ON THE FARM

Photo credit: Lauren Norton, Rathbaun Farm, Ardrahan, Co. Galway, Ireland
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CHAIR MESSAGE
Stephanie Altman, Shannon Martin Dilley, Megan Galey, Fatima Maria Ahmad, and Anastasia Telesetsky

As the chairs of the International Environmental and Resources Law Committee (IERLC), Agricultural Management Committee, and the Section of International Law International Environmental Law Committee (IELC), we are pleased to offer a joint special edition newsletter: On the Farm.

This newsletter focuses on issues surrounding agriculture. As the world population grows, increased burdens are changing farming practices, highlighting the need for sustainable agriculture. Innovative technologies are providing potential solutions; however, with new technologies come unique legal challenges. This newsletter touches on technologies and innovation, legal challenges, and sustainability in agriculture.

Author Jeremy Coller outlines the state of factory farming and how the same industrialization and technology that created the state of factory farming are now creating exciting new models to reshape the future of farming. Author Leslie Couvillion discusses approaches for managing food chain sustainability in an excerpt from a book entitled *International Farm Animal, Wildlife, and Food Safety Law*, which was edited by Gabriela Steier and Kiran Patel and will be published in the fall. Co-authors Michael Barrowclough and L. Leon Geyer explain the new commercial drone rules, potential for use of drones in the agricultural sector, and the legal challenges. Co-authors Thomas P. Redick and Jhoset A. Burgos-Rodriguez’s article is a candid discussion of the current controversy over GM labelling at an international, national, and state level. The newsletter concludes with Martha Noble’s update on large blooms of cyanobacteria, commonly known as blue-green algae, that have occurred in the Western Basin of Lake Erie due in large part to agricultural run-off.

We encourage members to attend and enjoy interesting CLE content and networking with colleagues. SEER continues to provide timely information and assistance to our members to aid them in becoming better lawyers. Please take note that the next the next Section conference is the 46th Spring Conference on March 29–31, 2017 in Los Angeles. Please note the Environmental Summit of the Americas, a special one-day program for international lawyers, will be held on March 29. Stay tuned for more details. Additionally, the ABA Section of International Law Fall 2016 Conference will take place in Tokyo, Japan, October 18–22, 2016.

Our committees enjoy active participation by members, with quality programs arising from member involvement. If you want to get more involved in any of our committees’ activities, please let our committee chairs know: IERLC (Stephanie Altman, stephanie.l.altman@gmail.com, or Shannon Martin Dilley at dilleyshannon@gmail.com); AMC (Megan Galey, megan.galey@huschblackwell.com); or SIL IELC (Fatima Maria Ahmad, fatima.maria.ahmad@gmail.com or Anastasia Telesetsky, atelesetsky@uidaho.edu). Additional information is available on the committee websites.

Our newsletter editors are always ready to entertain article ideas and we also welcome periodic guest editors to help put together these newsletters. If you wish to propose an article, please contact our committee newsletter vice chairs: IERLC (Elizabeth Hessami at Ebeh777@aol.com or Gabriel Monroe at gabriel.monroe@arb.ca.gov); AMC (Martha Noble, marthanoble101@gmail.com, or Thomas P. Redick, tpr@geeclaw.com); or SIL IELC (Guillermo Malm Green, gmalmgreen@brons.com.ar, or Linda Lowson, lmlowson@gmail.com).

Stephanie Altman and Shannon Martin Dilley are co-chairs of the International Environmental Law and Resources Committee. Megan Galey is the chair of the Agricultural Management Committee. Fatima Maria Ahmad and Anastasia Telesetsky are co-chairs of the International Environmental Law Committee in the Section of International Law.
Since the 1960s the way we produce meat has undergone a revolution. The increasing use of industrial methods and improved technology has created a system dominated by factory farms—a system that now looks unsustainable. However, it is the same forces of industrialization and technology that are now creating exciting new models to reshape the future of farming.

An Unsustainable Business Model

Factory farming, defined as manufacturing-style operations rearing large numbers of farm animals in confinement, is now the predominant mode of global meat production. It rears over 70 percent of the world’s farmed animals, rising to a remarkable 99 percent in the United States (U.S.), according to the American Society for the Prevention of Cruelty to Animals (ASPCA).

It is a relatively recent phenomenon. During Bill Clinton’s presidency, 30 percent of all U.S. pigs were factory farmed. With a potentially new Clinton presidency next year, this percentage has risen to over 97 percent. Large poultry farms can contain more than 500,000 chickens; pig farms can contain more than 10,000 hogs; and cattle feedlots can hold upwards of 100,000 cattle at any one time—almost the entire dairy population of Greece. Food & Water Watch, Factory Farm Nation, 2015 Edition (May 2015), available at https://www.foodandwaterwatch.org/sites/default/files/factory-farm-nation-report-may-2015.pdf. Industrialized farming methods are also spreading rapidly in China, Africa, and other emerging markets, as the demand for meat accelerates in these markets.

Producing the feed for these animal factory farms has meant that over one-third of the world’s grain harvest is now fed to farmed animals, according to the American Journal of Clinical Nutrition and the United Nations Environmental Program (UNEP) statistics. On average, it takes around 6 kilograms (kg) of plant protein to produce 1kg of animal protein. Feeding this insatiable appetite has caused cereal production for animals to rise 3.3 percent since the 1960s, while cereal production for humans has risen just 1.6 percent in the same period, according to 2015 data published by the United Nations (UN) Food and Agriculture Organization Statistics Division (FAOSTAT). Farm Animal Investment Risk & Return, Factory Farming: Assessing Investment Risks (2016), available at http://www.fairr.org/wp-content/uploads/FAIRR_Report_Factory_Farming_Assessing_Investment_Risks.pdf

At first glance, the growth in factory farming could be seen as a positive trend. We are feeding the world; meat is cheaper than ever before, and the number of laborers required to work on the land has plummeted. In 1900, around 41 percent of America’s labor force worked on a farm; now the percentage is below 2 percent, according to research published by The Economist. Technology Quarterly: The Future of Agriculture, Factory Fresh, THE ECONOMIST (2016) http://www.economist.com/technology-quarterly/2016-06-09/factory-fresh (last visited Aug. 8, 2016). However, these developments fail to take into account the fact that the long-term risks of factory farming pose a material threat to investors and to society as a whole.

animals with antibiotics. A staggering 80 percent of all antibiotics produced in the United States are now used by factory farms; in Europe the percentage is approximately 50 percent. Id. This overuse of antibiotics is likely catalyzing the risk of drug-resistant bacteria, such as bacteria resistant to colistin—medicine’s ‘drug of last resort’ for serious infections in human patients. Colistin-resistant bacteria were discovered for the first time in livestock and human patients in China in late 2015 and have now also been identified in Europe and the United States.

Emissions are another example of the unsustainable consequences of animal factory farms. The global livestock sector is currently responsible for more greenhouse gas emissions than the transport sector. From an investment point of view, this leaves the animal factory farming sector critically exposed to potential new climate legislation as we transition to a more carbon-constrained world.

