Indiana Law Review

Volume 53 **2020** **Number 1**

SYMPOSIUM

AFTER AGRARIAN VIRTUE

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> Time present and time past
> Are both perhaps present in time future,
> And time future contained in time past.
> If all time is eternally present
> All time is irredeemable.
>
> T.S. ELIOT, FOUR QUARTETS[1]

I. PRINCIPIIS OBSTA

Stretched across the entirety of time, history represents a "modern 'creation myth' that 'reflects the best attempts of our society to answer questions about origins.'"[2] Among stories vying to solidify and unite the species, no creation myth boasts greater narrative scope or deeper scientific support than evolution.[3] "[B]eautifully suited to anchor our search for planetary consensus," the "Epic of Evolution" promises to unite not just human tribes, but our species with the entire tapestry of life.[4]

Contemplating agriculture and its regulation over this time frame leaves no doubt that agricultural law is a branch of environmental law.[5] By the same token, marking time on a geological clock reinforces the cosmic insignificance of anthropocentric interests. In the long run all species are extinct.[6] Among "five [to]

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1. T.S. ELIOT, FOUR QUARTETS 13 (1st ed. 1968).
2. David Christian, *The Case for "Big History,"* 2 J. WORLD HIST. 223, 235 (1991).
3. EDWARD O. WILSON, THE FUTURE OF LIFE 133 (2002).
4. URSULA GOODENOUGH, THE SACRED DEPTHS OF NATURE 174 (1998).
5. *See generally*, *e.g.*, Jim Chen, *Get Green or Get Out: Decoupling Environmental from Economic Objectives in Agricultural Regulation*, 33 OKLA. L. REV. 333 (1995); J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263 (2000).
6. *Cf.* JOHN MAYNARD KEYNES, A TRACT ON MONETARY REFORM 80 (1923) ("*In the long run* we are all dead.") (emphasis in original).

fifty billion species" that "have existed at one time or another," only "one in a thousand" exists today.[7] Biological dominance guarantees nothing: Ecological dominance at one moment can lead to extinction in a geological blink.[8] Evolution's "truly lousy survival record" of "99.9 percent failure"[9] confirms in scientific terms what poets have long suspected:

A starlit or a moonlit dome disdains
All that man is,
All mere complexities,
The fury and the mire of human veins.[10]

Among humanity's sources of ethical inspiration, the Judeo-Christian tradition and the broader Western philosophical tradition bear heavy responsibility for the "roots of our ecological crisis."[11] Agriculture and its practitioners are routinely characterized as oblivious to such ethereal concerns: "Slave of the wheel of labor, what to him / Are Plato and the swing of Pleiades?"[12] That supposition does not bear serious scrutiny. Within the law, agriculture is "so vast that fully to comprehend it would require an almost universal knowledge ranging from geology, biology, chemistry and medicine to the niceties of the legislative, judicial and administrative processes of government."[13] I might add: And ethics, philosophy, and religion. No less than "problems of welfare economics," agricultural ethics "must ultimately dissolve into a study of aesthetics and morals."[14]

Though we could examine agriculture's contribution to this crisis through the theological lens of original sin,[15] I propose instead to address a distinct question of agricultural ethics. In the vein suggested by Alasdair MacIntyre's classic study of moral theory, *After Virtue*,[16] this article will examine the idea of *agrarian*

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7. DAVID M. RAUP, EXTINCTION: BAD GENES OR BAD LUCK 3-4 (1991).

8. *See* David Tilman et al., *Habitat Destruction and the Extinction Debt*, 371 NATURE 65 (1994).

9. RAUP, *supra* note 7, at 4.

10. WILLIAM BUTLER YEATS, *Byzantium*, *in* THE COLLECTED POEMS OF W.B. YEATS: A NEW EDITION 251 (Richard J. Finneran ed., 1983), http://triggs.djvu.org/djvu-editions.com/YEATS/POEMS/Download.pdf [https://perma.cc/X29H-W3UE].

11. Lynn White, *The Historical Roots of Our Ecological Crisis*, 155 SCIENCE 1203 (1967). *See generally*, *e.g.*, DAVID R. KINSLEY, ECOLOGY AND RELIGION (1995); J. BAIRD CALLICOTT, EARTH'S INSIGHTS: A MULTICULTURAL SURVEY OF ECOLOGICAL ETHICS FROM THE MEDITERRANEAN BASIN TO THE AUSTRALIAN OUTBACK (1994); Judith Green, *Retrieving the Human Place in Nature*, 17 ENVTL. ETHICS 381, 389-93 (1995).

12. EDWIN MARKHAM, *The Man with a Hoe*, *in* THE MAN WITH A HOE AND OTHER POEMS 15-18 (Doubleday & McClure 1899), https://poets.org/poem/man-hoe [https://perma.cc/Z9Y4-67JK].

13. Queensboro Farms Prods., Inc. v. Wickard, 137 F.2d 969, 975 (2d Cir. 1943).

14. R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 43 (1960).

15. *See* Jim Chen, *Of Agriculture's First Disobedience and Its Fruit*, 48 VAND. L. REV. 1261 (1995).

16. ALASDAIR MACINTYRE, AFTER VIRTUE: A STUDY IN MORAL THEORY (3d ed. 2007).

virtue. According to MacIntyre, a "virtue is an acquired human quality the possession and exercise of which tends to enable us to achieve those goods which are internal to practices and the lack of which effectively prevents us from achieving any such goods."[17] Though "partial and tentative,"[18] this definition indicates that no "history of practices and institutions" can be credible or complete "unless that history is also one of . . . virtues and vices."[19]

Part II of this article, *Ecce Homo*, examines the ecological footprint of contemporary agriculture. Human domination of land for food, fiber, and fuel production has contributed to the Anthropocene transformation of the planet.

Part III, *Fiat Lex*, reveals what much of contemporary law has treated as the fulcrum of agrarian virtue and vice. Far from the material concerns that should lie at the heart of Anthropocene agricultural policy, contemporary law devotes enormous amounts of energy to purely expressive concerns.

Part IV, *Sic Transit*, retrains this article's focus on the true sources of agrarian vice during the Anthropocene epoch: resource exhaustion and irreversible evolutionary consequences. Concerns over the use of advanced biotechnology in agriculture should emphasize antibiotic, pesticide, and herbicide resistance.

Part V, *Maiorem Hac Dilectionem*, attempts to reconcile the tension between the material and expressive dimensions of agricultural law. In an ironic twist on MacIntyre's moral vision, the key to agrarian virtue lies not in the restoration of *telos* (*τέλος*), but in the recognition that the human food production process is governed by *kyklos* (κύκλος). *Fiat voluntas tua*.

II. ECCE HOMO

Pound pastrami, . . . can kraut, six bagels — bring home for Emma

WALTER M. MILLER, JR., A CANTICLE FOR LEIBOWITZ (1959)[20]

A Canticle for Leibowitz, a 1959 science fiction novel by Walter Miller, recounts a catastrophic "Flame Deluge," in which "great engines of war . . . of such might that they contained the very fires of Hell" turned cities into "puddles of glass, surround by vast acreages of broken stone."[21] Worse yet, sickened and confused survivors unleashed "the bloodletting of the Simplification," in which "maddened mobs" slaughtered "rulers, scientists, leaders, technicians, teachers," and all others accused of bringing about the Deluge and its ensuing Fallout.[22]

MacIntyre's *After Virtue* imagines a similar cataclysm in which "a Know-Nothing political movement . . . successfully abolishes science teaching" and

17. *Id.* at 191.
18. *Id.*
19. *Id.* at 195.
20. WALTER M. MILLER, JR., A CANTICLE FOR LEIBOWITZ 26 (Eos 2006) (1959).
21. *Id.* at 61.
22. *Id.* at 62.

