

White Paper

Livestock Traceability: Opportunities for Animal Agriculture

Information synthesized from the National Institute for Animal Agriculture's Annual Conference, "Livestock Traceability: Opportunities for Animal Agriculture" conducted April 10-11, 2018, in Denver, Colorado. Full presentations are available online at www.animalagriculture.org.

DISCLAIMER: The information provided in this White Paper is strictly the perspectives and opinions of individual speakers and discussions at the 2018 annual conference, 'Livestock Traceability: Opportunities for Animal Agriculture.'

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Background

The conference, “Livestock Traceability: Opportunities for Animal Agriculture”, conducted April 10-11, 2018, in Denver, CO, was hosted by the National Institute of Animal Agriculture (NIAA). The conference brought together one hundred ninety-one (191) livestock industry professionals, and included producers, representatives of livestock markets, fairs, and shows, veterinarians, representatives of identification technology companies, and regulatory animal health officials. The goal was to present the view of the federal government on ADT and the future, review emerging technologies such as Blockchain, discuss data management technologies and solutions, review Canadian experiences to help give insight into U.S. traceability and the U.S. position globally, and to delve into the relationship between traceability, One Health, and sustainability.

Over the last decade, livestock traceability has been the focus of numerous discussions. In 2013, the Animal Disease Traceability Rule became law. Four years after its implementation, the USDA undertook comprehensive assessment of the ADT program. This Conference provided an opportunity for stakeholders to lead the traceability discussion and push the movement forward, looking to positive outcomes in the future as the U.S. progresses towards national traceability.

The NIAA is a non-profit, membership-driven organization that unites and advances animal agriculture for the challenges facing animal agriculture industries (aquatic, beef, dairy, equine, goat, poultry, sheep and swine). NIAA is dedicated to furthering programs for the eradication of diseases that pose risk to the health of animals, wildlife and humans; promoting the efficient production of a safe and wholesome food supply for our nation and abroad; and promoting best practices in environmental stewardship and animal health and well-being.

The 2018 conference, ‘Livestock Traceability: Opportunities for Animal Agriculture’ was funded in part by Allflex, Agrident, American Angus Association, Bovine Veterinarian magazine, Colorado Cattleman’s Association, Colorado Livestock Association, Dairy Herd Management, Datamars Inc., Drovers, IMI Global, Farm Journal, Inc., Fort Supply Technologies, Global VetLINK, Henke-Sass, Wolf, the USDA, Texas Cattle Feeders Association, Tracefirst, Virox Animal Health and Y-TEX Corporation.

Purpose and Design of the Conference

The purpose of the conference was to bring together livestock industry leaders and animal health officials to lead the traceability discussion and seek informed consensus to advance positive outcomes to this challenging issue. The objective was to provide a national vision for the future of traceability, with insight from our Canadian neighbors and consideration of global marketing issues; to identify potential solutions for data management and security; and to approach traceability through the lens of One Health, with an eye toward sustainability. Conference participants also gained unique insight into the views and initiatives of the various segments of the industry, which will continue to enhance collaborations for advancement of identification and traceability.

Conference Planning Committee Members

Mr. Glenn Fischer, Allflex USA, Inc.

Chelsea Good, J.D., Livestock Marketing Association

Mr. Ernie Birchmeier, Michigan Farm Bureau

Mr. Neil Hammerschmidt, USDA-APHIS-VS

Mr. Todd Low, Hawaii Department of Agriculture

Mr. Dave McElhaney, Allflex USA, Inc.

Dr. Lucas Pantaleon, Virox Animal Health

Conference Topics and Speakers

(in order given at the conference)

Welcome and Opening Remarks, Deputy Commissioner Jennifer Yezak, Colorado Department of Agriculture

Keynote Address: ADT and the Future, Mr. Gregory Ibach, Undersecretary of Agriculture for Marketing and Regulatory Programs, USDA

Traceability: How to Leverage the Lessons from Others, Mr. Brian Sterling, President & Founding Partner, SCS Consulting

Overview of the Canadian Traceability Administration, Ms. Anne Brunet-Burgess, General Manager, Canadian Cattle Identification Agency

Transforming Food Supply with Blockchain, Nigel Gopie, PhD, Global Marketing Leader, IBM Food Trust™, IBM Blockchain

One Health, Traceability and Emerging Technologies, Mr. Thomas Burke, Food Traceability Scientist, Institute of Food Technologies – Global Food Traceability Center

Traceability in an International Context, Mr. Thad Lively, Senior Vice President, Trade Access, U.S. Meat Export Federation

The Role of Traceability in Branded Beef, Mr. Mark McCully, Vice President, Production, Certified Angus Beef

The Intersection Between Traceability and Sustainability, Greg Thoma, PhD, Professor, University of Arkansas, College of Engineering

Executive Summary

Traceability discussions in the United States were initiated in 2002. The vision for a national traceability program has been introduced, debated, revised, and reintroduced several times. The NIAA Annual Conference focused on four main facets of the current traceability discussion: a national vision for the future of traceability, with insight from our Canadian neighbors and consideration of global marketing issues; identification of potential solutions for data management and security; marketing opportunities and access provided by traceability; and an approach to traceability through the lens of One Health, with an eye toward sustainability. Conference participants also gained unique insight into the views and initiatives of the various segments of the industry, which will continue to enhance collaborations for advancement of identification and traceability.

The USDA is committed to traceability and envisions traceability as it fits into the larger federal government vision of animal disease protection. Safeguarding America's food supply is encompassed by a three-pronged approach to animal disease: prevention, preparedness, and response, which are closely aligned with traceability; expansion of the capabilities of the National Animal Health Laboratory Network (NAHLN), allowing for more rapid detection of animal disease; and development of a national animal vaccine bank to protect U.S. livestock in the event of an animal disease incursion.

