Resilience: The Food Policy Imperative for a Volatile Future

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I. Introduction

Now and for the foreseeable future, these are the conditions of human life on earth: *Hot. Thirsty. Volatile. Crowded. Hungry*. The climate on the only planet capable of sustaining our species is more hostile now than at any other point in human history. As temperatures climb, glaciers melt, sea levels in acidifying oceans rise, and extreme weather events become devastatingly frequent,[1] disruption is the new normal.

Human activity has transformed the climate. The way we fuel our *lifestyles*, our heedless burning of fossil fuels, has undoubtedly altered the atmosphere. But so has the way we fuel our *lives*, the way we feed our bodies. Unlike other goods, our use of which can be abandoned or sharply restricted, we cannot simply give up food. Indeed, with a growing population, we cannot even realistically and responsibly set our sights on producing and consuming significantly less food. In the words of just about every grandmother ever, "You have to eat!"

When facing the massive, wicked problems presented by climate change and planetary limits, it is tempting to do just that—eat—and little more. Bury our anxiety in a cheeseburger and fries, drown our sorrows in a pint of beer, keep calm, and eat cake! Doing so, however, will only compound the crisis and hasten the heating. To sustain ourselves in an uncertain future, we must change our approach to *all* of our energy sources, including the most intimate energy source: food.

If we are to simultaneously produce sufficient food under challenging conditions and rapidly decrease greenhouse gas (GHG) emissions, we must swiftly abandon short-sighted land conversions, resource-intensive, GHG-spewing industrial agricultural practices, and the routine long-distance transport of most agricultural inputs and outputs. Systemic changes will need to be complemented by individual and cultural shifts in dietary preferences and consumption patterns. In other words, we also need to rethink the way that people and communities consume and connect around food. Changing our approach to producing and consuming food also requires us to craft agrifood law and policy around a new imperative. Instead of being propelled by productivism, we must pursue resilience.

To sustain a growing population on a changing planet, food policies at all levels—community, regional, national, and global—must promote judicious resource use, prioritize stewardship, align with ecosystems, advance social and distributive justice, consider national security, and position us to weather long- and short-term disruptions, both climate change-driven and otherwise. This Comment considers the power of a profuse human population, reviews climate consequences of the way we have been satisfying our food needs, and demonstrates the exigencies of new approaches to withstand the mounting pressures and disruptions assailing agriculture. It offers resilience as an essential organizing imperative for agrifood systems, policies, and laws. In so doing, the Comment explores the nature and value of resilience, outlines the characteristics of resilient food systems, identifies benefits of orienting our food future around resilience, and suggests preliminary steps in the direction of reforming agrifood policy for resilience.

II. The Problem

A. *Living Large: Collective Human Transformation of the Planet*

We are in a global mess of our own making. The existence and primary causes of the climate crisis are beyond question and no longer open for serious debate: 97% of climate scientists agree that climate change is both real and

1. *See generally* Intergovernmental Panel on Climate Change (IPCC), Summary for Policymakers, Climate Change 2013: The Physical Science Basis (2013) (Contribution of Working Group I to the IPCC Fifth Assessment Report), *available at* http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf. Global average land and ocean surface temperatures increased by 0.85 degrees Celsius between 1880 and 2012.

being caused by human activity.[2] Many environmental scientists also believe that we have entered a new epoch, called the Anthropocene Era, in which geologically significant conditions and processes are being profoundly altered by human activities such as colonization, agriculture, resource extraction, and urbanization.[3] Human activity causes erosion and sediment transport, alters the chemical composition of the atmosphere, oceans, and soils, and influences the cycles of elements.[4] Our efforts to coax sustenance from the land and seas contribute significantly to these changes, which, in turn, produce global warming, ocean acidification, and spreading of hypoxic dead zones in our aquatic ecosystems.[5] Human transformations of the natural world have further direct and indirect consequences on land and in water ecosystems, resulting in habitat loss, predation, species invasions, and mistiming of dependent species.[6] In other words, humans have become a force of nature.[7]

The collective power of contemporary humanity is a function not only of our sophistication, but also of our numerosity.[8] When our ancestors began cultivating the earth and birthing civilizations around 8000 B.C., there were a mere 5 million people scattered across the globe.[9] The advent of agriculture slowly increased the persistence of humanity; the world population grew at a steady rate of about .05% per year from the dawn of agriculture to the awakening of industry, rising to somewhere around 500 million by the start of the 18th century. Thanks to the Industrial Revolution, the global population nearly doubled over the next 100 years, reaching one billion around 1804. During the 20th century, the tally of humans alive at the same time rose from 1.65 billion to an astounding 6 billion. The world population now exceeds 7.3 billion and is expected to reach 8 billion within 10 years.[10] By 2050, the number of human lives we will ask the planet to sustain will exceed 9.6 billion.[11] At the start of the next century, the number could easily hover just under the 11 billion mark.[12]

Meeting the basic needs, to say nothing of satisfying the desires, of nine billion humans is a task of unprecedented enormity. It is especially daunting because we are not doing a terribly good job of feeding those already alive. Although our global food supply currently contains more than 2,700 calories per capita per day,[13] over 805 million people will go to bed hungry tonight.[14] Tomorrow, nearly 8,500 children will die of causes related to malnutrition.[15] These tragedies will occur while roughly one-third of the global food supply is lost or wasted.[16] Hunger amid plenty, waste amid want: These are clear signs of systemic failures.

Present climatic conditions, natural resources, agricultural knowledge, and technologies enable the production of sufficient food for everyone currently on the planet, as well as all the additional people we expect to join us by 2050. But through a crushing combination of market failure, insufficient political will, and corruption, not everyone gets enough to eat.[17] Additionally, because most people enjoy eating, those who are able will almost always seek out a deliciously diverse, often decadent diet. The growth of the global middle class means an increasingly wide and voracious appetite for and economic ability to demand so-called first-world food. The contemporary Western diet, featuring larger and more varied meals centered around animal-based protein, offers enjoyable indulgence in the place of simple sustenance. Pleasing palates comes at a cost: Per calorie, this way of eating demands larger swaths of land, greater quantities of water, and more intensive investment of other essential resources.[18]

B. Producing Under Pressure

While the rapidly expanding human population features ever more (and increasingly epicurean) mouths to feed, the