"imprison[s] and execut[es]" all surviving scientists.[23] Eventually an enlightened restoration "seek[s] to revive science," even though the members of this movement "have largely forgotten what [science] was."[24]

In a novel twist on the "imaginary possible world" created by Miller and other "science fiction writers," MacIntyre hypothesized that philosophy had undergone a comparable catastrophe.[25] Just as the survivors of Miller's Flame Deluge and Great Simplification would be reduced to recite "surviving portions of the periodic table and . . . some of the theorems of Euclid" until they eventually, generations later, regained "expressions such as 'neutrino,' 'mass,' [and] 'specific gravity,'"[26] contemporary philosophers "possess . . . simulacra of morality" and "use many of the key expressions," despite having "lost our comprehension, both theoretical and practical, o[f] morality."[27]

Whether *agrarian* virtue, as a peculiar and parochial branch of MacIntyre's philosophical purgatory, has survived the cataclysm remains to be seen. For the moment, it suffices to establish this much: Humanity has stamped its image upon earth, to the detriment of the planet's capacity to sustain the lives of humans and the organisms that humans have embraced as worthy of their love.

Ecce homo: Behold the man![28] Humanity's ecological footprint arguably warrants the re-designation of this moment in geological time from the Holocene epoch to the Anthropocene.[29] Although formal stratigraphic recognition remains elusive,[30] the idea of the Anthropocene provides a vivid reminder that human activity has profoundly affected every physical and biological aspect of earth.[31]

The Anthropocene is coextensive with agriculture. "Defining the onset of the Anthropocene in terms of the initial domestication of plants and animals world-

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23. MACINTYRE, *supra* note 16, at 1.

24. *Id.*

25. *Id.* at 2. MacIntyre has explicitly acknowledged *A Canticle for Leibowitz*, "that extraordinary novel by Walter M. Miller, Jr.," as a source of inspiration for *After Virtue*. *Id.* at *xv*.

26. *Id.* at 1.

27. *Id.* at 2.

28. *John* 19:5 (Revised Standard Version) ("So Jesus came out, wearing the crown of thorns and the purple robe. Pilate said to them, 'Behold the man!'").

29. *See* Paul J. Crutzen, *Geology of Mankind*, 415 NATURE 23 (2002); Paul J. Crutzen & Eugene Stoermer, *The "Anthropocene,"* 41 IGPP NEWSLETTER 17 (2000); *The Human Epoch*, 473 NATURE 254 (2011).

30. *See* Jan Zalasiewicz et al., *Stratigraphy of the Anthropocene*, 369 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y A 1036 (2011); Jan Zalasiewicz et al., *The New World of the Anthropocene*, 44 ENVTL. SCI. TECH. 2228 (2010).

31. *Compare* Whitney J. Autin & John M. Holbrook, *Is the Anthropocene an Issue of Stratigraphy or Pop Culture?*, 22 GSA TODAY 60-61 (July 2012) *with* Jan Zalasiewicz et al., *Response to Autin and Holbrook on "Is The Anthropocene an Issue of Stratigraphy or Pop Culture?,"* 22 GSA TODAY ONLINE: COMMENTS & REPLIES (Oct. 2012), http://www.geosociety.org/gsatoday/comment-reply/pdf/i1052-5173-22-10-e21.pdf [https://perma.cc/83CK-PGDB]. For legal perspectives on the Anthropocene, see Eric Biber, *Law in the Anthropocene Epoch*, 106 GEO. L.J. 1 (2017); James Ming Chen, *Anthropocene Agricultural Law*, 3 TEX. A&M L. REV. 745 (2016).

wide 11,000-9000 years ago . . . resolves the serious challenge of satisfying geological standards for establishing a new epoch . . . in a . . . compelling manner. . . ."[32]

Humanity has triggered the sixth great extinction spasm[33] of the Phanerozoic Eon, a span of 542 million years beginning with the emergence of hard-shelled animals.[34] (The term *Phanerozoic* is derived from the ancient Greek words *φανερός* and *ζωή*, which together mean "visible life.")[35] Given the biological sparseness of the human larder — barely 100 species account for nine-tenths of the per capita supply of food plants around the world[36] — catastrophic losses of biodiversity weigh heavily on agriculture. Specific indicators such as vertebrates,[37] insects,[38] tropical forests,[39] and coral reefs[40] reveal severe declines in biodiversity.

Biologically speaking, agriculture extracts value from *ecosystem services* and channels them for the specific benefit of human beings. Ecosystem services fall into three categories, plus a fourth foundational category that sustains all of these

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32. Bruce D. Smith & Melinda A. Zeder, *The Onset of the Anthropocene*, 4 ANTHROPOCENE 8, 13 (2013) (inline citation omitted).

33. *See*, *e.g.*, ELIZABETH KOLBERT, THE SIXTH EXTINCTION: AN UNNATURAL HISTORY (2014); RICHARD LEAKEY & ROGER LEWIN, THE SIXTH EXTINCTION: PATTERNS OF LIFE AND THE FUTURE OF MANKIND (1995); Stuart H.M. Butchart et al., *Global Biodiversity: Indicators of Recent Declines*, 328 SCIENCE 1164 (2010); J.A. Thomas et al., *Comparative Losses of British Butterflies, Birds, and Plants and the Global Extinction Crisis* 303 SCIENCE1879, 1881 (2004).

34. *See*, *e.g.*, Alexander V. Markov & Andrey V. Korotayev, *Phanerozoic Marine Biodiversity Follows a Hyperbolic Trend*, 16 PALAEOWORLD 311 (2007); Kenneth G. Miller et al., *The Phanerozoic Record of Global Sea-Level Change*, 310 SCIENCE 1293 (2005).

35. *See* POCKET OXFORD CLASSICAL GREEK DICTIONARY 338, 150 (James Morwood & John Taylor eds., 2002). The other five extinction events of the Phanerozoic Eon are the Ordovician-Silurian, the late Devonian, the Permian-Triassic, the Triassic-Jurassic, and the Cretaceous-Paleogene. *See*, *e.g.*, David M. Raup & J. John Sepkoski, Jr., *Mass Extinctions in the Marine Fossil Record*, 215 SCIENCE 1501 (1982); Robert A. Rohde & Richard A. Muller, *Cycles in Fossil Diversity*, 434 NATURE 208 (2005).

36. *See* Robert Prescott-Allen & Christine Prescott-Allen, *How Many Plants Feed the World?*, 4 CONSERVATION BIOLOGY 365 (1990).

37. *See* Ben Collen et al., *Monitoring Change in Vertebrate Abundance: The Living Planet Index*, 23 CONSERVATION BIOLOGY 317 (2009).

38. *See* Caspar A. Hallmann et al., *More Than 75 Percent Decline Over 27 Years in Total Flying Insect Biomass in Protected Areas*, 12(10) PLOS ONE e0185809 (Oct. 18, 2017); Thomas et al., *supra* note 33.

39. *See* Matthew C. Hansen et al., *Humid Tropical Forest Clearing from 2000 to 2005 Quantified by Using Multitemporal and Multiresolution Remotely Sensed Data*, 105 PROC. OF THE NAT'L ACAD. OF SCIS. 9439 (2008).

40. *See* Blake Armstrong, *Maintaining the World's Marine Biodiversity: Using the Endangered Species Act to Stop the Climate Change Induced Loss of Coral Reefs*, 18 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 429 (2012).

other categories:[41]

1. *Provisioning* services provide direct benefits and amenities, such as water, food, fiber, and fuel.[42]
2. *Regulating* services purify water and air, control pests, and pollinate crops.[43] Of particular interest in the face of anthropogenic climate change is carbon sequestration as a regulating service.[44]
3. *Cultural* services provide humans with recreation and entertainment, artistic and scientific inspiration, and spiritual meaning.[45]
4. Foundational processes such as photosynthesis, nutrient recycling, and soil formation provide *supporting* services underlying these provisioning, regulating, and cultural services.[46]

As fractal theory predicts,[47] the layered nature of ecosystem services pervades each facet of the earth as a living superorganism.[48]

With the salient exception of the United States, the nations of the world have committed to reducing greenhouse gas emissions so that the global mean temperature rises by no more than 2°C by 2050.[49] As much devastation as

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41. *See generally*, *e.g.*, CONSERVING AND VALUING ECOSYSTEM SERVICES AND BIODIVERSITY (K.N. Ninan ed., 2009); MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: A SYNTHESIS (2005); NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS (Gretchen C. Daily ed., 1997); PETER H. RAVEN ET AL., TEAMING WITH LIFE: INVESTING IN SCIENCE TO UNDERSTAND AND USE AMERICA'S LIVING CAPITAL (1999); TEEB, THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY: CLIMATE ISSUES UPDATE (2009); Dana Marie Bauer & Robert J. Johnston, *The Economics of Rural and Agricultural Ecosystem Services: Purism Versus Practicality*, 42 AGRIC. & RESOURCE ECON. REV. iii (2013) (foreword to a special issue on ecosystem services); Graciela Chichilnisky & Geoffrey Heal, *Economic Returns from the Biosphere*, 391 NATURE 629 (Feb. 1998); Robert Costanza et al., *The Value of Ecosystem Services: Putting the Issues in Perspective*, 25 ECOL. ECON. 67 (1998); Stephen Farber et al., *Linking Ecology and Economics for Ecosystem Management*, 56 BIOSCIENCE 121 (2006).

