

Foreword

Environmental Law and the Changing Data Paradigm

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I am honored to introduce *Ecology Law Quarterly*'s special issue on environmental governance and technology.¹ This dedicated volume focuses on the tension between rapidly advancing data technology and slower-moving law and policy adaptation. This issue could not come at a more important time, as we are in the midst of a historic transformation of our data capacities. Environmental law is a heavily data-dependent field, and alterations in the scale and scope of available information can cause reverberations throughout.

Environmental law has long struggled with the challenges of trying to govern in the face of uncertainty.² Effectively managing natural resources requires extensive knowledge of the status, conditions, and trends of the resource in question, and we frequently do not have sufficient information to be certain of these parameters.³ Thus we have developed models, analogs, and other analytical tools that make the best of what information we have. The result has been countless debates about what constitutes best available information in data-poor conditions.

Though we have continued to wrestle with it, managing in the face of uncertainty is not a new challenge. In recent years, however, its magnitude has grown exponentially. We are in the midst of an era defined by climate change,

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1. In addition to the overall effort expended by the editorial board of *Ecology Law Quarterly*, two special thanks are owed. First, to three students who were pivotal in the conception of this special issue: Lindsay Walter '16, Aaron Voit '17, and Jennifer Pierce '17. And second, to the three students whose dedicated and excellent editorial work transitioned this issue from a concept to reality: Caitlin Brown '17, Taylor Ann Whittemore '17, and Alex Tom '17.

2. For an analysis of the role of uncertainty in environmental and natural resource decision making, see generally Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 Wash. L. Rev. 547 (2007).

3. See, e.g., Eric Biber, *The Problem of Environmental Monitoring*, 83 U. Colo. L. Rev. 1 (2011) (emphasizing the importance of regular collection of reliable data to support environmental law).

which is single-handedly increasing the level of uncertainty.⁴ This grows our need for environmental data to enable new models and forecasts that will help us effectively respond to changing baselines and unforeseen disasters. In parallel, we are also experiencing a data transition where cheaper, faster technology is proliferating the scope, scale, and types of information available.⁵ We are experiencing new sources of data, such as citizen science and crowd-sourced information, drone- or other remote device-collected data, and smart meters and home monitoring tools that collect previously inaccessible metrics without endangering customer privacy.⁶ We are also retrieving new types of data, including big data, which is defined as data sets so large that they challenge our traditional analytical systems.⁷

One might assume that the proliferation of data is a good thing, at least as it relates to environmental governance, and that more information will lead to better natural resources decisions. That certainly is the hope. It is not, however, guaranteed. More information does not automatically mean more of the right type of information; for example, careful planning and action must be taken to avoid overweighting available data that fails to paint a complete picture. And new types of data do not automatically plug into our existing analytical and

4. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, FIFTH ASSESSMENT, CLIMATE CHANGE 2014, SYNTHESIS REPORT 64 (2014) (“Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development. Increasing magnitudes of warming increase the likelihood of severe, pervasive and irreversible impacts for people, species and ecosystems.”).

5. See *Preface to* ROB KITCHIN, *THE DATA REVOLUTION: BIG DATA, OPEN DATA, DATA INFRASTRUCTURES & THEIR CONSEQUENCES*, at xv (Sage Publ’g 2014) (“Rather than being scarce and limited in access, the production of data is increasingly becoming a deluge; a wide, deep torrent of timely, varied, resolute and relational data that are relatively low in cost and, outside of business, increasingly open and accessible. A data revolution is underway, one that is already reshaping how knowledge is produced, business conducted, and government enacted.”); see also Meg Leta Ambrose, *Lessons from the Avalanche of Numbers: Big Data in Historical Perspective*, 11 *I/S J. L. & Pol’y for Info. Soc’y* 201 (2015) (comparing the current influx in data to the avalanche of printed numbers that occurred just following the Industrial Revolution and proposing that we are at the verge of an epistemic shift).

6. See NAT’L ADVISORY COUNCIL FOR ENVTL. POLICY AND TECH., *ENVIRONMENTAL PROTECTION BELONGS TO THE PUBLIC: A VISION FOR CITIZEN SCIENCE AT EPA*, EPA 219-R-16-001 ix (2016) (“Increasingly during the last decade, rapid technical advances have opened opportunities for broader and deeper interaction and participation among individuals, communities and governments, allowing all levels of government to engage previously uninvolved people in issues affecting their communities and local environments.”); Lucas Satterlee, *Climate Drones: A New Tool for Oil and Gas Air Emission Monitoring*, 46 *Envtl. L. Rep. News & Analysis* 11,069, 11,069 (2016) (“The drone phenomenon is just starting to catch on in the area of environmental monitoring and enforcement.”); ETHAN ELKIND, *CENTER FOR LAW, ENERGY & THE ENV’T, BERKELEY LAW, KNOWLEDGE IS POWER: HOW IMPROVED ENERGY DATA ACCESS CAN BOLSTER CLEAN ENERGY TECHNOLOGIES & SAVE MONEY* (2015).