Canada implemented a full national traceability system in 2002. Their system provides an example and potential guide for implementation of traceability in the United States. Canada's system is a partnership between government and industry, with government developing the regulations but industry administering the program. Livestock traceability is maintained with the option for value-added capability included. Parts of two large domestic food sectors have also achieved whole chain traceability: produce and seafood. The Produce Traceability Initiative (PTI) was created in 2006 when the vulnerable produce sector identified growing concerns of foodborne illness, food fraud, and consumer demand and decided to act together against those threats. Seafood traceability projects were driven by consumer desire for transparency, government concerns about fraud and illegal fishing, and concern for rising risk to fisheries stocks globally. For these sectors, traceability provides more in value than it costs to implement, thus reducing business risk and failure costs, lowering the cost of poor quality, streamlining the supply chain, and strengthening brand equity and market access.

Ninety-five percent of the world population is outside the United States, and as that population grows in economic status, the global demand for beef increases. The key to global export markets is traceability. Many top international exporters of beef employ traceability as a key component of their own branding programs. Including traceability as a significant part of its export program can make the United States more competitive in this world market. The United States and India are the only major beef export markets without mandatory national traceability, making the U.S. not only vulnerable to stresses on its export capabilities like foreign animal diseases, but also denying the U.S. access to valuable marketing claims that are supported by traceability.

Traceability provides for increased transparency and consumer trust, as well as a framework on which to build value added marketing claims that further increase revenue, consumer trust, and consumer

loyalty. Traceability data can be used to assure the consumer that someone is paying attention and cares about the animal that produced their beef and how it was processed. Traceability can provide claim assurance, market access, and brand and trademark integrity. Sharing data from traceability between partners down the supply chain can provide information that leads to better informed management decisions and ultimately better animal health. A robust traceability system provides the framework on which to build value, enhance animal health, and ultimately increase revenue. These attributes could be a significant driver of traceability acceptance and adoption by the industry.

Traceability is built on ready access to relevant and reliable data about the product being considered. One of the most difficult parts of traceability for the producer is the need to give sensitive data to government authorities. Blockchain technology is a new platform on which safe and secure exchange of sensitive data can occur, through means of a distributed database. It provides a system that enhances data security, interfaces with existing data management systems, provides the option of value-added capabilities, and inherently protects and secures individual producers' data. However, blockchain is only as good as the data that is put into it – for any blockchain system to work, there must be a critical mass of participants.

Finally, traceability is uniquely placed to support initiatives for the advancement of One Health and sustainability, through its ability to collect large datasets. Sustainability in the agriculture industry is of growing importance as the global population expands, and demand for high quality protein increases. The addition of traceability data to the equation greatly enhances our ability to promote and provide sustainability. The One Health approach offers increased cooperation and collaboration between public health entities in human, animal, and plant disciplines with a goal of enhancing the health not only of people, but that of animals and the environment. In short, the goal of One Health is sustainability. Traceability has a unique ability to collect and provide large amounts of data that can be used and interpreted by diverse disciplines to propel the sustainability discussion into the future. Life Cycle Assessment provides a research framework for the interpretation of this data, with a method that enables processes and impacts of the entire system to be condensed and communicated in a meaningful way. Using Life Cycle Assessment, we can identify what parts of the system matter the most for sustainability and communicate those findings.

The United States is making progress towards traceability. We are moving away from the hindrance of old technology and old attitudes, and toward an overall better system. Our Canadian neighbors and other food sector industries within the United States can offer insights and examples of successful traceability practices from which we can build. Blockchain, Life Cycle Analysis, and other developing technologies and research tools provide a new way to overcome old obstacles. There will be a cost, but the gains made in market access, consumer trust, sustainability, and value-added opportunities far outweigh the cost.

Presentation Highlights

Keynote Address: ADT and the Future

Mr. Gregory Ibach, *Under Secretary of Agriculture for Marketing and Regulatory Programs, USDA*

The goal of the USDA is to be the most efficient, effective, customer-focused agency in the federal government. In service to that goal, the USDA strives to be open to new and revised regulations that will facilitate growth in agriculture.

A significant priority of the USDA is safeguarding the domestic food supply and the tools needed to enhance animal disease prevention, such as animal disease traceability, biosecurity, and diagnostic capability. The approach of the USDA to animal disease is a ‘three-legged stool’ approach. The first leg – and the main leg that addresses animal disease traceability – is prevention, preparedness, and outbreak response. Components include animal disease surveillance; prevention of animal disease through enhanced detection, particularly at high risk entry points; outreach to producers and the public regarding biosecurity; and training to develop rapid outbreak response capability. The second leg is the National Animal Health Laboratory Network (NAHLN). The USDA would like to see expanded laboratory capabilities that support states’ local diagnostic abilities, located closer to the producers and animal population that require their services. If directed by Congress, the final leg is development of a vaccine bank. Initial focus would be on the Foot and Mouth Disease (FMD) vaccine, but it would also be prudent to have stocks of vaccine to address other diseases as well. Dr. Julie Smith, University of Vermont, expressed concern about the lack of timely access to vaccines held in the vaccine bank. Mr. Ibach explained that the release of vaccine involves several considerations, not the least of which is the implication for trade. Often use of vaccine has significant trade reduction implications, and that issue will in some cases slow release of banked vaccine.

Over the past few years, the beef industry has shown a real openness to engage in dialogue regarding animal disease traceability. We need to leverage this openness to move past the same 14 points we keep discussing. The USDA’s envisions several actions in the facilitation of steps toward national animal disease traceability. The first is to exit the mechanical and technology discussions and turn those over to industry. Industry is better able to develop their preferred technology with input and support from the USDA. The second action is to achieve a bookend traceability system, with identification at farm of origin and again at harvest. Finally, USDA supports action that can improve the performance and adoption of electronic certificates of veterinary inspection (eCVIs). The USDA commits to consider bookend traceability and eCVIs as they develop the framework for an animal disease traceability system that embraces state, federal, and producer needs, with industry to taking that framework and filling in the substance in a manner that supports producer needs and implements full animal disease traceability.

