SUSTAINABLE AGRICULTURE AND A SAFE FOOD SUPPLY

John Ikerd, retired professor of soil science at the University of Missouri has said, "We cannot prove through empirical studies that one approach to agriculture is sustainable or that another is not. It would quite literally "take forever" to collect the data for such a study. Thus, we must rely on the science of logic. What are the logical prerequisites for agricultural sustainability? I believe there is a growing consensus in support of three fundamental prerequisites: A sustainable agriculture must be ecologically sound, economically viable, and socially responsible. Furthermore, I contend that these three dimensions of sustainability are inseparable, and thus, are equally critical to long run sustainability."

NEW TECHNOLOGIES

Increasing stresses from more erratic weather and new and different pests that move in generate a need for every possible tool we can get to help make our crops as productive as they possibly can be while maintaining a sustainable agriculture and safe food supply. Modern tractors and harvesters are more fuel efficient and emit less particulate matter and nitrous oxide and yet are more productive than equipment sold as recently as 2000. Linked with GPS and satellites, computers can control field operation from monitoring irrigation and tracking soil nutrients to forecasting weather conditions and predicting yields. Planting equipment is improving, allowing for narrower rows and more selective seed planting and reducing soil compaction. Tillage passages are reduced by planting equipment designed to penetrate crop residue. Reduced tillage means less loss of top soil through erosion, improved soil tilth, conservation of water, and lower carbon emissions.

Use of drip irrigation and pivot agriculture have allowed farmers to irrigate better with less water loss to evaporation and runoff. The reduced irrigation has, in turn, allowed for better fertilization and less soil erosion. New methods utilize field sensors to track moisture and nutrients allowing selective treatment of fields. All these modern techniques involve initial startup funding and ongoing maintenance. In order to take advantage of these new technologies, farmers need continuing education and support.

Traditionally, biotechnology has included such practices as plant and animal breeding, fermentation, cheese and bread production, use of organisms for medicinal purposes, or development of glues, solvents and other products from plant or animal sources. Genetic engineering is one recent branch of biotechnology that has captured attention and generated controversy, but there are many other biotechnology applications in agriculture. Cloning of plants has long been a staple of farm production (cut up a potato and plant the pieces, and the new potatoes will be genetically identical), but cloning of animals began in the late 20th century. Biotechnology, as applied in agriculture and food supply, raises key questions about public vs. private research funding, the use and misuse of science, patenting of life forms, and the regulation of novel foods and processes. Plant breeding is not a new technology. Since man first domesticated plants, plant growers have **selectively** used seed from crops with desirable qualities, choosing seed from the sturdiest plant, the largest or tastiest fruit. Following the work of Gregor Mendel, in the mid 19th century, plant breeders learned how to **crossbreed** compatible types of plants, creating hybrids that combined the best features of both parent plants.

As plant breeding techniques became more sophisticated, researchers discovered ways to overcome fertility barriers between similar species. A hybrid cereal, triticale, was created in 1875 by crossing wheat and rye. Since then, **cross-species hybridization** has yielded fruit like tangelos (tangerine and grapefruit) and the peachcot (peach and apricot), which have been well received by the public. Over the past 100 years, plant

breeders have developed more breeding tools for improving crops for a variety of purposes including drought resistance, disease resistance, chemical resistance, longer storage, increased nutrition and yield, better flavor. Many of these tools require generations of plant growth before a marketable seed is produced.

Chemically or radioactively induced mutations, first introduced in the late 1920s, expanded after World War II. Seeds from plants are treated with either chemicals or irradiation and then selected for desired traits. These types of mutations have yielded over 2500 new varieties of plants, including most varieties of modern wheat, barley, rice, potatoes, soybeans, and onions.

In the mid-twentieth century, the discovery of DNA and research in genetics and molecular biology made possible a new approach to both plant and animal breeding through genetic engineering. **Precision breeding** is a technique involving the use of genetic markers to track the inheritance of genes (one of many genetic engineering techniques) when closely related plants are crossed. Plants produced using this technique are, by definition, not transgenic. In **genetic engineering** genetic material of the target organism is altered though insertion of specific genes with known function into the DNA to produce what are known as transgenic animals or plants, or genetically modified organisms (GMOs). GMO modification remains controversial and will be discussed in detail in a separate fact sheet.

