“Ethics of Biosurveillance” to be submitted to *Science* Policy Forum

Devitt, S.K., Baxter, P.W.J. & Hamilton, G.

Introduction

The world’s population is anticipated to grow from 7 billion in 2011 to over 11 billion by the end of the century (United Nations Department of Economic and Social Affairs, 2015, 29 July). Food production must increase by 70% to feed people and by even more to offset losses from incursions of pests and pathogens (Griffin, 2014, p. 694). Economically and socially, governments must keep agricultural systems free of exotic pests that threaten global agricultural production and international trade. But a serious cost of keeping agriculture pest-free may be an invasion of privacy and lost autonomy for farmers.

Traditional biosurveillance involves periodic inspection and sampling of crops, produce and other biotic materials. New technologies such as satellite imagery and unmanned aerial vehicles (UAVs, aka ‘drones’) are increasingly employed to scan the landscape for pests on a constant basis. These technologies can lead to more comprehensive surveillance to ensure more rapid detection of incursions and faster responses, but also significantly increase the volume of data collected on private land. Thus, while biosurveillance offers great promise to global food security, there is a clear and urgent need to consider ethical issues for individuals around privacy, information use, access and control that emerge in parallel with technical innovation. Here we present an ethical framework to guide the anticipated future of biosurveillance.

We propose that biosurveillance policies require social justice considerations across farm, state and national boundaries. An ethical framework that meets this challenge is John Rawl's (1971/1999) theory of justice, which seeks to ensure fair cooperation of free and equal stake-holders. Rawls imagined the fairest social contract is one negotiated and agreed to by each individual in society, irrespective of their socioeconomic circumstances or capacities. Rawls argued that social justice was best ensured via universalized, top-down governance using a range of mechanisms such as *policy* (e.g. biosurveillance), *infrastructure* (e.g. transport), *service provision* (e.g. telecommunications) and *regulation* (e.g. herbicide applications). Some disagree with a top-down liberal view of the social contract whilst agreeing with its model of fairness. For example, communitarians believe that smaller social groups such as Chayanov's natural family farms (Carlson, 2014) or specific agricultural industries ought to develop contextually relevant knowledge and responsibility for governance (Walzer, 1990). However, modern biosurveillance requires federal government oversight to maintain international trade agreements. Therefore, we adopt a top-down federal regulatory approach in this paper, while acknowledging the potential for communitarian arguments against this.

Recommendations for ethical biosurveillance

We propose the following recommendations for ethical biosurveillance:

1. Establish the boundaries of a biosurveillance social contract;
2. Justify surveillance operations for the farmers, researchers, industry, the public and regulators;
3. Give decision makers over their own land a reasonable measure of control over their data; and
4. Choose surveillance methodologies that give the appropriate information.

1. Establish Boundaries of a Biosurveillance Social Contract

Our first recommendation is to establish the boundaries of a biosurveillance social contract. A social contract, first proposed by Hobbes (1651/2016), is a theoretical contract of agreed rules of behavior that individuals adopt to liberate them from a "brutish" state of nature. Modern social contract theorists agree that participants may opt into a social contract without being obliged to obey it, or opt out should specific circumstances warrant it (Freeman, 2007). To understand these hypothetical individuals, John Rawls (1971/1999) suggested a thought experiment to consider the ideal society from 'behind the veil of ignorance' in 'the original position', that is, to create rules that would be agreed to by any one in society *before* they knew what role in society they would play. Using this technique might help regulators and farmers understand each other's perspectives and experiences. Ethical biosurveillance inspired by such a social contract could mean surveying diverse stakeholders in a region affected by planned activities. Another technique could be to represent hypothetical scenarios, model possible decisions and then display the distribution of outcomes of decisions. Researchers and government agencies seeking to implement extensive, possibly intrusive biosurveillance ought to illustrate a sequence of scenarios where their programs are implemented, and pest and disease eradication and management become significantly more efficient, effective, fairer and easier than if measures had not been taken.

2. Justify surveillance operations

Our second recommendation is that each activity within an incursion surveillance program needs to be *justified* scientifically for farmers, researchers, industry, the public and regulators. Justifications are explanations that enable stakeholder understanding and acceptance of their anticipated benefits. A justification might explain why particular data are needed within a specific timeframe, for example to create a useful model for decision making with anticipated benefits. Justifications ought to highlight potential advantages to stakeholders of accepting surveillance, such as achieving a Pest Free Area (PFA) designation to reduce the need for fumigation and increase trade efficiency (Kalaris et al., 2014).