In addition to animal disease traceability, the USDA will be reaching out to producers regarding biosecurity. Biosecurity is one of the best ways to combat disease, via prevention before it can even start. To this end, USDA is considering a requirement for state biosecurity plans as qualification for indemnity programs in the future. Receipt of indemnity will require having a state and farm-level

biosecurity system in place. Dr. Dustin Oedekoven, South Dakota State Veterinarian, asked how USDA's proposed changes to indemnity would protect the 'good' operators from their less secure neighbors. Mr. Ibach explained that at the end of the day, the desire is to create an environment where we mitigate the ability of disease to manifest and spread. Indemnity isn't the first line of defense, but rather a last alternative.

Finally, the president's budget includes a proposal to move the national bioagridefense facility from the Department of Homeland Security to USDA, to be called the National Bio- and Agri-defense Facility. The target would be a 2023 start, with Agricultural Resource Service (ARS) and the Animal and Plant Health Inspection Service (APHIS) operating the facility in partnership.

The three-legged stool, dialogue and partnership with producers, biosecurity, and moving to operate the National Bio- and Agri-Defense Facility are all pieces of USDA's vision for the future of animal agriculture. All of these pieces work together to support animal agriculture and animal health.

Traceability: How to Leverage Lessons from Others

Mr. Brian Sterling, *President & Founding Partner, SCS Consulting*

Whole chain traceability is a proven tool. Its value has been demonstrated among diverse industries (electronics, automotive, pharmaceuticals) and food sectors. Collaboration on traceability has been shown to improve individual business performance.

Traceability is the systematic ability to access all information relating to a food under consideration. Traceability is not the bar codes, radio frequency identification (RFID) tags, and written logs. These are important technologies, but not sufficient for traceability. Traceability is about data that follows a product throughout the entire life cycle, by means of recorded identification. For traceability to work, we need a standardized system that can trace a product backward, from where it came, and forward, to where it went.

Traceability means a change of thinking, but with that change of thinking comes a critical value: consumer trust. Consumers are driving a massive transition in the food industry, bringing food traceability to the forefront and making it mainstream. It's more than recalls and animal health; it encompasses supply chain efficiencies, better marketability, and lower cost along the entire chain, with full transparency for consumers regarding where their food comes from and how it was handled. The consumer is now becoming "the CEO of the food system" and traceability is a key component that builds trust and makes the business opportunities possible.

Traceability is, effectively, free. It provides more in value than it costs to implement, reducing business risk and failure costs, lowering the cost of poor quality, streamlining the supply chain, and strengthening brand equity and market access. Taken together, these values far outweigh the cost of traceability. However, it is often difficult for producers to see those values in dollar terms. The Global Food

Traceability Center (part of the Institute of Food Technologists) has developed online tools that are available to help individual businesses figure out their own traceability value proposition.

There are two categories of traceability: internal and external. Internal traceability is the ability to follow a product within your business. External traceability is the ability to follow a product between businesses. Whole chain traceability builds on both and enables stakeholders to follow the product from the farm to the dinner table. It is this ability to know where products are in the chain that drives the value of traceability.

In order to exchange traceability data regarding a specific food product throughout the supply chain, the system of identification and numbering must be uniform across supply chain steps, subsystems, and states. There are 3 main categories of data needed: identifiers about the product (the “what”), premises identification (the “where”), and movement identification (the “when”). Traceability requires data from all 3 categories.

Arguments resisting traceability often address 4 concerns: the cost, the liability, data security, and loss of efficiency. Most of these arguments are fear-based myths. Traceability reduces exposure to risk and liability, through transparency and improvement of quality afforded by traceability data. Instead of loss of privacy and confidentiality, traceability provides increased transparency and reinforces consumer trust. Traceability does require technology; however, that technology can speed up the rate of commerce and reduce or eliminate human error in data management. The business opportunity offered through traceability leads to an increase in revenue that far outweighs the cost of implementing the system.

While guidelines and requirements for traceability may be set by regulators, it is the business value that will drive adoption. Traceability is a tool for improved business performance.

There are parts of two large food sectors that have achieved whole chain traceability: produce and seafood. The Produce Traceability Initiative (PTI) is a voluntary program created in 2006 when the vulnerable produce sector identified growing concerns – foodborne illness, food fraud, and consumer demand for more information – and decided to act together. Many companies in the produce industry had very good traceability programs in place within their organizations, but they were not linked, and the relevant traceability information was not transferred or captured as product moved through the supply chain. PTI was created to achieve whole chain traceability by incorporating the use of technology and commonly used unique product identification standards (supported by GS1) to serve as linkages between internal traceability programs. An industry steering team guided strategy and planning, and the program focused on traceability through the entire chain, from grower to point of sale.