An industry that disregards environmental and social concerns is becoming unacceptable to consumers as well. In June 2016, U.S. agribusiness giant Perdue Foods responded to rising concern about animal welfare from its customer base by announcing that it will overhaul its treatment of chickens, including retrofitting chicken houses with windows to provide light for the animals and installing systems that put the birds to sleep before they’re slaughtered.

From pandemics to pollution, to consumer backlashes against animal cruelty, to the treatment of processing plant workers, the animal factory farming sector is increasingly being labeled as a high-risk sector by investors and one that needs urgent reform.

The Future Is Not What It Used to Be

Farmers and agricultural companies are a critical part of the solution to mitigate these problems. Between now and 2050, the planet’s population is forecasted to rise to 9.7 billion from the current 7 billion, according to the U.N. Population Division.

UN Dep’t of Economic and Social Affairs, World Population Projected to Reach 9.7 Billion by 2050 (July 29, 2015), http://www.un.org/en/development/desa/news/population/2015-report.html (last visited Aug. 8, 2016). This enormous population will not only need to eat, but also will increasingly want to eat well.

Meeting this food demand will require food production to increase by approximately 70 percent from 2009 production, according to data published by the UN Food and Agriculture Organization. Food & Agric. Org., How to Feed the World in 2050 (2009), available at http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf. This enormous increase in food production will need to be accomplished without putting irreparable strain on the Earth’s environment, soils, oceans, and animals.

The unsustainability of the current animal factory farming model means that we cannot rely on animal protein to meet all this demand. We must investigate and develop different ways to produce the nutrition that we require, as well as adding sustainability considerations to our increasing use of technology and manufacturing-style processes in farming. There are three types of innovation that will therefore shape the future of animal factory farming:

- The growth of alternative sources of protein;
- Business model innovations; and
- The rise of ‘smart’ farming.

The Growth of Alternative Sources of Protein

In the venture capital community, there is growing interest in start-ups applying cutting-edge thinking and technology in biotechnology, medical science, manufacturing, and data management, aiming to reinvent the way we think about food. We are at the start of a food tech revolution. It may sound unlikely now, but consider that in recent history we have moved from a horse to the Model T Ford to the Tesla,
and from basic communication to smartphones, yet we still use the cow or chicken as our prime, and primitive, technology for producing food.

Meat alternatives are more sustainable over the long-term, and in the short-term generally offer lower and less volatile input costs (e.g., chickpeas are much cheaper to produce than chicken), and exciting opportunities exist to use current manufacturing processes to quickly build scale. Bruce Friedrich, Chief Executive Officer at specialists New Crop Capital argues that, “In 2014, the global meat substitutes market was worth about $3.4 billion and is forecast to grow by 7.5 percent a year over the next five years—making it worth nearly $6 billion by 2022.” And these are conservative estimates.

The first type of innovation in this market is “replacement innovations,” i.e., foods that use biotechnology and other methods to provide an identical or improved sensory experience to consumers compared to the product they replace. For example, California-based Impossible Foods has found a way to make a veggie-burger taste like meat by adding a “heme” molecule found in the root of some plants. Impossible Foods raised an impressive $108 million in new funding in October 2015, with backers including the likes of UBS and Bill Gates.

Another example is San Francisco-based food tech leader Hampton Creek, who has made a popular eggless mayonnaise product called “Just Mayo.” Hampton Creek’s revenue grew by more than 350 percent in 2015 and they are one of the fastest-growing food companies in history. Last year’s avian flu epidemic in the U.S. (largely catalyzed by animal factory farms) and the consequent hike in the price of eggs resulted in a spike in demand for Hampton Creek’s products, and it is noticeable that Unilever has seen the importance of this market and unveiled its own “egg-free” mayonnaise brand earlier this year. Elaine Watson, *Hampton Creek’s Revenues Surge 350% in 2015, Says CEO: We’re About More than Just Mayo* (Feb. 4, 2016), http://www.foodnavigator-usa.com/Manufacturers/Hampton-Creek-s-revenues-sumed-350-in-2015-says-CEO.

The second type of innovation shaping the future is the rise of “cultured meat” – i.e., the race to create laboratory-developed hamburgers and sausages that can be sold to a mass market. This sector is led by firms such as Memphis Meats, who uses fat cells to add juiciness to its lab-grown meat. Academics like Dr. Amit Gefen at Tel Aviv University are also involved; Gefen is finalizing the recipe for developing cultured chicken. The sector also has high-profile support from the likes of Google co-founder Sergey Brin.

**Business Model Innovations**

Technology also means that farming no longer happens only on a farm. We are seeing the emergence of companies such as Agricel and AeroFarms, who are using new methods to reduce the cost of production at scale, for example, methods of indoor vertical farming that take advantage of the decreasing cost of LED lights and use LED lighting to grow vegetables in large warehouses, thereby providing fresh products for urban markets that are grown 24 hours a day but with considerable savings in water, chemicals, and logistics.

A great example of this can be found in a maze of tunnels beneath Clapham in south London where the company Growing Underground is nurturing a variety of salad plants, intended for sale to food outlets across the United Kingdom’s (UK) capital city. Instead of using a greenhouse, Growing Underground uses LEDs and sensors to provide the optimal amount of light, humidity, and temperature for the plants’ photosynthesis.

**The Rise of Smart Farming**

The wide-scale introduction of new crop varieties and agricultural chemicals in the 1950s and 1960s has been christened the “green revolution,” and farming today is witnessing change on a similar scale that may be dubbed the “smart farming” revolution.

Farms are increasingly using computer-controlled systems to improve sowing, watering, fertilizing,
and harvesting. From the use of unmanned agricultural drones, to GPS to ensure precision fertilizing, to precision genetic manipulation and advances in aquaculture, we are seeing numerous innovations with the potential to create significant yield-enhancing shifts.

In the short term, these improvements are boosting farmers’ profits, by cutting costs and increasing yields, and should also benefit consumers in the form of lower prices. In the longer term, they also may provide solutions to key environmental sustainability problems.

**Seeing the Future Requires a Lens of Sustainability**

Industrialization and technology have been the most powerful forces shaping animal factory farming in the last 40 years and can continue to be so in the future, but only if they are applied through the filter of sustainability. The industry must change to live within environmental limitations and the demands of society as a whole. If the industry can successfully meet this challenge, then we could be on the brink of an exciting new food tech revolution, with the capability to provide better food for more people within the escalating environmental constraints of our planet.

Jeremy Coller is chief investment officer of Coller Capital, and founder of Farm Animal Investment Risk and Return (FAIRR) Initiative. He founded FAIRR in 2013 as part of Jeremy Coller Foundation’s animal welfare programme to end animal factory farming, by putting animal welfare on the ESG agenda and establishing animal factory farming as a core value within the UNPRI reporting framework.

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**TOOLS FOR CHANGE: INTERNATIONAL LAW AND POLICY APPROACHES TO MANAGING FOOD CHAIN SUSTAINABILITY**

Leslie Couvillion
Edited by Gabriela Steier, Esq. and Kiran K. Patel, LL.M, Esq.


**Introduction**

The food chain offers a number of potential levers for promoting sustainability goals. This chapter explores how governments (often with the help of consumers, industry groups, nonprofit organizations, and other stakeholders) manage the intersections between the food, environmental, and energy sectors.