7. ENVTL. L. INST., *BIG DATA AND ENVIRONMENTAL PROTECTION: AN INITIAL SURVEY OF PUBLIC AND PRIVATE INITIATIVES* 3 (2014), <https://www.eli.org/sites/default/files/eli-pubs/big-data-and-environmental-protection.pdf>.

decision-making structures; systems must be amended and adopted to effectively and appropriately process new types of information.⁸

The flood of new data not only strains our data storage systems, but also tests our analytic capacity. Accompanying advances in data science are accelerating development of modeling, mapping, and other information technologies. Some of these new tools and technologies are updated methods for acquiring or viewing familiar types of information, albeit in larger streams. But others are fundamentally different from anything we have employed before, either because we have reached a threshold that allows us to aggregate and analyze data sets in new ways or because we have not previously had access to a particular type of information.

In short, while more data promises better decision making over the long term, it requires adapting our governance frameworks to effectively accommodate it. The rate of new data production continues to accelerate, while our institutions are far slower to integrate it.

The changing data paradigm triggers complex legal questions across the life cycle of environmental decision making. For example, it raises questions about what data can be used lawfully in what situations, and what type of information will meet what statutory standards. It also raises questions about how courts will review, consider, and judge decisions based on nontraditional data analytics. And it raises questions about how we involve people in natural resources decision making, because new systems for public engagement are an incredible opportunity to engage people in a proactive manner, but also create concerns about equity and inclusion.

In a world made more uncertain by climate change, the risks of failing to adapt are immense. Within this context, this special issue helps explore a key question about the changing nature of information and our relationship to it: Do our current decision-making structures allow for effective, efficient, and equitable use of new types of data, and accommodate new analytical tools? Or—and this author believes this is the case—do systems based on a static perception of the nature of data need to adapt?

HOW MORE DATA AFFECTS DECISION MAKING

Two years ago, Professor Ryan Kelly published an article exploring how new technology for data generation can facilitate agency implementation of more adaptive decision making by improving the information feedback loop between management decisions and their effects. He highlighted that in order

8. See, e.g., Daniel A. Farber, *Modeling Climate Change and Its Impacts: Law, Policy, and Science*, 86 Tex. L. Rev. 1655 (2008) (examining issues involved in validating climate models, the limits of the models, and their use in regulatory proceedings and court); Rónán Kennedy, *E-Regulation and the Rule of Law: Smart Government, Institutional Information Infrastructures, and Fundamental Values*, 21 Info. Polity 77 (2016) (proposing a new field of study, “e-regulation,” to address “how the ‘shape and style’ of government may change as it becomes more ‘smart,’ relying on software, databases, and distributed devices”).

for monitoring to be effective in informing the decision-making process, regulators must monitor with a particular aim in mind and make sure they are monitoring causal factors.⁹

In the new article, Professor Kelly and his co-authors, Professors Phil Levin and Kai Lee, analyze a listing decision made by the National Marine Fisheries Service under the Endangered Species Act regarding several rockfish species in Puget Sound, Washington. By reviewing the unusual circumstances and actions taken, the authors explore key questions surrounding the use and collection of information in an uneven data landscape. That is, data is proliferating in many areas, and surrounding many resources, but with uneven coverage and at uneven rates. Thus, many decisions are still being made in data-poor conditions, and the authors explore the institutional and other factors that determine how an agency will act in such situations and the propriety of existing evidentiary burdens.

HOW NEW TECHNOLOGIES AFFECT COMPLIANCE AND ENFORCEMENT

In 2008, Professor Robert Glicksman published an insightful analysis of how and when agency use of advanced modeling and surrogate techniques fulfills mandates to use best available science. He proposed that, when it comes to the use of models to fill gaps in knowledge, judicial review is an important tool for holding agencies accountable for science-based decisions. He suggested that courts should require agencies to explain the assumptions upon which their models rely, provide descriptions of remaining scientific uncertainties, and describe how both affected the agency's decisions. Further, courts should reject decisions in which the agency failed to demonstrate that the model used is appropriate for dealing with the specific data gaps that the agency is attempting to fill.¹⁰

