongly Disagree***, ***Mildly Disagree***, are ***Unsure***, ***Mildly Agree***, or ***Strongly Agree*** with it.

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will ensure that we do NOT make the earth unlivable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

We will now ask you for some demographics information. With these questions we are primarily concerned with collecting demographic information at the group level to compare with national averages and determine how representative our group's responses are.

1. What state are you from?
2. What state do you currently live in?
3. Which of the following best describes your age? (Dropdown menu)

4. Do you live in a primarily urban, suburban, or rural area?
 - a. Urban
 - b. Suburban
 - c. Rural
 - d. Other (please describe):
5. Which of the following best describes your level of education?
 - a. Some high school
 - b. High school graduate or equivalent
 - c. Trade or vocational degree
 - d. Some college/university
 - e. Associates degree
 - f. Bachelors degree
 - g. Graduate or professional degree
6. Which of the following best describes your employment status?
 - a. Employed full time
 - b. Employed part time
 - c. Not employed but looking for work
 - d. Not employed and not looking for work
 - e. Retired
 - f. Student
 - g. Homemaker
7. Which of the following includes your household income (in \$US before tax)?
 - a. Less than \$20,000
 - b. \$20,000-\$29,000
 - c. \$30,000-\$39,000
 - d. \$40,000-\$49,000
 - e. \$50,000-\$69,000
 - f. \$70,000-\$99,999
 - g. \$100,000 or more
8. Which of the following best describes your orientation on:
 - a. Economic issues: extremely liberal, very liberal, somewhat liberal, neutral, somewhat conservative, very conservative, extremely conservative
 - b. Social issues: extremely liberal, very liberal, somewhat liberal, neutral, somewhat conservative, very conservative, extremely conservative
9. Which of the following best describes your political affiliation
 - a. Democrat
 - b. Independent
 - c. Republican
 - d. Libertarian
 - e. Other

Appendix B: Farmer Interviews

Introductory Questions

In which state is your farm located?

Name of Farm:

When was the farm established?

What do you produce?

How many employees do you have?

What are your annual costs?

What are your annual revenues?

What are your annual net profits?

What training and/or education do you have?

What percent of the food you produce is certified organic by the USDA?

How have the crops/livestock you produce changed since the farm was first established?

How does your farm's soil health compare to soil at other farms that you know of?

How does the climate in your area compare to the climate of other farms?

Other things that might affect profitability

To farmers with only organic products:

1. From the following, choose the top 5 factors you prioritize when you design a business plan, and rank them with number 1 as what you consider first.
 - a. Fixed costs
 - b. Variable costs
 - c. Market prices
 - d. Competitors
 - e. Consumer demands
 - f. Financial sustainability
 - g. Environmental sustainability
 - h. Short term profits
 - i. Long term profits
 - j. Other: please describe
2. In what year did your products become certified organic?
3. From the following, choose the top 5 factors that motivated you to produce only organic certified food and rank them with number 1 as the factor that motivated you the most:
 - a. Environmental benefits
 - b. Consumer demands
 - c. Ethical/moral duty
 - d. Tradition
 - e. Lower costs
 - f. Financial sustainability
 - g. Environmental sustainability
 - h. Ease
 - i. Financial incentives
 - j. Higher revenues
 - k. Higher profits
 - l. Other: please describe

4. Rank these factors by how much you thought they could be problematic when you decided to produce all your foods organically (Number 1 is the factor that you thought would be the most problematic and Number 6 is the factor that you thought would be the least problematic):
 - a. Having to make structural changes
 - b. Potentially higher costs
 - c. Going against tradition
 - d. Lower revenues
 - e. Lower profits
 - f. Other: please describe
5. Which of those factors did end up being a problem?
 - a. Having to make structural changes
 - b. Potentially higher costs
 - c. Going against tradition
 - d. Lower revenues
 - e. Lower profits
 - f. Other: please describe
6. For your organic crops, what practices do you employ?
 - a. Control invasive species, especially those that threaten natural areas
 - b. Select diverse forage varieties that are best adapted to your region to optimize the capture of solar energy
 - c. Plant resistant and tolerant crop varieties to control plant disease and insect pests
 - d. Use green manure, animal manure, or compost to improve soil
 - e. Minimize soil erosion
 - f. Use organic seeds
 - g. Maintain/improve the physical, chemical, and biological condition of the soil
 - h. Rotate crops
7. For your organic livestock, what practices do you employ?
 - a. Raise pigs and poultry on pasture
 - b. Slaughter/process poultry at USDA-inspected facilities
 - c. Breed them from only organically produced animals
 - d. Use no physical alterations (ie. For identification, prevent injury from fighting, improve product quality/marketability, for livestock health)
 - e. Manage pasture to provide sufficient quality and quantity for animals to graze throughout grazing season
 - f. Slaughter/process beef, hogs, sheep, and goats at USDA-inspected facilities
 - g. Provide appropriate, clean, and dry bedding
 - h. Manage manure in such a way that it doesn't contaminate crops, soil, or water, and optimizes recycling of nutrients
8. If you use pesticides and/or fertilizer, which ones?
9. Do you know the requirements you have to meet for organic certification, or can you easily find them?
 - a. Yes
 - b. No
 - c. Sometimes
10. What aspects of organic production are more expensive than conventional production?