Agricultural plant and animal products often have a complex lifecycle: they are grown, transported, processed, packaged, and—ultimately—consumed, discarded, or recycled. Each of these processes is interrelated. Therefore, efficiency improvements at any stage can support greater sustainability of the entire food chain, with significant environmental, economic, and social welfare repercussions. For instance, better practices at the end of the cycle (like recycling and composting programs for packaging and food scraps) can reduce the amount
of food that must be grown at the beginning of the cycle. Lowered demand allows farmers to use less land, water, and chemicals to produce food. In turn, this can reduce the agricultural sector’s impacts on wildlife biodiversity; save money, energy, and resources; and boost food safety by increasing the integrity and nutrient value of food. Moreover, good food waste management practices can help to lower greenhouse gas (GHG) emissions; provide new sources of clean energy (e.g., by fueling biogas plants); and enhance food security.

In the interest of scope, the chapter hones in on regulatory approaches at two distinct stages of the food chain:

1. End of the cycle: controlling food waste, including both organic (e.g., food scraps) and inorganic (e.g., packaging) waste; and
2. Middle of the cycle: improving food sector transportation efficiency (e.g., reducing “food miles”).

Of course, other stages of the food chain provide opportunities for achieving efficiency and sustainability gains as well. At the start of the cycle, laws on agroforestry or organic, ecological, or biodynamic farming can support growers who convert to more sustainable farming techniques. For example, Kenya’s Agriculture (Farm Forestry) Rules require farmers to establish and maintain farm forestry on at least 10 percent of their agricultural lands, while England’s 2003 Organic Farming (England Rural Development Programme) Regulations provide for aid payments to farmers who introduce organic farming methods and comply with certain environmental conditions. Such techniques have many environmental benefits, including reducing the contamination risk from pesticides and fertilizers.

At mid-cycle processing and packaging stages, laws that ban specific food packaging chemical compounds (e.g., the United States’ Food, Drug, and Cosmetics Act Food Additive Regulations) set maximum “empty space” requirements for food packaging; provide for bottle deposit refunds (e.g., Israel’s national Deposit on Beverage Containers Law; Germany’s Packaging Waste Ordinance); or prohibit plastic bags, containers, and utensils (e.g., South Africa’s Plastic Bags Regulation; India’s regional Tamil Nadu Plastic Articles (Prohibition of Sale, Storage, Transport and Use) Act) can all help to lower the resource-intensity of the food and beverage industries. Since the array of tools for improving the environmental and energy impacts of the food sector is vast, this chapter focuses on the two categories highlighted above: food waste management and food sector transportation efficiency.

### National-Level Approaches

#### Food Waste Management

Most countries have a general national-level waste management law or policy. However, these systems vary widely in their scope and effectiveness. Many countries, including the United States, delegate responsibility from the federal government to state or municipal bodies. These local entities must follow the goals and objectives set out in a national statute or policy document.

Most national waste management plans do not make special provisions for organic food waste. Instead, such waste is managed alongside other types of municipal solid waste (MSW). (Inorganic food waste, such as plastic or glass packaging, is often regulated separately from other waste streams under recycling laws and programs.) In most cases, this means that food waste is collected and sent to landfills, just like any other form of trash. Increasingly, however, governments (like those in Japan, the EU, and some U.S. cities) require organic waste to be handled independently from other waste streams. In these areas, households and businesses must sort their organic waste into separate bins, and municipalities must collect this biodegradable waste and put it to some use other than landfilling. Alternative disposal options include composting, turning it into animal feed, or using it for clean energy production. This growing field of “food recycling” or “landfill diversion” laws is an exciting and active one. However,
unwanted food continues to end up in landfills in most places around the world.

**Food Transportation Efficiency.** Similarly, the field of food transportation efficiency is a promising, but still emerging, one. In many countries, transportation in the food and beverage industries is a significant end-use contributor to climate change. See W. Wakeland, S. Cholette, K. Venkat, *Food Transportation Issues and Reducing Carbon Footprint* (2012); J. Boye & Y. Arcand (eds), *Green Technologies in Food Production and Processing*, pp 201–202. In the United States, for instance, transportation accounts for over 10 percent of the total carbon emissions of the food chain, with produce traveling an average of 2,000 kilometers from farm to market. *Id.* Public and private interest alike in “greening” food transportation is mounting. For example, the United Kingdom (UK) is the host to an industry-led initiative to reduce the “food miles” associated with the country’s food supply. See Food and Drink Federation, *Transport Efficiency Commitment* (2014), http://www.fdf.org.uk/transport_efficiency.aspx (last visited Aug. 4, 2016). Reducing food miles means driving fewer miles, as well as using more efficient fuel, speed, and loading practices. Australia has codified some of these concepts in its Heavy Vehicle National Law (HVNL), which applies to the country’s entire commercial transportation sector. Although the HVNL is not specific to the food industry, it could lead to energy efficiency gains in Australia’s food sector since transportation is one of the key links in the food chain. Efforts to improve the lifecycle sustainability of the food sector can yield substantial environmental, economic, and social co-benefits. However, few countries are actively regulating in this arena.

**International-Level Approaches**

The United Nations Food and Agriculture Organization (UN FAO or FAO) estimates that 1.3 billion tons of food—or one-third of the world’s total food supply—is thrown away each year. United Nations Food and Agriculture Organization, *Food Wastage Footprint: Impacts on Natural Resources Summary Report*, 6 (2013), available at http://www.fao.org/docrep/018/i3347e/i3347e.pdf. This staggering figure places a significant and unnecessary strain on the world’s agricultural production sectors. However, international law does not yet play a strong, direct role in governing food waste or food chain efficiency. Indeed, there is no binding global mechanism targeting these issues. Nevertheless, some international law instruments can indirectly affect how nations and regions structure their waste and food chain management policies. This section highlights several such examples.

The Agreement on Technical Barriers to Trade (TBT Agreement) and the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) are related international trade instruments.

**Agreement on Technical Barriers to Trade (TBT Agreement) (1995) and Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (1995).** The World Trade Organization (WTO) has administered both agreements since 1995. Through these instruments, the WTO seeks to balance two competing concerns: (a) the right of individual countries to regulate as they see fit; and (b) the need for efficient, transparent, and fair global trading markets. As of November 2015, there are over 160 WTO Member States, all of whom are bound by the terms of the agreements. See World Trade Org., *Understanding the WTO: The Organization: Members and Observers* (2015) https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (last visited Aug. 4, 2016). The treaties have important implications for the food and agriculture industries, especially for importers and exporters of food products.