Four types of biosurveillance activities require justification (Biosurveillance Science and Technology Working Group, 2013, 14 June)—henceforth referred to as (BST WG, 2013):

1. Aberration detection
2. Risk anticipation
3. Threat identification and characterization; and
4. Information integration, analysis, and sharing

Aberration detection requires the surveillance of baseline information about normal on-farm and off-farm operations to compare with unusual and potentially risky circumstances. For example, farmers might accept that a year of intense baseline surveillance at the beginning of a 10-year program is justified in order to enable less frequent, yet more targeted biosurveillance for the subsequent 9 years.

Risk anticipation requires evaluating the likelihood of risky pest and disease population increases and geographic dispersal. Activities are justified because the earlier a risk is anticipated, the faster and more efficiently an appropriate response can be deployed. Typically delimiting surveys determine the extent and distribution of a pest incursion and its eradicability as a measure of risk (Kalaris et al., 2014). However, forecasting is greatly enhanced by integrating ongoing real-time data from a variety of data sources including remote sensing (e.g. drones) and fixed, distributed autonomous or semi-autonomous surveillance platforms (e.g. CCTV to record human movements across farms and regions) (BST WG, 2013). Ongoing, real-time surveillance for risk anticipation needs to be justified via sensitivity analysis (e.g. scenario tree modeling) and historical data to establish risk profiles for a region.

Threat identification and characterization requires accurately defining a potential pest incursion. Farmers, researchers, industry, the public and regulators need to be sure that a stated pest or disease is a threat and that the magnitude of the threat is accurately presented such that actions can be rationally undertaken. Surveillance activities to validate the identification and characterization of plant pests and diseases will be justified if they significantly improve the accuracy of reports. The costs of a false positive and false negative report to growers should be highlighted before surveillance is undertaken.

Information integration, analysis and sharing requires combining data from multiple farms for greater understanding of pest and disease outbreaks. Such activities need to be justified to individuals as part of a bigger project of securing their land and their region over long time periods, rather than protecting immediate assets. Privacy protection measures might allow participants to opt in to information analysis projects on a case-by-case basis, rather than allowing *carte blanche* access to their data. Individual privacy measures could be implemented with the aid of a privacy exchange authority, an intermediary body that helps individuals secure privacy preferences in the face of big data (Pascalev, 2016).

3. Give decision makers reasonable control over their data

Our third recommendation is to give farm decision makers a reasonable measure of control over their land use, personal and crop data. While given fresh urgency with the volume and resolution of private data collectable, this recommendation stems from enduring philosophical and legal discussions relating to the right to privacy. Privacy has historically been defined as 'the right to be let alone' (Rubenfeld, 1989; Warren & Brandeis, 1890). Judith Jarvis Thompson (1975) argued that privacy is a cluster of derivative rights, such as rights to own or use one's own property, the right to one's person, or one's right to decide what to do with their body. More recently privacy has been defined as a general right to have a reasonable measure of control over our self-presentation (and that of what is ours) to others (Marmor, 2015). Marmor (2015, p. 14) argues that a person's right to privacy is violated when someone manipulates an information environment—without justification—that significantly diminishes a person's ability to control what aspects of themselves they reveal to others. For example, suppose an industry database is designed to capture private information about the prevalence of a particular crop disease in an agricultural region. The organization may have justification to diminish an individual farmer's control over their information due to the need to aggregate accurate information across multiple, contiguous locations to establish strategic and tactical disease management practices. However, such justifications do not consider the right of farm decision makers over their own data. An immediate consequence of endorsing the recommendation to allow farmer decision makers reasonable control over their data might be the diminution of data sets, risking poorer analyses and recommendations, when farmers decline to make their data available at a given time or potentially into the future.

The concept of 'reasonable control' requires a rational process to occur between farm decision makers and biosurveillance operators. For example, an unreasonable level of control might be for a farmer to share no data from their farm or activities at all ~~for five years~~. It is unreasonable because it prevents any proactive or reactive response to pest and disease management to the detriment of all. Even if a farmer wished to remain informationally isolated for a long period of time, it is possible that their property would suffer an incursion of some threat during their isolation and thus would benefit from data relating to the event. A reasonable level of control might be for a farm decision maker to share property and movement data on a sporadic, yet systematic basis, e.g. each farm in a region is scrutinized intensively for one out of five years.