11. What cost savings result from organic production but not conventional production?
12. How does organic production, as opposed to conventional production, affect your revenues?
 - a. Increases
 - b. Decreases
 - c. Stays the same
 - d. Fluctuates between increase and decrease
13. How many times in a year does an inspector from a USDA-accredited certifier come?
14. How do days that inspectors come differ from typical days?
15. Do you know the federal and state regulations you have to meet to be a certified farmer, or can you easily find them?
 - a. Yes
 - b. No
 - c. Sometimes
16. How many times in a year do federal and state inspectors come?
17. How do days that those inspectors come differ from typical days?
18. How has adhering to organic certification requirements changed since 1990?
 - a. Much easier
 - b. A little easier
 - c. Stayed the same
 - d. A little harder
 - e. Much harder
19. What got easier or harder? What stayed the same?
20. Has the USDA ever told you that you can use a pesticide/ingredient/chemical only up to a certain time or for a certain use? If so, please describe the experience.
21. Has the USDA ever extended or eliminated the deadline by which you must stop using a certain pesticide/ingredient/chemical? If so, for which ones?
22. How has adhering to federal and state regulations for conventional food production changed since 1990?
 - a. Much easier
 - b. A little easier
 - c. Stayed the same
 - d. A little harder
 - e. Much harder
23. What got easier/harder? What stayed the same?
24. Do you plan to exclusively produce organic food? Why or why not?

To farmers with only conventional products:

1. From the following, choose the top 5 factors you prioritize when you design a business plan, and rank them with number 1 as what you consider first.
 - a. Fixed costs
 - b. Variable costs
 - c. Market prices
 - d. Competitors
 - e. Consumer demands

- f. Financial sustainability
 - g. Environmental sustainability
 - h. Short term profits
 - i. Long term profits
 - j. Other: please describe
2. Have you considered switching to organic?
 3. If yes, from the following, choose the top 5 factors that motivated you to do so and rank them with number 1 as the factor that motivated you the most:
 - a. Environmental benefits
 - b. Consumer demands
 - c. Ethical/moral duty
 - d. Tradition
 - e. Lower costs
 - f. Financial sustainability
 - g. Environmental sustainability
 - h. Ease
 - i. Financial incentives
 - j. Higher revenues
 - k. Higher profits
 - l. Other: please describe
 4. Rank these factors by how much you think they would be a problem if you did produce some foods organically (Number 1 is the factor that would be the most problematic and Number 6 is the factor that would be the least problematic):
 - a. Having to make structural changes
 - b. Potentially higher costs
 - c. Going against tradition
 - d. Lower revenues
 - e. Lower profits
 - f. Other: please describe
 5. For your crops, what practices do you employ?
 - a. Control invasive species, especially those that threaten natural areas
 - b. Select diverse forage varieties that are best adapted to your region to optimize the capture of solar energy
 - c. Plant resistant and tolerant crop varieties to control plant disease and insect pests
 - d. Use green manure, animal manure, or compost to improve soil
 - e. Minimize soil erosion
 - f. Use organic seeds
 - g. Maintain/improve the physical, chemical, and biological condition of the soil
 - h. Rotate crops
 6. For your livestock, what practices do you employ?
 - a. Raise pigs and poultry on pasture
 - b. Slaughter/process poultry at USDA-inspected facilities
 - c. Breed them from only organically produced animals
 - d. Use no physical alterations (ie. For identification, prevent injury from fighting, improve product quality/marketability, for livestock health)

- e. Manage pasture to provide sufficient quality and quantity for animals to graze throughout grazing season
 - f. Slaughter/process beef, hogs, sheep, and goats at USDA-inspected facilities
 - g. Appropriate, clean, dry bedding
 - h. Manage manure in such a way that it doesn't contaminate crops, soil, or water, and optimizes recycling of nutrients
7. If you use pesticides and/or fertilizer, which ones?
 8. Do you know the federal and state regulations you have to meet to be a certified farmer, or can you easily find them?
 - a. Yes
 - b. No
 - c. Sometimes
 9. What aspects of conventional production are more expensive than organic production?
 10. What cost savings result from conventional production but not organic production?
 11. How does conventional production, as opposed to organic production, affect your revenues?
 - a. Increases
 - b. Decreases
 - c. Stays the same
 - d. Fluctuates between increase and decrease
 12. How many times in a year do federal or state inspectors come?
 13. How do days that inspectors come differ from typical days?
 14. How has adhering to federal and state regulations for conventional food production changed since 1990?
 - a. Much easier
 - b. A little easier
 - c. Stayed the same
 - d. A little harder
 - e. Much harder
 15. What got easier/harder? What stayed the same?
 16. Do you plan to exclusively produce conventional food? Why or why not?

To farmers with both organic and conventional products:

1. From the following, choose the top 5 factors you prioritize when you design a business plan, and rank them with number 1 as what you consider first.
 - a. Fixed costs
 - b. Variable costs
 - c. Market prices
 - d. Competitors
 - e. Consumer demands
 - f. Financial sustainability
 - g. Environmental sustainability
 - h. Short term profits

- i. Long term profits
 - j. Other: please describe
2. Which products are organic and which are not?
3. Do you store organic products separately from conventional products?
 - a. Yes
 - b. No
 - c. Sometimes
4. When did you choose to produce those foods organically?
5. From the following, choose the top 5 factors that motivated you to produce some organic certified food and rank them with number 1 as the factor that motivated you the most:
 - a. Environmental benefits
 - b. Consumer demands
 - c. Ethical/moral duty
 - d. Tradition
 - e. Lower costs
 - f. Financial sustainability
 - g. Environmental sustainability
 - h. Ease
 - i. Financial incentives
 - j. Higher revenues
 - k. Higher profits
 - l. Other: please describe
6. Rank these factors by how much you thought they could be problematic when you decided to produce those foods organically (Number 1 is the factor that you thought would be the most problematic and Number 6 is the factor that you thought would be the least problematic):
 - a. Having to make structural changes
 - b. Potentially higher costs
 - c. Going against tradition
 - d. Lower revenues
 - e. Lower profits
 - f. Other: please describe
7. Which of those factors did end up being a problem?
 - a. Having to make structural changes
 - b. Potentially higher costs
 - c. Going against tradition
 - d. Lower revenues
 - e. Lower profits
 - f. Other: please describe
8. For your organic crops, what practices do you employ?
 - a. Control invasive species, especially those that threaten natural areas
 - b. Select diverse forage varieties that are best adapted to your region to optimize the capture of solar energy
 - c. Plant resistant and tolerant crop varieties to control plant disease and insect pests
 - d. Use green manure, animal manure, or compost to improve soil
 - e. Minimize soil erosion