The TBT Agreement has a broad, general scope. It prevents individual WTO Member States from setting technical regulations, standards, and other requirements that create “unnecessary obstacles” to trade. At the same time, the agreement protects countries’ right to implement measures that achieve

For example, imagine that a country is considering enacting new regulations that would set a minimum recycled content requirement for packaging on all food products sold in the country. Any foreign (exporting) company would have to comply with these packaging requirements in order to sell its products within the (importing) country. See State of Oregon, Dep’t of Envil. Quality, *Packaging Waste Reduction: International Packaging Regulations* (July 14, 2005), available at http://www.deq.state.or.us/lq/pubs/docs/sw/packaging/intlpkgregulations.pdf. If the new requirements in the importing country are stricter than what the exporting company is used to (or can find in other markets), meeting the new threshold would entail higher costs. Such expenses might dissuade the foreign company from entering (or staying in) the importing country’s market. This could present a potential “unnecessary obstacle to trade.” Therefore, the importing country might not be able to enact environmentally friendly packaging requirements if such requirements are too different (i.e., too much more stringent) than those in other countries. As a result, the TBT and SPS Agreements are unlikely to be strong tools for promoting food chain sustainability. In fact, governments and advocates alike should be aware of the potential for these international trade agreements to block regulatory innovations.

Regardless of the approach taken in any given location, it is also important to consider the role of public awareness and public engagement on food waste management issues. Public awareness campaigns have played a huge role in supporting—and even instigating—government reforms in the EU, China, and Japan. In contrast, a lack of awareness or concern about food waste problems has been an obstacle to improving food waste management in places like Australia and parts of Africa. See S. Afun, *Government Regulations and Legislations Will Ensure Sustainable Waste Management in Nigeria* (2009), available at http://www.iswa.org/uploads/tx_iswaknowledgebase/le_2009_2-357.pdf. Therefore, public awareness campaigns are another potential tool for change. Indeed, an informed and engaged population can help a government to implement and enforce better food chain management practices. An efficient food cycle promotes, in turn, an efficient economy and a healthy, well-nourished population.

*Leslie Couvillion* is a 2015 graduate of Yale Law School and the Yale School of Forestry and Environmental Studies, where she served as a Teaching Fellow for the Environmental Protection Clinic and a student director for the Visual Law Project (a student-run documentary film production group). Leslie received a B.A. in Anthropology from Vassar College in 2008.
DRONES ON THE FARM
Michael Barrowcough and L Leon Geyer

Introduction

Drones are beginning to transition from government and military use into commercial markets, with an expected 80 percent of use going towards agriculture. Assoc. for Unmanned Vehicle Systems Int’l, The Economic Impact of Unmanned Aircraft Systems Integration in the United States (Mar. 2013). The Federal Aviation Administration (FAA) predicts there could be as many as 10,000 commercial drones in the air by 2020, generating more than $94 billion in total spending over the coming decade and creating more than 100,000 domestic jobs. See Fed. Aviation Admin., FAA Aerospace Forecast: Fiscal Years 2012–2032 (2012); Assoc. for Unmanned Vehicle Systems Int’l, The Economic Impact of Unmanned Aircraft Systems Integration in the United States (Mar. 2013). The opportunities for drones to be utilized across different sectors of the economy are numerous. They can be used to detect the source of a power outage after a storm, verify insurance claims, identify land-use changes, appraise property values, locate a criminal evading police, and even deliver your next package or meal. Overstating their potential role in society appears to be an incredibly difficult task.

The rapid advancement of drone technology has left the FAA to play regulatory catch up, with the U.S. Congress tasking the FAA to develop a national strategy to safely integrate drones into domestic airspace. Recently, the FAA issued a new set of commercial drone rules in hopes of correcting what has been an industry lacking any well-defined, comprehensive regulations. Fed. Aviation Admin., Small Unmanned Aircraft Systems Part 107, https://www.faa.gov/uas. Before this ruling, regulations regarding commercial drone use simply consisted of an outright ban. Even after these new regulations are placed into law however, significant legal and ethical questions regarding their use remain. How does the onset of drone technology change individual and societal privacy and property rights? Should they be regulated similarly to airplanes and automobiles with vehicle identification numbers and readable identification numbers, requiring registration, insurance, and a license? Are they allowed to fly in the same space as commercial airliners? Can they be operated now? Though some of these questions depend on government (federal, state, or local) action to answer, such as the newly released FAA rulings, there is information available now that helps point to possible conclusions.

The unique flight capabilities and characteristics of drones make them a highly valuable tool across many industries, particularly agriculture. These same attributes also test current property and privacy rights and may make previous court cases antiquated and in need of update, either through new legislation or lawsuits. This article briefly explores the current state of legislation, precedent court cases, and drone technology to try and explain the possible limits of drone users, particularly in the agricultural realm. The authors believe the FAA should make the establishment of appropriate regulatory guidelines concerning the integration of drones into our nation’s airspace a top priority to avoid further interruptions of this developing industry. The intent of this paper is a prompt discussion on how regulatory measures, both state and federal, regarding commercial drone use could and should be established.

Drone Regulations and Agricultural Use

Using the authority given to it by Congress, the FAA released its new rules and guidelines regarding the commercial use of drones in our nation’s airspace on June 21, 2016. As stated by the FAA, these new rules are meant to “prohibit model aircraft from endangering the safety of the National Airspace System.” Fed. Aviation Admin., Operation and Certification of Small Unmanned Aircraft Systems, RIN 2120–AJ60, http://www.faa.gov/uas/media/RIN_2120-AJ60_Clean_Signed.pdf. To help ensure this goal is met, these new regulations included operational limits, pilot accreditations and responsibilities, as well as aircraft requirements. Examples of these limits and requirements include: drones must weigh no more than 55 pounds, including any payload; pilot-drone visual contact must be maintained at all times;
flights must occur during daylight and may not fly over individuals; drones may not exceed an altitude higher than 400 feet and a speed greater than 100 miles per hour (mph); pilots must obtain a remote pilot airman certificate; FAA is allowed to inspect and/or test said drone as well as obtain access to any related documents; the user must disclose to the FAA within 10 days of any accidents related to the operation of said drone; and the drone must be registered in a similar manner as all other aircraft. Registration and Marking Requirements for Small Unmanned Aircraft, 80 FR 78594 (Dec. 16, 2015). In regards to these new regulations and their potential impact on agricultural use, they do not appear to be overly demanding or burdensome. Many of the newly released regulations will have limited, if any, effect on agricultural use.

The possibilities for integrating drones into the agricultural sector are immense, spanning from the individual farm level to the agricultural service sector. Drones may be used for a variety of agricultural purposes, replacing current practices requiring human or even animal involvement and can lead to new services. The following is a list of potential agricultural purposes:

- Livestock herding
- Crop health analysis
- Livestock health analysis
- Crop damage assessment
- Crop disease preventative measures
- Pest maintenance
- Remote sensing
- Field and property mapping
- Fertilizer and pesticide application
- Field data collection
- Multispectral imaging
- Soil testing
- Drone insurance

Drones may be used to measure the health of both crops and livestock, capture images of farm fields, herd livestock, and even conduct soil testing. Perhaps the most binding of the new regulations on agricultural use are the 55-pound payload limit and the maintained pilot-drone visual line of sight. Depending on the farmer’s purpose for the drone, the 55-pound payload maximum could reduce this new technology’s effectiveness. For example, if a farmer wanted to use their drone to apply fertilizers, they would be limited to the tank size allowed by the regulation. In cases where a farmer would need to land and “restock” material or equipment, an individual decision would need to be made on whether it is as time- and cost-effective as more contemporary methods. Regulations regarding a constant pilot-drone visual line of sight will obviously vary on an individual basis. Using a drone in the state of Rhode Island, where the average farm size is less than 100 acres, would likely not be an issue, whereas the average farm size in Wyoming is greater than 3,000 acres and could cause discontinuities in the pilot-drone line of sight.