42. *See* MILLENNIUM ECOSYSTEM ASSESSMENT, *supra* note 41, at 56-57.

43. *See id.* at 57-58.

44. *See id.* at 58.

45. *See id.* at 58-59.

46. *See id.* at 59-60.

47. *See generally*, *e.g.*, MANFRED SCHROEDER, FRACTALS, CHAOS, POWER LAWS: MINUTES FROM AN INFINITE PARADISE (1991); D.R. Morse et al., *Fractal Dimension of Vegetation and the Distribution of Arthropod Body Lengths*, 314 NATURE 731 (1985); David G. Post & Michael B. Eisen, *How Long Is the Coastline of the Law? Thoughts on the Fractal Nature of Legal Systems*, 29 J. LEGAL STUD. 545 (2000).

48. *See generally*, *e.g.*, JAMES LOVELOCK, GAIA: A NEW LOOK AT LIFE ON EARTH (reprt. 2016); JAMES LOVELOCK, THE REVENGE OF GAIA: EARTH'S CLIMATE CRISIS AND THE FATE OF HUMANITY (2006); Lynn Margulis, *Gaia Is a Tough Bitch*, *in* THE THIRD CULTURE: BEYOND THE SCIENTIFIC REVOLUTION 129-51 (John Brockman ed., 1995).

49. *See*, *e.g.,* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT (2014); JAMES H. WILLIAMS ET AL., PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 1 (2014); Malte Meinshausen et al., *Greenhouse-Gas Emission Targets for*

anthropogenic climate change portends,[50] "climate change is only the tip of the iceberg."[51] Beyond altering "the carbon cycle, humans are . . . significantly altering several other biogeochemical, or element cycles, such as nitrogen, phosphorus, and sulphur, that are fundamental to life on the Earth."[52] Put bluntly, sheer exhaustion of basic inputs jeopardizes agriculture.

The iconic instance of resource exhaustion involves petroleum. Geologist M. King Hubbert predicted that the peak production of petroleum would signal its eventual depletion.[53] Subsequent work has elaborated "peak oil" as a singularly alarming problem for a world still hooked on fossil fuels.[54] Perhaps no other phenomenon illustrates the fundamental paradox of the Anthropocene:[55] "human well-being has reached high levels in many countries while our planetary life support system is simultaneously being eroded."[56]

"Less well known" than peak oil "is the potential shortage of the mineral phosphorus."[57] Phosphorus comprises the backbone of the nucleic acids DNA and RNA and is the essential ingredient in ATP (adenosine triphosphate).[58] Because phosphorus plays a key biochemical role in the transfer of genetic material and

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Limiting Global Warming to 2 °C, 458 NATURE 1158 (2009).

50. *See*, *e.g.*, Douglas H. Erwin, *Climate as a Driver of Evolutionary Change*, 19 CURRENT BIOL. R575 (2009); Camille Parmesan, *Ecological and Evolutionary Response to Recent Climate Change*, 37 ANN. REV. ECOL. EVOLUTIONARY SYS. 637 (2006); Andreas Schmittner et al., *Climate Sensitivity Estimated from Temperature Reconstructions of the Last Glacial Maximum*, 334 SCIENCE 1385 (2011).

51. Will Steffen et al., *The Anthropocene: Conceptual and Historical Perspectives*, 369 PHIL. TRANS. ROYAL SOC'Y A 842, 843 (2011).

52. *Id.* at 843.

53. *See* M. KING HUBBERT, NUCLEAR ENERGY AND THE FOSSIL FUELS 22 (1956), http://www.hubbertpeak.com/hubbert/1956/1956.pdf; M. King Hubbert, *Energy from Fossil Fuels*, 109 SCIENCE 103 (1949).

54. *See* JACQUES GRINEVALD, LA BIOSPHÈRE DE L'ANTHROPOCÈNE: CLIMAT ET PÉTROLE, LA DOUBLE MENACE (2007); STEVE SORRELL ET AL., AN ASSESSMENT OF THE EVIDENCE FOR A NEAR-TERM PEAK IN GLOBAL OIL PRODUCTION (2009); Adam R. Brandt, *Testing Hubbert*, 35 ENERGY POL'Y 3074, 3074-75 (2007); Steve Sorrell et al., *Shaping the Global Oil Peak: A Review of the Evidence on Field Sizes, Reserve Growth, Decline Rates and Depletion Rates*, 37 ENERGY 709 (2012).

55. *See generally* Ciara Raudsepp-Hearne et al., *Untangling the Environmentalist's Paradox: Why Is Human Well-Being Increasing as Ecosystems Services Degrade?*, 60 BIOSCIENCE 576 (2010).

56. Will Steffen et al., *The Anthropocene: From Global Change to Planetary Stewardship*, 140 AMBIO 739, 749 (2011).

57. *Id.* at 739.

58. *See* Raymond S. Uchida, *Essential Nutrients for Plant Growth: Nutrient Functions and Deficiency Symptoms*, *in* PLANT NUTRIENT MANAGEMENT IN HAWAII'S SOILS: APPROACHES FOR TROPICAL AND SUBTROPICAL AGRICULTURE 31-56, 34 (James A. Silva & Raymond S. Uchida eds., 2000); F.H. Westheimer, *Why Nature Chose Phosphates*, 235 NATURE 1173 (1987).

energy, it "is an essential element for all life forms."[59]

Along with nitrogen and potassium, phosphorus is one of three macronutrients in plant fertilizers.[60] Without phosphorus, agriculture has no way to sustain current yields.[61] Indeed, the use of sulfuric acid in processing phosphate is so vital to the production of fertilizer that this application represents the primary industrial demand for sulfuric acid and elemental sulfur.[62]

Phosphorus in the form of rock phosphate is an exhaustible resource and is heavily mined for use in fertilizer production.[63] Global supplies of phosphorus are expected to peak in 2030 and to be exhausted within another thirty to eighty years.[64] As the global population continues to grow, and especially "as diets change with the rapid development of China, India and other large developing countries," phosphorus production will probably peak before demand reaches its apex.[65] "Without careful management of phosphorus production and distribution in an equitable and long-term manner," vulnerable parts of the world face not only "diminishing supplies of petroleum," as peak oil predicts, but also "a deterioration of food security" traceable to peak phosphorus.[66]

Potassium, the third plant macronutrient after nitrogen and phosphorus, is an abundant resource, mined around the world and readily recoverable from wood

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59. K.C. Ruttenberg, *The Global Phosphorus Cycle, in* 8 TREATISE ON GEOCHEMISTRY 585 (William H. Schlesinger ed., 2003).

60. *See* Heinrich Dittmar et al., *Fertilizers, 2. Types*, *in* ULLMAN'S ENCYCLOPEDIA OF INDUSTRIAL CHEMISTRY 200 (7th ed. 2011).

61. *See* K. Ashley, D. Cordell & D. Mavinic, *A Brief History of Phosphorus: From the Philosopher's Stone to Nutrient Recovery and Reuse*, 84 CHEMOSPHERE 737, 741 (2011).

62. *See* Joyce Ober, *Sulfur*, *in* INDUSTRIAL MINERALS AND ROCKS: COMMODITIES, MARKETS, AND USES 935, 964 (Jessica Elzea Kogel, Nikhil C. Trivedi, James M. Barker & Stanley T. Krukowski eds., 7th ed. 2006).

63. *See* Roland W. Scholz et al., *Sustainable Use of Phosphorus: A Finite Resource*, 461–62 SCI. TOTAL ENV'T 799, 800 (2013).