- f. Use organic seeds
 - g. Maintain/improve the physical, chemical, and biological condition of the soil
 - h. Rotate crops
9. For your organic livestock, what practices do you employ?
- a. Raise pigs and poultry on pasture
 - b. Slaughter/process poultry at USDA-inspected facilities
 - c. Breed them from only organically produced animals
 - d. Use no physical alterations (ie. For identification, prevent injury from fighting, improve product quality/marketability, for livestock health)
 - e. Manage pasture to provide sufficient quality and quantity for animals to graze throughout grazing season
 - f. Slaughter/process beef, hogs, sheep, and goats at USDA-inspected facilities
 - g. Appropriate, clean, dry bedding
 - h. Manage manure in such a way that it doesn't contaminate crops, soil, or water, and optimizes recycling of nutrients
10. For your non-organic crops, what practices do you employ?
- a. Control invasive species, especially those that threaten natural areas
 - b. Select diverse forage varieties that are best adapted to your region to optimize the capture of solar energy
 - c. Plant resistant and tolerant crop varieties to control plant disease and insect pests
 - d. Use green manure, animal manure, or compost to improve soil
 - e. Minimize soil erosion
 - f. Use organic seeds
 - g. Maintain/improve the physical, chemical, and biological condition of the soil
 - h. Rotate crops
11. For your non-organic livestock, what practices do you employ?
- a. Raise pigs and poultry on pasture
 - b. Slaughter/process poultry at USDA-inspected facilities
 - c. Breed them from only organically produced animals
 - d. Use no physical alterations (ie. For identification, prevent injury from fighting, improve product quality/marketability, for livestock health)
 - e. Manage pasture to provide sufficient quality and quantity for animals to graze throughout grazing season
 - f. Slaughter/process beef, hogs, sheep, and goats at USDA-inspected facilities
 - g. Appropriate, clean, dry bedding
 - h. Manage manure in such a way that it doesn't contaminate crops, soil, or water, and optimizes recycling of nutrients
12. If you use pesticides and/or fertilizer, which ones?
13. Do you know the requirements you have to meet for organic certification, or can you easily find them?
- a. Yes
 - b. No
 - c. Sometimes
14. What aspects of organic production are more expensive than conventional production?
15. What cost savings result from organic production but not conventional production?

16. How does organic production, as opposed to conventional production, affect your revenues?
 - a. Increases
 - b. Decreases
 - c. Stays the same
 - d. Fluctuates between increase and decrease
 17. What aspects of conventional production are more expensive than organic production?
 18. What cost savings result from conventional production but not organic production?
 19. How does conventional production, as opposed to organic production, affect your revenues?
 - a. Increases
 - b. Decreases
 - c. Stays the same
 - d. Fluctuates between increase and decrease
 20. How many times in a year does an inspector from a USDA-accredited certifier come?
 21. How do days that inspectors come differ from typical days?
 22. How has adhering to organic certification requirements changed since 1990?
 - a. Much easier
 - b. A little easier
 - c. Stayed the same
 - d. A little harder
 - e. Much harder
 23. What got easier/harder? What stayed the same?
 24. Has the USDA ever told you that you can use a pesticide/ingredient/chemical only up to a certain time or for a certain use? If so, please describe the experience.
 25. Has the USDA ever extended or eliminated the deadline by which you must stop using a certain pesticide/ingredient/chemical? If so, for which ones?
 26. Do you know the federal and state regulations you have to meet to be a certified farmer, or can you easily find them?
 - a. Yes
 - b. No
 - c. Sometimes
 27. How many times in a year do other federal or state inspectors come?
 28. How do days that these inspectors come differ from typical days?
 29. How has adhering to federal and state regulations for conventional food production changed since 1990?
 - a. Much easier
 - b. A little easier
 - c. Stayed the same
 - d. A little harder
 - e. Much harder
 30. What got easier/harder? What stayed the same?
 31. How did the organic certification requirements and conventional regulations differ in 1990?
 32. How do they differ now?
- Do you plan to change your mix of organic and conventional foods? Why or why not?

Thank you for your participation!

If you have any reactions, comments, suggestions, hated some things, loved some things, or have spotted any problems with the interview, then please provide them below. We really do value your feedback!