2. *See* National Aeronautic and Space Admin., *Scientific Consensus, Global Climate Change: Vital Signs of the Planet*, http://climate.nasa.gov/scientific-consensus/. For a list of the 197 international scientific organizations that hold the position that climate change has been caused by humans, visit the State of California Office of Planning and Research website, http://opr.ca.gov/s_listoforganizations.php.
3. The concept of the Anthropocene Era has been embraced by environmental scientists since 2000, but its designation as a new geological epoch is not yet official. The International Union of Geological Sciences is currently contemplating designation and will issue its recommendation in 2016. *See* Subcommission on Quaternary Stratigraphy, *Working Group on the Anthropocene*, http://quaternary.stratigraphy.org/workinggroups/anthropocene/.
4. *Id.*
5. *Id.*
6. *Id.*
7. *See* Simon Lewis, *A Force of Nature: Our Influential Anthropocene Period*, Guardian, July 23, 2009, http://www.theguardian.com/commentisfree/cif-green/2009/jul/23/climate-change-humanity-change.
8. Historical population estimates in this paragraph are drawn from the data and studies aggregated and reviewed by the U.S. Census Bureau, http://www.census.gov/population/international/data/worldpop/table_history.php.
9. *See generally* Bruce D. Smith, The Emergence of Agriculture (1995).
10. U.N. Dep't of Econ. and Soc. Affairs (DESA), Population Division, World Population Prospects: 2012 Revision, Vol. I: Comprehensive Tables, *available at* http://esa.un.org/unpd/wpp/Documentation/pdf/WPP2012_Volume-I_Comprehensive-Tables.pdf.
11. *Id.*; *see also* U.N. News, *World Population Projected to Reach 9.6 Billion by 2050* (2013), http://www.un.org/en/development/desa/news/population/un-report-world-population-projected-to-reach-9-6-billion-by-2050.html.
12. U.N. DESA, *supra* note 10.
13. U.N. Food and Agric. Org., Statistical Div. (FAOSTAT), *Food Balance Sheets*, http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368#ancor.
14. U.N. Food and Agric. Org. (FAO), Food and Nutrition in Numbers: 2014, *available at* http://www.fao.org/3/a-i4175e.pdf ("Undernourishment refers to food intake that is insufficient to meet dietary energy requirements for an active and healthy life. About 805 million people are estimated to be chronically undernourished in 2012-2014.").
15. Robert E. Black et al., *Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries*, 382 Lancet 9890, 427-51 (2013) (estimating that "undernutrition in the aggregate—including fetal growth restriction, stunting, wasting, and deficiencies of vitamin A and zinc along with suboptimum breastfeeding—is a cause of 3.1 million child deaths annually or 45% of all child deaths in 2011").
16. U.N. FAO, *Global Food Losses & Food Waste: Extent, Causes & Prevention* v (2011), *available at* http://www.fao.org/fileadmin/user_upload/suistainability/pdf/Global_Food_Losses_and_Food_Waste.pdf.
17. Evan Fraser, Video 4: The Need for More Equitable Food Distribution (Feeding Nine Billion 2014), https://feedingninebillion.com/video/need-more-equitable-food-distribution#_ftn6.
18. Richard King, *Global Food Crisis: The Challenge of Changing Diets*, Guardian, June 1, 2011, *available at* http://www.theguardian.com/global-development/poverty-matters/2011/jun/01/global-food-crisis-changing-diets.

rapidly destabilizing climate makes it ever more difficult to produce food. The United Nations Food and Agriculture Organization (FAO) warns:

> Climate change will affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It will have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Its impacts will be both short term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns.[19]

There are no silver bullet solutions to guarantee sufficient availability, equal accessibility, optimal utilization, or simple stability of food and food systems. As the Consultative Group for International Agricultural Research counsels, we will have to "recalibrate" our approach to food production.[20] Real recalibration requires a sophisticated understanding of agri-environmental and agri-social interactions and a nuanced, intentional approach to meeting human nutritional needs.

No society or nation state, not even one as economically robust, politically powerful, and agriculturally sufficient as the United States, is insulated from climate change-driven threats to its food supply. Indeed, researchers predict that "climate-change-caused variation in US agricultural production and food prices could be the most pervasive and consistent impact of climate change in the US."[21] They reach this conclusion based on the understanding that a "changing climate will alter the ability to translate the various ecosystem functions that support crop growth into food, feed, and fiber." Further, they predict that substantial climate change-induced negative impacts on U.S. crop and livestock production will spread far beyond our shores, increasing global food prices, decreasing standards of living, and potentially prompting food riots throughout the world.[22]

No wait is necessary to witness the effects of climate change on food production in the United States (or, for that matter, abroad).[23] The leading edge of the coming climate storm has arrived. California is currently gripped by one of the severest droughts on record.[24] Thanks to the greatest absolute water reduction California agriculture has ever seen, with river water for Central Valley farms reduced by roughly one-third, the state's agricultural sector has already taken a $1.5-billion revenue hit, lost over 17,000 jobs, and taken 428,000 acres out of production.[25] California producers are relying heavily on poorly managed groundwater supplies to make up for the surface water shortages, borrowing against what is likely to be a very arid future.[26] Because of its unparalleled agricultural output (nearly one-half of the domestically grown fruits, nuts, and vegetables, and one-quarter of the milk and cream come from the Golden State), threats to California agriculture impair food security for all Americans.[27]

California's cautionary tale clearly counsels against putting all of our eggs—or spinach, almonds, oranges, or artichokes—in one basket. But do not make the mistake of assuming that localized or urban food systems are the whole solution. Consider the 2011 washout of the Intervale, a network of urban farms that supplies roughly 10% of Burlington, Vermont's, fresh food. Hit hard by Hurricane Irene, the Intervale found itself under five feet of floodwater when the Winooski River crested.[28] Hurricane Sandy was no less savage to the urban agrarians and apiaries in Brooklyn, New York. Red Hook Community Farm took on two feet of polluted water during the storm, fouling even those crops that did not wash away.[29] Nearby, one million bees at the Brooklyn Grange's Navy Yard urban farm perished (their prized genetics lost) when 25 hives were torn apart by the storm.[30] Regardless of how inspiring, innovative, or important it is, no individual farm or regional food system is immune from the ravages of an angry atmosphere.

C. The Production of Food, Emissions, and Uncertainty

It is too late for us to forestall the consequences of climate change, which are already affecting farmers and consumers