ASPECTS OF AGRICULTURAL PRODUCTION

Since the green revolution, much of American farming has focused on production of biofuels, not just human nutrients. Many large farms have little crop diversity and have centered on the production of staple products such as corn, soybeans and sugar beets (monoculture). In large part, these crops are used as a source of energy rich carbohydrate in processed food, more recently for ethanol production and as animal feed, encouraging the growth of Concentrated Animal Feeding Operations (CAFOs). Animal agriculture provides the human consumer with protein, energy and many trace nutrients; however, CAFOs are less efficient than pasture-fed animals on plant based diets because they require significantly more energy, water and soil nutrients. A recent review of studies, comparing grass fed and CAFO beef,[1] reported in the Nutrition Journal found support for "the argument that grass-fed beef (on a g/g fat basis), has a more desirable saturated fatty acid lipid profile as compared to grain-fed beef."

The rate of soil loss, through conventional agricultural practices and natural geographical erosion, raises concern about the agricultural system's capability to feed the global population and safeguard soil fertility and the soil itself. An average of ten times as much soil erodes from American agricultural fields as is replaced by natural soil formation. This loss of soil affects productivity since surface soil contains most of the micro-organisms and plant nutrients required for good crop production. The decrease in the uptake of nutrients by plants affects the nutrient content of current foods. Soil erosion and runoff of chemicals used in agricultural production not only threaten the sustainability of agriculture, but also pollute water resources. The current emphasis of soil and water conservation plans is on disturbing the soil as little as possible (such as by no till practices) and crop diversity (as in rotating crops or incorporating new crops); however, the 2007 Census of Agriculture shows that only 25% of farms used some conservation methods and 18% practiced crop rotation.

THE FEDERAL GOVERNMENT ROLE IN AGRICULTURE

These technologies and practices, as they affect farmers and the food supply, bring farmers and a number of government agencies together in a variety of ways in the effort to build a sustainable agriculture and a safe and ample supply of food. The principal federal agencies and the roles they play are given below.

[1] http://www.nutritionj.com/content/pdf/1475-2891-9-10.pdf, accessed 10/11/13.

Farm Bill and Budget Authorizations

USDA programs described in the table below are determined in large part by the Farm Bill and the political process associated with its reauthorization. Congressional decisions about both mandatory and discretionary funding determine the budgets available to implement the programs. Mandatory funding means that the Farm Bill itself designated the amount of funding to allocate to a program. Programs with discretionary funding must go through a new appropriations process every year, in which Congressional committees decide how much money should be allocated. Funding for discretionary programs is thus much less certain.

USDA authorized spending has climbed from $116 billion in 2009 to the $156 billion authorized for the 2013 fiscal year before the fiscal cliff and sequester, and other cuts were made. The 132-page Fiscal Year 2014 budget proposes $146 billion in total spending (8% below the 2013 budget), but the exact amount will not be known until the new Farm Bill is approved.

United States Department of Agriculture (USDA)

The USDA and its agencies develop, implement, and administer policy and programs related to farming, agriculture, nutrition, food safety, land management and natural resources, forestry, and rural development. The USDA mission statement is that it "provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on sound public policy, the best available science, and efficient management."

The following chart lists USDA's seven **mission areas**. There are currently 17 agencies and 17 offices under USDA, each of which has a specific function. The USDA agencies and/or offices involved in each area are included in the description.

Mission Area	Description, Agencies/Offices Involved
Farm and Foreign Agricultural Services	Work with farmers to guard against uncertainties of weather and markets and to improve stability of the agricultural economy. Deliver commodity, credit, conservation, disaster, and emergency assistance programs. **Mission area agencies** include: • Farm Service Agency (FSA); • Foreign Agricultural Service (FAS); and • Risk Management Agency (RMA).
Food, Nutrition and Consumer Services	Work to end hunger and improve health in the United States. Administer federal domestic nutrition assistance programs and link scientific research to the nutrition needs of consumers through science-based dietary guidance, nutrition policy coordination, and nutrition education. **Mission area agencies** include: • Center for Nutrition Policy and Promotion (CNPP); and • Food and Nutrition Service (FNS).
Food Safety	Ensure the U.S. commercial supply of meat, poultry, and egg products is safe, and is properly labeled and packaged. Plays a key role in the President's Council on Food Safety and in coordinating a national food safety strategic plan among various partner agencies including the Food and Drug Administration in the Department of Health and Human Services and the Environmental Protection Agency. **Mission area agency** is Food Safety Inspection Service (FSIS).
Marketing and Regulatory Programs	Facilitate domestic and international marketing of U.S. agricultural products and ensure the health and care of animals and plants. Actively participates in setting national and international standards. **Mission area agencies** include: • Agricultural Marketing Service (AMS); • Animal and Plant Health Inspection Service (APHIS); and • Grain Inspection, Packers and Stockyards Administration (GIPSA).

