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Division of Dockets Management (HFA-305)
Food and Drug Administration
5630 Fishers Lane, rm. 1061
Rockville, MD 20852

DOCKET NUMBER: **FDA-2010-N-0085**

Dear Food and Drug Administration:

Thank you for the opportunity for Wild Farm Alliance (WFA) to submit comments on preventative controls for fresh produce. Our comments are meant to inform the development of: (1) Safety standards for fresh produce at the farm and (2) strategies and cooperative efforts to ensure compliance.

SUMMARY

WFA encourages FDA to create risk management assessment standards that allow for the co-management of food safety and conservation. Wildlife and their habitat are a low food safety risk (see Appendix I). Moreover, the conservation and restoration of grasses and wetlands that filter *E. coli* pathogens, and the promotion of diverse soil microorganisms that are antagonistic to these pathogens, increases the safety of food. By building co- management into the produce standards, FDA will not create conflicts with the Endangered Species Act, Migratory Bird Treaty Act, Federal and State water quality mandates, the National Organic Program rule, or the USDA Natural Resources Conservation Service (NRCS) that provides over $4 billion each year for Farm Bill programs.

COORDINATION OF PRODUCE FOOD SAFETY PRACTICES AND SUSTAINABLE AND/OR ORGANIC PRODUCTION METHODS

The National Organic Program (NOP) Rule requires that organic farm production practices maintain or improve the natural resources of the operation, including *soil, water, wetlands, woodlands and wildlife*. The definition of organic farming is a production system that is managed to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that *foster cycling of resources, promote ecological balance, and conserve biodiversity*.[1, 2]

In addition, organic farmers cannot be expected to decrease biological diversity because they rely on it to help them grow their crops. By installing native plants that support natural enemy insects, they manage pest insect outbreaks. Hedgerows and natural riparian areas also support pollinators at a time when US farms are experiencing a pollination crisis. The more farmers can do to provide a diverse diet of pollen and nectar, the better the health and survival of honeybee and wild pollinators will be. Organic farmers depend on bird and bat boxes and raptor roosts that

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[1] National Organic Program website: http://www.ams.usda.gov/AMSv1.0/nop (then click on "NOP Regulations" and then "Electronic Code of Federal Regulations (eCFR) (Standards)."

[2] Wild Farm Alliance website: www.wildfarmalliance.org/resources/organic_BD.htm

encouraged predatory birds and bats to help keep pest insect and rodent populations under control.

What often gets overlooked, is that the soil on organic farms is alive, diverse and resilient. Farmers feed the soil with cover crops and compost, and do not hamper the survival of beneficial microorganisms by using acidic fertilizers or toxic fumigants. This is important for food safety considerations since research shows *E. coli* pathogens decline more rapidly in soils with a large diversity microorganisms rather than in sterile soils, and this is due to antagonistic interactions with indigenous life in the soil.[3] FDA should ensure that organic farmers are allowed to co-manage the ecological services nature provides with food safety standards at the same time that they are complying with the NOP.

COORDINATION OF PRODUCE FOOD SAFETY PRACTICES AND FEDERAL, STATE, LOCAL AND TRIBAL GOVERNMENT STATUTES AND REGULATIONS

Standards must incorporate Endangered Species Act, Migratory Bird Treaty Act and Federal and State water quality mandates. WFA is located near the Salinas Valley of California and has seen first hand how native habitat was removed because of misguided food safety requirements. Over a mile of riparian trees and shrubs, one hundred feet wide, was bulldozed along the Salinas River[4] in 2008. Because more than 2/3 of the federally-listed rare species are found on private land, private property is very important in the management and conservation of habitat for fish, wildlife and plants. Riparian areas are critical to the movement of migratory birds. While most farmers consider themselves good stewards of the land Salinas Valley farmers under great pressure from food safety auditors and their buyers reported in a survey that they had adopted measures to actively deter or eliminate wildlife on huge acreages (bare ground buffers were used on about 92,000 acres, trapping on 87,000 acres, poisoned bait stations on 108,000 acres, and fencing on 66,000 acres).[5] FDA should be careful not to force farmers to make decisions between complying with food safety rules and illegally taking out habitat.

Clean water helps to support rare species, and human uses. Water quality protections are mandated by the Clean Water Act, and in California, farmers are specifically required to address runoff by the State Water Resources Control Board. Conservation practices typically used for water quality benefits include grassing ditches, using native shrubs and trees along waterways to stabilize soils, and installing sediment basins to capture runoff before it leaves the field. Food safety auditors pressured Salinas Valley farmers to remove conservation practices for water quality/wildlife habitat on 30,000 acres,[4] and we don't want to see this happen nationwide. Food safety produce standards should not trump the Clean Water Act, a state's farm water quality regulations, or the Endangered Species Act (see Appendix II for more information).

STRATEGIES TO ENHANCE COMPLIANCE

As shown in the above survey, food safety auditors are known to broadly target all wildlife and their habitat, without scientific justification or understanding the co-benefits of conservation

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[3] Xiuping Jiang, J. Morgan, and M. P. Doyle. Fate of *Escherichia coli* O157:H7 in manure-amended soil. *Applied and Environmental Microbiology*, May 2002, p. 2605–2609.