Appendix C: Detailed Changes in Requirements

Table 1: Changes in Allowed and Prohibited Chemicals under Organic Certification

<i>Date</i>	<i>Requirements and Prohibitions Established</i>
1990	<ul style="list-style-type: none"> • Cannot use fertilizers with synthetic ingredients or commercially blended fertilizers with materials prohibited under this Chapter of the Code of Federal Regulations • Cannot add synthetic ingredients during processing or postharvest handling • Cannot add ingredient known to have over certain levels of nitrates, heavy metals, or toxic residues • Cannot add sulfites, nitrates, or nitrites • Cannot add non-organic ingredients <p>(Organic Food Products Act, 1990)</p>
12/21/2000	<p>The National Organic Program becomes the jurisdiction of the Agricultural Marketing Service (AMS), which is part of USDA</p> <ul style="list-style-type: none"> • Establishes the National List of Allowed and Prohibited Substances: The list of allowed substances can include substances only if they are not harmful to health and they are necessary to produce. They also must contain only active synthetic ingredients included in a set of categories and contain synthetic inert ingredients not classified by the EPA as inerts of toxicological concern, and is used in handling, is non-synthetic, but is not organically produced • Establishes an accreditation program for state officials and private entities that want to become certifying agents • Establishes requirements for organic product labeling: products labeled as “organic,” must have at least 95% organic agricultural ingredients, products labeled as “made with organic ingredients” must have between 70% and 95% organic agricultural ingredients. <p>(National Organic Program, 2000)</p>
2000	<ul style="list-style-type: none"> • Cannot add sulfites (except to produce wine), nitrates, or nitrites (National Organic Program, 2000)
10/31/2003	<p>Amendments to National List:</p> <ul style="list-style-type: none"> • Clarifies that farmers can use synthetic substances but in such a way that they do not contaminate crops, soil, or water and only when provisions of 205.206(a) - (d) are insufficient to control pests • Adds copper sulfate as an algicide (once per field over 2 years), ozone gas as an irrigation system cleaner only, peracetic acid for disinfecting equipment, seed, and asexually propagated planting material

	<ul style="list-style-type: none"> • Adds copper sulfate to control tadpole shrimp in rice production and once per field in 2 years • Adds peracetic acid to control fir blight bacteria (National Organic Program, 2003)
11/3/2003	Amendments to National List: <ul style="list-style-type: none"> • Adds animal enzymes • Adds glucono delta-lactone • Adds cellulose (National Organic Program, 2003)
10/21/2005	Amendments to National List: <ul style="list-style-type: none"> • Adds DL-methionine, DL-Methionine-hydroxyl analog, and DL-Methionine-hydroxyl analog calcium for use In organic poultry production until Oct 1, 2008 so that the organic poultry industry can research non-synthetic alternatives until then (National Organic Program, 2005)
2005	<ul style="list-style-type: none"> • Cannot add synthetic ingredients not appearing on the National List during processing and postharvest handling • National List of exemptions for prohibited substances can include substances only if they are not harmful to health and they are necessary to produce. They also must contain only active synthetic ingredients included in a set of categories OR contain synthetic inert ingredients not classified by the EPA as inerts of toxicological concern (National Organic Program, 2005)
9/11/2006	Amendments to National list: <ul style="list-style-type: none"> • Adds glycerine oleate for use until Dec 31, 2006 • Adds hydrogen chloride (for delinting cotton seed) and ferric phosphate. • Adds egg white lysozyme • Adds L-Malic acid • Adds microorganisms • Adds activated charcoal (only from vegetative sources and only as filtering aid) • Adds cyclohexylamine, diethylaminoethanol, and octadecylamine only as boiler water additive for packaging sterilization • Adds peracetic acid and peroxyacetic acid for use in water or sanitizer used to on food contact surfaces • Adds sodium acid pyrophosphate as a leavening agent • Adds tetrasodium pyrophosphate (only in meat analog products) (National Organic Program, 2006)

6/27/2007	<p>Interim Final Rule with request for comments - Amendments to National list:</p> <p>*Nonorganic products allowed as ingredients:</p> <ul style="list-style-type: none"> • <u>color ingredients</u> like annatto extract color, beet juice extract color, beta-carotene extract color from carrots, black currant juice color, blueberry juice color, carrot juice color, cherry juice color, chokeberry-aronia juice color, elderberry juice color, grape juice color, grape skin extract color, paprika color - dried powder and vegetable oil extract, pumpkin juice color, purple potato juice color, red cabbage extract color, red radish extract color, saffron extract color, turmeric extract color. • <u>Ingredients/processing aids from agricultural products:</u> casings from processed intestines, celery powder, chia, dillweed oil, fish oil, fructooligosaccharides, galangal, gelatin, hops, inulin (oligofructose enriched), konjac flour, lemongrass, orange shellac (unbleached), pepper (chipotle chile), rice starch (unmodified; for use until 2 years from publication date), sweet potato starch (bean thread production only), Turkish bay leaves, wakame seaweed, whey protein concentrate (National Organic Program, 2007)
12/10/2007	<p>Amendments to National List:</p> <ul style="list-style-type: none"> • Adds Sucrose octanoate esters for crop and livestock production (National Organic Program, 2007)
12/12/2007	<ul style="list-style-type: none"> • Adds The Animal Medicinal Drug Use Clarification Act of 1994 (excipients = ingredients in livestock medications that don't exert therapeutic/diagnostic effects at intended dosage, although they may improve product delivery; ex. Fillers, preservatives, coloring agents, flavors) <p>Amendments to National List</p> <ul style="list-style-type: none"> • Adds Atropine only by veterinarian, in compliance with AMDUCA, and a meat withdrawal period of over 56 days after administering to livestock intended for slaughter, and milk discard period of over 12 days after administering for dairy animals • Adds Butorphanol only by veterinarian, in compliance with AMDUCA, and a meat withdrawal period of over 42 days after administering to livestock intended for slaughter, and milk discard period of over 8 days after administering for dairy animals • Adds both flunixin and furosemide with withdrawal periods of at least twice that required by FDA • Adds magnesium hydroxide - only by veterinarian, in compliance with AMDUCA Adds peroxyacetic/peracetic acid for sanitizing equipment • Poloxalene for emergency treatment of bloat • Adds tolazoline only to reverse effects of sedation and analgesia from xylazine - vet, AMDUCA, meat withdrawal period of 8 days, milk discard period of 4 days • Adds xylazine (in emergencies) - only by veterinarian, in compliance with AMDUCA, and a meat withdrawal period of 8 days, milk discard period of 4 days. • Adds Excipients, only for use in the manufacture of drugs used to treat organic livestock when the excipient is: Identified by the FDA as Generally