64. *See* Stuart White & Dana Cordell, *Peak Phosphorous: The Sequel to Peak Oil,* PHOSPHORUSFUTURES, http://phosphorusfutures.net/the-phosphorus-challenge/peak-phosphorus-the-sequel-to-peak-oil/ [https://perma.cc/ZG8U-U5HH]; Ashley, Cordell & Mavinic, *supra* note 61, at 743; Dana Cordell, Jan-Olof Drangert & Stuart White, *The Story of Phosphorus: Global Food Security and Food for Thought*, 19 GLOBAL ENVTL. CHANGE 292 (2009); Tina-Simone S. Neset & Dana Cordell, *Global Phosphorus Scarcity: Identifying Synergies for a Sustainable Future*, 92 J. SCI. FOOD & AGRIC. 2 (2011); Harald U. Sverdrup & Kristin Vala Ragnarsdóttir, *Challenging the Planetary Boundaries II: Assessing the Sustainable Global Population and Phosphate Supply, Using a Systems Dynamics Assessment Model*, 26 APPLIED GEOCHEM. S307 (2011); *cf.* D.P. Van Vuuren, A.F. Bouwman & A.H.W. Beusen, *Phosphorus Demand for the 1970-2100 Period: A Scenario Analysis of Resource Depletion*, 20 GLOBAL ENVTL. CHANGE 428, 434 (2010) (projecting a worst-case scenario of 40 to 60 percent exhaustion by 2100).

65. Steffen et al., *supra* note 51, at 854.

66. *Id. See generally* D. Cordell, A. Rosemarin, J.J. Schröder & A.L. Smit, *Towards Global Phosphorus Security: A Systems Framework for Phosphorus Recovery and Reuse Options*, 84 CHEMOSPHERE 747 (2011).

ash.[67] Nitrogen is even more abundant, comprising 78 percent of the earth's atmosphere.[68] The energy-intensive but ubiquitous Haber-Bosch process for producing ammonia[69] has nearly displaced the traditional mining of sodium nitrate (Chilean saltpeter) as fertilizer.[70] Farmers too poor to afford commercial fertilizer — or, perhaps paradoxically, wealthy enough to eschew synthetic nitrogen within an organic production model — may still inoculate crops with rhizobia that can fix atmospheric nitrogen into the soil.[71]

We may therefore frame agricultural policy in the Anthropocene in terms of the three elements most essential to plant macronutrition. Potassium is abundant and readily recoverable. At the other extreme, peak phosphorus portends the physical exhaustion of an elemental resource with no substitute.

Nitrogen occupies intriguing middle ground. Commercially produced ammonium nitrate provides abundant fertilizer for bourgeois agriculture,[72] the affluent developed-world farmers whose economic, cultural, and political interests dominate contemporary agricultural policy.[73] Symbiosis between plants and nitrogen-fixing rhizobia nevertheless retains resonance for farmers driven by circumstance or self-imposed morality to eschew commercial fertilizer.

This specific facet of plant macronutrition figures prominently in Supreme Court jurisprudence.[74] In *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, the Supreme Court denied a patent for a clever but naturally occurring combination of non-mutually inhibiting bacteria for inoculating the rhizomes of leguminous plants and inducing them to fix atmospheric nitrogen in their roots.[75] This process promises to provide an appropriate setting for evaluating agricultural law and policy under conditions of scarcity and resource exhaustion. And so it will — in due time. A different face of Anthropocene agricultural attitudes demands more immediate attention.

In a society lacking "shared moral first principles," the absence of "genuine

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67. *See* UNITED STATES GEOLOGICAL SURVEY, 2008 MINERALS HANDBOOK: POTASH (2010); *see also* NORMAN N. GREENWOOD & ALAN EARNSHAW, CHEMISTRY OF THE ELEMENTS 69 (2d ed. 1997) (identifying potassium as the seventh most abundant element on earth and estimating that it comprises 2.6 percent of the earth's crust by mass).

68. *See* GREENWOOD & EARNSHAW, *supra* note 67, at 406–07.

69. *See* VACLAV SMIL, ENRICHING THE EARTH 135 (2001).

70. *See* STEPHEN R. BOWN, A MOST DAMNABLE INVENTION: DYNAMITE, NITRATES, AND THE MAKING OF THE MODERN WORLD 158 (2005); GREENWOOD & EARNSHAW, *supra* note 67, at 407–09.

71. *See, e.g.*, Daniel J. Gage, *Infection and Invasion of Roots by Symbiotic, Nitrogen-Fixing Rhizobia During Nodulation of Temperate Legumes*, 68 MICROBIOL. & MOLECULAR BIOL. REVS. 280 (2004); Hamdi Hussein Zahran, *Rhizobium-Legume Symbiosis and Nitrogen Fixation under Severe Conditions and in an Arid Climate*, 63 MICROBIOL. & MOLECULAR BIOL. REVS. 968 (1999).

72. *See generally* DEIRDRE MCCLOSKEY, THE BOURGEOIS VIRTUES: ETHICS FOR AN AGE OF COMMERCE (2006); Donald N. McCloskey, *Bourgeois Virtue*, 63 AM. SCHOLAR 177 (1994).

73. *See generally* JOHN KENNETH GALBRAITH, THE AFFLUENT SOCIETY (1958).

74. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127 (1948).

75. *See id.* at 131–32.

moral consensus" transforms "modern politics" into "civil war carried on by other means."[76] The poet laureate of such a society is surely T.S. Eliot, nowadays derided because he lacked sufficient "interest in the great middle ground of human experience (as distinct from the extremes of saint and sinner)."[77] "Let us therefore "play a game of chess / Pressing lidless eyes and waiting for a knock upon the door."[78] The *Zwischenzug* is a chess tactic.[79] Instead of making an expected move, a player poses an immediate, surprising threat that the opponent must answer. After gaining material or disrupting what might have been a strong sequence for the opponent, the player then makes the expected move. I therefore turn to a discussion of a radically different set of legal concerns that have riveted agricultural policymaking during the Anthropocene.

III. FIAT LEX

With shared disdain for the traditional and "singular goal" of "[m]aximum efficient production for short-term economic return[,]"[80] nearly every contemporary legal scholar extols a vision of sustainability that addresses "food and cultural identity" and "economic inequalities" in addition to traditional concerns over "output maximization."[81] In large measure, however, many battles over agricultural sustainability attach greatest significance to issues that have little to do with production. Instead, these battles are essentially expressive. They involve "the symbolic value of food choice."[82] These controversies often point in the opposite direction from concerns over resource exhaustion. They represent the

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76. MACINTYRE, *supra* note 16, at 253.

77. THE NORTON ANTHOLOGY OF ENGLISH LITERATURE 2163 (M.H. Abrams et al. eds., 3d ed. 1974); *accord* Jim Chen, *Mastering Eliot's Paradox: Fostering Cultural Memory in an Age of Illusion and Allusion*, 89 MINN. L. REV. 1361, 1366–67 (2005). *See generally* LYNDALL GORDON, T. S. ELIOT: AN IMPERFECT LIFE (1st ed. 1999); THE CAMBRIDGE COMPANION TO T. S. ELIOT (A. David Moody ed., 1994).

78. T.S. ELIOT, THE WASTE LAND 42 (Paul Muldoon ed. 2013).

79. *See*, *e.g.*, DAVID HOOPER & KENNETH WHYLD, THE OXFORD COMPANION TO CHESS 460 (2d ed. 1992).

80. Frederick L. Kirschenmann, *Anticipating a New Agricultural Research Agenda for the Twenty-First Century*, *in* ROUTLEDGE INTERNATIONAL HANDBOOK OF FOOD STUDIES 364, 364 (Ken Albala ed., 2013).

81. Ernesto Hernández-López, *Sustainable Food and the Constitution*, 50 ARIZ. ST. L.J. 549, 550-51 (2018); *see also* Laurie Ristino, *Back to the New: Millennials and the Sustainable Food Movement*, 15 VT. J. ENVTL. L. 1, 23 (2013); Stephanie Tai, *The Rise of U.S. Food Sustainability Litigation*, 85 S. CAL. L. REV. 1069, 1073 (2012).