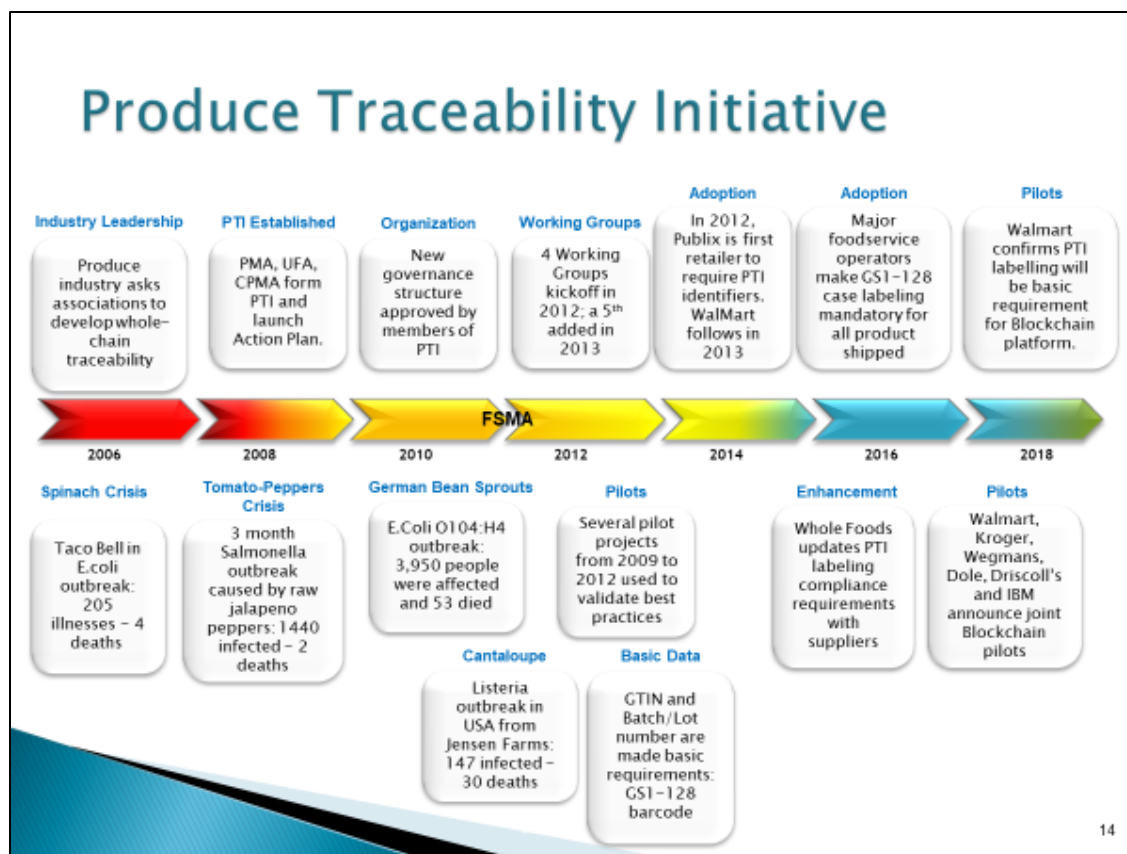


Figure 1. Evolution of the Produce Traceability Initiative.¹

Seafood traceability projects have a global scope, and one major initiative in 2015 included 48 businesses on four continents encompassing nine seafood value chains. In seafood, the drivers were consumer desires for transparency, government concerns about fraud and illegal fishing, and overall concerns for rising risks to fisheries stocks. Seafood firms view traceability from a strategic perspective, letting traceability needs and benefits guide selection of seafood production system, and approaching traceability with big vision, but implementing with achievable small steps.

Traceability is a tool that reduces costs and business risks, while it increases value chain efficiencies, and strengthens brand equity and market access. Traceability is free, but it is not a gift – it requires work to realize its potential.

Finally, collaboration is key. As the seafood traceability projects have proven, the more collaboration that exists between producers, processors, members of the supply chain, retailers, and government, the better the performance of the individual businesses and the entire food system.

Overview of the Canadian Traceability Administration

Ms. Anne Brunet-Burgess, *General Manager, Canadian Cattle Identification Agency*

The Canadian traceability system is a government-industry partnership. The Canadian Food Inspection Agency (CFIA) created and enforces the National Livestock Identification Regulations under the authority of the Health of Animals Act, and industry administers the program with three 'responsible administrators': Agri-Traçabilité Québec (ATQ), PigTrace, and the Canadian Cattle Identification Agency (CCIA).

A responsible administrator must apply to the CFIA and meet several requirements. The main responsibilities of a responsible administrator are to oversee animal indicators and transceivers, allocate and manage regulatory data, allocate identification to manufacturers, communicate regulatory interpretations to stakeholders and the public, and to protect the security and integrity of data. CCIA is a not-for-profit, industry-initiated and led organization incorporated to establish a national livestock identification program and traceability initiatives to support efficient trace back and containment of serious animal health and food safety concerns. The CCIA is the largest of the three responsible administrators, and administers the Canadian Livestock Tracking System (CLTS), the database for both traceability and some value-added information. Data entered into the CLTS database is protected by the Privacy Act - Section XV of the Health of Animals Regulations². The CCIA strives to provide leadership and secure cost-effective traceability services that enhance the Canadian livestock industry. CCIA member organizations represent the species administered by CCIA, as well as dealers and markets, veterinarians, and production groups. CCIA staff is limited, with a main focus on client support. CCIA staff fielded over 19,000 inquiries in 2017.

The three pillars of livestock traceability include premises identification, animal identification, and animal movement. Species currently federally regulated in Canada include bovines (cattle and bison), sheep, and swine, but the system is expected to expand in 2018 to include goats and farmed cervids. All cattle, sheep, and bison must be tagged prior to leaving the farm of origin, although if an animal arrives at an intermediate tagging site without a tag from the farm of origin, a tag may be applied at that intermediate site. It is not illegal to transport an untagged animal from the farm of origin without a tag to a tagging site, as long as that untagged animal travels directly to that intermediate tagging site. At the other end of the production system, it is mandatory for slaughterhouses to report tag retirement for cattle and bison. It is not currently required to report sheep tag retirement.