Mission Area	Description, Agencies/Offices Involved
Natural Resources and Environment	Ensure land health through sustainable management. Work to prevent damage to natural resources and the environment, restore the resource base, and promote good land management. **Mission area agencies** include: • Forest Service (FS); and • Natural Resources Conservation Service (NRCS).
Research, Education and Economics	Provide integrated research, analysis, and education with a goal of creating strong communities, families and youth and maintaining a safe, sustainable, competitive U.S. food and fiber system. **Mission area agencies and offices** include: • Agricultural Research Service (ARS); • Economic Research Service (ERS); • National Agricultural Library (NAL); • National Agricultural Statistics Service (NASS); • National Institute of Food and Agriculture (NIFA); and • Office of the Chief Scientist (OCS).
Rural Development	Provide financial programs to support essential public facilities and services in rural America: water and sewer systems, housing, health clinics, emergency service facilities, and electric and telephone service. Promote economic development by providing loans to businesses through banks and community-managed lending pools and by helping communities participate in community empowerment programs. **Mission area agency** is Rural Development (RD).

Programs and services provided by the agencies and offices of the USDA include: rural broadband, grants and loans; disaster assistance to farmers and rural residents; insurance programs; restoration and conservation programs (soil, water, forests, natural prairies); environmental markets (carbon sequestration, wetland management, water quality, ecosystem services); water resources; wildfire prevention; Supplemental Nutrition Assistance Program (SNAP, also known as food stamps); Women, Infant & Children (WIC) and child nutrition programs; an organic program; food security; importing and exporting goods; agricultural statistics; and economic and agricultural research. A few examples of these programs are given below.

Food Safety: The safety of meat, poultry and egg products is a major responsibility of the USDA Food Safety Inspection Service which oversees inspection of meat processing facilities. Recently there has been concern that processors may be able to conduct most of the inspections without supervision from the USDA inspectors. Both the USDA inspector general and the GAO found the results of a pilot program of this process unacceptable.

The USDA provides protection for the consumer not only of animal products, but also of fruits and vegetables. Through the Agricultural Marketing Service, Fruit and Vegetable Program, Specialty Crops Inspection (SCI) Division's Audit Programs, voluntary independent audits of produce suppliers throughout the production and supply chain are available. While these programs are voluntary, any farmer who desires to market to a major supplier must achieve certification through a SCI Division Good Agricultural Practices (GAP) and Good Handling Practices (GHP) audit. These audits focus on best agricultural practices to verify that fruits and vegetables are produced, packed, handled, and stored in the safest manner possible to minimize risks of microbial food safety hazards. SCI Division GAP & GHP audits verify adherence to the recommendations made in the U.S. Food and Drug Administration's *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables* and industry recognized food safety practices.

To become certified, the farmer incurs a cost for the GAP audit; to successfully pass an audit, the farmer must have comprehensive records and a multitude of plans for all aspects of the production and management of the crop. The scope of the audit is broad and includes such things as a contingency plan for deer entering his fields, procedures for hand washing by drivers who might enter a storage facility and records of all

chemicals applied to the crop the disposal of crop residue, and records of all chemical applications to the crop. Procedures for handling oil leaks from machinery must be in place. Over 90 fruit and vegetable crops may be audited for GAP certification.

Safety of imported foods is under the purview of the USDA Animal and Plant Health Inspection Service (APHIS), which generally uses a bilateral "positive list" approach in dealing with foreign imports, excluding all commodities from all sources except for individual products from specific sources approved for import. The import protocols to meet the strict U.S. phytosanitary standards usually require exporting countries to make substantial public and private investments. While many of these protocols directly affect the food product, some may be aimed at protecting our domestic farms. For example, an import protocol to decrease the likelihood of the Mediterranean fruit fly's entering the United States usually requires an importing country to conduct frequent field surveys and requires producers to build a special packinghouse.