19. U.N. FAO, *Climate Change & Food Security: A Framework Document* iii (2008), *available at* ftp://ftp.fao.org/docrep/fao/010/k2595e/k2595e00.pdf.
20. *See* Phillip Thornton, *Recalibrating Food Production in the Developing World: Global Warming Will Change More Than Just the Climate* (Consultative Grp. for Int'l Agric. Research, Policy Brief 2012), https://cgspace.cgiar.org/bitstream/handle/10568/24696/CCAFS_PB06-Recalibrating%20Food%20Production.pdf?sequence=6.
21. Erik J. Nelson et al., *Climate Change's Impact on Key Ecosystem Services and the Human Well-Being They Support in the US*, 11 Frontiers Ecology & Env't 9, 483-84 (2013), http://www.esajournals.org/doi/pdf/10.1890/120312.
22. *Id.* Because the food supply is so critical, major economic disruptions are likely to occur in the United States and reverberate across the world even though U.S. farms currently only contribute 1% to the U.S. annual gross domestic product (GDP) and support just 0.5% of all U.S. jobs.
23. *See generally* Phillip Thornton, *Impacts of Climate Change on the Agricultural and Aquatic Systems and Natural Resources Within CGIAR's Mandate* (Consultative Grp. for Int'l Agric. Research, Working Paper No. 23, 2012), https://cgspace.cgiar.org/handle/10568/21226.
24. Kat Kerlin, *Drought Impact Study: California Agriculture Faces Greatest Water Loss Ever Seen*, U.C. Davis News Serv., July 15, 2014, http://news.ucdavis.edu/search/news_detail.lasso?id=10978.
25. Richard Howitt et al., *Economic Analysis of the 2014 Drought for California Agriculture*, U.C. Davis (2014), *available at* https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.
26. *Id.*; Benjamin I. Cook et al., *Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains*, Sci. Advances (Feb. 12, 2015), *at* http://advances.sciencemag.org/content/1/1/e1400082 (predicting a "remarkably drier future that falls far outside the contemporary experience of natural and human systems in Western North America, conditions that may present a substantial challenge to adaptation").
27. National Agric. Statistics Serv., *California Agricultural Statistics: 2013 Annual Bulletin*, http://www.nass.usda.gov/Statistics_by_State/California/Publications/California_Ag_Statistics/index.asp. (Over one-third of the U.S. vegetables and two-thirds of the country's fruits and nuts were produced in California in 2013.).
28. Intervale Ctr., *Recovering From Irene*, http://www.intervale.org/recovering-from-irene/.
29. Susie Cagle, *New York City's Urban Farms Gasp for Air After Sandy*, Grist (Oct. 31, 2012), *at* http://grist.org/news/nycs-urban-farms-gasp-for-air-after-sandy/.
30. Susie Cagle, *Sandy Wipes Out Biggest Beekeeping Operation in New York City*, Grist (Oct. 30, 2012), *at* http://grist.org/news/sandy-wipes-out-biggest-beekeeping-operation-in-new-york-city/.

around the world, but with swift, decisive, and significant action, we might be able to stop short of tipping points that will accelerate warming, increase climate volatility, hasten decline, tighten the grip of droughts, famine, and epidemics, and even irreversibly alter the biosphere.[31] Respected climate scientist James Hansen, along with several of his colleagues, has cautioned: "If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that [carbon dioxide] CO_2 will need to be reduced . . . to at most 350 [parts per million] ppm."[32] Reliable recent measurements of atmospheric CO_2 put current levels over 401.5 ppm.[33] These numbers prove the need to both adapt and mitigate.

The most emphasized and hotly debated efforts to reduce GHG emissions are quite appropriately focused on the energy sector, inclusive of power generation, industry, and transportation. Transitioning from dirty fossil fuel to clean, renewable energy sources is imperative for three reasons. First, fossil fuel combustion generated 32,310.287 million metric tons (MMT) of CO_2 emissions in 2012.[34] Second, to stay below 2 degrees Celsius of warming (the likely too low but at least internationally agreed-upon target limit in the Copenhagen Accord[35]), we cannot release more than 565 gigatons of CO_2 into the atmosphere before 2050.[36] Third, there are at least 2,795 gigatons of carbon in the proven global reserves of coal, oil, and gas.[37] We cannot safely burn all, let alone one-fifth, of the fuel on hand without burning up our international agreements and our atmosphere.[38]

Decreasing fossil fuel dependence is the most imperative and potentially impactful climate-stabilizing action, but energy is not the only sector in need of a comprehensive revolution. Agriculture—that most fundamental of human enterprises—is, at once, a victim and perpetrator of climate change. Agricultural production is the next most significant source of GHG emissions. Admittedly, it is a distant second, following energy consumption (for power, heat, and transportation combined).[39] Unfortunately, emissions levels related to agricultural production are on the rise: The FAO reports that global agricultural emissions from crop and livestock production in 2011 totaled over 5.3 billion tons of CO_2 equivalents (CO_2e), a 14% increase over the 4.7 billion tons emitted in 2001.[40]

Taking a closer look: Enteric fermentation (methane produced and released via the digestive systems of ruminant animals) is responsible for 40% of agricultural emissions. Manure left on pasture comes in second at 16%, but direct and indirect nitrous oxide (N_2O) emissions from synthetic fertilizers added to agricultural soils by farmers are close behind at 13% and catching up fast. Emissions from synthetic fertilizers rose 37% since 2001 and are expected to shoot up another 30% by 2030. Rice cultivation (10%), manure management (7%), and burning of savanna (5%) account for the rest.

The agriculture and energy sectors cannot be neatly decoupled. Agriculture, which is substantially dependent on fossil fuel energy to power agricultural machinery, irrigation pumps, and fishing vessels, generated more than 785 million tons of CO_2e emissions in 2010, a staggering 75% increase since 1990.[41] By defining the global food system broadly—accumulating not only the popular "field-to-fork" components of production, processing, temperature-controlled storage and transport, but also less-emphasized but equally entwined activities like agriculturally prompted deforestation and land use changes, fertilizer production, food packaging, and food waste—we see that food is a major driver of climate change. Up to one-third of anthropogenic GHG emissions are attributable to the global food system.[42] Some 86% of these emissions relate to agricultural production.[43] Thus, emissions slow but do not stop once crops are harvested. The bal-

31. *See generally* Anthony D. Barnosky et al., *Approaching a State Shift in Earth's Biosphere*, 486 Nature 52 (2012), http://www.nature.com/nature/journal/v486/n7401/full/nature11018.html.
32. James Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?*, http://arxiv.org/pdf/0804.1126.
33. Scripps Data, Reposted on CO2Now.org, http://co2now.org/images/stories/data/co2-atmospheric-mlo-monthly-scripps.pdf.
34. U.S. Energy Info. Admin. (EIA), *International Energy Statistics*, http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=ww,&syid=2008&eyid=2012&unit=MMTCD.
35. U.N. Framework Convention on Climate Change (UNFCCC), Copenhagen Accord (2009), *available at* http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf:
    > To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change.
36. Malte Meinshausen et al., *Greenhouse Gas Emission Targets for Limiting Global Warming to 2 °C*, 458 Nature 1158-62 (2009), http://www.nature.com/nature/journal/v458/n7242/full/nature08017.html.
37. Carbon Tracker Initiative, *Unburnable Carbon: Are the World's Financial Markets Carrying a Carbon Bubble?* 6 (2012), http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf.
38. Bill McKibben, *Global Warming's Terrifying New Math*, Rolling Stone, July 19, 2012, http://www.rollingstone.com/politics/news/global-warmings-terrifying-new-math-20120719#ixzz3XJRhBE7f.
39. Laura Reynolds, *Agriculture and Livestock Remain Major Sources of Greenhouse Gas Emissions*, Worldwatch Inst., May 8, 2013, http://www.worldwatch.org/agriculture-and-livestock-remain-major-sources-greenhouse-gas-emissions-0.
40. Francesco N. Tubiello et al., *Agriculture, Forestry and Other Land Use Emissions by Sources and Removals by Sinks* (U.N. FAO, Working Paper No. 2, 2014), http://www.fao.org/docrep/019/i3671e/i3671e.pdf; *see also* U.N. FAO, *Agriculture's Greenhouse Gas Emissions on the Rise* (2014), http://www.fao.org/news/story/en/item/216137/icode/; Francesco N. Tubiello et al., *The Contribution of Agriculture, Forestry and Other Land Use Activities to Global Warming, 1990-2012*, Global Change Biology (2015), http://onlinelibrary.wiley.com/doi/10.1111/gcb.12865/full.
41. Tubiello et al., *Agriculture, Forestry and Other Land Use Emissions, supra* note 40.
42. Sonja Vermeulen et al., *Climate Change and Food Systems Annual Review of Environment and Resources*, 37 Env't & Resources 195-222 (2012) (calculating that the whole food system emitted 9,800-16,900 megatonnes (Mt) in 2008.). *See also* Christopher Weber & H. Scott Matthews, *Food Miles and the Relative Climate Impacts of Food Choices in the United States*, 42 Envtl. Sci. & Tech. 3508 (2008), http://pubs.acs.org/doi/pdf/10.1021/es702969f (putting the average U.S. household's annual food consumption-related emissions footprint as 8.1 Mt of CO_2e, only 11% of which is related to transportation).
43. Vermeulen et al., *supra* note 42.