For tag allocation, manufacturers obtain unique numbers from CCIA. Beef tag inventories are kept at CDMV's warehouses. Tags are then sold via call center, website or through the tag dealers network and once sold, numbers must be issued into a producers account within 24 hours of sale. There are several tags approved for use in cattle, and a more limited number of tag choices available for other regulated species. Tags must be approved for use through the Animal Indicator Approval Process, which requires both a field and a lab test. The responsible administrator facilitates tag testing and makes recommendations to the Minister of Agriculture. Once a tag is approved or revoked, the responsible administrator communicates the information to regulated parties.

Events that can be entered into the CLTS database include cross referencing for tag replacement; movement by groups or individual animals, age verification and birth certificates, and applied vs not applied tag inventory. Client support is provided through call center, the online resource center <http://support.canadaid.ca/> , and a mobile phone app. Additionally, CCIA supports a number of value added activities in the CLTS database, including the Beef Information Exchange System (BIXS), the Dairy industry initiative proAction, Verified Beef Production Plus (VBP+), and others.

The CFIA created the regulations for traceability. Industry, through three responsible administrators, administer the program. The CCIA provides leadership and secure, cost-effective traceability services to the livestock industry while fostering strategic partnerships and developing innovative solutions that will enhance the Canadian livestock industry. Finally, the Canadian Livestock Tracking System is the database that keeps track of it all.

Transforming Food Supply with Blockchain

Nigel Gopie, PhD, *Global Marketing Leader, IBM Food Trust™, IBM Blockchain*

The food system faces a number of inherent challenges. Foodborne illness, lack of traceability, fraud and inauthenticity, food waste, and other issues all threaten the system's stability and economic viability. A more transparent food system offers a way to minimize these problems, and traceability can connect the dots. The problem for most food supply chains is that the various members – from growers to distributors to retailers – have their own records kept in disparate and siloed systems that cannot necessarily interface or communicate with each other. Blockchain is a relatively new technology that allows the sharing of disparate database information in a way that is secure, audible, and private.

The IBM Food Trust solution is built on blockchain technology. It consists of a set of three modules providing traceability to improve food transparency and efficiency. Blockchain is used to create a trusted connection with shared value for all ecosystem participants, from growers to distributors to consumers. This solution offers connectors for interoperability between network members based on existing GS1 standards.

Blockchain is a distributed network. Data is held as a 'block' of information with a unique fingerprint, or 'hash'. Hashes are used to align the blocks, and each block that is connected has the hash of the previous block, allowing data to be connected in a chain. The distributed nature of the network offers significant cybersecurity, as all participants in the chain must agree in consensus about altering any data on the existing chain. If someone tries to tamper with a data element, the hash will automatically change, thus subsequent blocks will not be able to connect, and the system will know that there has been a breach. Users can select permissioned data sharing, allowing data to go to certain partners without sharing to all partners. It is also possible to share just parts of data. This allows collaborators to share data with each other while not providing mission critical data to their competitors.

In scaling the IBM Food Trust digital ecosystem, the goal is to ensure shared value, excellent user experience, industry standardization, confidence in a secure system, and extended value through analytical tools that can be added to the system.

Blockchain is only as good as the data that is put into it – for any blockchain solution to be effective, there must be a critical mass of participants. With IBM Food Trust, IBM is creating a vision, not just a product. That vision is of a safer, more sustainable food system, with scalable food traceability based on standards and interoperability between connected systems.

One Health, Traceability and Emerging Technologies

Mr. Thomas A. Burke, *Food Traceability Scientist, Institute of Food Technologies – Global Food Traceability Center*

‘One Health is defined as a collaborative, multisectoral, and trans-disciplinary approach — working at the local, regional, national, and global levels — with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.’³ The One Health approach offers increased cooperation and collaboration between public health entities in human, animal, and plant disciplines. This approach leads to a unique marriage of experience and perspective that enables the identification of novel exposures and vulnerabilities that go unrecognized when approached through a single lens. The response to the Highly Pathogenic Avian Influenza (HPAI) outbreak of 2014-2015 exemplified this approach, with ecological, epidemiological, and environmental strategies informing the understanding of what happened.

While One Health holds great promise, the lack of cross-disciplinary research methods, broad range, and data interpretability issues can significantly hinder the realization of that promise. Traceability offers One Health new multidisciplinary research methods that may work better than traditional approaches; holistic data with applicability and interpretability to all three One Health disciplines; and automated, standardized data collection methods that provide understandable data. Enhancements offered through traceability include standardization of data which enables interoperability; technical solutions to emerging issues; and real-time tracking that increases data collection and thus creates larger datasets. Analytics and machine learning can be applied to those larger datasets, creating the meaningful conclusions that are often unreachable through the One Health approach. Through the data solutions it provides, traceability is a tool to accomplish One Health objectives.

There are many emerging technologies on the horizon. One of these, Blockchain, is a technology that shows considerable potential. The decentralized nature of blockchain provides greater user privacy than that of traditional databases, potentially minimizing the fear barrier to database use. It is constantly updated, greatly speeds recall procedures, and can connect disparate parts of the supply chain. Other emerging technologies include the Internet of Things, embedded sensors, and data collected from Low Earth Orbit (LEO) satellites. These also offer the promise of integration, speed, connectivity, and wide-ranging application.

One Health needs better data coordination and methods clarification, and traceability can supply those needs. Traceability initiatives, combined with emerging technologies, have the potential to enable the full realization of the One Health promise. The data and technology offered by traceability support One Health goals and accomplish progress toward a One Health agricultural approach.

Questions were posed by conference attendees regarding collaboration vs. technology, as well as scalability of the approach. The mechanisms of technology and data collection need to happen first, building the large traceability datasets that could inform One Health. Once that data is collected, collaboration is the key to interpreting and using the data across disciplines. The goal is to attach One Health to traceability, using the ability of traceability to collect data as a method to enhance collaboration. Regarding scalability, moving too quickly to expand technologies to include value-added opportunities distracts from making meaningful conclusions on collected data. The initial focus needs to be on the use of traceability for research questions, and once those mechanisms and analysis are in place, the value-added aspects of the technological system can be explored.