	Recognized as Safe, approved by FDA as a food additive; or Included in the FDA review and approval of a New Animal Drug Application or New Drug Application." (National Organic Program, 2007)
9/18/2008	Amendments to National List: <ul style="list-style-type: none"> • Extends use of DL-Methionine, DL-Methionine-hydroxyl analog, and DL-Methionine-hydroxyl analog calcium for use in organic poultry production until Oct 11, 2010 ((National Organic Program, 2008)
7/6/2010	Amendments to National List: <ul style="list-style-type: none"> • Adds expiration date for tetracycline (use only until October 21, 2012) • Adds sulfurous acid for on-farm generation of substance utilizing 99% purity elemental sulfur (National Organic Program, 2010)
12/13/2010	Amendments to National List: <ul style="list-style-type: none"> • Adds sodium carbonate peroxyhydrate (only on approved food uses identified on the product label) • Adds aqueous potassium silicate (sourced from naturally occurring sand) • Removes expired exemption for glycerine oleate to use only until Dec 31, 2006. • Adds gellan gum (high-acyl form only) to permissible nonorganic ingredients for products labeled “organic” or “made with organic” • Adds fortified cooking wines (marsala, sherry) and tragacanth gum, both to permissible nonorganic ingredients for foods labeled as “organic” (National Organic Program, 2010)
3/14/2011	Amendments to National List: <ul style="list-style-type: none"> • Extends DL—Methionine, DL—Methionine hydroxyl analog, and DL—Methionine hydroxyl analog calcium for use only in organic poultry production until October 1, 2012 • Adds at the following maximum levels of synthetic methionine per ton of feed: Laying chickens—4 pounds; broiler chickens—5 pounds; turkeys and all other poultry—6 pounds (National Organic Program, 2011)
2/14/2012	Amendments to National List: <ul style="list-style-type: none"> • Adds microcrystalline cheesewax for log grown mushroom production (must be made w/o either ethylene propylene co-polymer or synthetic colors). • Removes Lecithin--bleached and adds acidified sodium chlorite for secondary direct antimicrobial food treatment and indirect food contact surface sanitizing, acidified with citric acid only - as nonorganic substance allowed as ingredient for food labeled “organic” or “made with organic” • Adds orange pulp, dried and seaweed, Pacific kombu as nonorganic substances allowed as ingredients for food labeled as organic (National Organic Program, 2012)
5/15/2012	Amendments to National List: <ul style="list-style-type: none"> • Adds fenbendazole (only by veterinarian) and moxidectin (to control internal pesticides only) as parasiticides. They are prohibited in slaughter but allowed in emergency treatment for dairy and breeder stock when organic system plan-approved preventive management does not prevent infestation • Adds ivermectin (National Organic Program, 2012)

8/2/2012	<p>Amendments to National List:</p> <ul style="list-style-type: none"> • § 205.601(i)(12) - Inserts “in apples and pears”; between the words “control” and “only,” in the current annotation and replaces expiration date of “October 21, 2012” with the new expiration date, “October 21, 2014”, after which tetracycline may not be used in organic crop production • Adds Formic acid for use as pesticide only w/in honeybee hives • Adds Attapulgate as a processing aid in handling of plant and animal oils (National Organic Program, 2012)
9/19/2012	<p>Amendments to National List:</p> <ul style="list-style-type: none"> • Removes expiration date for synthetic methionine and revises max levels allowed per ton --DL-Methionine, DL-Methionine-hydroxy analog, and DL-Methionine-hydroxy analog calcium for use only in organic poultry production at the following maximum levels of synthetic methionine per ton of feed: laying and broiler chickens—2 pounds; turkeys and all other poultry—3 pounds. (National Organic Program, 2012)
5/28/2013	<p>Amendments to National List:</p> <ul style="list-style-type: none"> • Amends paragraph (b) of section 205.605 to: Potassium hydroxide—prohibited for use in lye peeling of fruits and vegetables except when used for peeling peaches. Silicon dioxide—Permitted as a defoamer. Allowed for other uses when organic rice hulls are not commercially available For nonorganic substances allowed as ingredients for products labeled as "organic" or "made with organic" • Amends paragraph (d)(3) to: Beta-carotene extract color—derived from carrots or algae; and removes annatto extract color for nonorganic substances in products labeled organic (National Organic Program, 2013)

Table 2: Changes in Livestock Management Requirements under Organic Certification

<i>Date</i>	<i>Requirements and Prohibitions Established</i>
1900	<ul style="list-style-type: none"> • Organically produced meat cannot come in contact with non-organic meat (National Organic Program, 1990)
2/17/2010	<p>Final rule based on comments on National Organic Program's Access to Pasture:</p> <ul style="list-style-type: none"> • Adds definition of "class of animal" to be the group of livestock that shares a similar stage of life or production • Took "sod" out of definition for "crop," because sod farms may remove soil, crop, and organic matter unsustainably and there are no NOP standards or guidance currently • Includes in the definition of "dry matter demand": expected dry matter intake for a class of animal • Includes in the definition of "dry matter intake": total pounds of all feed, devoid of all moisture, consumed by a class of animals over a given period of time. • Definition of "dry lot" amended to clarify how it would be acceptable for organic ruminant livestock; by adding "little or no" in: "A fenced area that may be covered with concrete, but that has <i>little or no</i> vegetative cover -- to prevent incorrect usage of dry lots with some vegetation as pasture" • Definition of "feed lot" amended to clarify how it would be acceptable for organic ruminant livestock • Replaced "growing season" with "grazing season," because pastures that may not have sufficient grazing during growing season could sustain grazing outside of growing season • Included bees and fish in the definition of "livestock" • Add definition for "stage of life" to prevent the animal's stage of life from determining temporary inaccessibility to pasture/outdoors and prevent abuse of exceptions • Definition of organic livestock ration clarifies that any agricultural ingredients in feed additives/supplements must be handled organically • Further clarifies the paragraph about antibiotics prohibited in feed • Clarifies definition of Dry Matter Intake (DMI) and adds requirement for producers to provide sufficient quality and quantity of pasture to graze and a minimum average of 30% of their DMI from grazing to ruminants under their organic system plan (there was an exception for animals denied pasture in accordance with other sections) • Grazing season is defined as no less than 120 days in a year • Adds "Year-round" to "year-round living conditions to accommodate behavior" • Adds requirements for indoor and outdoor water access and for the description of year-round access (which includes: shade, shelter, sunlight,