[4] Wild Farm Alliance website: www.wildfarmalliance.org/Press Room/press_room_destruction.htm

[5] Beretti, M. and D. Stuart. Food safety and environmental quality impose conflicting demands on Central Coast Growers. *California Agriculture* 62(2):68-73.

practices with regard to food safety and the environment. Unlike California pest control advisors who work with farmers, they are not certified. Food safety auditors should be certified so that they do not require farmers to make costly and environmental damaging mistakes, and so they uniformly address the same issues. A program could be modeled after California's Pest Control Advisor License.[6] FDA should require all food safety auditors to be certified, and to take continuing education classes that keep them abreast of new information. Part of the educational program should teach about agricultural natural resource protections that reduce the incidence of pathogens, and the multiple other benefits to having conservation practices.

Standards must be flexible and able to accommodate new research results. This is not the case with the Leafy Green Marketing Agreement. Even though the research in Appendix I shows that deer species present in the US are a low risk, they are still listed in the "animal of significant risk" list. FDA should build a program that can incorporate new information as research studies enlighten us how food can be more safely grown.

COORDINATION OF PRODUCE FOOD SAFETY PRACTICES AND ENVIRONMENTAL AND/OR CONSERVATION GOALS OR PRACTICES

We run the risk of reaching for an unattainable and indeed risky "sterile" growing environment for the nation's food crops, at great cost to farmers, consumers, and wildlife. We could instead build upon conservation practices already underway on many farms to enhance the effective ecosystem services provided by a healthy growing environment while ensuring the safe growing of food. Grass and wetlands are known to filter out 70- 99% of *E. coli* so that it does not spread throughout the landscape.[7, 8] Larger vegetation, such as hedgerows and windbreaks, filter dust and since *E. coli* O157 can be carried on dust,[9] they too serve to reduce pathogen transfer. The billions of dollars spent by USDA NRCS's and others' on farm conservation should augment FDA standards, not be at odds with them.

WFA recommends that FDA use the guidance from the Association of Food and Drug Officials' (AFDO) code on animal presence in order to determine how best to address the conflicts of conservation and food safety.[10] The question of whether animals are present or not is at the heart of the conflict. By using AFDO's common sense code, which is not overly prescriptive, site-specific conditions can be addressed through a risk assessment strategy. The code states:

> "The responsible party shall assess the impact of domestic and wild animal activity on potential for pathogen contamination of produce, considering the crop characteristics, type and number of animals, pathogens of concern, nearness to the growing field, proximity to harvest, and other relevant factors."

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[6] California Department of Pesticide Regulation website: www.cdpr.ca.gov/docs/license/adviser.htm

[7] Tate, K. W., E. R. Atwill, J. W. Bartolome, and G. Nader. Significant *Escherichia coli* attenuation by vegetative buffers on annual grasslands. *Journal of Environmental Quality*. 35: 795-805. 2006.

[8] Knox, A. K., K. W. Tate, R. A. Dahlgren, and E. R. Atwill. 2007. Management reduces *E. coli* in irrigated pasture runoff. *California Agriculture* 61, no. 4.

[9] Miller MF, Loneragan GH, Harris DD, Adams KD, Brooks JC, Brashers MM. Environmental dust exposure as a factor contributing to an increase in *E. coli* O157 and *Salmonella* populations on cattle hides in feedyards. *J Food Prot*. 2008 Oct; 71(10): 2078-81.

[10] Association of Food and Drug Officials website: www.afdo.org

One more factor should be added to this list: conservation practices used to reduce indirect spread of pathogens.

FDA should take this nuanced approach by using the AFDO code that allows for the diversity of farm situations and animal presence around the country.

The following examines how a farmer can use a decision-tree approach with the AFDO code to deal with relevant issues of their operation while producing safe food.

Impact of Animal Presence When Considering Crop Characteristics

- Does the crop have a kill step, such as cooking?
  - If so, animal presence is not a risk.
- Is the raw eaten crop field packed, or is it rinsed with water before it is packed?
  - If field packed, it has less of a risk of spreading contamination than if water is used.
  - If crop is rinsed, consider planting in an area of reduced risk or use hedgerows and windbreaks to buffer against neighboring uses.

Impact of Animal Presence When Considering Type of Animals and Pathogens of Concern

- Are cattle present? (Cattle are considered high-risk species because of their high probability to carry *E. coli* pathogens).
  - If so, are adequate fences present to keep animals out of growing areas; is a grassed buffer needed between the livestock and the produce operations; or is a ditch required to divert runoff from livestock to produce operations?
- Are animals present that serve as *E. coli* or *Salmonella* vectors between contaminated areas created by human activity and the farm (including but not limited to non-field rodents and some birds)? Potential sources of contamination include use of untreated or improperly treated manure; large concentrated animal operations; nearby waste disposal areas, and heavily grazed areas.
  - If so, either discourage animals, grow a crop with a kill step, or do not grow raw eaten produce near a polluted area.
- Are native wildlife species present?
  - If so, they are a low risk. (Limited studies have shown that the majority of native wildlife populations have a low probability of carrying of *E. coli* and *Salmonella* pathogens – zero to less than three percent.)