82. Anne Barnhill, *Choice, Respect and Value: The Ethics of Healthy Eating Policy*, 5 WAKE FOREST J.L. & POL'Y 1, 3-4 (2015). *See generally id.* at 29-34; *cf.* Nancy Kass et al., *Ethics and Obesity Prevention: Ethical Considerations in 3 Approaches to Reducing Consumption of Sugar-Sweetened Beverages*, 104 AM. J. PUB. HEALTH 787 (2014) (discussing the symbolic importance of regulatory agencies that supervise food choices and of those agencies' dietary recommendations).

triumph of informational commitments and social signaling interests far removed from the economic profitability or even the viability of agricultural producers.

The opposite ends of the food value chain in affluent societies, especially in Europe and within certain niches of the American market, share an antipathy toward bioengineering. Labeling food according to compliance with organic production standards (including avoidance of genetically modified organisms) may be the most salient of these issues.[83] Act 120 in Vermont, which requires labels to disclose whether food has been produced entirely or in part through genetic engineering, may succeed in exporting a single state's labeling policy to the rest of the country.[84] As a matter of temperament, if not partisan allegiance within contemporary American politics, consumer resistance to bioengineering reflects a deep conservatism. It "stands athwart history, yelling *Stop*."[85]

The category of symbolic battles over food, however, spans terrain far beyond organic production and the use or avoidance of genetically modified organisms. The food fights of the comfortably fed routinely contest expressive or symbolic terrain,[86] far removed from the ecological merits or demerits of Anthropocene agriculture. The metaphysics of consumption overrides the nutritional value of food and the cold equations underlying the ecology and economics of agricultural production.

The iconic Supreme Court controversy epitomizing the symbolic focus of contemporary agricultural law may be the 2012 case of *National Meat Association v. Harris*.[87] The Federal Meat Inspection Act[88] ("FMIA") establishes "an elaborate system [for] inspect[ing]" live animals and carcasses in order "to prevent the shipment of impure, unwholesome, and unfit meat and meat-food products[.]"[89] A California statute imposed additional requirements on "nonambulatory animal[s]," banning their sale and processing, and requiring

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83. *See generally* Jim Chen, *Food and Superfood: Organic Labeling and the Triumph of Gay Science over Dismal and Natural Science in Agricultural Policy*, 48 IDAHO L. REV. 213 (2012).

84. *See* VT. STAT. ANN. tit. 9, §§ 3041-48; Grocery Mfrs. Ass'n v. Sorrell, 102 F. Supp. 3d 583 (D. Vt. 2015), *appeal filed*, Case No. 15-1504 (2d Cir. May 6, 2015); *cf.* Hunt v. Wash. State Apple Advert. Comm'n, 432 U.S. 333 (1977).

85. William F. Buckley Jr., *Our Mission Statement*, NAT'L REV. (Nov. 19, 1955), https://www.nationalreview.com/1955/11/our-mission-statement-william-f-buckley-jr/ [https://perma.cc/5S9T-CD5V]. On nostalgia in food culture, see generally Minna Autis et al., *Consuming Nostalgia? The Appreciation of Authenticity in Local Food Production*, INT'L J. CONSUMER STUD., http://doi.org/10.1111/ijcs.12029 (May 23, 2013); John D. Holtzman, *Food and Memory*, 35 ANN. REV. ANTHROP. 361 (2006).

86. *See generally* Ernesto Hernández-López, *Food, Animals, and the Constitution: California Bans on Pork, Foie Gras, Shark Fins, and Eggs,* 7 U.C. IRVINE L. REV. 347 (2018); Hernández-López, *supra* note 81, at 564-79.

87. 565 U.S. 452 (2012). *See generally* Marya Torrez, *Health and Welfare Preempted: How* National Meat Association v. Harris *Undermines Federalism, Food Safety, and Animal Protection*, 10 J. FOOD L. & POL'Y 35 (2014).

88. 21 U.S.C. §§ 601-695 (2006).

89. Pittsburgh Melting Co. v. Totten, 248 U.S. 1, 4-5 (1918).

slaughterhouses to "tak[e] immediate action to humanely euthanize [such] animal[s]."[90]

The Supreme Court held that the FMIA preempted California's ban on the slaughter and nonhumane handling of nonambulatory animals: Allowing "any State [to] impose any regulation on slaughterhouses just by framing it as a ban on the sale of meat produced in whatever way the State disapproved," the Court reasoned, "would make a mockery of the FMIA's preemption provision."[91] In the interest of human health, the FMIA's implementing regulations exclude all nonambulatory cattle from slaughter,[92] as well as swine infected with hog cholera[93] or anthrax.[94]

California took issue with federal law's failure to categorically exclude nonambulatory pigs from slaughter.[95] In a revealing effort to salvage state law, however, California confessed that it undertook to ban the slaughter of nonambulatory animals in order "to ensure the humane treatment of pigs, rather than the safety of meat."[96]

We can draw further lessons from a failed effort to regulate retail coffee sales in Berkeley, California.[97] A 2002 referendum would have required all coffee sold within the city to be brewed from beans certified as organic, fair-trade, shade-grown, or some combination of any of those traits.[98] Organic production aspires to a vague hope that avoidance of synthetic pesticides and fertilizers can "foster cycling of resources, promote ecological balance, and conserve biodiversity."[99] Fair trade certification seeks to reorder the economics of agricultural production. Ideally, the elimination of intermediaries within the supply chain minimizes opportunities for exploitation by agribusiness purchasers and enables coffee producers, who often live in developing countries, to realize greater profits.[100] For its part, shade-grown coffee embodies ecological ambitions in agroforestry, insofar as growing coffee under a biodiverse canopy outperforms coffee monocultures on unshaded plantations along multiple ecological measures.[101]

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90. CAL. PENAL CODE ANN. § 599f (2010).

91. *Nat'l Meat Ass'n*, 565 U.S. at 464.

92. 9 C.F.R. § 309.3(e) (2012).

93. § 309.5(a).

94. § 309.7(a).

95. *Nat'l Meat Ass'n*, 565 U.S. at 466.

96. *Id.*

97. *See* Jim Chen, *Around the World in Eighty Centiliters*, 15 MINN. J. INT'L L. 1, 5 (2006).

98. *See Inside Politics Campaign Report*, CNN.com (Aug. 9, 2002), http://edition.cnn.com/2002/ALLPOLITICS/08/06/elec02.campaign.report/index.html [https://perma.cc/RK7N-D58W].

99. 7 C.F.R. § 205.2; s*ee generally* Organic Foods Production Act, 7 U.S.C. §§ 6501-6522.

100. *See*, *e.g.*, Jesús Alvarado, *Fair Trade in Mexico and Abroad: An Alternative to the Walmartopia?* 88 J. BUS. ETHICS 301-17 (2009); Terrence H. Witkowski, *Fair Trade Marketing: An Alternative System for Globalization and Development*, J. MKTG. THEORY & PRACTICE, Sept. 2005, at 22.

101. *See*, *e.g.*, Patricia Moguel & Victor M. Toledo, *Biodiversity Conservation in Traditional Coffee Systems of Mexico*, 13 CONSERVATION BIOLOGY 11–21 (1999); Robert A. Rice, Russell

All three of these aspirations have their virtues and their limitations. Combining them, however, exposes a certain logical incoherence. Fair trade certification's labor-oriented objectives — the redirection of economic surplus from supply-chain efficiency toward higher returns on agricultural labor — have no connection to shade-grown coffee as a form of permaculture or to organic production's more diffuse ecological ambitions.

In decision theory if not in actual human minds, choices should be independent of irrelevant alternatives.[102] If a coffee drinker's true allegiance favors ecologically sustainable cultivation of the crop, whether through the use of shaded fields or the avoidance of synthetic fertilizers and pesticides, the impact on wages and profits realized by supply-chain intermediaries should be irrelevant.