	<p>exercise, fresh air suitable to species, stage of life, climate, and environment) changes the stage of production to the stage of life</p> <ul style="list-style-type: none"> • Removes the requirement for ruminants to have continuous year-round management on pasture, (ex. temp confinement is fine during rainfall to comply with water regulations) but recurrent/frequent temporary confinement is not compliant • Adds that bedding must be organic and gives specific examples • Adds that yards, feeding pads, and feedlots may provide ruminants with outdoor access during non-grazing season and supplemental feeding during grazing season; also explains they must be well-drained and kept in good condition and adds that they must prevent runoff of waste • Adds exceptions for temporary denial of outdoor access/pasture to all types of animals and takes into account more circumstances under which animals might be temporarily confined/provided shelter • Changed terminology about temporary confinement from "temporarily deny a non-ruminant animal access to the outdoors" to "provide temporary confinement and shelter for an animal" • Adds provision for preventive healthcare procedures • Adds that when sorting and shipping animals, they must be given organic feed and under organic management during their allowed confinement. • Adds that bred animals shall not be denied access to pasture during grazing season • Extended denial of pasture access from one week prior to birthing to three weeks • In "Housing of newborn cows" add "dairy" after "newborn" to clarify that it applies only to dairy ruminants • Adds provision that prohibits confinement that would prevent animal from lying down, standing up, fully extending limbs, and moving freely. • Removed hay in racks from list of required living conditions (which includes lying area, yards, shade, water, feeding equipment) for newborns because it was too prescriptive. • Requires maintenance of slaughter stock finishing on pasture each day of the finishing period that corresponds with the grazing season in that location • Adds that ruminant slaughter stock, typically grain finished, shall be maintained on pasture for each day that the finishing period corresponds with the grazing season for the geographical location and allows for use of yards, feeding pads, or feedlots to provide finish feeding rations; also adds that these must be large enough so they are not crowded nor competing for food • For resource management of outdoor access, including fencing/buffer zones, adds a requirement for managing manure so that it does not contaminate soil and water and removes the requirement of building a fence (which could be costly), but requires some kind of measure • Removes redundant and irrelevant portions of the description of pasture management as a crop, adds a sentence to convey that land used for annual crop production that will be used to graze livestock is subject to provisions
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	<p>205.202 - 205.206, which are about land, soil fertility and crop nutrient management, seeds and planting stock, crop rotation, and pest, weed, and disease management. ,</p> <ul style="list-style-type: none"> • Adds a sentence on irrigation to require its use as needed and when available, to promote pasture growth • Rearranges but basically requires continuous pasture access for ruminants with pasture that provides at least 30% dry matter intake, minimizes the spread of disease/parasites, and refrains from putting soil/water quality at risk • Adds a reminder to producers/certifying agents that any changes in the comprehensive pasture plan that may affect operation's compliance with OFPA and NOP must be cleared by the certifying agent. • Replaced the requirement to describe pasture crops and haymaking system with a requirement to describe type of pasture to specifically acknowledge feed requirements • Removes specific cultural practices and instead allows producers/certifying agents to determine what practices will ensure sufficient pasture and level of detail • Adds a new paragraph in the description of the regional grazing season to require a pasture plan that includes a description of grazing season • Eliminated the crop rotation requirement for maintenance of soil fertility because pasture/rangeland isn't typically subjected to crop rotation and removed the requirement for a crop rotation system within the pasture plan to prevent duplication in reporting requirements • Add requirement for erosion control that organic livestock producers manage outdoor access areas, including pastures, in a manner that doesn't put soil/water quality at risk and removed reference to soil/water quality in this paragraph to prevent duplication in reporting (National Organic Program, 2010).
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Table 3: Changes in the Pesticide Registration Process for Conventional Agriculture

<i>Date</i>	<i>Changes Made by the Federal Government</i>
1947	Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): The first primary federal law that regulates the pesticide approval process (Federal Insecticide, Fungicide, and Rodenticide Act of 1947)
1972	Amendment to FIFRA by the Federal Environmental Pesticide Control Act (FEPCA): <ul style="list-style-type: none"> • EPA regulates pesticides to protect human health and the environment • EPA can ask the chemical manufacturer to give proof in order to strengthen the registration process • EPA can prevent the use of banned and unregistered products through enforcement • EPA can publicize the regulatory framework not in the original law (Federal Environmental Pesticide Control Act of 1972)
1996	Passage of the Food Quality Protection Act (FQPA) <ul style="list-style-type: none"> • Makes the Federal Food, Drug, and Cosmetic Act (FFDCA) stricter: it evaluates pesticide use on food crops • Includes definition of "pesticide chemical" to all active and inert ingredients (previously only included pesticides used for raw agricultural commodity) • Requires the completion of a mass reassessment of the tolerance levels for all pesticides used for food production by 2006 (over 99% done on Aug 3, 2006). • Strengthens EPA safety standards for pesticide risks, especially for infants and children • Requires EPA to assess the aggregate and cumulative impacts of pesticide exposure from our food, water and other sources • Requires more refined risk assessments that reflect reality and create an adequate safety buffer for children and infants • Creates 4 committees that will facilitate more stakeholder and public involvement in the assessment processes • Expedites the review process for registering or amending tolerance levels for reduced risk pesticides • Strengthens regulations on protecting human research subjects (prohibits research that intentionally exposes children and pregnant/nursing women to pesticides, extends ethical protections for other adults too, requires EPA to submit protocols for review, and requires establishment of Human Studies Review board as a third party for peer review) (Food Quality Protection Act of 1996)
2003	Pesticide Registration Improvement Act (PRIA) of 2003 <ul style="list-style-type: none"> • Determines the category of the pesticide, the amount of the pesticide registration fee, and decision review periods for a more predictable review process.