Impact of Animal Presence When Considering Number of Animals

- Is there unusually heavy wildlife activity in the field?
  - If so, are any of the following steps taken to reduce their numbers?
    - Animals are discouraged with motion sensors, loud noises, etc.
    - Animals are attracted to other areas with food, water, etc.
    - If fencing is used, it only encloses the growing fields, not the whole farm, so that wildlife can still move through the landscape.
    - If poison is used as a last resort, it does not accumulate in the animal causing a secondary kill, and it is not placed near a waterway where it can cause pollution.

- Is there unusually heavy non-native feral pig activity in the field?
    - If so, consider hunting to reduce their numbers?

Impact of Animal Presence When Considering Proximity to Harvest

- Was the field flooded exposing it to pathogens from high-risk animals, or was it grazed before the crop was planted?
    - If so, has the field been properly tilled to incorporate any pathogens present and has an adequate time period occurred to inactivate them since the ground was tilled before planting?
- Have any animal tracks or feces been found since the crop was planted?
    - If so, has it been determined where the tracks lead, and if feces are found, has the crop been flagged for not harvesting in and around that spot?

Impact of Animal Presence When Considering Nearness to The Growing Field

- Do animals pass through a polluted area as described above before arriving at a produce field being harvested for raw consumption?
    - If so, see discussions above about reducing animal numbers.
- Do native wildlife pass through conservation plantings, riparian zones or other wildlife habitats?
    - If so, they pose a low risk.

Impact of Animal Presence When Considering Conservation Practices Used to Reduce Indirect Spread Of Pathogens

- Are conservation practices funded by the Farm Bill, such as vegetative buffer strips, grasses, and wetlands, used to help filter out contamination in overland water flows from pastures, livestock feedlots, and manure storage areas?
- Are hedgerows and windbreaks used to block pathogen-laden dust coming from roads, and animal loafing areas, compost operations?

THE IMPACT OF SCALE OF GROWING OPERATIONS ON THE NATURE AND DEGREE OF POSSIBLE FOOD SAFETY HAZARDS

Standards must be able to accommodate all farm sizes and crop mixes. FDA should take into consideration the fact that small farms are more constrained on their land options. Requiring any buffer zone between crops and natural areas would force farmers to take out habitat, some of which could be supporting rare species and important ecological functions. Overly large sterile buffer zones near other areas, such as grazing, compost facilities, and structures, could make small farmers reduce their production acreage so much so that it puts them out of business. Large farmers on the other hand could decide to grow something else near those areas, since they have many parcels to choose from. <u>Instead, FDA should require hedgerows or windbreaks be planted in lieu of large bare ground buffers, where feasible.</u>

FDA should create general standards that work for multiple crops grown in the same location so that farmers producing a diversity of crops do not have to fill out separate forms. For instance, farmers growing unprocessed leafy greens, tomatoes, and melons should not have to fill out and comply with FDA's guidance documents on these crops. Since it is very likely that FDA will create new guidance for other crops as well, the paperwork burden would be untenable for small farmers. While guidance is just that and not standards, they are required de facto since proactive farmers will feel forced to fill out the paperwork in case they ever have a food safety incident and end up in court. FDA should not hamper a farmer's ability to spread her/his financial risk by growing more than just a single crop, or make their marketing more difficult. "Buy Fresh, Buy Local" campaigns around the country are encouraging consumers to eat lots of fresh produce and shop at farmers' markets and local stores. Small farmers often sell a diversity of crops through these channels because they can optimize sales by selling small amount of many types of produce. Growing multiple crops also allows for crop rotation, which ensures that the soil is not overly depleted of certain nutrients, and also reduces the potential for insect buildup. As a result, there is less need for fertilizers and pesticides, and healthier food is produced. FDA should create general standards for a diversity of crops grown in the same location.

IDENTIFICATION AND PRIORITIZATION OF RISK FACTORS
Standards must address industrial leafy green harvesting and processing issues. More surfaces for microbial invasion are present in pre-cut and pre-chopped leafy greens than in bunched spinach, or whole lettuce heads. Since salad mix, baby spinach, and large portions of iceberg lettuce are bagged, an ideal environment exists for pathogens to grow. According to Community Alliance for Family Farmers' analysis of data, between 1999 and 2008, all of the *E. coli* O157:H7 outbreaks related to spinach and lettuce that created serious illness were linked to fresh-cut products in sealed bags. The processing system should remove pathogens, not spread them. A greater risk occurs in the processing plant than on the farm. In addition, industrially mowing leafy greens from the ground endangers nearby frogs that may stray from their habitat. The large salad mower itself is not hygienic; when in operation it builds up a slime similar to the bottom of a lawn mower. The system of harvesting needs to be redesigned to quickly find and avoid frogs, and to prevent the buildup of slimy residues on the salad mower. Volume also matters. The output of 26 million servings of leafy greens every week from a large processing plant, like the one that caused the 2006 *E. coli* 0157:H7 contaminated spinach to affect consumers in 28 states, is far riskier than a small farm processing operation. As well, shelf life should be based on safety, not profitability. Decreasing shelf life for bagged products, that now stretch to as much as 17 days, would not only cut down on the opportunities for pathogens to grow but also cut down on nutritional losses. FDA should focus its efforts mainly on large processors, not the farm, require leafy green harvesters to be redesigned, and shorten the allowed shelf life for perishable leafy greens.