**Legal Issues**

While safety is a main regulatory concern, many individuals and organizations are worried that privacy and property rights will not be adequately addressed. The ambiguity of airspace ownership at low altitudes has led some drone operators to push the limits of privacy and property, rousing widespread concern and causing many to ask, “Can I shoot them down?” There is no set limit for when property ends in airspace, though it is at least 83 feet. *Causby v. United States*, 328 U.S. 256 (1946). While the FAA controls the who, what, when, and where of airspace, the judicial system will decide the controversial matter of privacy and property. The following are a brief preview of court cases regarding the current state of privacy and property rights that relate to drone technology in the United States in an attempt to frame guidelines for drone use.

Privacy from drones involves questions of where the drone is flying, what technology it is using to supposedly breach a person’s privacy, and what a reasonable expectation of privacy in modern society is. In *California v. Ciarolo*, the courts looked at whether a police helicopter flight was an unreasonable search because it looked into the private property of Ciarolo without a warrant. The courts ruled that it was not an unreasonable search because the evidence was clearly visible

These cases tackled the question of the reasonable expectation of privacy first discussed in *Katz v. United States*. *Katz v. United States*, 389 U.S. 347 (1967). It appears that courts are unwilling to accept a person’s right to privacy in areas of property that are easily visible from public airspace. However, what if technology more advanced than basic cameras had been used in these investigations? In *Kyllo v. United States* the court ruled that the use of radar and “sense-enhancing technology” was an unreasonable search because it breached a person’s expected privacy. Chris Schlag, *The New Privacy Battle: How the Expanding Use of Drones Continues to Erode Our Concept of Privacy and Privacy Rights*, 13 PGH. J. TECH. L. & POL`Y (2013), *Kyllo v. United States*, 533 U.S. 27, 37 (2001). The technology used was not readily available to the public; therefore, individuals could not predict the need to protect themselves from it. As technology changes and drone use increases, the courts will likely be faced with similar cases.

The next question that must be addressed is where drones can operate. The onset of commercial aviation helped put an end to the idea that property extended in space to the heavens, but it opened up the question of how much airspace a person’s property covers. One of the first cases regarding a person’s right to airspace above their property was *Causby v. United States*. Causby claimed military flights from an adjacent airport were breaching and destroying the economic use of his property, a chicken farm. Planes were flying so low and causing such an immense amount of noise that the chickens were killing themselves. The court ruled that the military’s use of the airport had affected a taking of his property that required compensation. While recognizing that an owner’s property does not extend infinitely into the skies, the court determined that “the landowner owns at least as much airspace as he can occupy or use in connection with his land.” *Causby v. United States*, supra. A similar case, *Griggs v. Allegheny County*, involving a private airport and landowner, yielded the same results. *Griggs v. Allegheny County*, 369 U.S. 84 (1962).

*Causby v. United States* does not provide a specific altitude where the owner’s property ends, only that it is at least 83 feet. With the FAA declaring airspace above 500 feet to be public domain, a breach of the Fourth Amendment or a trespass case would need to occur below that. This makes property ownership rights unclear between 83 and 500 feet and will likely lead to more conflict between property owners and drone users.

**Conclusion**

New technologies often face a balancing test of being able to use the technology while ensuring that it is not used in a dangerous or irresponsible manner. The FAA’s newly released drone regulations are a good step forward; however, rapidly changing drone technology coupled with antiquated privacy and property laws are sure to lead to increased conflict in the future. The potential impact that drones will have on agriculture, and society as a whole, will be dependent on how the court system decides these expected future conflicts.

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Genetically engineered (GE) or genetically modified (GM) organisms (GMO) have been around for two decades, largely unnoticed by most American consumers while these crops fed countless animals and vehicles. They covered over 90 percent of United States acreage of corn, soybeans, cotton, and canola, but less than 10 percent of the harvest of these crops went to food while non-GMO markets thrived. Genetic engineering refers to the scientific method used to introduce new traits or characteristics to an organism using recombinant DNA (rDNA) plant breeding technology (as opposed to older techniques for inducing hybrids or mutants via chemical or radiation mutagenesis). GE foods are those derived from these methods or include ingredients that are derived from these rDNA methods. Food and Drug Admin. (FDA), Questions & Answers on Food from Genetically Engineered Plants, http://www.fda.gov/food/foodscienceresearch/biotechnology/ucm346030.htm (last visited Aug. 4, 2016).

This article will discuss the current controversy over “GM” labeling of these foods, using the “GM” and “GMO” acronym used in various state laws that have been passed in the United States in the last few years. Vermont’s mandatory GMO labeling law, which was in effect for a month or so before federal law was signed by President Obama to preempt it, will be analyzed for its potential trade disruption effects, which could trigger disputes under the World Trade Organization (WTO). Similar future state efforts at regulating labeling might also run afoul of trade law. The new federal GM labeling law might also be challenged by the same trading partners who took issue with U.S. laws mandating dolphin-safe tuna and country-of-origin labels, so this article will place that preemptive law in its international context.

Internationally, at least 64 countries have enacted GMO labeling statutes and regulations, but none of these laws has been challenged at the WTO to date. At the federal level, the United States just recently passed a law preempting Vermont’s GMO labeling law, but also requiring some labeling of GM food. While the Federal Food, Drug, and Cosmetic Act (FFDA) prohibit misbranded food and regulates misleading “non-GMO” labels, the United States has long taken the position that the presence of GMO does not require explicit disclosure because they are “like products.” Statement of Policy: Foods Derived from New Plant Varieties, 57 Fed. Reg. 22,991. The new federal law represents a change in position at the federal level, and this could raise eyebrows among key trading partners that do not label any GM food (e.g., Canada, Mexico, and some other major trading partners are not among the 64 nations with GMO labeling laws).

A national controversy arose after several states passed laws requiring GM food labeling. Connecticut and Maine enacted conditional GMO labeling laws containing provisions stating that their state will not enforce labeling requirements until a requisite number of states pass similar legislation, including one contiguous state (Vermont’s law, if not preempted by recent federal law, could have put those laws closer to entering into force). Connecticut’s Act Concerning the Labeling of Genetically-Engineered Food and Act to Protect Maine Food Consumers’ Right to Know About Genetically Engineered Food and Seed Stock. CONN. GEN. STAT. §21a-92c (2013) ME. REV. STAT. tit. 22, §§2591–2595 (2014). Not waiting for conditions, the state of Vermont passed a GMO labeling law without any similar triggering requirement, to take effect July 1, 2016. VT. STAT. ANN. tit. 9 §§ 3041N3047 (2014). Labeling laws enacted by states can have constitutional and international repercussions on trade.