ance of the emissions are associated with transporting and transforming raw agricultural commodities into the food that lands on our plates, activities that are almost always energy- and-emissions-intensive.[44]

Looming climate crises, chiefly natural disasters and inhospitable growing conditions, and related resource scarcity, are so significant that they tend to eclipse other issues. Remember, however, that they are far from the only threats to food security. Our food systems are also vulnerable to economic shocks, especially food price spikes. Civil unrest often follows food price volatility, which can quickly compound a food crisis.[45] Areas hosting violent conflict, war zones, and regions managing internal or cross-border displacement are prone to serious supply disruptions.[46] Hunger and famine are all too easily added to the horrors of war or the anxiety and devastation of infectious disease outbreaks and environmental illness epidemics.[47] Centralized, consolidated food supplies and technology-dependent food production and storage methods are also tempting targets for terrorism and cyber attacks.[48] Even in the context of a completely stable climate, stresses and shocks are a given. Organizing our food systems and policies around a resilience imperative is the only safe bet.

III. The Solution: Resilience

A. *Conceptualizing Resilience*

A resilience framework offers a systems-oriented way of responding to climate-driven shocks and population-related pressures, which disproportionately affect the vulnerable, poor, and least deeply resourced people and communities in our societies. Thus, it is not surprising that resilience is emerging as a nascent but natural concept in the realm of food and nutrition security and a critical component of a justice-framed food politics.[49]

The concept of resilience is a familiar one in the fields of ecology and psychology. It also is currently in vogue in the areas of smart development and urban planning, and has even begun to enter the vernacular of humanitarian workers and nongovernmental organizations. Though definitions differ based on context and usage, *resilience* can be broadly defined as the capacity of any entity, ranging from an organism, an individual, a household, a corporation, a community, a sector, or a society, to preemptively prepare for sudden, unpredicted disruptions, to recover from them, and then thrive on new, potentially disguised opportunities produced by the disruption.[50]

Judith Rodin, president of the Rockefeller Foundation and author of *The Resilience Dividend*, identifies five main characteristics of resilient entities: They are aware, diverse, integrated, self-regulating, and adaptive.[51] Awareness encompasses both reflective knowledge of strengths, assets, liabilities, risks, threats, and constantly updating knowledge of evolving situations.[52] Diversity refers to a multiplicity of capabilities.[53] Integration involves the coordination of functions, actions, ideas, and solutions in ways that are transparent and collaborative.[54] Self-regulation means the ability to endure anomalous events without collapsing or cascading into catastrophe; this is also known as the ability to "fail safely."[55] Adaptivity implies flexibility, especially with respect to plans, behaviors, resource allocation, and responsibility.[56] Resilience is, therefore, "fed" by a combination of fresh, well-combined knowledge and capacity and prepared according to good "recipes."

Rodin's work is inspired by ecological systems theorists, who map the process by which systems absorb and respond to external change to a four-phase adaptive cycle: (1) rapid growth; (2) conservation; (3) release (prompted by a disruption or threshold); and (4) reorganization.[57] The first two phases are known as the foreloop, and the second two as the backloop.[58] To understand the adaptive cycle without obtaining a degree in ecology, look no further than the forest. At first, an array of plant life grows rapidly, creating what we recognize as a forest. Over time, as the canopy fills and old trees dominate, the growth rate slows and diversity decreases. That continues until there is a release, such as a spark that starts a fire or a logging operation that fells a stand, a disruptive event that places the system at a crossroads. Down one path is devastation; along the other path, accessible only via resilience, is adaptation, change, and growth.

Loosely framed by the adaptive cycle, it is obvious that the pursuit of resilience in human systems works best as a proactive endeavor, one that does not wait to be shoved forward by crisis.[59] As such, we should try to "live, as much as we possibly can, in the foreloop," cultivating in periods

44. *See* Univ. of Mich. Ctr. for Sustainable Food Sys., *U.S. Food System Factsheet*, Pub. No. CSS01-06, *available at* http://css.snre.umich.edu/css_doc/CSS01-06.pdf (graphing data on energy inputs (but not related emissions) in the U.S. food system and demonstrating that food processing, wholesale and retail services, and household energy consumption make up nearly 60% of food-related energy flows, while transportation is responsible for another 13%).
45. *See, e.g.*, David Adam, *Food Price Rises Threaten Global Security—UN*, Guardian, Apr. 9, 2008, *available at* http://www.theguardian.com/environment/2008/apr/09/food.unitednations.
46. *See, e.g.*, U.N. FAO, *Food Crisis Escalates in South Sudan* (2015), http://www.fao.org/news/story/en/item/276874/icode/.
47. *See, e.g.*, U.N. News Serv., *West Africa on Brink of Major Food Crisis in Wake of Ebola Outbreak*, U.N. News Ctr. (2014), http://www.un.org/apps/news/story.asp?NewsID=49305#.VTFWOBfUqhE.
48. *See, e.g.*, Strategic P'ship Program Agroterrorism (SPPA) Initiative, First Year Status Report (Sept. 2005-June 2006), *available at* http://www.usda.gov/documents/8-10-06%201%20yr%20report%20SPPA%20agroter5.pdf.
49. *See* Shenggen Fan et al. eds., *Resilience for Food & Nutrition Security*, Int'l Food Pol'y Research Inst. 3 (2014), http://www.ifpri.org/publication/resilience-food-and-nutrition-security.
50. Judith Rodin, The Resilience Dividend: Being Strong in a World Where Things Go Wrong 3 (2014).
51. *Id.* at 13-14.
52. *Id.* at 14-20.
53. *Id.* at 14, 20-26.
54. *Id.* at 14, 26-31.
55. *Id.* at 14, 31-34.
56. *Id.* at 14, 34-39.
57. *Id.* at 49. *See generally* Resilience Cycle, http://www.resalliance.org/index.php/adaptive_cycle.
58. *Id.*
59. Rodin, *supra* note 50, at 285.