Thank you for considering these comments.

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APPENDIX I: RELATIVE RISK TO UNPROCESSED PRODUCE FROM ANIMAL PRESENCE[11]

Most cattle operations, some feral pigs, and relatively few wildlife, especially those associated with polluted areas, are a food safety concern. Wildlife have a low incidence of carrying pathogens, yet many well-intentioned efforts to make the growing environment "clean" have created misguided farm requirements, harmful to both food safety and land stewardship practices. Grasses and wetlands can filter microbial pollution, especially when the residence time for water flowing through the systems is prolonged. While nature can never provide zero risk, the benefits that habitat brings outweighs the drawbacks of a denuded farm.

SUMMARY TABLE RELATIVE RISK TO UNPROCESSED PRODUCE FROM ANIMAL PRESENCE PREPARED BY WILD FARM ALLIANCE www.wildfarmalliance.org			
DOMESTIC ANIMALS[12]	**FOOD SAFETY RISK**	**CURRENT SCIENCE WE KNOW**	**WHAT A FARMER CAN DO**
Cattle	Very High	Research shows cattle are major reservoirs of *E. coli* pathogens on the landscape. For *E. coli* pathogens in cattle farms and feedlots in the study areas, 63, 64, 75, 100, 100, 100, and 100% of the operations were positive with *E. coli* pathogens in 13 States and in Northwest U.S. In specific cattle herds within these and other operations, 0.3, 0.35, 0.7, 0.9, 1.0, 1.01, 1.25, 1.4, 1.8, 2.5, 3.7, 4.3, 6.9, 6.9, 13.4, 16.1, 19.7, 20.0, 21.0, 26.7, 27.3, 33.8, 53.0% were found to have *E. coli* pathogens in California, Kansas, Nebraska, North Dakota, Southern U.S., Texas, Washington, Wisconsin, Czech Republic, England, Norway, and Switzerland. For *Salmonella* pathogens, cattle were found with 1.25 and 7% in Texas and Colorado (see supporting data). Amounts of *E. coli* pathogens present in herds depend on the age of the cattle, season, and how management of feed, and of grazing lands can affect re-infection rates (Hancock et al. 1998a, Hancock and Besser 2006, Hussein 2007, Khaitsa et al. 2006, Knox et al. 2007, Kuhnert et al. 2005). Grasses and wetlands can filter up to 99% of *E. coli* in water (Knox et al. 2007, Tate et al. 2006). Pathogens in made compost containing cattle manure can exist for up to 150 days or longer under some conditions. The outside edges of improperly made compost are known to contain pathogens (Erickson et al. 2010).	Prevent pasture and rangeland runoff from direct contamination of cropland and water sources used for crop management. Keep grasses and other vegetated buffers between crops and grazing lands. Rest grazing areas at least a week prior to irrigation. Filter runoff through conserved and restored wetlands. Putting cattle on healthy grasslands, instead of in confined feeding areas, may reduce the incidence of *E coli* pathogens. Use certified compost or ensure compost made on the farm is turned evenly and the temperature is measured in multiple locations so that all parts reach proper temperature.

[11] WFA initially conceived these appendices for Community Alliance with Family Farmers' GAPs.
[12] Other domestic livestock, such as sheep, goats, and pigs, have been found at times to carry human pathogens, but further research is needed to determine the extent of the problem.