10/26/2007	<ul style="list-style-type: none"> EPA Updated data requirements for pesticides so that they are clearer, more transparent, and provide more accurate and sound assessment for their effects on human health and the environment (Pesticides; Data Requirements for Conventional Chemicals, 2010)
2007	Pesticide Registration Improvement Act (PRIA) of 2007
2012	Pesticide Registration Improvement Act (PRIA) of 2012 <ul style="list-style-type: none"> Reauthorized it for 5 more years so it lasts until 2017

Table 4: Changes in Livestock Management Requirements under Federal Law

<i>Date</i>	<i>Requirements from EPA</i>
3/9/1999	<ul style="list-style-type: none"> All owners and operators of animal feeding operations expected to develop and implement technically sound and economically feasible site-specific Comprehensive Nutrient Management Plans (CNMPs) (U.S. EPA 2014) Nat'l Pollutant Discharge Elimination System (NPDES) defines concentrated animal feeding operations (CAFOs) and gives them permits to develop CNMPs, requires them to minimize threat to water quality/public health, comply with the Clean Water Act, ensure that animal manure is utilized properly, and require reporting on proper implementation. (U.S. EPA 2003)
12/15/2002	Large beef cattle/veal, large chicken/turkey, swine: <ul style="list-style-type: none"> Production Area must be designed to contain all of the CAFO's manure plus the runoff from a 25-year, 24-hour rainfall event (large storms). Depth markers must be installed in liquid manure storage structures. Production areas must be inspected weekly and all water lines must be inspected daily. Any problems must be corrected as soon as possible. Dead animals must be handled properly. Land application area: Manure must be applied at rates permitted by the authority's standards, analyzed for nutrient content at least once a year, and not applied to any land within 100 feet of surface water. The soil from land application fields for phosphorus amounts must be analyzed every 5 years. The land application equipment must be inspected from time to time for leaks (U.S. EPA 2012).
2008	<ul style="list-style-type: none"> Changes the requirement for all CAFOs to apply for NPDES permits to require only CAFOs that discharge or propose to discharge to apply for permits EPA's clarification of the evaluation calls for a case-by-case determination by the CAFO owner or operator as to whether the CAFO does or will discharge from its production area or land application area The final rule also provides a voluntary no discharge certification option for CAFOs that do not discharge or propose to discharge CAFOs submit the NMPs along with their NPDES permit

	<ul style="list-style-type: none"> • Permitting authorities must review the NMPs and provide the public with an opportunity for meaningful review and comment on the plans. Permitting authorities are also required to include the terms of the NMP as enforceable elements of the permit. The final rule lays out a process for including these facility-specific provisions in both individual and general permits. • The yearly report must include: the rates at which manure will be applied, analysis of manure for nutrient content at least once a year, analysis of the soil from land application fields for phosphorus amounts every 5 years. Manure should not be applied to land within 100 feet of surface water. Land application equipment should be checked for leaks from time to time (U.S. EPA 2008)
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Table 5: Changes in Pesticide Regulations in California

<i>Date</i>	<i>Requirements made by California Department of Food and Agriculture</i>
2000	<ul style="list-style-type: none"> • Listed pesticide products that are exempt from registration (CCR, Section 6147)
2004	<ul style="list-style-type: none"> • Added a fee for the registration of new pesticides and amendments to pesticide product labels (CCR Sections 6148, 6148.5) as well as an annual renewal fee (CCR Section 6216). • In Chapter 4 of Division 6, on Environmental Protection, CDFA repealed advisories for ground water protection. In Article 1 of the subchapter on groundwater, CDFA repealed the section on pesticide management zones. • Use requirements for six chemicals were repealed and requirements for five types of water protection areas were adopted in Article 5 of Chapter 2 (CCR Sections 6486-6487).
2006	<ul style="list-style-type: none"> • For Chapter 4 of Division 6, on Environmental Protection, in Article 1 of the subchapter on groundwater CDFA (which lists 105 chemicals that may pollute groundwater and therefore are subject to hearings and more regulations) added provisions to protect surface water from contamination (CCR Section 6800).
2008	<ul style="list-style-type: none"> • From 2008 and 2014, Article 4 on Field Fumigation Use Requirements lost general requirements and methods for one chemical and gained general requirements for four, as well as a section on volatile organic compound emission reporting (CCR § 6445-6452).
2010	<ul style="list-style-type: none"> • For Chapter 4 of Division 6, on Environmental Protection, CDFA adopted a restriction of maintenance gardener pest control (CCR Section 6531).
2011	<ul style="list-style-type: none"> • CDFA enacted legislation on enforcement mechanisms, like civil penalty fines for not complying with the code, thereby strengthening its regulations on pesticides (CCR Sections 6128, 6130, 6131).
2012	<ul style="list-style-type: none"> • For Chapter 4 of Division 6, on Environmental Protection, in Article 1 of the subchapter on groundwater, CDFA added provisions to protect surface water from contamination.
2013	<ul style="list-style-type: none"> • For Chapter 4 of Division 6, on Environmental Protection, California adopted recommendations on how to use non-fumigants in a particular valley (CCR Section 6558).