of growth and conservation.[60] Where possible, we must take control of when and how we respond to a disruptive release.[61] Once we have built capacity, we may even strategically seek out disruptions by seizing opportunities that both carry an array of calculated risks and offer the potential for growth.[62]

To wrap our minds around the nature of resilient human systems and resilience-building policies, it can help to analogize to the form of resilience we most often observe: human resilience. Call to mind an acquaintance you would characterize as resilient, and think carefully about why they earn this descriptor. It is unlikely that the person you are thinking of has found clever ways to evade stressors, tragedies, or crises. Bad things happen to resilient people. But when the going gets tough, the resilient among us tap into personal strengths, acknowledge their own limitations, communicate their problems, cultivate strong relationships, and accept the support of family and friends, all while remaining mostly optimistic.[63] In short, resilient people are realistic, reflective, and connected. They adjust themselves to changed circumstances, drawing upon both their own resources and those of their close contacts. They examine, but do not get mired in, the past and look forward with a blend of prudence and optimism.

Expanding our gaze, but remaining connected to the habitats of humanity, we can also contemplate the features of resilient communities. Communities are thought to be most vulnerable at the places where their human systems intersect with the natural and built environments.[64] Communities can, however, strengthen themselves by accumulating information, translating it into knowledge, and developing effective systems for its accurate transfer. They can also fortify themselves by organizing around and emphasizing shared values, investing in supportive networks, and cultivating the ability and willingness to adapt.[65] In other words, communities can strengthen themselves by behaving a lot like resilient people.

People and communities thrive when the places they inhabit are also primed for resilience. Not surprisingly, urban planners have begun to recognize the value of resilience, especially as an intentional response to urbanization and resulting pressures on aging infrastructure, undersized systems, and diverse populations. Retrofitting cities and gearing new development toward resilience has become a major theme in place-making and, conveniently, there is already overlap between resilience planning and urban agriculture facilitation. For example, in recognition of the importance of urban food systems to city design and resilience, ICLEI-Local Governments for Sustainability and the Resource Center for Urban Agriculture and Forestry (RUAF) jointly launched a CITYFOOD network on resilient city-region food systems and urban agriculture.

B. Characteristics of Resilient Food Systems

Drawing from the resilience-supporting features of organisms, ecosystems, and entities, we can begin to articulate the core characteristics of resilient food systems. Before doing so, however, it is important to clarify what is meant by a food system. A food system encompasses all of the "steps, processes, and actors involved in bringing food from farms to the mouths of consumers and encompasses a multifarious supply chain of growers, harvesters, processors, packagers, distributors, marketers, wholesalers, retailers, purchasers, preparers, servers, and consumers of what we eat," inclusive of the food that gets lost or wasted along the way.[66]

When trying to undo damage done, it is tempting to point the finger at an instigator, send it to the corner of our minds, and then look for something more virtuous to pick up the pieces. Because the multinational food system is a profligate problem-maker, the impulse to deify local alternatives is insistent. To be sure, "[s]trong community food systems are the foundation of food security." Nevertheless, as Phillip Ackerman-Leist, who champions place-based, community-centered food systems in his book *Rebuilding the Foodshed*, reminds us, "well-managed regional, national and international food systems currently contribute to a diverse food security portfolio for all global citizens."[67] Because resilience is, in part, a function of elegant redundancy, our task is not to choose one system over another, but to recognize that all scales are interlinked, clearly nested within, and to some degree dependent on each of the others.[68] Our task is to push each system to its best uses, hold it accountable for any harms it produces, and limit reliance on or expansion of systems in ways that are antithetical to resilience.

Mindful of the complexity and scales of food systems, we can elaborate resilient food systems. Resilient food systems are diverse, distributed, natural, innovative, social, inclusive, just, and deliberate.[69] Because

60. *Id.*
61. *Id.* at 286.
62. *Id.*
63. *See, e.g.*, *This Emotional Life: What Is Resilience?*, PBS, http://www.pbs.org/thisemotionallife/topic/resilience/what-resilience.
64. *See generally* Resilience Alliance, http://www.resalliance.org/.
65. *See* Alastair McAslan, *Community Resilience: Understanding the Concept and Its Application*, Torrens Resilience Inst. (2011), *available at* http://torrensresilience.org/images/pdfs/understanding%20community%20resilience.pdf.
66. Nicole Civita, *Agrarians Feeding Communities: Reconnecting Federal Farm Policy and Nutrition Assistance for a More Just Agri-Food System*, 7 Nw. Interdisc. L. Rev. 69 (2014); *see also* Nourish Life, *Nourish Food System Map*, http://www.nourishlife.org/pdf/Nourish_Food_System_Map_11x14.pdf.
67. Phillip Ackerman-Leist, Rebuilding the Foodshed 17 (2013).
68. *See id.* at 277-92 (visualizing food systems as "dynamic, interlocking systems—a vast network of differently sized centerpoints connected to one another by means of surging flows that create exchanges of resources, ideas, and of course foods").
69. ICLEI, *Resilient Urban Food Systems in Brief*, http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2013/RUFS/RUFS_in_brief.pdf (describing resilient urban food systems as diverse, distributed, natural, innovative, social, and inclusive). Not surprisingly, urban planners have begun to recognize the value of resilience, especially as an intentional response to urbanization and resulting pressures on aging infrastructure, undersized systems, and diverse populations. Retrofitting cities and gearing new development toward resilience has become a major theme in place-making, and happily, there is already overlap between resilience planning and urban agriculture facilitation.

these eight words have both formal definitions and colloquial uses within and outside of the food sector, it is especially important to detail their meaning in the context of food resilience.

1. Diverse

Resilient food systems diversify supply chains, aggregate the outputs of many producers, and welcome imperfection and heterogeneity within product categories. They value biodiversity, both by creating markets for a wide variety of plant and animal foods and by protecting the diversity of natural ecosystems through agroecological production practices that deliver ecosystem services. They ensure equal access to seeds and plant genetics and provide strong protections for and open access to traditional, heirloom, and improved seeds, while balancing incentives for innovations in agricultural biotechnology.

2. Distributed

Resilient food systems feature multiple flows of food, produce, inputs (seeds and soil amendments), tools, workforces, and remittances. These systems both connect and disconnect across geography in ways that are sensible and sensitive, not merely profit-driven. They grow food in various locations, across the open landscape and in and around the built environment. They are distributed centrally and peripherally, vertically, and horizontally. In this way, they are less likely to be devastated by extreme weather events and other disruptions. They are also more likely to spread value and opportunity among a diverse array of stakeholders.