NON-DOMESTIC ANIMALS	FOOD SAFETY RISK	CURRENT SCIENCE WE KNOW	WHAT A FARMER CAN DO
Cattle (con't)	Very High	*E. coli* O157 can survive in dried conditions for long periods and be transferred in aerosols. Manure-laden *E. coli* O157 dust has made people sick at county fairs (Brabban 2004, Cooley et al. 2007). Pathogens like *E. coli* O157 are allowed to mutate and proliferate in confined animal feeding operations where unhealthy conditions and sub-therapeutic doses of antibiotics are given to make the animals gain weight quickly (Pew Charitable Trusts 2008).	Cattle loafing areas can be sites where manure is ground into dust and blown onto crops. Use hedgerows and windbreaks to reduce dust blowing in on the wind.
Feral (non native) Pigs	Moderately Low	In California, two studies documented 5% and 14.9% of feral pig samples containing *E. coli* O157 (see supporting data). These pigs were found in association with cattle. Feral pigs did not evolve in the U.S. and so are not compelled to hide from natural predators, although they may learn to hide from hunters. Since they are highly mobile on large home ranges, removing habitat is not an effective control strategy (Jay and Wiscomb, 2008). Feral pigs compete with native wildlife for resources and can help to destroy fragile ecosystems in wild areas.	Monitor cropped field for feral pig intrusion and define a no-harvest zone if fecal matter is present. Hunt feral pigs, or if continuously present in large numbers, install a short, hog wire fence. Do not remove habitat; it will not dissuade the animals.
WILDLIFE			
Deer	Low	For *E. coli* pathogens, deer were found with 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0.25, 0.3, 0.4, 0.64, 0.7, 0.79, 1.5, 1.8, and 2.4% in California, Kansas, Louisiana, Nebraska, Oregon, Texas, Washington, Wisconsin, Wyoming, Southern US, Norway, and Sweden. Higher results of 9% came from a small study in Oregon where deer feces, not colon swabs, were collected; and of 23.9% from Spain where a mix of European elk, deer, and mountain sheep results were reported together. For *Salmonella* pathogens, deer tested positive 0, 0, 1, and 7.69% in Nebraska, Texas, Norway and Sweden (see supporting data).	Since the incidence of deer carrying *E. coli* O157 is low, removing habitat that protects water quality is counterproductive and the cost would not appear, at this time, to be justified. Providing an inexpensive feeding attractant away from cropped areas may reduce intrusion. If unusually high deer activity is detected in the field, consider discouraging animals with loud noises, motion sensors, food attractants placed in other areas, and fencing as a last resort (fence only the growing fields, not the whole farm).

WILDLIFE	FOOD SAFETY RISK	CURRENT SCIENCE WE KNOW	WHAT A FARMER CAN DO
Rodents	Moderate	Rodents near buildings, confined animal feeding operations, and polluted areas are sometimes found carrying human pathogens. Rodents were found with 0 and 40% *E. coli* pathogens on dairy farms and cattle feedlots, respectively. Mice and rats tested positive 16.2% for *Salmonella* pathogens on chicken layer farms (see supporting data).	See p. 14 about rodents in or near storage areas. Do not grow crops eaten raw next to areas of concentrated cow manure.
Field Rodents	Low	*E. coli* pathogens were prevalent in rodents 0, 0, 1.4, and 20% (2 out of 10 rodents on cattle farms). According to UC Cooperative Extension, it is hard to justify extensive trapping, baiting, fencing, and vegetation clearing for the specific purpose of reducing animal (rodent) vectoring of *E. coli* O157, unless future research findings indicate otherwise (Salmon et al. 2008). Field rodents can be a significant food quality risk for processed crops because of the possibility of being chopped up into the harvest (see supporting data).	Since the incidence of field rodents carrying *E. coli* O157 is low, removing habitat that filters pathogens in water is counterproductive.
Birds Near Cattle Feedlots, Cattle Ranches, Dairy Farms or Polluted Areas	Low	Some of the time some birds near cattle and other pollution sources do carry *E. coli* and *Salmonella* pathogens, but the prevalence is low. For *E. coli* pathogens, birds near cattle or pollution were found with 0, 0, 0, 0, 0.5, 0.9, 1, 1.6, 2.2, 2.9, 3.3, 3.6, 5, and 5.4% in California, Kansas, Nebraska, Ohio, Pacific Northwest, Washington, Wisconsin, Czech Republic, Denmark and England. For *Salmonella* pathogens, birds near cattle or pollution were found with 0, 0.7, 9, and12.9% in Colorado, Kansas and Scotland (see supporting data).	While some birds can be a low risk, it may be prudent when growing freshly eaten crops near cattle or polluted areas, to not plant (or at least not harvest) in areas where birds consistently perch directly over the planted beds. Since the incidence of birds carrying *E. coli* and *Salmonella* pathogens is low, removing habitat that filters pathogens in water is counterproductive.
Birds Not Near Cattle or Pollution	Very Low	No birds were found with *E. coli* pathogens in study areas not near cattle or pollution: 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, and 0% in Colorado, Massachusetts, New Jersey and Virginia and Sweden. For *Salmonella* pathogens, a few birds were found with low levels of 0.6, 4, and 4% in New Jersey, Virginia, and Wisconsin (see supporting data).	Even though birds not associated with cattle are a very low food safety risk, monitoring for high bird populations and when found creating a non-harvest zone in this area may be wise.

WILDLIFE	FOOD SAFETY RISK	CURRENT SCIENCE WE KNOW	WHAT A FARMER CAN DO
Amphibians and Reptiles	Low	Pathogens are known to be associated with amphibians and reptiles when exposed to abnormally high doses and when in unnatural areas, but the practical significance of this information for farmers is limited (Lowell et al. 2010). Frogs were found to shed *E. coli* O157 during specific lifecycle stages, but they had been inoculated with abnormally high levels under laboratory conditions (Gray et al. 2007). Kids and adults have been infected with *Salmonella* when handling their caged pets, which are often kept in unclean enclosures (Mermin et al. 2004) or in zoos (Bauwens et al. 2007). The cause of an outbreak with *Salmonella* tainted orange juice was never determined even though rodent and bird droppings were found inside the juice processing plant and one toad carrying the pathogen outside (Cook et al. 1998). No *Salmonella* was found in wild reptiles in Virginia (see supporting data).	Since amphibians are attracted to water, ensure that nearby riparian areas are not unnaturally depleted of water during the crop season. Conserve habitat.
Insects	Low	Studies show that flies can be vectors of *E. coli* pathogens from infected manure to crops, but data on the practical significance or relationship to outbreaks is unknown. For *E. coli* pathogens, 0, 3.33, 3.4, 5, 17, and 61% were found in Central California, Southern California, Wisconsin and Denmark. While fly regurgitation found on spinach had persisted for one week in the lab, it is unknown if it would persist in the field. It is thought flies tend to stay close to manure source unless they are drawn into a produce field by other food source, such as honeydew excreted by aphids.	Do not grow crops eaten raw next to areas of concentrated cow manure. Do not harvest crops impacted by high populations of flies close to harvest.