To be sure, the rhetoric (if not the strict logic) of contemporary environmental decision-making might salvage laws of this sort by invoking the precautionary principle.[103] As framed by the United Nations' Rio Declaration of 1992: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[104] Whether the precautionary principle satisfies decision theory's independence axiom is fiercely debated.[105] This much seems reasonably certain: Decision-making according to a goal of minimizing worst-case regret does generate preferences that cannot be ordered in coherent, monotonic fashion.[106]

Imagining that Berkeley's coffee ordinance might have tipped coffee suppliers toward a more "sustainable" model of cultivation requires more faith than an evidence-based system of law can muster. Instead, the freedom to choose among these three forms of nonconventional coffee cultivation performs the expressive function of protesting less virtuous methods for growing or distributing coffee. Drinking our elixir makes you virtuous. Drinking any other swill makes you vile.[107]

Greenberg & Martha van der Voort, *Shade Coffee: A Disappearing Refuge for Biodiversity*, 46 BIOSCIENCE 598–608 (1996).

102. *See*, *e.g.*, KENNETH J. ARROW, SOCIAL CHOICE AND INDIVIDUAL VALUES 28 (2d ed. 1963); DONALD G. SAARI, DECISIONS AND ELECTIONS: EXPLAINING THE UNEXPECTED 39 (2001); AMARTYA K. SEN, COLLECTIVE CHOICE AND SOCIAL WELFARE 17 (1970).

103. *See generally*, *e.g.*, DANIEL STEEL, PHILOSOPHY AND THE PRECAUTIONARY PRINCIPLE: SCIENCE, EVIDENCE, AND ENVIRONMENTAL POLICY (2015).

104. U.N. Conference on Environment and Development, *Rio Declaration on Environment and Development*, June 14, 1992, U.N. Doc. A/CONF. 151/5, 31 I.L.M. 874 (1992).

105. *Compare* Martin Peterson, *The Precautionary Principle Is Incoherent*, 26 RISK ANALYSIS 595 (2006) (incoherent), *and* Martin Peterson, *Should the Precautionary Principle Guide Our Actions or Our Beliefs*, 33 J. MED. ETHICS 5 (2007) (incoherent), *with* Thomas Boyer-Kassem, *Is the Precautionary Principle Really Incoherent?*, 37 RISK ANALYSIS 2026 (2017) (coherent).

106. *See* René Caldentey et al., *Intertemporal Pricing Under Minimax Regret*, 65 OPERATIONS RES. 1 (2016).

107. *Cf.* LEWIS CARROLL, ALICE'S ADVENTURES IN WONDERLAND 4 (Dover Thrift Editions 1993) (1865) ("It was all very well to say 'Drink me,' but the wise little Alice was not going to do

In his *Theory of the Leisure Class*, Thorstein Veblen recognized that the "honorific" consumption of "more excellent goods is an evidence of wealth."[108] At the same time, he also recognized that "the failure to consume in due quantity and quality becomes a mark of inferiority and demerit."[109] More modern — and more cynical — observers might characterize this behavior as virtue signaling.[110]

Internal inconsistency likewise characterizes controversies over milk from cows treated with recombinant bovine somatotropin (rbST).[111] This bitter contest has devolved into a stalemate, as federal appellate courts have banned not only forced disclosures of rbST use,[112] but also state-law prohibitions of voluntary labeling by farmers who have elected not to treat their cows with rbST.[113] Consistent with its broader policy that food vendors may not label their foods as "GM free" or "biotech free" unless they simultaneously disclose that foods so labeled are neither safer nor nutritionally superior to unlabeled foods,[114] the United States Food and Drug Administration requires milk touting its origin in cows not treated with rbST to disclose that "[n]o significant difference has been shown between milk derived from rbST-treated and non-rbST-treated cows."[115] The resulting legal equilibrium is as unhappy as it is stable.

Prohibitions on *foie gras*[116] are arguably even more pointed in their castigation of noncompliant consumers. If you eat foie gras, so the logic goes, you condone the force-feeding of ducks or geese. Again, there is no intrinsic demerit in opposing *gavage* as a matter of law and business ethics. Short of

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that in a hurry.").

108. THORSTEIN VEBLEN, THE THEORY OF THE LEISURE CLASS: AN ECONOMIC STUDY IN THE EVOLUTION OF INSTITUTIONS 74 (Createspace 2016) (1899).

109. *Id.* at 25.

110. *See generally* MARC ORLITZKY, INTEGRITY IN BUSINESS AND MANAGEMENT, VIRTUE SIGNALING 172-87 (Marc Orlitzky & Manjit Monga eds., Routledge 2018).

111. *See generally* Jim Chen, *The American Ideology*, 48 VAND. L. REV. 809, 863-73 (1995); Jim Chen, *The Agroecological Opium of the Masses*, CHOICES, Fourth Quarter 1995, at 16.

112. *See* Int'l Dairy Foods Ass'n v. Amestoy, 92 F.3d 67 (2d Cir. 1996).

113. *See* Int'l Dairy Foods Ass'n v. Boggs, 622 F.3d 628 (6th Cir. 2010).

114. *See* Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering, 66 Fed. Reg. 4839 (Jan. 18, 2001).

115. Interim Guidance on the Voluntary Labeling of Milk and Milk Products from Cows That Have Not Been Treated with Recombinant Bovine Somatotropin, 59 Fed. Reg. 6279, 6280 (Feb. 10, 1994).

116. *See*, *e.g.*, Ass'n des Éleveurs de Canards et d'Oies du Québec v. Harris, 729 F.3d 937 (9th Cir. 2013); Ass'n des Éleveurs de Canards et d'Oies du Québec v. Harris, 79 F. Supp. 3d 1136 (C.D. Cal. 2015), *cert. denied*, 135 S. Ct. 398 (2014); Ill. Rest. Ass'n v. City of Chi., 492 F. Supp. 2d 891 (N.D. Ill. 2007), *vacated as moot*, No. 06 C 7014, 2008 WL 8915042 (N.D. Ill. Aug. 7, 2008); Animal Legal Def. Fund, Inc. v. Aubertine, 991 N.Y.S.2d 482 (App. Div. 2014). *See generally* Joshua I. Grant, *Hell to the Sound of Trumpets: Why Chicago's Ban on Foie Gras Was Constitutional and What It Means for the Future of Animal Welfare Laws*, 2 STAN. J. ANIMAL L. & POL'Y 52 (2009); Deborah Heath & Anne Meneley, *The Naturecultures of Foie Gras: Techniques of the Body and a Contested Ethics of Care*, 13 FOOD, CULTURE & SOC'Y 421 (2010).

adopting a strictly vegan ethos,[117] the law tolerates animal slaughter.[118] At the same time, the law recognizes gradations of decency.[119] The general right to kill animals does not necessarily subsume a specific right to practice an agricultural technique that a democratic majority may find abhorrent. Little wonder that even the European Union is divided: Foie gras, a staple in French gourmet cuisine, now violates German law.[120] Other jurisdictions have banned other food items, such as eggs from hens confined in battery cages[121] and shark fin soup,[122] on the basis of moral objections to the treatment of animals used in their production.

Labeling controversies effectively treat conventional coffee and milk as food taboos. Outright bans on *foie gras*, battery cage eggs, and shark fin soup go even further by removing entire categories of food from lawful diets and, consequently, forbidding farms to engage in practices leading to the production and sale of taboo foods. "[P]rohibitions to eat certain foods" have arisen across cultures throughout human history.[123]

Such taboos almost invariably arise from belief in "negative magic."[124] Rules of sympathetic magic dictate that contact with disgusting objects constitutes permanent contamination and that visual similarity constitutes qualitative equivalence.[125] Because food that touches a cockroach is repulsive, so is otherwise wholesome food that has been crafted to resemble a cockroach. The principle *juxta hoc, ergo propter hoc* — near this, therefore because of this — is "characteristic of mythical thinking," which treats "every contact in time and space as an immediate relation of cause and effect."[126] Consistent with the view

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117. *Cf.* Nat'l Fed'n of Indep. Bus. v. Sebelius, 567 U.S. 519, 557-58 (2012) (rejecting congressional power over "mandatory purchases of . . . broccoli"); *id.* at 607-08 (Ginsburg, J., concurring in part, concurring in the judgment in part, and dissenting in part).

118. *See generally* Animal Welfare Act, 7 U.S.C. §§ 2131-2159 (LexisNexis 2019); 7 C.F.R. §§ 2.1-2.134 (LexisNexis 2020).

119. *Cf.* Schechter Poultry Corp. v. United States, 295 U.S. 495, 554 (1935) (Cardozo, J., concurring) (observing that "law is not indifferent to considerations of degree").