Traceability in an International Context

Mr. Thad Lively, *Senior Vice President, Trade Access, U.S. Meat Export Federation*

The U.S. Meat Export Federation is a not-for-profit trade association based in Denver, Colorado. The Federation represents the export interests of the beef, pork, and lamb industries. The work of the Federation falls under two headings: market development (*i.e.* demand-building) and market access.

Beef exports are of growing importance to the global food industry, with 2.8 million pounds exported globally in 2017.⁴ The top three beef exporting countries are Brazil, Australia, and the United States.⁵ All of the top 10 beef exporting countries around the world have instituted traceability systems, and 7 of 10 of these systems are mandatory. Among the beef importing countries that are our customers, all major markets have adopted internal traceability standards, but China is the only one of these that makes traceability a requirement externally, for imports. Almost all major global traceability systems require cattle identification, ear tags, tracking of movements, and a central database.

Disease control, market access, and to a much lesser degree, food safety, were all cited as reasons for the institution of traceability programs among the top 10 beef exporters. The European Union was the leader of the traceability movement in 1997, and their system became the global standard to address the public health concerns generated by animal disease.

The United States does not yet have a robust traceability system. This fact has not kept us out of foreign markets so far, but we are extremely vulnerable to unforeseen developments that could put us at a severe competitive disadvantage. A foreign animal disease (FAD) outbreak such as Bovine Spongiform Encephalopathy (BSE), an increase in the number of export markets that require full traceability, and consumer expectations all loom as potential tipping points to upset our place in world trade. Additionally, traceability is often tied to a 'green and safe' message, with the implication that those nations not fully embracing traceability don't produce a product that is green or safe.

What would make the U.S. adopt traceability? A mandatory legislative initiative, such as a response to an FAD, could close that gap. Voluntary adoption is most likely to occur as a response to market pressure, such as new requirements or consumer expectations in a major export market, or as a response to a major domestic customer in the United States.

The United States needs a national traceability program. Traceability is becoming increasingly important in the global market. The U.S. is the only major beef exporting country that doesn't have a national traceability system. Currently China is the only major importing country that requires traceability, but that may change. Other countries are already at a competitive advantage globally as they use their national traceability programs as a selling point, and that advantage will only increase if additional global export markets begin to require traceability. As the only major exporting country without mandatory national traceability, the U.S. is vulnerable – both economically and competitively.

Questions from conference attendees addressed the cost of implementing traceability, consumer desire, and value-added capabilities. It is difficult to put a price on traceability or to determine who would pay for it. In the event of an FAD the cost would likely be shared between taxpayers and industry. Consumers say they want traceability, but data indicates that people are much more likely to say yes to the concept than to be interested in paying more for traceable beef. Finally, value-added capability could be a significant driver of traceability adoption. The EU and Canadian traceability systems discovered one value-added market opportunity associated with their traceability systems in the ability to trace cattle fed genetically modified soy.

The Role of Traceability in Branded Beef

Mr. Mark McCully, *Vice President, Production, Certified Angus Beef*

Certified Angus Beef LLC is a non-profit organization owned and initiated 40 years ago by the American Angus Association. Certified Angus Beef (CAB) is the only owner of the *Certified Angus Beef*[®] brand trademark, and partners with the beef industry in all other endeavors. Five million head of Angus cattle are certified annually, producing over 1 billion pounds of beef for the brand.

As trademark owners, the organization is focused on market demand. In a recent poll, 69% of customers indicated they want more information about a company's social, economic, animal welfare, and environmental practices⁶. These are the expectations of the next generation of consumer. It's important that we track animals from a disease perspective, but that's not the image the consumer has of production agriculture. It is simply the expectation of the consumer that we can trace animals in the event of disease. Traceability in and of itself is not a value-added marketing claim – but traceability does create a framework on which to build the value-added marketing claims that can sell in the premium space.

Traceability provides a variety of benefits for Certified Angus Beef. The first is production claim assurance. The assurances provided by their 'natural' and other lines of products rely on knowing the farm of origin for each pound of beef sold. Second, regionally sourced claims, such as 'product of the

northwest', or 'Fresh from Florida' are made possible by traceability and work with existing systems. Certified Angus Beef superimposes their branding on the existing supply chain to provide value-added products that customers want. Third, traceability provides market access, particularly to export markets that demand traceability. Finally, traceability assures brand and trademark integrity. It ensures that every trademark in use, including those by restaurants and other retailers, is being utilized accurately and correctly.

As we move into the future, brand protection and a proactive traceability system are paramount for maintaining consumer trust. Animal care and handling, environmental practices, employment practices, and other sustainability metrics can be traced and communicated, further bolstering consumer trust in the brand. Traceability offers accurate production sector feedback, providing the backflow of information down the supply chain necessary to improve management practices. As an example, end stage supply chain information provided back down the line to feedyard managers can enable the more efficient identification of feeder cattle with respiratory disease. This enhanced identification then provides the information to improve genetics and ultimately leads to a healthier population of cattle. Supply and risk management could be streamlined as well. For all these management issues, better information and more sophistication through traceability leads to better management decisions.

Traceability provides for increased transparency and consumer trust, with the ability to enhance the brand through that trust. In addition, traceability provides information that can be used to improve overall cattle health and management efficiency. Finally, a traceability system provides the framework on which to build value added marketing claims that further increase revenue.