Sustainability: Through the Natural Resources Conservation Service, farmers receive assistance in developing soil and water conservation plans and knowledge about best management practices to enhance and protect the quality of the soil. While the programs are voluntary, cost sharing from the federal or state governments may be available for some practices, such as cover crops, in which the farmer incurs additional costs.

Nutrition Education: The USDA has been active in nutrition education since early 1900s. Food guides, for children and adults, based on food groups have been provided as education tools. The Basic Four and Basic Seven Food Groups and the Food Pyramid have been taught in schools as a way to have a moderate diversified diet that provides required amounts of vitamins, minerals, fiber, protein and energy for good health. Most recently, the program has been redesigned as "MyPlate." Every five years, the USDA produces the *Dietary Guidelines for Americans.* The guideline makes recommendations of food groups for those two years of age and older including those susceptible to chronic disease.

Food Content: The USDA Nutrient Data Base is produced by the Nutrient Data Laboratory with a mission of developing "authoritative food composition databases and state of the art methods to acquire, evaluate, compile and disseminate composition data on foods and dietary supplement." These resources are used by professionals, schools, the general public, and as a general database for numerous publications; however, there is controversy about what the perfect diet is. *The Food-a-Pedia, Super Tracker* is an on-line tool that provides the opportunity to compare nutritional value of over 8000 foods from fresh vegetables to processed snacks. The tools provided are excellent and information is available on how to use them. However, education level may affect the use and understanding of the contents.

Food Distribution: The Food and Nutrition Service of the USDA provides food to those in need through a variety of programs: Food Distribution Programs, Supplemental Nutrition Assistance Program, (SNAP, formerly known as Food Stamps), Child Nutrition Programs that includes the National School Lunch Program and the School Breakfast Program, and Women Infants and Children (WIC) program that includes the Farmers Market Nutrition Program and the Senior Farmers Market Nutrition Program. All these programs are designed to provide nutritional food access through all parts of the population. More information is available on the website http://www.fns.usda.gov/.

The SNAP program, with a 2012 budget of $80 billion, has been controversial. The average per person benefit is about $135 monthly, which is intended to supplement the individual's income. Over 47 million Americans participated in the program in 2012. Opponents question whether the applicants honestly qualify for the program and feel it creates a dependence on government. Supporters point to the number of families living below poverty levels and our moral responsibilities. The House recently passed a bill to remove the SNAP program from the Farm Bill, substantially reducing its funding level.

Environmental Protection Agency (EPA)
Agriculture is impacted in many ways by EPA regulations. The EPA addresses general concerns of environmental pollution, as well as reviews and registers toxic materials at both the level of use and as residues in food, air and water.

The EPA has recently expanded and updated regulatory requirements for Concentrated Animal Feeding Operations (CAFO) under the Clean Water Act (CWA) and the National Pollution Discharge Elimination System Permits (NPDES) program. Recently updated Clean Air Act regulations will impact the management of manure, diesel equipment and other activities with air emissions. Currently, in Maryland, new equipment must meet air quality standards and the fuel for diesel engines must comply with sulfur content regulations. In Colorado, farm equipment requires pollution control devices and annual inspections to ensure that the devices are working properly and that no leaks of exhaust occur.

Management of water runoff issues is addressed through the CWA. States are required to identify impaired waters and then establish a Total Maximum Daily Load (TMDL) for each body, which is the maximum level of certain pollutants allowable to maintain water quality.

Under the Federal Insecticide, Fungicide and Rodenticide Act, the EPA and the states register and license pesticides for use. Before registering a new pesticide, the EPA requires the applicant to provide scientific studies and test data. For pesticides used in food production, the EPA sets tolerance limits for residuals in or on food. As part of the pesticide process, the EPA registers the pesticides that are genetically added to plants – Plant Incorporated Protectants (PIP). The EPA does not register the plant. The developer of the PIP must submit the same scientific research and data as they would for other pesticides. A review takes place that includes evaluation of risks to humans from exposure. The EPA requires registered users to incorporate Insect Resistant Management in to their planting program. This includes the planting of refuge crops (plantings of rows of the similar crops which are not pesticide resistant in the same or adjacent field) to reduce the risk of insects developing resistance.