120. *See* Tierschutzgesetz [TierSchG] [Animal Welfare Act], May 18, 2016, BGBL I at 1206, § 3, art. 9, last amended by Gesetz [G], Nov. 20, 2019 BGBL I at 1626 (Ger.) (banning *gavage* in the production of bird livers).

121. *See* Missouri v. Harris, 58 F. Supp. 3d 1059 (E.D. Cal. 2014), *aff'd in relevant part sub nom.* Missouri *ex rel.* Koster v. Harris, 846 F.3d 646 (9th Cir. 2016).

122. *See* Chinatown Neighborhood Ass'n v. Harris, 794 F.3d 1136 (9th Cir. 2015), *cert. denied*, 136 S. Ct. 2448 (2016).

123. JAMES GEORGE FRAZER, THE GOLDEN BOUGH: A STUDY IN MAGIC AND RELIGION 24 (1922).

124. *Id.* at 25.

125. *See* Paul Rozin et al., *Operation of the Laws of Sympathetic Magic in Disgust and Other Domains*, 50 J. PERSONALITY & SOC. PSYCHOL. 703, 704 (1986).

126. ERNST CASSIRER, THE PHILOSOPHY OF SYMBOLIC FORMS—VOLUME TWO: MYTHICAL THOUGHT 45 (Ralph Manheim transl., 1955); *accord*, *e.g.*, WILLIAM KREHM, BABEL'S TOWER, THE DYNAMICS OF ECONOMIC BREAKDOWN 25 (1977); Falk Seeger & Heinz Steinbring, THE MYTH OF MATHEMATICS, *in* CONSTRUCTING MATHEMATICAL KNOWLEDGE: EPISTEMOLOGY AND

that law must "curb certain natural propensities" and "control human instincts,"[127] modern (and modernist) sentiment counsels "the removal of ornament" from food items as "utilitarian objects."[128]

Lest food taboos prohibiting resort to "many animals and plants, wholesome enough in themselves," be dismissed as "superstitions of the savage,"[129] contemporary behavioral science recognizes the persistence of superstition and magical thinking, even among educated and emotionally stable adults.[130] Food taboos — ranging from seasonal limitations such as Lenten avoidance of meat and Mormon prohibitions on coffee, tea, and alcohol, to comprehensive rules prescribing kosher or halal practices — give meaning to religions commanding hundreds of millions of adherents worldwide.

Ultimately, the objectives of consumer-oriented intelligence at the end of an affluent society's food value chain must be understood as being more akin to religion than to science. Certainly, nothing in legislation banning *foie gras* or battery cage eggs approaches the rigor with which the Food, Drug, and Cosmetic Act ("FD&CA") demands that all new human drugs be "safe and effective."[131] Food derived from genetically modified organisms, including dairy cows treated with rbST, is not "adulterated," as that word is understood in the FD&CA.[132] If such foods were determined unfit for human consumption, the appropriate remedy is not disclosure coupled with faith that self-preserving instincts among consumers will prevent harm to public health. Items "unfit for food" should not enter the stream of commerce at all.[133] Adulterated products may be seized and condemned.[134]

MATHEMATICS EDUCATION 151, 161 (Paul Ernst ed., 2012).

127. BRONISŁAW MALINOWSKI, CRIME AND CUSTOM IN SAVAGE SOCIETY 64 (1926).

128. Adolf Loos, ORNAMENT AND CRIME, *in* CHINESE ORNAMENT: THE LOTUS AND THE DRAGON 19, 20 (Jessica Rawson ed., 1984).

129. FRAZER, *supra* note 123, at 277.

130. *See, e.g.*, Jane L. Risen & Thomas Gilovich, *Why People Are Reluctant to Tempt Fate*, 95 J. PERSONALITY & SOC. PSYCHOL. 293, 303 (2008).

131. 21 U.S.C. § 321(p) (LexisNexis 2020); *see also* § 355(d), (e); Weinberger v. Hynson, Westcott & Dunning, Inc., 412 U.S. 609, 613-14 (1973); Weinberger v. Bentex Pharm., Inc., 412 U.S. 645, 652-53 (1973).

> A drug is effective . . . if there is general recognition among experts, founded on substantial evidence, that the drug in fact produces the results claimed for it under prescribed conditions. . . . [E]ffectiveness does not necessarily denote capacity to cure. In the treatment of any illness, terminal or otherwise, a drug is effective if it fulfills, by objective indices, its sponsor's claims of prolonged life, improved physical condition, or reduced pain.

United States v. Rutherford, 442 U.S. 544, 555 (1979). *See generally Weinberger*, 412 U.S. at 629-34 (1973).

132. 21 U.S.C. §§ 331(a), 342(a)(1) (LexisNexis 2020); *see also* § 348 (treating the presence of an unapproved food additive as adulteration).

133. United States v. 71/55 Gallon Drums, 790 F. Supp. 1379, 1380 (N.D. Ill. 1992).

134. *See* 21 U.S.C. § 334 (LexisNexis 2020); United States v. Argent Chem. Labs., Inc., 93

If anything, labels purporting to communicate the absence of genetically modified organisms flirt dangerously with the FD&CA's prohibition against the misbranding of food.[135] This prohibition protects consumers against false or misleading advertising.[136] It is one thing to convey a system of belief or ideology through signals in a food label. At the threshold where food labels mislead or even convey false information, however, regulatory intervention becomes appropriate.[137] Claiming greater safety or nutritional superiority for foods not derived from genetically modified organisms crosses that line.

Virtue signaling in food choices stands apart from the agrarian virtues of resource conservation and food safety. Taxation and regulation are the standard responses to environmentally deleterious practices. If a practice threatens human health, the proper regulatory response is an outright ban. If a practice exports costs to unwilling bystanders, taxes can redirect those externalities toward the practitioner. By contrast, a proliferation of labels does little more than to facilitate self-segregation among consumers of food who have the means and social standing to signal their affluence.

But for grave material threats to human survival, the frolic and detour of contemporary agricultural law into expressive concerns would sound no alarm. Ecological crisis, however, leaves no room for such luxuries. The ghost of Thomas Malthus still walks,[138] and food security wobbles amid the vagaries of the Anthropocene.[139] This is the iron law of food security in the Anthropocene: Those who can afford to do so, fetishize food. Those who cannot, starve.

In fairness, the precautionary principle demands no strict adherence to standards of evidentiary sufficiency. Symbolic and expressive interests among food consumers need not heed the strictly scientific standards that govern the introduction of bioengineered inputs at the head of that chain. Whether rooted in religious tradition or secular philosophy, food taboos abound. But false and

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F.3d 572, 578 (9th Cir. 1996).

135. *See* 21 U.S.C. §§ 321(n) (LexisNexis 2020), 343(a)(1) (2010).

136. *See*, *e.g.*, United States v. Ninety-Five Barrels, 265 U.S. 438, 442-43 (1924); United States v. An Article of Food . . . "Manischewitz . . . Diet Thins," 377 F. Supp. 746, 749 (E.D. N.Y. 1974) (warning against the exploitation of "[p]urchasers of diet products," who "are often 'pathetically eager' to obtain a more slender figure").

137. *See* Va. State Bd. of Pharmacy v. Va. Citizens Consumer Council, 425 U.S. 748, 771 n.24 (1976); Friedman v. Rogers, 440 U.S. 1, 9-10 (1979); Cent. Hudson Gas & Elec. Corp. v. Pub. Serv. Comm'n, 447 U.S. 557, 564, 566 (1980).

138. *Compare* THOMAS MALTHUS, AN ESSAY ON THE PRINCIPLE OF POPULATION 15-22 (Geoffrey Gilbert ed., Oxford World's Classics 1999) (1798), *with* Keith Aoki, *Malthus, Mendel, and Monsanto: Intellectual Property and the Politics of Global Food Supply: An Introduction*, 19 J. ENVTL. L. & LITIG. 397, 399-400 (2004).

139. *See, e.g.*, Paul Gepts, *A Comparison Between Crop Domestication, Classical Plant Breeding, and Genetic Engineering*, 42 CROP SCI. 1780 (2002); Jonathan Knight, *Crop Improvement: A Dying Breed*, 421 NATURE 568 (2003); Susan McCouch, *Diversifying Selection in Plant Breeding*, 2 PLOS BIOLOGY 1507 (2004).

misleading claims command no respect in other branches of law.[140] Such interests deserve no greater traction within the law of food.