2014	<ul style="list-style-type: none"> In Chapter 2, Subchapter 4, CDFR added to Article 1's list of 18 exempted substances a list of about 53 restricted pesticides on top of those restricted by the Federal Insecticide, Fungicide, and Rodenticide Act (CCR § 6400, 6402).
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Table 10: Changes in Livestock Management Regulations in North Carolina

<i>Date</i>	<i>Requirements made by North Carolina Department of Agriculture</i>
May 2002	<p>A Certified Animal Waste Management Plan (CAWMP) is required for all swine facilities issued a Certificate of Coverage under the Swine Waste Operation General Permit and must include these components (Article 21 Chapter 143 of the General Statute §143-215.10C):</p> <ul style="list-style-type: none"> • Potential odor sources and site-specific best management practices to minimize those sources • Potential insect sources and site-specific best management practices to minimize those sources • Provisions for acceptable methods of disposing of dead animals • Provisions for best management practices for riparian buffers, particularly along perennial streams • Provisions for testing waste products used as nutrient sources as close to the time of land application as practical (at least within 60 days), and at least annual inspections of soils where waste will be applied • Provisions regarding waste utilization plans that ensure a balance between nitrogen application rates and nitrogen crop requirements • Provision for completing and maintaining records as required by the state (U.S. EPA 2002)

Table 6: Changes in Fertilizer Regulations in California

<i>Date</i>	<i>Requirements made by California Department of Food and Agriculture</i>
1982	<ul style="list-style-type: none"> Warning labels become mandatory for commercial fertilizers with more than 0.1% boron or 0.001% of molybdenum (CCR Section 2300)
1991	<ul style="list-style-type: none"> Establishes labeling requirements (CCR Section 2303) Requires listing available phosphoric acid in the material (CCR Section 2309) Experimental use of noncommercial fertilizer is exempt from licensing (CCR Section 2319) Requires registration of fertilizers and other inputs (CCR Section 2320) Requires semi-annual tonnage reporting (CCR Section 2321)
2002	<ul style="list-style-type: none"> Lists concentration limits for seven elements and recyclable material in fertilizing materials (CCR Section 2302) Requires a statement of guarantee that fertilizers with iron, manganese, zinc or phosphates do not exceed standards for arsenic, cadmium and lead; requires listing the amounts of 9 different elements for commercial fertilizers except for 17 types of products; inaccurate information about content becomes a misbranding violation (CCR Section 2303)

2010	<ul style="list-style-type: none"> • Adds reporting requirements for fertilizing materials: list each ingredient and its purpose, source, characteristics, manufacture process, and impurities (CCR Section 2300)
2012	<ul style="list-style-type: none"> • Limits use of the statement “State of CA Approved” on labels of only organic input material; allows the use the official “Registered Organic Input Material” logos on those materials (CCR Section 2300) • Makes fertilizer/input registration fee \$500 (CCR Section 2320.1) • Lists requirements for organic input materials (CCR Sections 2320.2)
2014	<ul style="list-style-type: none"> • Explains when organic input materials need to be registered (only when makes claims to National Organic Program standards and claims it’s suitable for use in organic production) (CCR Section 2320.3) • If an organic material doesn’t meet NOP standards, its label must include a statement saying “Not for use in organic crop and organic food production.” (CCR Section 2320.4)

Table 7: Changes in Livestock Management Regulations in California

<i>Date</i>	<i>Requirements made by California Department of Food and Agriculture</i>
1956	<ul style="list-style-type: none"> • Added Subchapter 5 on Poultry Inspection (CCR Sections 1200-272)
1973	<ul style="list-style-type: none"> • Requires evidence for safety of feed (CCR Section 2676) • Lists pesticide residue, fluorine, and heavy metal tolerances (amended in 1997) (CCR Section 2678, 2679, 2680) • Explains requirements and tolerance levels for components of various feed products (CCR Sections 2773-2803)
1982 with amendments in 1991	<ul style="list-style-type: none"> • Lists requirements and tolerance levels for drug use in commercial feeds (CCR Sections 2700-2708)
2002	<ul style="list-style-type: none"> • Prohibits use of animal protein in ruminant feed in accordance with the Federal Code of Regulations (CCR Section 2681)

Table 8: Changes in Pesticide Regulations in North Carolina

<i>Date</i>	<i>Requirements made by North Carolina Department of Agriculture</i>
1971	<ul style="list-style-type: none"> • Under the NC Pesticide Law of 1971, creates a Pesticide Board and a Pesticide Advisory Committee to assist it • Gives the Board powers and guidance on regulation, registration, fees, application methods, reports (NC Pesticide Law of 1971)
1976	<ul style="list-style-type: none"> • Creates a pesticide section in the food and drug protection division in accordance with the NC Pesticide Law of 1971 (NCAC 09L, Section .0101), exempts from registration some custom blends of pesticide and fertilizer (NCAC 09L, Section .0301), establishes general tolerance levels (NCAC 09L, Section .0402), and establishes methods for creating exemptions (NCAC 09L, .1006)

1977	<ul style="list-style-type: none"> • Repeals a section on exemptions for pesticide use in emergencies • Includes a section on restricted use pesticides, which add one pesticide in addition to the federally restricted use pesticides (NCAC 09L, Section .0502) • Prohibits the use or storage of arsenic trioxide in/near any building used as a human dwelling (NCACL 09L .1201)
1978	<ul style="list-style-type: none"> • Repeals a section on criteria for pesticide dealers
1988	<ul style="list-style-type: none"> • Repeals a section on reviewing an application for completeness • Adds a provision to follow federal regulations on exemptions of pesticide use in emergencies • Repeals a section on sampling procedures