Food and Drug Administration (FDA)
The scope and mission of the Food and Drug Administration, in the Department of Health and Human Services, is to provide food safety protection and education. The FDA regulates domestically produced and imported human and animal drugs, biologics, medical devices, food and animal feed, cosmetics, and products that emit radiation. The FDA accomplishes its mission by designing and enforcing regulations through the review of reports submitted by food suppliers, periodic inspections of food processing facilities, and investigations of reported food problems. These activities are supported by roughly 28% of the total FDA budget.

Food groups under FDA authority include dairy (milk, cheese, butter), plant products (vegetables, fruits, nuts, juices, spices), dietary supplements, seafood (finfish, shellfish, crustaceans, surimi-based), grain-based (bread, cereals, flour), bottled water and veterinary food and medicine. The safety of genetically engineered food and food labeling, both primarily responsibilities of the FDA, will be discussed in a later paper dealing with agricultural technology.

Food Labeling: Managing the food label program is one of the FDA's major responsibilities; it is undertaken in collaboration with USDA (primarily responsible for labels on meat products) and the Federal Trade Commission (FTC) (responsible for prosecution of labeling violations and misleading advertising). Foods are required to bear specific nutrition and ingredient labeling in a standard system. Food, beverage, and dietary supplement labels that bear nutrient content claims and certain health messages must comply with specific requirements. The FDA does not perform pre-market approvals of food labels, including

nutrition facts or of structure-function claims (e.g., calcium builds strong bones). Neither does it regulate labels defining agricultural production processes (e.g., organic, natural, grass-fed) for which USDA is responsible.

Food label requirements include quantity information to protect against the large, partially-filled box and to facilitate consumers' comparing prices per unit for similar products. Grades and standards, product ingredients, and nutrition information are also required. In recent years, attention focused on food labeling has exploded with concerns related to nutrition, genetic modification, pesticide residue, additives, identification of known allergens, product origin disclosure, tracking of product relative to recalls, and more.

Hot topic issues in the labeling arena all seem to be fall under the umbrella of transparency. Much of the discussion in food labeling centers on the consumer's right to know (at one time this would have been considered covered in the 1962 Consumer Bill of Rights) – this is true of claims that are made, as well as information that is not shared. There is a growing market that is willing to pay extra for food with certain desired attributes, but the absence of uniformly accepted standards creates confusion amongst consumers.

A GAO report states that consumers have difficulty understanding the implications of different types of health, qualified health, and structure/function claims on food labels. The Center for Science in the Public Interest is seeking for better rulemaking and enforcement from the FDA on misleading food labels. There are many products that claim health benefits, when there is no evidence to support the claim. According to Michael Jacobson, of the Center for Science in the Public Interest, accuracy in food labels is a low priority for the FDA. FDA staff attorney, Rebecca Goldberg, speaking in a personal capacity, stated that barriers include an alphabet soup of overlapping regulatory agencies as well as First Amendment rights relative to commercial speech.

Food Safety: Legislation affecting the FDA food safety mission includes: approval of an FDA role in monitoring pesticide residues (1954), definitions and rules concerning food (1958) and color (1960) additives, labeling and post-market monitoring of infant formula (1980), nutrition labeling and education (1990), food allergen labeling and consumer protection (2004), and the Food Safety Modernization Act (2011), which calls for the FDA to prevent rather than simply respond to food contamination; the FDA describes this act as the most significant change in U.S. food safety legislation in 70 years.

The Food Safety Modernization Act gives the FDA authority to address food safety issues more fully than previously authorized; the FDA is now in the process of consulting with stakeholders to develop regulations that will establish science-based minimum standards for the safe production and harvesting of fruits and vegetables and will address soil amendments, worker health and hygiene, packaging, temperature controls, water, and other issues. Food facilities will be required to implement a written preventive control plan, provide for the monitoring of the performance of those controls and specify the corrective actions the facility will take when necessary – actions similar to the current voluntary requirements now under the USDA.