4. Choose appropriate biosurveillance methodologies

Our final recommendation is to choose surveillance methodologies that accommodate the first three recommendations to provide *appropriate* information. Once biosurveillance measures are justified (see *recommendation 2*) and individual privacy considered (see *recommendation 3*), the question of appropriateness remains. Appropriate biosurveillance combines the individual privacy preferences of stakeholders with the scientific justification of their use. It should anticipate information gaps. For example, suppose Farmer J has specified a desire to 'be let alone' two out of every three years. Researchers and government agencies seeking to implement effective biosurveillance strategies need to ask: "What are the best methodologies to accommodate J's stated preference?" rather than simply express exasperation. Surveys, models and algorithms can work respectfully around limited information. Researchers have an obligation to use the most rigorous and up-to-date methodologies for finding and using data to create models to assist effective and efficient decision-making by land owners. These methodologies need to ensure that appropriate information is attained under surveillance, rather than less nuanced approaches to get as much data as possible given technical capacities of technology, e.g. drone use is driven by the needs of data models, not the amount of storage or flying time available.

Conclusion

Ideal biosurveillance operations require close to real-time, unimpeded access to crop, pest and disease on-farm data correlated with climate, weather, human movement and trade practices data (BST WG, 2013). Human events (e.g. farm-to-farm travel) and environmental events (e.g. storms, floods) help correlate on-farm data with extrinsic causal factors. Real-time, location-specific data gathering, within a precautionary approach to biosecurity, implies frequent, ongoing surveillance of farmers' lands and behaviors for aberration detection and proactive intervention. These "ideal" biosurveillance operations do not take individual rights to data privacy and control into consideration. We argue that excellent biosurveillance systems can be put in place while respecting individual rights. Planning and designing biosurveillance within an ethical framework requires moderate changes to data measurement and access. Additionally, ethical biosurveillance needs data analysis tools that work well with incomplete data sets. The benefits of incorporating "ethical design" include increased adoption by many participants and accumulated trust over time. Long term trust and cooperation will produce higher quality data overall and mitigate against anticipated information gaps that may emerge due to disrespecting landholder rights.

References

Biosurveillance Science and Technology Working Group. (2013, 14 June). *National biosurveillance science and technology roadmap*. National Science and Technology Council Committee on Homeland and National Security, Subcommittee on Biological Defense Research and Development, United States Government. Retrieved from https://www.whitehouse.gov/sites/default/files/microsites/ostp/biosurveillance_roadmap_2013.pdf.

Carlson, A. (2014, 11 Oct). Society: Seven pillars of the family-centred economy. *News Weekly*, pp. 12-13.

Freeman, S. (2007). *Justice and the social contract*. Oxford: Oxford University Press.

Griffin, R. (2014). The future of regulatory plant science. In G. Gordh & S. McKirdy (Eds.), *The handbook of plant biosecurity: principles and practices for the identification, containment and control of organisms that threaten agriculture and the environment globally* (Vol. 1). Dordrecht: Springer.

Hobbes, T. (1651/2016). *Leviathan* Retrieved from https://ebooks.adelaide.edu.au/h/hobbes/thomas/h68l/

Kalaris, T., Fieselmann, D., Magarey, R., Colunga-Garcia, M., Roda, A., Hardie, D., . . . Whittle, P. (2014). The role of surveillance methods and technologies in plant biosecurity. In G. Gordh & S. McKirdy (Eds.), *The handbook of plant biosecurity: principles and practices for the identification, containment and control of organisms that threaten agriculture and the environment globally*.

Marmor, A. (2015). What Is the Right to Privacy? *Philosophy & Public Affairs, 43*(1), 3-26. doi:10.1111/papa.12040

Pascalev, M. (2016). Privacy exchanges: restoring consent in privacy self-management. *Ethics and Information Technology*, 1-10. doi:10.1007/s10676-016-9410-4

Rawls, J. (1971/1999). *A Theory of Justice*. Cambridge M.A.: Harvard University Press.

Rubenfeld, J. (1989). The right of privacy. *Harvard law review*, 737-807.

Thomson, J. J. (1975). The Right to Privacy. *Philosophy & Public Affairs, 4*(4), 295-314.

United Nations Department of Economic and Social Affairs. (2015, 29 July). World population projected to reach 9.7 billion by 2050 [Press release]. Retrieved from http://www.un.org/en/development/desa/news/population/2015-report.html

Walzer, M. (1990). The communitarian critique of liberalism. *Political theory, 18*(1), 6-23.

Warren, S. D., & Brandeis, L. D. (1890). The right to privacy. *Harvard law review*, 193-220.