3. Natural

Resilient food systems acknowledge and nurture synergies among climate, ecosystem, and food system needs. They recognize the limits of imposing industrial imperatives and processes on biological systems. In so doing, they can help mitigate food safety risks.[70] Further, through their alignment with natural processes and acceptance of limits, they better manage natural resources. Cognizant of water's vital nature, resilient food systems preserve, protect the quality of, and mindfully allocate available water. Recognizing the elegance and wisdom of natural ecosystems, where possible, resilient food systems mimic nature and seek to restore healthy, functional ecosystems while meeting human food needs.[71]

4. Innovative

Resilient food systems innovate. They also make good use of appropriate technology and cutting-edge design. Creativity is vital at all loci: on the rural farm; on rooftops and walls; in parks and public spaces; in rehabilitated, cultivated urban environs; at sea and on the docks; at the processing plant; at the wholesale market; at the grocer; in the kitchen; in primary, secondary, culinary, and nutrition education; in community-supported agriculture; and in public procurement by local governments.[72] Resilient food systems also look for ways to close waste cycles and prevent nutrient leaching.[73] To this end, these systems are built on an ethos of food conservation: They promote the careful and most complete utilization of our food resources and of the hidden resources that are embedded in our food.[74]

5. Social

Resilient food systems are built by and for people. The nourishment of humanity (as dramatic as that may sound) is the raison d'être of the food system. Resilient food systems provide the benefits of employment opportunities with living wages, opportunities for advancement, and rewarding work. They can be powerful tools of poverty alleviation, community-building, markets, networks, citizen engagement, and even individual empowerment. They also recognize that gustatory delight is part of the human experience and do not ignore the power that food derives as a source of pleasure, a conduit of sense memory, and an expression of love.[75]

6. Inclusive

Multiple players and interests are involved in resilient food systems: private entities (producers, transporters, processors, sellers); public bodies (local and central governments, as well as schools and other public institutions that provide food); citizen-led organizations; and grassroots initiatives. The interests of these actors must be deliberately prioritized, based on the degree to which they further food security and the other components of resilience, and weighted accordingly. Moreover, resilient food systems also value, recognize as partners, and protect the interests of the non-human lives—plant, animal, and soil microbe—within the system. Grounded in an ethic of competent husbandry, they care for and "connect conservingly . . . all the strands in the living network that sustains us."[76]

70. *See* Susan A. Schneider, *Beyond the Food We Eat: Animal Drugs in the Livestock Industry*, 25 Duke Envtl. L. & Pol'y F. (forthcoming 2015).
71. *See generally*, Mark Shepard, Restoration Agriculture (2013) (explaining how perennial farms modeled on native ecosystems can simultaneously produce abundant food, fiber, and fuel and provide critical ecosystem services such as sequestering carbon, building soil, recharging groundwater, and enhancing wildlife habitat and biodiversity).
72. ICLEI, *Resilient Urban Food Systems in Brief*, *supra* note 69.
73. *See generally* Phillip Ackerman-Leist, Rebuilding the Foodshed, 61-96 (2013).
74. Nicole Civita, *Food Conservation, Donation and the Law* (forthcoming chapter in monograph based on The Last Food Mile Conference, University of Pennsylvania School of Veterinary Medicine (Dec. 8-9, 2014)).
75. *See* Carlo Petrini, Terra Madre: Forging a New Global Network of Sustainable Food Communities 45-61 (2010) (discussing the right to pleasure in food).
76. Wendell Berry, *Renewing Husbandry*, Orion Mag., at https://orionmagazine.org/article/renewing-husbandry/.

7. Just

Food resilience aligns with the internationally recognized human right to food: the right of all human beings to feed themselves in dignity, either by producing their food (which implies a right to access land, seeds, water, and other resources) or by purchasing it (which implies money and access to a market).[77] Leaving no one hungry, cut off, or disproportionately vulnerable is a principal aim of a resilient food system. Similarly, resilient food systems make sure that no group of people suffers the unavoidable externalized harms of agricultural production without redress or compensation. "Just resilience" is about "planning and preparing for a fast changing world in ways that leave no one behind."[78] Placing justice at the heart of resilience allows us to "embrac[e] the uncertain, the unknown, and the stranger who is actually a neighbor," and "requires us to step out beyond the realms of comfort and certainty, and into more distant communities—not simply to find answers, but to create them together."[79]

8. Deliberate

Making mindful choices about what we eat, what we grow, who or what our commodities feed (people, animals, or vehicles?),[80] as well as where and how we produce our food, is essential for food resilience on a hot and crowded planet. Dennis Meadows said that "[y]ou could have 10 billion people living on the planet at a subsistence level and be fine. Or 500,000 people on the planet living a first world lifestyle. It is not the absolute number of people, but the multiple of the high-consumption lifestyle."[81] Our quest for food resilience will challenge our consumption patterns, ask us to get creative with and develop a taste for some new foods, and require us to mainstream alternative food sources.[82]

C. Benefits of Incorporating Resilience Into Agrifood Policy

Agrifood systems are, happily, both in dire need of a resilience-directed revision and an ideal laboratory for the work of bringing economic, social, and environmental systems into closer harmony. They are also places where we can realize what Rodin calls the "resilience dividend," the rewards that can be reaped by resilient entities and systems. Rodin encourages us with a reminder that resilient entities not only "bounce back to a functioning state, they bounce forward: they nurture natural systems, improve structures, and strengthen social ties," thereby acquiring a resilience dividend. This is a very appealing equation for farmers, food producers, and eaters.

Our often incoherent agrifood policy has left us with a dominant food system that is brittle and breaking, one that is resistant and generates resistance. Currently, the favored method of guarding against famine and crop failure is based principally on increased production. Unfortunately, the methods used to produce larger amounts of food in smaller spaces and over less time are not always ecologically astute. In fact, these methods appear to be trading short-term gains for formidable long-term problems.

Three examples readily illustrate this. First, the widespread subtherapeutic use of antibiotics is producing lethal pathogens capable of resisting all known antimicrobial agents.[83] Second, the widespread use of broad-spectrum herbicides is giving rise to vexatious super-weeds that require more toxic herbicides in higher concentrations.[84] Third, a similar phenomenon happens with the use of pesticides and the planting of crops in monocultures across enormous acreages.[85]

Resilience can be thought of as a counterpoint to resistance. By challenging agri-industrial productivism, and prioritizing methods that produce food without producing as many negative externalities and unintended consequences, resilience can reduce resistance and powerfully elevate food security, even at the margins and in crises. The International Food Policy Research Institute (IFPRI), which seeks sustainable solutions for ending hunger and poverty, notes that most current and past post-crisis humanitarian activities save lives, but do little