This article discusses the application of the Vermont’s GMO labeling law in light of international trade regulations set by the WTO and, assuming federal law has successfully preempted
all relevant aspects of Vermont’s law, the effect of WTO disciplines on the federal alternative recently passed by Congress. The constitutional implications of state GMO labeling are not addressed but can be found in a recent article by co-author Thomas Redick in the ABA SEER Constitutional Law Committee newsletter.

The Vermont Law

In 2014, the state of Vermont enacted the Labeling of Food Produced with Genetic Engineering Act (Vermont Act). Vt. Stat. Ann. tit. 9 §§ 3041–3047 (2014). The Vermont Act is intended to reduce consumer confusion and deception, improve public health and food safety, inform decisions regarding environmental impacts, and protect religious practices. As of July 1, 2016, the Vermont Act mandates retailers to label food offered for sale that is produced entirely or partially from genetic engineering if it is to be sold in or into the state of Vermont. The Vermont Act includes domestic and international manufacturers and provides a list of labeling exceptions and required regulations. The labeling exceptions include food consisting entirely of or derived entirely from an animal which has not itself been produced with GM; food that has been grown without the knowing or intentional use of food or seed produced with GM; foods produced with processing aids or enzymes produced with GM; food that the GM material in the aggregate do not account for more than 0.9 percent of the total weight of the processed food; food verified by independent organization approved by Vermont Office of Attorney General; medical food; and various food not packed for retail sale and intended for immediate consumption. Major food makers have already begun to react with GM labels or withdrawal of products from Vermont, including Pepsi, Frito-Lay, Coca-Cola, General Mills, Kellogg’s, Nestlé, Campbell’s, Dannon, Smuckers, Starbucks, and other major food companies.

Although some manufacturing companies took steps to comply with Vermont’s GM labeling as of July 1, 2016, such labels could be preempted under pending court case. Case No. 5:14-cv-117-cr. Multiple trade associations have filed a federal lawsuit challenging the Vermont Act. The District Court ruled in favor of the State of Vermont and denied the preliminary injunction motion. Given the preemptive effect of the federal law discussed below, the industry appellants dropped their appeal to the Second Circuit Court of Appeal before it could render a decision.

Congress Reacts to Vermont and President Obama Signs Preemptive Legislation

On July 14, 2016, the U.S. House of Representatives voted 306–117 approving H.R. 1599, The Safe and Accurate Food Labeling Act of 2015, to preempt Vermont’s mandatory GMO food labeling law, following a Senate vote on compromise legislation on July 7, 2016. Dianne Lugo, U.S. Senate Passes GM Food Labelling Bill, SCIENCE MAGAZINE (July 8, 2016), http://www.sciencemag.org/news/2016/07/us-senate-passes-gm-food-labeling-bill (last visited Aug. 4, 2016). This bill, colloquially known to anti-GM activists as the “Deny Americans the Right-to-Know” Act (DARK Act), places the National Bioengineered Food Disclosure Standard in The Agricultural Marketing Act of 1946 (S. 764). It establishes a national mandatory “GM” food disclosure standard. The mandatory aspect of the new federal Act directs the food manufacturer to select the disclosure form that includes text, symbol, or electronic or digital link. A voluntary system for non-GMO certification gives the U.S. Department of Agriculture (USDA) additional impetus to process certification faster (critics say is it less rigorous than the non-GMO projects with little testing or segregation). With the federal act, independent verifiers would use the USDA label-certifying process (comparable to the National Organic Program). It remains to be seen if the new USDA verification process might cost more or be more burdensome than existing independent verifications.

Under this law, foodmakers will use “quick response” or QR codes (a smartphone camera reads a code) as well as 1-800 numbers and websites (but...
no textual package labeling, as Vermont would have required). Organic activists assert that it will exempt “most GE foods” from labeling, including the new breeding techniques that edit genes without rDNA methods. The USDA has two years to write regulations for the national labeling standard using an internal working group and will study “technological challenges that may impact whether consumers would have access” to QR codes and other digital disclosure methods within one year.

Aspects of the law are relevant to WTO analysis. In particular, the new federal Act states that GM food approved by the Food and Drug Administration (FDA) is a “like product” to non-GM food products—a term that is referenced in the WTO Technical Barriers to Trade Agreement (TBT). Finally, the federal Act expressly prohibits states from establishing GM labeling policies. Signed since by President Obama, the federal act may have turned the implications of Vermont’s Act on international trade into an academic exercise. The new federal Act would likely experience international scrutiny.

As directed by the federal Act, states will no longer have the right to mandate labeling of GE foods. The issue has now shifted to the U.S. obligations under the WTO, which has rules regarding labeling that may be implicated by aspects of the Sanitary and Phytosanitary Measures (SPS) or the Technical Barriers to Trade (TBT) Agreements.

**Worldwide Labeling Law and Policy**

Motivated by consumer concern, the European Union (EU) introduced the first GM labeling policies in 1997. Since then, 64 other countries have adopted GM labeling policies, none of which has been challenged under the WTO. Adopted policies among countries are not homogenous. Guillaume Gruère & S.R. Rao, *A Review of International Labeling Policies of Genetically Modified Food to Evaluate India’s Proposed Rule*, AGBioForum 51–64 (2007). On one hand, countries like Australia, China, and Brazil and the EU require mandatory GM labeling. On the other hand, Canada, Hong Kong, and South Africa have voluntary GM labeling. Labeling policies also differ in coverage and exceptions such as labeling animal feed with GM, labeling of unpackaged food or the amount of GM ingredients required for labeling. Additionally, countries could label a product as GM if the engineered material is detectable in the finished product or label the product as GM if such a technology was used during the production process, regardless of the presence of GM material on the final product. One example is the labeling of canola and soybean refined oil by the EU and China even if no GM material can be traced on the final product. Countries also differ in the threshold percentage level of GM material in the aggregate. Threshold tolerance levels range from 0 percent (e.g., China), 0.9 percent (e.g., EU and Russia), 1 percent (e.g., Brazil, Australia, New Zealand and Saudi Arabia), to a 5.0 percent (e.g., Japan, Thailand, Taiwan, and Canada). Gruère (2007), *supra*. Finally, the degree of implementation differs among countries since many countries have labeling policies that are not being executed, China as the exception with effective GM labeling implementation.

**Effects of GE Labeling**

Since the implementation of mandatory GM labeling in international markets like the EU, producers and retailers rushed to avoid GM inputs into their products. Nicholas Kalaitzandonakes & Jos Bijman, *Who Is Driving Biotechnology Acceptance?* Nature Biotechnology, 366–369 (2003). This is a result of potential loss of consumers due to GM public controversy; generalized rejection of GM products by the public; avoidance of bad brand effects based on negative campaigns targeting GM labeled products; and the availability to replace GM ingredients with non-GM such as the use of non-GM palm oil to replace soy oil. Gruère (2007), *supra*. Since the implementation of EU labeling, U.S. corn soy trade lost over $3 billion. Thomas Bernauer, *Genes, Trade & Regulation: The Seeds of Conflict in Food Biotechnology*, Princeton University
Although ingredient replacement is an alternative for some countries, the cost of replacement increases in countries with greater GM dependency such as the United States and Canada. Some industries in the United States and Canada would not be able to meet threshold percentages or replace ingredients at a reasonable cost. Regardless of mandatory GM labeling, consumers blindly utilize hidden GM food since exceptions and threshold percentage allows GM food to reach the market without labeling. Gruère (2007), supra.