SUPPORTING DATA[13, 14]

DOMESTIC ANIMALS

Cattle Found with *E. coli* Pathogens

Branham et al. 2005, livestock grazing in **Texas**
- 1.25% (1/80)

Chapman et al. 1997, 4,800 tests of cattle in **England**
- 13.4% of beef cattle
- 16.1% of dairy cattle

Cizek et al. 1999, fecal samples of cattle in feedlot in the **Czech Republic**
- 20% (72/365)

Faith et al. 1996, dairy cow manure in **Wisconsin**
- 1.8% (10/ 560) calves
- 3.7% (19/51) follow-up testing

Fischer et al. 2001, cattle in **Southern U.S.**
- 4.3% (13/305)

Hancock et al. 1998a, cattle in confined animal feeding operations (CAFO) in **13 States**
- 63% (63/100) of beef cattle feedlots with one or more samples testing positive
- 75% (27/36) of dairy herds with highest herd prevalence of 10 - 26.7%

Hancock et al. 1998b, cattle on farms in the **Northwest U.S.**
- 100% (12/12) farms with 1.1% to 6.1% prevalence within herds

Hancock, et al. 1997, cattle herds
- 64% (9/14) of herds, with overall herd prevalence of 1·0%, with higher amounts in the summer months.

Hussein et al. 2005 feedlot and range cattle
- 0.3 to 19.7% in feedlot cattle
- 0.7 to 27.3% in cattle on irrigated pasture
- 0.9 to 6.9% in cattle grazing rangeland forages

Jay et al. 2007, cattle on rangeland in **California**
- 33.8% (26/77)

Johnsen et al. 2001, intestinal contents from 1,541 cattle in **Norway**
- 0.35% (n=1,541)

Khaitsa et al. 2006, seasonal shedding of *E. coli* O157: H7 in feedlot cattle in **North Dakota**
- 1.4% (2/144) cattle in October
- 6.9% (10/144) cattle in November
- 21 – 53% (30/143 – 76/143) cattle twice in March

Kuhnert et al. 2005, organically and conventionally managed dairy cows in **Switzerland**
- 100% (60/60) STEC on organic dairy farms
- 100% (60/60) STEC on conventional dairy farms
- 25% (15/60) *E. coli* O157: H7 on organic dairy farms
- 17% (10/60) *E. coli* O157: H7 on conventional dairy farms

LeJeune et al. 2008, cow manure in Ohio
- 2.5% (48/1869)

Renter et al. 2003, fecal samples of cattle on ranches in **Kansas** and **Nebraska**
- 1.01% (92/9122)

Cattle Found with *Salmonella* Pathogens

Branham et al. 2005, livestock grazing in **Texas**
- 1.25% (1/80)

Pedersen et al. 2006, dairy manure in **Colorado**
- 7% (8/120)

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[13] When available, data is presented as a percentage of animals with pathogens, and then in parentheses with the first number corresponding to the number of animals testing positive, and the second the total animals tested.

[14] Where possible, a distinction is made between samples taken with swabs from trapped animals and from the colons of dead animals, versus those taken from the ground where they could have been contaminated by other animals, or multiple feces could have been deposited by the same animal.

NON- DOMESTIC ANIMALS

Feral Pigs Found with *E. coli* Pathogens

Jay et al. 2007, necropsy swabs and fecal samples from the ground of feral pigs on cattle rangeland in **California**
    14.9% (13/87)

Jay-Russell et al. 2010 trapped and killed or hunter harvested feral pigs on cattle ranches and nearby produce fields in **California**
    5% (10/200)

WILDLIFE

Deer Found with *E. coli* Pathogens

Branham et al. 2005, fecal and rumen samples of white-tailed deer near livestock grazing in **Texas**
    0% (0/26) *E. coli* O157: H7

California Department of Fish and Game 2009, hunter harvested black-tailed deer in **California**
    0% (0/311)

Dunn 2004, 3 studies of hunter harvested white-tailed deer in **Louisiana**
    0.3% (n=338)
    1.8% (n=55), captive in summer
    0.4% (n=226) captive year average

Fischer et al. 2001, 3 studies of deer with cattle nearby (both hunter harvested and feces on the ground) in **So. U.S**.
    0% (0/310)
    0.64% (3/469)
    0.7% (1/140)