77. *See* U.N. FAO, Right to Food Guidelines (2005), http://www.fao.org/3/a-y7937e.pdf.
78. Ackerman-Leist, *supra* note 73, at 278.
79. *Id.*
80. *See, e.g.*, Michal C. Moore & Sarah M. Jordaan, *Ethical Risks of Environmental Policies: The Case of Ethanol in North America* (Univ. of Calgary Sch. of Pub. Pol'y Research Papers, Energy & Env't, 2010), *available at* http://www.policyschool.ucalgary.ca/sites/default/files/research/biofuelsjordaanfinal.pdf.
81. Christian Parenti, *"The Limits to Growth": A Book That Launched a Movement*, Nation, Dec. 5, 2012, *available at* http://www.thenation.com/article/171610/limits-growth-book-launched-movement# (quoting from phone interview with Dennis Meadows).
82. *See, e.g.*, Joe Romm, *A Bug's Life: Will Americans Eat (More) Insects Before or After We Stop Running Our Cars on Corn?*, Climate Progress, May 1, 2014, http://thinkprogress.org/climate/2014/05/01/2112531/eat-insects/. *See also* Robert Giegengack, Presentation at the University of Pennsylvania: Food, Water, and Energy (Dec. 8, 2014), *available at* http://repository.upenn.edu/cgi/viewcontent.cgi?article=1008&context=thelastfoodmile.
83. *See, e.g.*, Ctrs. for Disease Control & Prevention (CDC), Antibiotic Resistance Threats in the United States (2013), http://www.cdc.gov/drugresistance/threat-report-2013/; David Wallinga, *The Invisible Epidemic: Giving Voice to the Faceless Victims of Antibiotic Overuse*, Think Forward Blog (Sept. 14, 2012), http://www.iatp.org/blog/201209/the-invisible-epidemic-giving-voice-to-the-faceless-victims-of-antibiotic-overuse; David Wallinga, *Antibiotics, Animal Agriculture & MRSA: A New Threat*, Inst. for Agric. & Trade Pol'y (2009), http://www.iatp.org/files/421_2_107139.pdf; Alliance for the Prudent Use of Antibiotics, *Antibiotic-Resistant Infections Cost the U.S. Healthcare System in Excess of $20 Billion Annually*, PR Newswire, Oct. 19, 2012, http://www.prnewswire.com/news-releases/antibiotic-resistant-infections-cost-the-us-healthcare-system-in-excess-of-20-billion-annually-64727562.html.
84. Nature Editorial Bd., *A Growing Problem*, 510 Nature 187 (2014), http://www.nature.com/polopoly_fs/1.15382!/menu/main/topColumns/topLeftColumn/pdf/510187a.pdf; Tom Phillipot, *Nearly Half of All US Farms Now Have Superweeds*, Mother Jones, Feb. 6, 2013, http://www.motherjones.com/tom-philpott/2013/02/report-spread-monsantos-superweeds-speeds-12-0 (reporting on the growing problem of herbicide resistance).
85. Miguel A. Altieri, *Modern Agriculture: Ecological Impacts and the Possibilities for Truly Sustainable Farming*, Agroecology in Action, 2000, http://nature.berkeley.edu/~miguel-alt/modern_agriculture.html.

to help communities withstand the next shock.[86] Likewise, most long-range development programs aimed at increasing food and nutrition security, reducing poverty, and promoting growth ignore inevitable shocks. In so doing, they may actually exacerbate vulnerabilities.[87] To address this disconnect, the IFPRI recommends an emphasis on resilience to "link short-term humanitarian efforts with longer-term development activities," and to "ensure that "long-term development programs consider short-term vulnerabilities."[88]

It is natural to think about resilience and alleviation of food insecurity and malnutrition. At the same time, an emphasis on resilience can also motivate us to tackle the problems of overnutrition, obesity, and diet-related chronic disease, which plague much of the developed world. Sick people—whether they are sick from too little food, too much food, or the wrong foods—are far less likely to bounce back from shocks and disruptions: They require more acute care and more complicated interventions in times of crisis, and they are less able to contribute to the work of getting through metaphorical and literal storms. We need resilient food systems to power resilient people, and we need resilient people to save our species.

By emphasizing the planning and preparedness aspects of resilience—the capacity-building, elegant redundancy, and intentional, complementary diversity—we not only position ourselves for better post-disruption outcomes and prevent disruptions from becoming disasters, but we also necessarily improve our day-to-day functioning. The side effect of our work to build more resilient food systems is support for our efforts to enhance agricultural sustainability and productivity, food access, and food safety.

D. Reform for Resilience

Infusing the capacity for resilience into the agrifood sector will require a systems mindset. "Systems thinking" is a holistic approach to analysis that focuses on the way constituent parts interrelate, as well as how systems work over time and within larger systems.[89] Systems thinking requires attention not only to components, but also to interrelationships, patterns, and dynamics that unite and propel.[90]

Developing full-scope, eco-literate, justice-driving solutions to the challenges facing agriculture requires direct dialogue and future-focused collaboration among foodmakers and lawmakers. To enhance food sovereignty and public acceptance of reforms, engaged eaters should also be invited into these exchanges. Though the challenges are imposing, the stakes high, and the goals lofty, we need not wallow in despond. Systems thinkers remind us that solutions are, or can be, as connected as problems. Thus, small shifts, particularly at leverage points ("places within a complex system . . . where a small shift in one thing can produce big changes in everything"[91]) can have profound effects. When considering such a shift, however, we must be sure to keep an eye on how the dominoes are stacked. In our pursuit of resilience, we do not want to trade one set of immediate problems for a more gnarly or intractable set of future crises.

The trick is that some of those small but mighty shifts will encounter serious friction. For example, to be both economically sustainable and resilient, revenue must be more equitably allocated throughout the food system. This means that we will need to pursue policies that are likely to decrease outsized profits that have long been accruing to the powerful players at the top of our consolidated multinational food system.[92] Signaling a shake-up of the scoreboard is sure to alarm those at the top, who have tremendous influence and the ability to derail transformational change. Their reluctance to cede power in any way is somewhat understandable: Growth is an essential and inescapable feature of profit-oriented capitalist economies.[93] The alternative is annihilation by competitors.

This is as true in the agrifood sector as it is in any other industry. You need not look further than the grocery aisle for proof, but if you do happen to survey America's productive lands, you will find overwhelming evidence of the "get big or get out" mandate. It is critical to remember, however, that when we are dealing with living systems, especially ones that behave less predictably thanks to our new climate, proportionality matters.[94] Rightness of size can dramatically influence a system's stability and sustainability.[95] Outsized monopolistic operations dubiously justified by the sanctimonious aim of feeding the world do not typically promote resilience. Robust public regulation that is both scale-appropriate and situationally flexible may be the best tool we have for driving smart growth, resilient positioning, and genuinely sustainable practices, as well as for protecting the commons.