For example, the EU’s statutory exceptions allow animal products feed with GM to be sold unlabeled and organic food can be sold unlabeled if it doesn’t reach the 0.9 percent GM aggregate threshold or use GM seeds if no other seed is available. The preempted Vermont Act included similar exceptions allowing GM foods to reach the market unlabeled.

These notable gaps in the coverage of typical GM labeling laws raises questions regarding the effectiveness of mandatory GM labeling and whether voluntary labeling provides equal transparency but reduces possible undesirable effects on the use of biotechnology and costs associated with compliance and enforcement. Another question is whether international harmonization could be achieved using voluntary standards as has occurred with dolphin-safe tuna. There is still debate and contradictory results on the effects of mandatory and voluntary labeling. Gruère (2007), supra. In the United States, some growers have voluntarily adhered to non-GM products (e.g., Whole Foods) and others have begun labeling products well in advance of the Vermont Act and the federal Act.

The Federal Act and Vermont Act Under the World Trade Organization

The WTO is an intergovernmental organization that regulates international trade and has 163 members as of July 2016. As a member of the WTO, the United States must observe all negotiated trade agreements or risk being sanctioned (as it now faces for its laws on labeling for dolphin-safe tuna and country of origin). Members of the WTO cannot be prevented from adopting or enforcing measures necessary to protect human, animal or plant life or health, protect the environment, ensure quality of exports, or for the prevention of deceptive practices. However, such measure cannot be applied in an arbitrary of unjustifiable discrimination between members. See SPS Agreement and TBT Agreement Preamble, www.wto.org.

As a governmental unit of the United States, the preempted Vermont Act could have been vulnerable to legal challenges either under the WTO’s Agreement on Sanitary and Phytosanitary Measures (SPS) or the Technical Barriers to Trade (TBT). Drew Kershen, Would State-Mandated Labels for Biotech Foods Violate World Trade Agreements? WASHINGTON LEGAL FOUNDATION (2012). This legal issue does not end with the preemption of the Vermont Act, since other states may seek to label food or other products for various consumer-driven reasons.

A state that passes a law impeding trade can trigger WTO Action, and this Vermont law, if not preempted, might have triggered the first GM labeling case under the WTO Agreement, for the following reasons.

First, the Vermont Act was probably not compliant with the SPS Agreement. The SPS Agreement expressively considers labeling requirements directly related to food safety. SPS Agreement Annex A. Under the SPS Agreement, WTO members can adopt SPS measures only to the extent necessary to protect human, animal, or plant life or health, if based on sufficient scientific evidence or in the case of insufficient scientific evidence, provisionally to adopt SPS measures with a duty to seek scientific evidence. SPS Agreement, art. 2 & art. 7. It also allows SPS measures with the use of international standards or in its absence the use of a risk assessment. SPS Agreement, art. 3. The Vermont Act falls within the SPS category as it intended to improve public health and food safety.
Nonetheless, the Vermont Act was probably not compliant since it will be difficult to meet the burden of establishing that it was based on sufficient scientific evidence. This is as a result of both national and international regulatory agencies around the world that have registered findings of safety for GE food and scientific studies not finding a link between GE food and health. Kershen (2012), supra. Also, there is no international standard that categorizes GM food as unsafe or unhealthy and the Vermont Act fails to use a risk assessment to justify GM labeling. This is particularly relevant since the WTO’s collaborator for food label standards, the Codex Alimentarius Commission, is no longer considering mandatory GM labeling due to lack of consent on a suitable WTO-legal approach to such labeling. Jack Bobo, Two Decades of GE Food Labeling Debate Draw to an End – Will Anyone Notice? 48 IDAHO L. REV. 251 (2012).

Second, the preempted Vermont Act probably also violated the TBT Agreement for requiring different labeling of “like” products. The TBT Agreement applies to technical regulations including labeling requirements. TBT Agreement, Annex, 1 Definition 1. In order to avoid unnecessary obstacles to international trade, the TBT requires that technical regulations shall not be more trade-restrictive than necessary to fulfill legitimate objectives such as the prevention of deceptive practices and the protection of human, environment, animal and plant health and safety. TBT art. 2.2. It also requires to treat “like products” alike in order to avoid favoring domestic of international products over the products of another country. TBT art. 2.2.

The preempted Vermont Act falls into the SPS category as it intended to improve public health and food safety. As in the case of the SPS Agreement, the Vermont Act failed to address a legitimate health and safety standard using scientific evidence in support of its labeling regime. The act could also fall into the SPS by addressing the prevention of deceptive practices as it intends to reduce consumer confusion and deception. Regardless, the Vermont Act could have been challenged as noncompliant since GM foods could still have made it to market unlabeled due to numerous exceptions (e.g., USDA Organic foods are exempt and could contain GM content but do not have to meet the 0.9 percent GM aggregate threshold).

Commentators have argued that due to this fact, the Vermont Act was a deceptive practice itself. Kershen (2012), supra. The Vermont Act could have also been challenged since before the recent federal Act, the United States already had a voluntary GM and non-GMO labeling system that would have made the mandatory labeling more trade restrictive than necessary. Finally, since national and international regulatory agencies do not differentiate between GM food and non-GM foods the act could be challenged as it discriminates “like products.”

Some scholars argue that a challenge bought to the WTO from a member state could be under either the SPS or the TBT. Kershen (2012), supra. In 2003, the United States, Argentina, and Canada brought an official complaint with the WTO claiming that the EU ban on GM approvals violated the SPS Agreement. The WTO ruled in favor of the plaintiffs. WTO, Panel Reports, Action by Dispute Settlement Body, European Communities – Measures Affecting the Approval and Marketing of Biotech Products, WT/DS291, WT/DS292, and WT/DS293 (2006). WTO members with mandatory GM labeling would probably not have challenged the Vermont Act or the federal Act, but countries with voluntary labeling such as Canada and members of the North American Free Trade Agreement (NAFTA) might raise formal concerns as they did with the U.S. country-of-origin label (COOL).

Now that Congress has acted, the mandatory “QR-code” aspects of labeling may be found to be in violation of the WTO, if the labeling is found to impose undue burdens on international trade without adequate scientific justification or a risk assessment for this labeling system.
A colorable argument can be made that this more limited QR-code labeling system is overly disruptive of international trade, when a non-GMO system could deliver the same benefits to consumers (a clear parallel exists to dolphin-safe labeling, which had a thriving international voluntary program in place, making the U.S. law appear unnecessary and overly burdensome).

Indeed, the legislative reference to GM and non-GM products being “like” is evidence that there is no technical basis for GM labeling. The TBT Agreement would require the United States to justify the labeling of GM products that are “like” non-GM. It remains to be seen whether U.S. trading partners who found fault with laws on labels for dolphin-safe tuna and country-of-origin will also find these QR-code labels overly burdensome.