Garcia-Sanchez 2007, deer rectal swab in **Spain**
    1.5% (n=206)

Jay et al. 2010, hunter harvested black-tailed deer in produce fields and on cattle ranches in **California**
    0% (0/19)

Keene et al. 1997, black-tailed deer feces on the ground in **Oregon**
    9% (3/32)
    0% (0/3), 4 months later

Lillehaug et al. 2005, hunter harvested deer in **Norway**
    0% (0/135) red deer
    0% (0/206) roe deer
    0% (0/150) raindeer

Olsen et al. 2002, fecal samples of deer in **Wyoming**
    0% (0/5 includes deer and elk samples)

Renter et al. 2003, ground scat and from hunter harvested deer near range cattle in **Kansas** and **Nebraska**
    0% (0/141)

Renter 2001, hunter harvested white tailed deer in **Nebraska**
    0.25% (4/1,608)

Rice et al. 2003, white tailed deer fecal samples
    0.79% (5/630)

Samadpour et al. 2002, fecal samples of deer near cattle in **Washington**
    0% (0/2)

Sanchez et al. 2009, deer in **Spain**
    23.9% (58/243, includes deer and 2 other species)

Sargaent et al. 1999, wild white-tailed deer fecal samples taken near cattle ranches in **Kansas**
    2.4% (5/212)

Shere et al. 1998, guts of deer near dairy farm in **Wisconsin**
    0% (0/89 includes deer and 9 other non deer species)

Wahlstrom et al. 2003, hunter harvested roe deer in **Sweden**
    0% (0/791 includes roe deer and 5 other non deer species)

Deer Found with *Salmonella* Pathogens

Branham et al. 2005, fecal and rumen samples of white-tailed deer near livestock grazing in **Texas**
    7.69 % (2/26)

Lillehaug et al. 2005, hunter harvested deer in **Norway**

0% (0/135) red deer
0% (0/196) roe deer
0% (0/153) reindeer

Renter 2006, hunter harvested white tailed deer in **Nebraska**
1% (5/500)

Wahlstrom et al. 2003, hunter harvested roe deer in **Sweden**
0% (0/791 includes deer and 5 other species)

<u>Rodents Found with *E. coli* or *Salmonella* Pathogens</u>

Cizek et al. 1999, stool samples of rats associated with **cattle feedlot** in the **Czech Republic**
40% (4/10) Norway rat *E. coli* O157

Henzler and Opitz 1992, rodents on **chicken layer farms** in **Maine**
16.2% (116/715) mice & rats *Salmonella* pathogens

Shere et al. 1998, guts of mice and rats near a **dairy** in **Wisconsin**
0% (1/89 includes multiple other species) *E. coli* O157

<u>Field Rodents Found with *E. coli* Pathogens</u>

Hancock et al., 1998b, live caught rodents on cattle ranches in the **Pacific Northwest**
0% (0/300)

Jay-Russell et al. 2010 trapped and release wild mice, voles and pack rats on nearby produce fields and cattle ranches in **California**
1.4% (1/72) deer mouse

Nielson et al. 2004, fresh rodent feces on cattle farms in **Denmark**
20% (2/10)

Rice et al. 2003, rodents in an undisclosed location
0% (0/300)

<u>Birds Found Near Cattle or Polluted Areas with *E. coli* Pathogens</u>

Cizek et al. 1999, fresh feces of birds nearby cattle feedlot in the **Czech Republic**
0% (0/50) pigeon
0% (0/20) sparrow

Gaukler et al. 2009, cloacal swabs of birds associated with a feedlot in **Kansas**
0% (0/434) European starlings

Hancock et al., 1998b, feces of wild birds on cattle ranches in the **Pacific Northwest**
0.5% (1/200)

Jay-Russell et al. 2010, colonic fecal samples or swabs from birds on cattle ranches and nearby produce fields in **California**
5.4% (5/93) American crows
3.3% (2/60) brown-headed cowbirds

LeJeune et al. 2008, guts of birds near a dairy farm in **Ohio**
2.2% (7/316) European starlings

Nielson et al. 2004, bird feces near cattle and pig farms in **Denmark**
1.6% (4/244) two tree sparrows, one barn swallow and one European starling

Renter et al. 2003, fecal samples of wild birds near cattle ranches in **Kansas** and **Nebraska**
0% (0/9)

Samadpour et al. 2002, ducks, cows and other species near a lake in **Washington**
5% (1/20) one duck

Sanderson et al. 2006, feces of birds from in a cattle feedlot
3.6 % (6/165) unknown bird species

Shere et al. 1998, guts of pigeons, turkeys, sparrows, starlings near a dairy in **Wisconsin**
1% (1/99) one pigeon

Wallace et al., 1997, fresh feces of Herring gull, black-headed gull, and common gull, crow, and jackdaw in two locations in **England**
2.9% intertidal zone
0.9% landfill

<u>Birds Found Near Cattle or Polluted Areas with *Salmonella* Pathogens</u>

Fenlon, 1981, seagull feces near sewage outfalls and lakes in **Scotland**, the former of which had the highest rates (17-21%)