Discussion from conference attendees focused on the term 'traceability' as understood by consumers. Mr. McCully noted that the consumer buzzword is 'transparency'. Trust and transparency are driving forces for Certified Angus Beef. Consumers just want to know that someone is paying attention and cares about the animal that produced the beef. Dr. Robert Cobb of Georgia pointed out that traceability in the regulatory arena means animal disease traceability. Transparency can be enabled by animal disease traceability, but regulators are concerned that a focus on transparency will overshadow the disease traceability aspect. Additionally, transparency is the aspect of traceability scares producers. Mr. McCully noted that his lens as a brand owner is transparency. He sees transparency and disease traceability as hand-in-glove, working very closely together, and thinks separating the two is redundant and counter-productive. His approach is to think of disease traceability as a framework on which to build transparency. Consumers want assurance that they're buying a quality product. Traceability allows for the transparency that assures consumers, and they don't want any information beyond that.

During the discussion, Mr. McCully noted that Certified Angus Beef has developed a Culinary Center. Ranch tours were developed as part of the Culinary Center experience, and due to high demand are now offered through the Culinary Center almost every week. During these tours, CAB has observed that as soon as the tour meets the rancher, most concerns dissipate. The light bulb comes on, and tour attendees see what it really means to raise a quality animal that provides the quality product on the table. Traceability provides a way to virtually meet that rancher.

The Intersection Between Traceability and Sustainability

Greg Thoma, PhD, Professor, University of Arkansas, College of Engineering

Animal agriculture has a huge land footprint, with about 70% of global agricultural land dedicated to supporting livestock.⁷ Additionally, consumption of animal-sourced food (*i.e.* livestock) is growing worldwide. This increased demand for animal-sourced food intensifies pressure on land and amplifies environmental risk, and we must manage world resources much more efficiently and effectively if we are to sustain the world population's demand.^{8,9} We cannot achieve this efficiency without traceability data.

This efficient and effective use of resources is often what is meant by the term sustainability. Another way to put it is 'living within our means'. To do that, we must continually improve our resource use efficiency. We must enable future generations to provide for themselves. For sustainability and efficient resource use to become reality, there must be measures and metrics to monitor progress, benchmark, and provide a baseline for documenting future improvements. Traceability can provide invaluable information in support of these measures and metrics.

Life Cycle Assessment provides a framework for capturing the information offered by traceability and quantifying the measures and metrics, and this framework is a good place to begin to approach sustainability. It is a wholistic accounting tool for environmental impacts, in this case, animal-sourced food. Life Cycle Assessment systematically quantifies inputs and outputs for a system in terms of a standardized unit of measure. There are four stages: interpretation, inventory, impact, and goal & scope.⁹ (Fig 2).

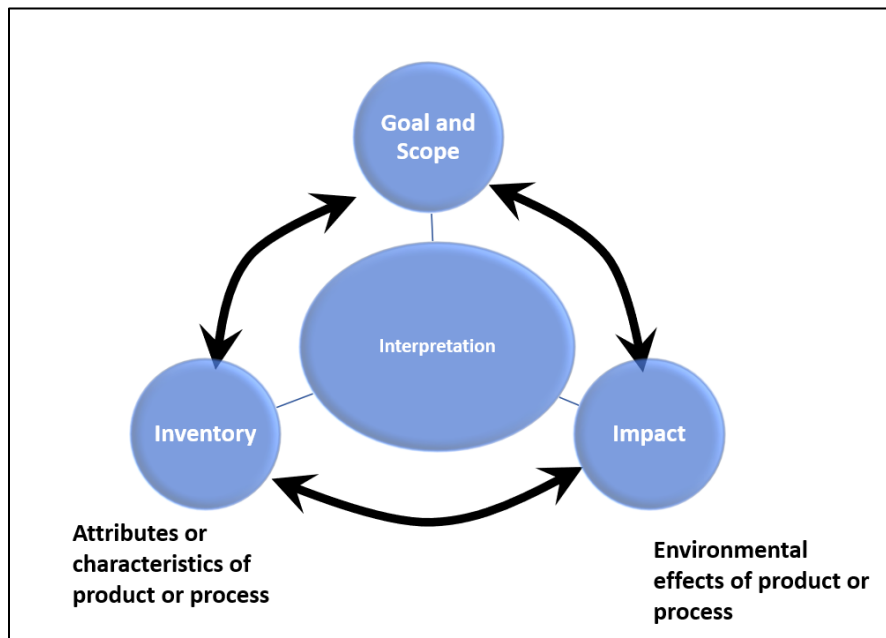


Figure 2. Life Cycle Assessment (LCA)¹⁰

Life Cycle Assessment modelling uses unit processes as building blocks. Each unit process incorporates inputs and outputs, both from nature and other processes. Material and data flows, emissions, and product characteristics are the key data elements captured.¹⁰ (Fig 3)

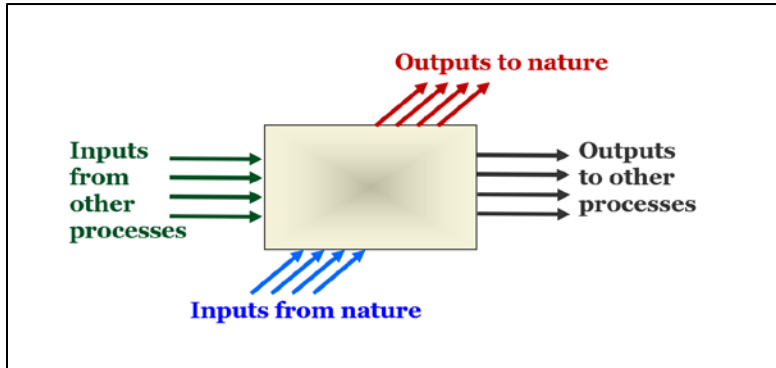


Figure 3. Unit process. The building block for Life Cycle Assessment.¹¹

Unit processes are built together to account for the entire supply chain in a Life Cycle Inventory (LCI) Model.¹⁰ (Fig 4)