Other provisions of the act include a new system for import oversight that requires importers to ensure that their foreign suppliers have adequate preventive controls in place and authority to make these new regulations that are scale-appropriate, conservation-friendly, and accessible to certified organic producers and value-added producers. The new regulations will focus on addressing food safety risks from microbial pathogen contamination (e.g., Salmonella, E. coli O157:H7, and Shigella). The act does not address food safety risks from genetically engineered crops, pesticide use, or antibiotic resistance nor does it change food safety regulations for meat, poultry, and egg products, which are under USDA jurisdiction.

Food safety was 42% of FDA budget in the 1970s but has been reduced to less than 25% since 2003. The Food Safety Modernization Act is expected to cost $1.4 billion over the next five years, yet only ~$50

million was appropriated by Congress for 2012. Federal and state appropriations support the FDA food safety mission and provide an inspectional capacity of approximately 2,000 inspectors for 130,000+ domestic facilities. The USDA, which has responsibility for meat, poultry and eggs, has approximately 7,800 inspectors for 6,800 facilities, and proposed regulations would turn a sizeable portion of the inspection responsibilities over to industry inspectors. The FDA inspects only 2% of imports, which represent 15% of food supply (seafood 75-80%, fresh fruit ~50%, vegetables ~20%); however this inspection rate is tempered by the USDA-established production protocols mentioned earlier. State departments of public health officers are partners in food safety compliance, but are subject to low and decreasing levels of both state and FDA funding to conduct inspections and product sampling.

Guidance for Industry is voluntary on many issues (e.g., use of antibiotic drugs in animal production, use of Hazard Analysis & Critical Control Points (HACCP) by food processors and restaurants). However, as with the voluntary GAP program, market conditions may stimulate adoption of voluntary procedures. Food safety regulations for farmers and processors, in many cases, are the same for producers of all sizes which is beneficial to large industrial producers. FDA has overlapping responsibilities with other agencies, especially with the USDA in the area of food safety, so that the system may not be as efficient as possible.

Interaction of Federal Agencies

In addition to the participants in food safety described above, other federal agencies such as the National Marine Fisheries Service (NMFS) and the Bureau of Alcohol, Tobacco and Firearms (ATF) also play a role. Even the Department of Transportation (DOT) is called upon in some instances.

A detailed discussion of these interacting services is provided in an article from the *Seton Hall Law Review* entitled "Organizing Federal Safety Regulations." The following table from that article shows the division of responsibilities by food type and agency and gives a description of each agency's focus. Although extensive, the table is not all inclusive as it leaves out activities such as the monitoring of food borne illnesses carried out by the CDC, the USDA role in fruit and vegetable safety that goes beyond pesticide concerns, as well as some of the enforcement of food advertising and labeling functions that are carried out by other agencies such as the Federal Trade Commission (FTC). The table demonstrates the intricate web of authority that currently exists in food safety.

Food	Regulator(s)	Comments
Alcoholic beverages	ATF, FDA	ATF licenses and inspects breweries. FDA oversees wine coolers
Eggs	FDA, AMS, FSIS, APHIS	FDA has lead jurisdiction over shell eggs. FSIS continuously inspects egg products. AMS operates a voluntary grading program. APHIS monitors animal health
Fruits & vegetables (including GE varieties)	FDA, EPA, USDA	EPA and USDA share pesticide regulation responsibilities. FDA enforces standards for pesticide residues on processed food. (Non-pesticide safe handling services are also provided for fruits and vegetables by AMS)
Grain	FDA, GIPSA, EPA	GIPSA establishes and enforces identity standards through inspection. FDA enforces standards for pesticide residues on processed food.
Meat & poultry	FSIS, FDA	FSIS inspects meat during processing. FDA holds regulatory authority once meat leaves the slaughtering or manufacturing plant.
Processed Foods	FDA	FDA is responsible for most non-meat products.
Seafood	FDA, NMFS	FDA oversees seafood safety generally. NMFS runs a voluntary inspection service.
Water	FDA, EPA	EPA regulates tap water, FDA bottled water.

This Fact Sheet was prepared by the League of Women Voters of Montgomery County, MD based upon research conducted for the LWVUS Agricultural Update. The LWVMC committee is: Margaret Chasson, Chair, Elaine Apter, Maxine Montgomery, Judy Morenoff, Lorna Post, Alyce Ortuzar, and Marilynn Smith.