In the past, however, international mandatory GM labeling has been found to have adversely impact U.S. trade in corn and soybeans, but no WTO case was ever filed challenging the EU labeling regime.

Conclusion

As a U.S. state, Vermont’s Act regarding mandatory GM food labeling could have been challenged at the international level because it would have failed to comply with the WTO SPS and TBT Agreements. The federal mandatory GM labeling law recently enacted could face similar challenges at the international level. If the mandatory GM food labeling aspects of the new federal law in the United States are found to be prejudicial to trade, a claim could ensue. Similar arguments may be forthcoming from the same trading partners who found fault with U.S. laws on dolphin-safe tuna and country of origin labeling.

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UPDATE: LAKE ERIE NUTRIENT POLLUTION - AGRICULTURE AND DRINKING WATER
Martha L. Noble

In recent years, large blooms of cyanobacteria, commonly known as blue-green algae, have occurred in the Western Basin of Lake Erie. These harmful algae blooms are stimulated by warm summer water temperatures and high phosphorus levels in waters that drain into the Lake.

The blooms include neural, liver and dermal toxins. Microcystins are toxic substances produced by the blue-green algae *Mycocystis spp.*, which pose especially serious health threats to human and animal health. The microcystin toxins are not degraded by high temperatures and boiling tap water does not lessen the health hazards. Contamination of water resources by algal blooms producing high levels of these toxins can result in the closure of drinking water systems and require beach closures to prevent human and animal contact with polluted water. See Eugene C. Braig IV et al., *Harmful Algal Blooms in Ohio Waters*, Ohio Sea Grant Program, Fact Sheet No. OHSU-FS-091 (2011) (updated 2016).

A dramatic example of the consequences of phosphorus contamination occurred in the summer of 2014, in Toledo, Ohio. The city relies on Lake Erie for its drinking water. A major summer algal bloom reached the city’s drinking water intake sites in the Lake. Due to the high levels of microcystins detected in the water supply, the city issued a “do not drink” warning and shut down the water system that served over 400,000 people for two days. The city assisted residents in obtaining bottled water for drinking and cooking and urged caution in the use of contaminated water for bathing. See Ohio State Sea Grant, Harmful Algal Bloom Q&A and Updates (Oct. 6, 2014).

The Lake Erie algal bloom in 2015 was the largest on record for the Lake, covering approximately 300 square miles in August 2015. Fortunately, this massive bloom remained in the center of the Lake away from municipal drinking water intake sites. See National Oceanic and Atmospheric Administration, Experimental Lake Erie Harmful Algal Bloom Bulletin (Bulletin No. 7) (Nov. 10, 2015).

A main driver of Lake Erie’s harmful algal blooms is elevated phosphorus loading from the watersheds draining into the western basin, particularly from the Maumee River watershed in Ohio. A conservative rough estimation found that 85 percent of the Maumee River’s phosphorus load to Lake Erie comes from farm fertilizers and manures. This estimate leads to the conclusion that an effective decrease in phosphorus loading to the Lake cannot be achieved without significantly reducing the contribution from agricultural operations. See Donald Scavia et al., Informing Lake Erie Agriculture Nutrient Management Via Scenario Evaluation (Univ. of Michigan Water Center (Apr. 2016). For a comprehensive overview of numerous factors affecting soluble phosphorus loading in Lake Erie, including agricultural factors, see Douglas R. Smith, Kevin W. King & Mark R. Williams, What Is Causing Harmful Algal Blooms in Lake Erie, *Journal of Soil & Water Conservation*, Vol. (No. 2) at 27A–29A (2015).

Direct federal government action to address the issue of water contamination due to harmful algal blooms has been limited. Currently, there are no federal water quality criteria or water quality regulations for cyanobacteria or cyanotoxins in drinking water under the Safe Drinking Water Act, nor are there ambient water quality standards under the Clean Water Act. The United States Environmental Protection Agency (EPA) has developed and submitted to Congress an Algal Toxin Risk Assessment and Management Strategy for Drinking Water (Nov. 2015) as required by the Drinking Water Protection Act of 2015 (H.R. 212, Pub. L. No.114-45) (Aug. 7, 2015).

The state of Ohio has increased regulatory action to address the issue of farm runoff into Lake Erie from its watershed. After the hazardous algal bloom of 2014, bipartisan agreement led the Ohio
Senate to pass Senate Bill No. 1 in 2015 with a unanimous vote. The measure not only further restricts manure application but also commercial fertilizer application on frozen ground in the Western Lake Erie Basin. Application is restricted when soil is snow-covered, frozen, or when the top two inches of soil is saturated or when there is a 50 percent chance of rainfall. The measure also requires increased monitoring and testing of phosphorus levels at publicly owned water treatment plants, imposes higher civil penalties for violations, and creates a designated position at the Ohio EPA to address urban contributions to nutrient runoff. Ohio Senate Bill No. 1 (2015)(amending sections 6109.10 and enacting sections 903.40, 905.326, 905.327, 1511.10, 1511.11, 3745.50, and 6111.32 of the Revised Code and amending Section 333.30 of Am. Sub. H.B. 59 of the 130th General Assembly to require applicators of fertilizer or manure to comply with specified requirements, to establish requirements governing dredged material and phosphorous testing by publicly owned treatment works).

In light of increased regulatory attention to phosphorus loading into Lake Erie, in March 2016, the United States Department of Agriculture’s (USDA) Natural Resources Conservation Service announced a new three-year initiative to provide conservation assistance to reduce phosphorus loading for farmers in the western drainage basin of Lake Erie which includes land in Michigan, Indiana, and Ohio. The funding, which totals $77 million in assistance from the Environmental Quality Incentives Program, will be available during fiscal years 2016–2018 for farmers with land that drains into the Western Basin. See USDA, Now Accepting Applications for New Western Lake Erie Basin Initiative (News Release, Mar. 31, 2016).

Canada also borders Lake Erie and phosphorus loading into Lake Erie is a matter of international law as well as domestic law. In 2015, Ohio, Michigan, Indiana, and the Canadian province of Ontario entered into a separate Western Basin of Lake Erie Collaborative Agreement. The Agreement requires that each jurisdiction take actions to reduce farm runoff and sewage overflows 40 percent by 2025, with an “aspirational” interim goal of a 20 percent reduction by 2020. See Western Basin of Lake Erie Collaborative Agreement (signed June 13, 2015). In addition, in February 2016, under the auspices of the Great Lakes Water Quality Agreement, the United States and Canada agreed to revise Lake Erie phosphorus loading targets from U.S. and Canadian watersheds. The overall goal is to reduce the phosphorus loading levels from watersheds in Lake Erie to a level 40 percent below the 2008 phosphorus loads by 2025 with an aspirational goal of reducing the load 20 percent by 2020.

The 2012 report by University of Michigan Water Center researchers, updated in 2016, found that current practices by farmers in the Lake Erie basin for controlling phosphorus run-off from fertilized and land-applied animal manure falls far short of controls needed to meet the goals of the new Collaborative Agreement. The implementation of new laws, regulations, and programs for controlling phosphorus loading will be closely watched by communities around Lake Erie that depend on the Lake for drinking water and income from the recreational use of the Lake.

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