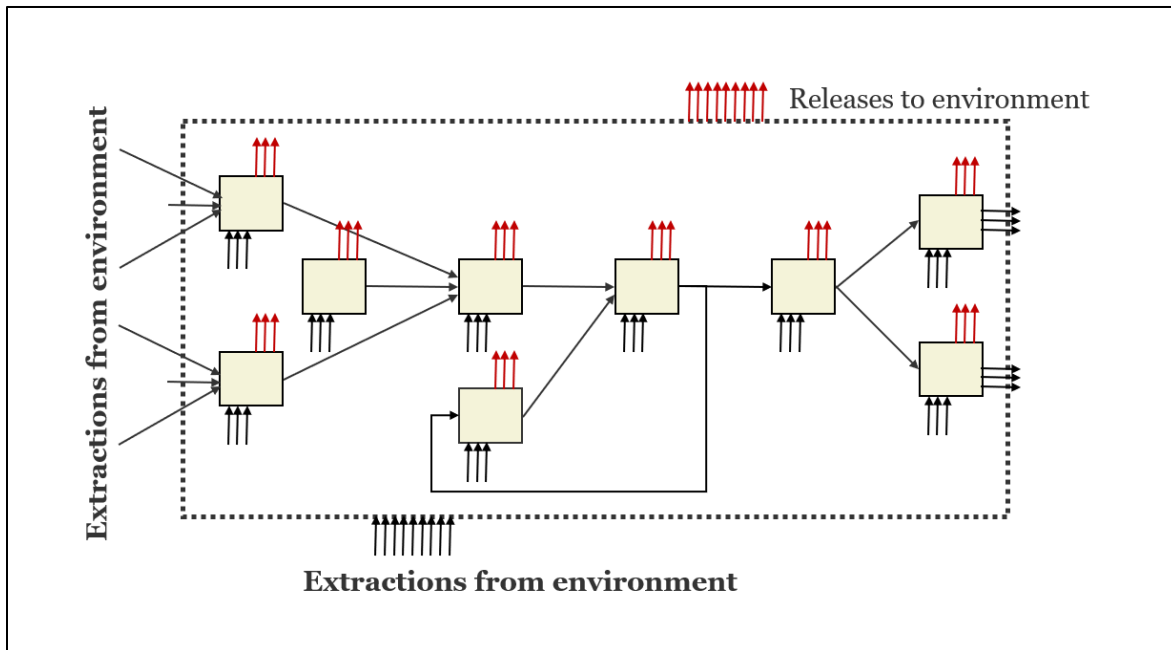


Figure 4. Life Cycle Inventory (LCI) Model. Unit processes are linked together to represent the entire supply chain.¹⁰

Impact assessment methods have been developed within the LCA community that aggregate similar emissions into broader categories such as global warming potential, also known as carbon footprint. In an animal-sourced food supply chain, inputs and outputs such as feed and enteric methane are taken

into account to inform assessments such as global warming potential, which may be aggregated to damage categories (human or ecosystem health) that help people make decisions. Ultimately, all the LCI information and impact analysis may be condensed into a single score that can be used for communication and consumer education. There is increasing uncertainty during progression from LCI Analysis toward that single score, but this process enables the processes and impacts of the entire supply chain to be communicated in a meaningful way to the consumer. Using Life Cycle Assessment, we can identify what parts of the supply chain matter the most for sustainability and communicate those findings.

The National Cattleman's Beef Association (NCBA) recently conducted a national evaluation of the sustainability of beef using LCA. For this evaluation, beef cattle production throughout the country was divided into seven regions, each of which were surveyed to collect production and management practice information. Survey responses from the regions were used to develop an 'archetypal' beef production system for each region in each of three categories: cow-calf, stocker, and finisher. These archetypal beef production systems were simulated in the integrated farm system model (ISFM) to determine resource use and emissions. Finally, ISFM results were used to create LCA models of regional archetypal production systems, which were analyzed and aggregated to provide national benchmarks for beef production.

The preliminary results from the NCBA LCA evaluation of integrated operations in the upper Midwest showed differences between farms driven almost entirely by nitrous oxide emissions, which are in turn driven by soil type. All other results were very similar among farms. The takeaway is that traceability – to farm of origin, and thus to soil type – matters if we are to effect changes to enhance sustainability.

Global agricultural resources are becoming limited as we respond to the increased pressure to provide a safe, affordable supply of food for a growing population. Understanding and documenting supply chain transactions is increasingly important to identify the environmental issues related to food production. LCA is a widely used tool to evaluate sustainability characteristics of products, but it requires detailed knowledge of material and energy flows at all stages of the supply chain. Tools providing traceability along supply chains provide an excellent backbone for collecting and managing the information that enables LCA for animal-sourced food sustainability.

Life Cycle thinking provides a systems framework for assessment and systematic documentation of supply chains with standards and transparency. The addition of traceability data to this perspective and thus to the sustainability equation greatly enhances our ability to promote and provide sustainability.

Footnotes

¹ Mr. Brian Sterling, SCS Consulting

² R.S.C., 1985, c.P-21. Retrieved from <http://laws-lois.justice.gc.ca/eng/acts/P-21/index.html> on May 22, 2018.

³ Centers for Disease Control. Retrieved from <https://www.cdc.gov/onehealth/basics/index.html> on May 22, 2018

⁴ Source: USDA/USMEF

⁵ United States Beef Export Association. Retrieved from <http://www.beefmagazine.com/exports/near-record-volume-global-beef-exports-2017-value-highest-2014> on June 12, 2018.

⁶ Hartman Group, 2017

⁷ FAO, 2009

⁸ Foley et al. 2011

⁹ Godfray et al. 2010

¹⁰ ISO 14040, 14044, 14046 Standards

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