In the new article, Professor Glicksman and his co-authors, Professors David Markell and Claire Monteleoni, examine the impact of new technological advances on government compliance. Expanded and improved monitoring capacity, new ways to disseminate information, and advanced analytical tools can be used to fundamentally affect compliance mechanisms. The Environmental Protection Agency is exploring these new approaches, and the article examines how new technology can strengthen the agency's compliance and enforcement programs but will also require changes in institutional structure, operations, and relations with state and private partners. The authors persuasively describe the potential of new data technologies and sources for strengthening environmental compliance—in the authors' words, by

9. Ryan P. Kelly, *Will More, Better, Cheaper, and Faster Monitoring Improve Environmental Management?*, 44 *Envtl. L.* 1111 (2014).

10. Robert L. Glicksman, *Bridging Data Gaps Through Modeling and Evaluation of Surrogates: Use of the Best Available Science to Protect Biological Diversity Under the National Forest Management Act*, 83 *Ind. L.J.* 465 (2008).

strengthening both the “how” of compliance efforts and the “who” involved—and outline key considerations to ensure success.

NEW TECHNOLOGIES AND PUBLIC PARTICIPATION

In recent years, numerous authors have discussed the potential for new online user interfaces to increase public participation in decision-making processes. For example, web-based tools can equip members of the public with new opportunities to review proposed actions and submit input and/or comments. However, while electronic rulemaking may make it easier for some members of the public to view and comment on proposed agency rules, others—including economically disadvantaged individuals without access to computers or high-bandwidth internet—may not experience the same increase in accessibility.¹¹

In his article, Professor Jeff Todd assesses the role of public participation in environmental justice movements. Through an examination of citizen submissions related to environmental enforcement under U.S. trade and investment treaties in Latin America, Professor Todd explores the limitations of citizen submissions as a remedy. But that is not the only value of this mechanism, he argues. Instead, through a case study of a citizen submission related to a processing facility in Tijuana, Mexico, Professor Todd delineates how citizen submissions can play a valuable role in environmental justice by providing a venue for data validation, for new information, and for sharing information throughout a community. In so doing he outlines important factors to be considered as new public participation tools, interfaces, and technologies are developed.

LOOKING FORWARD

This special issue of *Ecology Law Quarterly* contributes to the emerging field that addresses the challenges that lie at the intersection of rapidly increasing data, proliferating data technologies, and our legal and regulatory frameworks. New data technologies are fundamentally changing the relationship between natural resources managers and environmental data. Our legal and institutional systems must adapt by increasing capacity to assess the relevance of data, effectively analyze and manage it, incorporate it into decision-making structures, develop new compliance and enforcement approaches that utilize it, and build new engagement pathways for the public. Examples are needed of how government agencies can efficiently and

11. See, e.g., Cary Coglianese, *Enhancing Public Access to Online Rulemaking Information*, 2 Mich. J. Envtl. & Admin. L. 1 (2012); Stephen M. Johnson, *Beyond the Usual Suspect: ACUS, Rulemaking 2.0, and a Vision for Broader, More Informed, and More Transparent Rulemaking*, 65 Admin. L. Rev. 77 (2013); Nina A. Mendelson, *Rulemaking, Democracy, and Torrents of E-mail*, 79 Geo. Wash. L. Rev. 1343 (2011); Beth Simone Noveck, *The Electronic Revolution in Rulemaking*, 53 Emory L.J. 433 (2004).

effectively make use of these technologies without suffering from their drawbacks. The authors in this symposium issue use three very different case studies to illuminate some of the critical considerations that must be weighed in developing protocols and addressing these challenges.

The ability to collect and analyze vastly increased amounts of data should ultimately strengthen environmental governance. Those frameworks that depend upon large quantities of information, including adaptive management and compliance- and market-based regulations, can benefit from broader, deeper data sets that are cheaper and faster to produce. However, the simple proliferation of data will not automatically lead to such improvements.

The current default process is to develop new information systems and then make them available to resource managers to try to integrate into our governance systems. But this constrains the utility of these new data tools. To truly harness the potential of new data tools, policy experts need to be part of the conversation from the beginning to identify legal obstacles and opportunities, which may call for a relatively minor change to the supporting technology or a proposed amendment to the policy itself.

We are on the precipice of a data revolution, at the precise time that climate change necessitates it. But to get there—to move from simply having more data to a true data revolution—we need to adopt an interdisciplinary approach that brings together legal, scientific, and technological expertise to anticipate and address system challenges. If we do this, then more information may indeed lead to better decisions. If we do this, we might have a chance at managing in the face of global uncertainty.