Helpfully, resilience thinking has already made its way into environmental law. Legal scholars have exposed a

86. *See* Shenggen Fan et al. eds., *Resilience for Food and Nutrition Security*, Int'l Food Pol'y Research Inst. 3 (2014), http://www.ifpri.org/publication/resilience-food-and-nutrition-security.
87. *Id.*
88. *Id.* at 3-4.
89. *See generally* Donella H. Meadows, Thinking in Systems: A Primer (2008). For online access to a helpful collection of systems thinking tools, visit Meadows' website, http://www.donellameadows.org/systems-thinking-resources/.
90. Meadows, *supra* note 89.
91. Donella Meadows, *Leverage Points: Places to Intervene in a System*, http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/.
92. *See generally* Wenonah Hauter, Foodopoly: The Battle Over the Future of Food and Farming in America (2012).
93. *See, e.g.*, Myron J. Gordon & Jeffrey S. Rosenthal, *Capitalism's Growth Imperative*, 27 Cambridge J. Econ. 25 (2003) ("A capitalist firm operating in a competitive market is subject to a growth imperative, because uncertainty about the profit rate under a no-growth policy makes the firm's prospects highly unattractive in finite time and bankruptcy practically certain in the long run.").
94. Linda Booth Sweeney, *Thinking About Systems: 12 Living System Principles*, http://www.lindaboothsweeney.net/thinking/principles.
95. *Id.*

serious foundational flaw that underpins property, natural resource, and environmental law: The legal system assumes a globally stable Nature in a healthy state.[96] The law recognizes that human activity can alter the health of ecosystems and attempts to control some of the discharges into the environment, but believes that by limiting discharges, ecosystems will return to their prior state of good health.[97] Ignoring core ecological principles, among them the adaptive cycle, and assuming a static state of Nature, makes our laws and regulatory apparatus brittle, maladaptive, and out of step with ecological and social change.[98]

To meet the challenges of environmental governance in a way that accommodates social-ecological resilience and is enforceable, legal scholars have begun to propose new affirmative laws that foster resilience in nature, society, and people; reforms that build flexibility into existing laws; and changes to the regulatory system that facilitate adaptive management.[99] This proposed shift toward "adaptive law" is a vital tool for reorienting agrifood systems and policy toward resilience because adaptive law "aims for multiple forms of resilience": ecological and social, institutional and community.[100] Moreover, adaptive law "recognizes and embraces iterative processes, with feedback loops among multiple participants; limits to human and organizational rationality; the effects of social and ecological forces on the ordering and management of human affairs; and accountability mechanisms for the conservation of capital."[101]

Supporting food resilience will require new laws, policies, and institutions that attend to the contextual, longitudinal, and nested dimensions of food systems. Supporting food resilience will also require a broad, critical look at existing laws to identify areas ripe for reform. We must ask: What laws presently reduce resilience or block access to leverage points? Where can regulation, deregulation, or public investment be used to facilitate resilient change? What fences must be maintained or valves installed to ensure safe failures and stop catastrophic cascades? This type of inquiry is especially appropriate as we seek to develop the legal structures and marshal public support for reestablishing regional and local food systems that ensure resilience-supportive, place-based capacity, and elegant redundancy.

Finally, reaching resilience will also require shifting some social expectations and cultural norms around food and food choices. Indeed, the FAO recommends that we all do our part to reduce food-related climate and environmental harms by shifting our staple food preferences, selecting local produce with a lower carbon footprint, reducing consumption of land- and water-stressing grain-fed livestock, protecting biodiversity, exploiting underutilized wild foods, reducing reliance on overconsumed wild species, and promoting energy-efficient and dry cooking practices, among other consumer choice-based interventions.[102] As renowned systems thinker Donella Meadows states: "Systems thinking . . . can lead us to the edge of what analysis can do and then point beyond—to what can and must be done by the human spirit."[103] To that end, a resilience-framed food policy ought to enable and empower (or at least not inhibit) that work of spirit.

IV. Harnessing Human Strength, Confronting Catastrophe, Feeding the Future

The conjoined crises of climate change and population explosion require us to confront the realities of both finite natural resources and incredible human power. Johan Rockstrom, executive director of the Stockholm Resilience Center, both warns and inspires when he says: "We can no longer just manage nations, or businesses, or communities. We must now become planetary stewards of human well-being within a stable and resilient planet."[104] Indeed, we should have begun the work of becoming planetary stewards several decades ago (at the latest), as soon as the sheer force of anthropogenic power was revealed by science. But we have been overwhelmed into inaction and isolation. Perhaps, as Naomi Klein speculates, we have been silent and still "because we lack the collective spaces in which to confront the raw terror of ecocide [and] the end of the world as we know it."[105]

To inspire action, Klein recommends a strategic alliance between climate activists and proponents of all forms of social justice.[106] Advocates for food justice, food sovereignty, hunger eradication, sustainable agriculture, and agro-ecological farmers would do well to respond to this call and aim to align movements around the mutually beneficial and reinforcing tenets of resilience. Food is a powerfully galvanizing, deeply democratizing subject: Whatever the weather, we all want to eat. Regardless of ideological rifts, we will all be ravenous if we do not develop resilience. Perhaps it is time to begin viewing the places where we gather for food—be it the grocery aisle, the farmer's market, the garden, or the grill—as sites for collective confrontation and reservoirs for resilience.

Climate action, resilience-building, and food security all require innovative policy proposals and intentional implementation. These policies must be born of an alternative worldview "embedded in interdependence rather than

96. Social-Ecological Resilience and the Law 2 (Ahjond S. Garmestani & Craig R. Allen eds., 2014).
97. *Id.*
98. *Id.* at 3.
99. *Id.* at 7.
100. Craig Anthony Arnold & Lance H. Gunderson, *Adaptive Law*, *in* Social-Ecological Resilience, *supra* note 96, at 319.
101. *Id.*
102. U.N. FAO, Climate Change & Food Security: A Framework Document 41-42 (2008).
103. Donella H. Meadows, Thinking in Systems: A Primer 185 (2008).
104. Video Lecture: Planetary Boundaries & Human Opportunities (Sustainable Dev. Solutions Network 2014) (on file with Johan Rockström).
105. Naomi Klein, This Changes Everything: Capitalism vs. the Climate 461-62 (2014).
106. *Id.*

hyper-individualism, reciprocity rather than dominance, and cooperation rather than hierarchy."[107] To survive the "hot and stormy future we have already made inevitable through our past emissions," and build a protective barrier between "civilization and barbarism," Klein insists on "an unshakable belief in the equal rights of all people and a capacity for deep compassion."[108] Applying this radically rights-grounded, compassion-based worldview to the realm of food sets us on the path to a just and resilient food future in which the right to food can become a reality for the billions of people to come.

Informed optimists such as Klein and Rockstrom point to the power of the human race to profoundly influence planetary systems as encouraging evidence of our ability to change course and avert catastrophes. This power must be harnessed to quickly and intentionally reconfigure our political and economic systems, change agricultural production practices, and develop a new ideology around food production, access, and consumption. The alternatives are unacceptably bleak. In the face of certain uncertainty, resilience must become the primary organizing imperative for food systems and food policy.

107. *Id.* at 462.
108. *Id.*