12.9% (160/1,242)

Gaukler et al. 2009, cloacal swabs of birds associated with a feedlot in **Kansas**

0.7 % (3/434) European starlings

Pedersen et al. 2006, cloacal swabs of rock pigeons in two locations in **Colorado**

9% (9/106) dairy farms

0% (0/171) urban areas

<u>Birds Not Near Cattle or Polluted Areas Found with *E. coli* Pathogens</u>

Converse et al., 1999, bird feces in non-agricultural areas of **Massachusetts**, **New Jersey** and **Virginia**

0% (0/360) goose

Kullas et al. 2002, bird feces in **Colorado**

0% (0/397) goose

Palmgren et al. 1997, stool samples of birds in **Sweden**

0% (0/101) passerines

0% (0/50) seagulls

Rice et al. 2003, birds in an undisclosed location

0% (0/121) Canada geese

0% (0/67) trumpeter swan

0% (0/150) gull

0% (0/20) duck

0% (0/124) European starling

0% (0/83) wild turkey

Wahlstrom et al. 2003, hunter harvested geese and seagulls in **Sweden**

0% (0/791 includes geese and 5 other species)

<u>Birds Not Near Cattle or Polluted Areas Found with *Salmonella* Pathogens</u>

Converse et al., 1999, bird feces in non-agricultural areas of **Massachusetts**, **New Jersey** and **Virginia**

0.6% (2/360) goose

Palmgren et al. 1997, stool samples of birds in **Sweden**

4% (2/50) seagulls

Wahlstrom et al. 2003, hunter harvested birds in **Sweden**

4% seagulls

<u>Amphibians and Reptiles Found with *E. coli* and *Salmonella* Pathogens</u>

Gray et al. 2007, two ages of American bullfrog inoculated with high levels of *E. coli* O157 in **Tennessee** lab.

0% tadpoles in flow-through aquaria

54% metamorphs placed in stagnant aquaria (stale water used to speed up experiment)

Richards et al. 2004, cloacal swabs from free-living reptiles in **Virginia**.

0% *Salmonella* for 34 eastern box turtles, 14 eastern painted turtles, 14 snapping turtles, 6 black rat snakes, 2 redbelly turtles, 2 yellowbelly sliders, 2 eastern garter snakes, and 1 eastern river cooter.

<u>Insects Found with *E. coli* Pathogens</u>

Nielson et al. 2004, insects on cattle and pig farms in **Denmark**

0% (0/6) pooled insect samples

Rice et al. 2003, rodents in an undisclosed location

3.33% (2/60) pooled flies

Sanderson et al. 2006, houseflies in a cattle feedlot

3.4% (53/1,540) housefly

Shere et al. 1998, flies caught in a fly trap on a dairy in **Wisconsin**

5% (1/20)

Talley et al., 2009 filth flies fly captured in leafy green fields in **Central California**

61% (11/18)

Wayadande 2010, flies that fed on inoculated manure or bacterial lawns and then regurgitated onto spinach in **Southern California**.

17% (17/98) of pooled flies *E. coli* O157:H7

APPENDIX II: REGULATIONS PROTECTING NATURAL RESOURCES[15]

This table has been created to help producers understand federal and state regulations in order for them to educate their food safety inspectors/auditors. If a producer believes that their food safety inspector/auditor is suggesting or requiring an action that is contrary to these regulations, please contact the applicable agency immediately.

REGULATIONS PROTECTING NATURAL RESOURCES **PREPARED BY WILD FARM ALLIANCE** **www.wildfarmalliance.org**			
AGENCY	**WHAT IT PROTECTS / REGULATES**	**WHY IT IS IMPORTANT TO PROTECT**	**WEBSITES FOR MORE INFORMATION**
USDA National Organic Program	Soil, Water, Wetlands, Woodlands, and Wildlife	Conserves fertile soils, ensures water quality, helps to recharge groundwater and alleviate flooding, and protects native species and ecosystems important to agricultural production and the larger landscape.	www.wildfarmalliance.org http://attra.ncat.org/attra-pub/summaries/OSPtemplates.html
State and Federal Wildlife Agencies	Threatened and endangered plants and animals and their habitats. Migratory birds.	Helps to address the biodiversity crisis.	www.fws.gov/offices/statelinks.html
National Marine Fisheries Service	Threatened and endangered anadromous fish species (i.e. salmon, trout, sturgeon) and their habitats	Helps to address the biodiversity crisis.	www.nmfs.noaa.gov/
Environmental Protection Agency and State Water Agencies	Water quality	Helps to provide clean water resources and supplies for human and wild communities.	http://epa.gov/agriculture/water.html
US Army Corps of Engineers	Modifications to surface waters under USACE jurisdiction, such as: disposal of materials into water, adding or fixing a culvert, regrading slopes, and filling in wet depressional areas.	Helps to conserve riparian areas, recharge groundwater and alleviate flooding.	www.usace.army.mil/

[15] The regulations presented here are not meant to be an exhaustive. More detailed information can be obtained from the agencies themselves.

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