IV. SIC TRANSIT

Many of the bitterest consumer-driven controversies over the ethics of food have involved animal-derived products such as milk, eggs, and goose livers. Like other instances of heuristic decision-making, the signaling of agrarian virtue and vice may be superstitiously motivated and economically suboptimal, but not wholly without value. Perhaps some redemption lingers in the consumer-driven expressive function of food, beyond the resurrection of atavistic food taboos in a nominally secular society. A general tendency against the consumption of foods derived from animals, which demand greater commitments of energy and other resources,[141] is consistent with the suggestion that a Kuznets curve characterizes the path of environmental quality as economies develop.[142] More money, less meat. "Long is the way / And hard, that out of Hell leads up to Light."[143]

Virtue, in its agrarian sense or otherwise, consists of "those dispositions which will not only sustain practices and enable us to achieve the goods internal to practices, but which will also . . . enabl[e] us to overcome the harms, dangers, temptations and distractions which we encounter."[144] "*Et ne nos inducas in tentationem, sed libera nos a malo*."[145]

All of which returns us to the questions of plant macronutrition and peak phosphorus, which we last considered in connection with *Funk Brothers*. The 2013 case of *Bowman v. Monsanto Co.*[146] presages a related issue of Anthropocene agriculture: peak glyphosate. *Bowman* connects the resource exhaustion and evolutionary elements of the Anthropocene through

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140. *See, e.g.*, Milavetz, Gallop & Milavetz, P.A. v. United States, 559 U.S. 229, 250 (2010); Cent. Hudson Gas & Elec. Corp. v. Pub. Serv. Comm'n of N.Y., 447 U.S. 557, 566 (1980).

141. *See Foreword* to PAUL A. COLINVAUX, WHY BIG FIERCE ANIMALS ARE RARE: AN ECOLOGIST'S PERSPECTIVE (Christina Eisenberg eds., Princeton Univ. Press 2018) (1979).

142. *See, e.g.*, Gene M. Grossman & Alan B. Krueger, *Environmental Impacts of a North American Free Trade Agreement* (Nat'l Bureau of Econ. Research, Working Paper No. 3914, 1991), http://www.nber.org/papers/w3914 [https://perma.cc/PFS7-RUY4]; Nemat Shafik, *Economic Development and Environmental Quality: An Econometric Analysis*, 46 OXFORD ECON. PAPERS 757 (1994). *See generally* Simon Kuznets, *Economic Growth and Income Inequality*, 45 AM. ECON. REV. 1 (1955); James K. Galbraith, *Global Inequality and Global Macroeconomics*, 29 J. POL'Y MODELING 587 (2007).

143. JOHN MILTON, PARADISE LOST bk. 2, l. 432-33 (1667).

144. MacIntyre, *supra* note 16, at 219.

145. *Matthew* 6:13 (Modern English Version) ("And lead us not into temptation, but deliver us from evil."); *see* A.J.B. Higgins, *"Lead Us Not into Temptation": Some Latin Variants*, 46 J. THEOLOGICAL STUD. 179, 179 (1945).

146. 569 U.S. 278 (2013); *cf. Luke* 11:4 (Revised Standard Version). *See generally* Joseph A. Fitzmyer, *And Lead Us Not into Temptation*, 84 BIBLICA 259 (2003).

bioengineering and its distinctive impact on intellectual property law.[147]

Bowman is best known for holding that the patent exhaustion doctrine — which provides that "the authorized sale of a patented article" confers "a right to use or resell that article," but not the right "to make new copies of the patented invention" — does not permit the saving of patented, genetically modified seed.[148] Decades of agrarian struggle against industrialized plant breeding[149] culminated in the Supreme Court's rejection of one final effort to achieve the "real objective" of being "able to save seed from [a] harvest," without regard to intellectual property claimed by seed breeders.[150]

Seed-saving by farmers is a historical priority in agricultural diplomacy. The UPOV treaty, the first international instrument to recognize intellectual property in sexually reproduced plants, permitted signatory states to preserve the traditional expectation of farmers to save proprietary seed "for propagating purposes, on their own holdings."[151] Defending the "rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material,"[152] in principle, honors the supposedly "enormous contribution" by "farmers of all regions . . . for the conservation and development of plant genetic resources."[153]

This expression of agrarian independence, which emphasizes farmer control over genetic inputs, is perhaps most famously embodied in Thomas Jefferson's sentiment that "[t]he greatest service which can be rendered any country is, to add an useful plant to it's culture."[154] To like effect, the British rural apologist William Cobbett praised "the small working farmer [as] the social type of the

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147. *See generally* James Ming Chen, *An Agricultural Law Jeremiad: The Harvest Is Past, the Summer Is Ended, and Seed Is Not Saved*, 2014 WIS. L. REV. 235.

148. *Bowman*, 569 U.S. at 280.

149. *See generally* KEITH AOKI, SEED WARS: CONTROVERSIES AND CASES ON PLANT GENETIC RESOURCES AND INTELLECTUAL PROPERTY (2008).

150. Monsanto Co. v. David, 516 F.3d 1009, 1014 (Fed. Cir. 2008).

151. International Convention for the Protection of New Varieties of Plants, art. 15(2), Dec. 2, 1961, 33 U.S.T. 2703, 815 U.N.T.S. 89 (revised Nov. 10, 1972, Oct. 23, 1978, and March 19, 1991); *accord* 7 U.S.C. § 2543 (LexisNexis 2020) (allowing farmers "to save seed" from a crop derived from a plant variety protected under the Plant Variety Protection Act and to "use such saved seed in the production of a crop"). *See generally* J.E.M. Agric. Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124 (2001); Asgrow Seed Co. v. Winterboer, 513 U.S. 179 (1995).

152. FOOD & AGRIC. ORG., UNITED NATIONS, INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE 13 (2009).

153. *Id*.

154. THOMAS JEFFERSON, WRITINGS 703 (Merrill D. Peterson ed., 1984); *accord* Daryl Lim, *Self-Replicating Technologies and the Challenge for the Patent and Antitrust Laws*, 32 CARDOZO ARTS & ENT. L.J. 131, 139-40 (2013); *see also* Jennifer Wai-shing Maguire, *The Seed 2.0: Evolving Intellectual Property Rights of Agricultural Germplasm*, 8 BUFF. INTELL. PROP. L.J. 51, 54 (2012); H. Garrison Wilkes, *Plant Genetic Resources Over Ten Thousand Years: From a Handful of Seed to the Crop-Specific Mega-Gene Banks*, *in* SEEDS AND SOVEREIGNTY: THE USE AND CONTROL OF PLANT GENETIC MATERIAL 67, 70 (Jack R. Kloppenburg ed., 1988).

virtuous man."[155]

This romantic vision of seed-saving as the engine of genetic innovation in agriculture has no basis in economic reality. Indeed, the traditional practice of seed-saving has retarded meaningful development of a commercial seed-breeding industry by destroying the ability of breeders to recoup their investment beyond a single, initial sale of germplasm from a selectively bred (let alone bioengineered) plant variety.[156]

In a practical if not strictly legal sense, *Bowman v. Monsanto Co.*[157] ended any pretense over the true nature of genetic innovation and control over genetic inputs in contemporary agriculture. It is not farmers, but the agribusiness-industrial complex of seed breeders and manufacturers of synthetic fertilizers, herbicides, and pesticides that dictates the invention, production, and deployment of agricultural inputs. *Bowman* exposed the rhetorical prominence — and the prominent failure — of seed-saving as the embodiment of the collective contribution of farmers to the development of plant genetic resources.

Monsanto had "invented a genetic modification that enables soybean plants to survive exposure to glyphosate, the active ingredient in many herbicides (including Monsanto's own Roundup)."[158] Farmers planting Roundup Ready seed "can use a glyphosate-based herbicide to kill weeds without damaging their crops."[159]

Farmer Vernon Bowman bought "commodity soybeans," which state law limits to human or animal consumption rather than planting for reproductive purposes.[160] Bowman planted those beans. Accurately anticipating that other nearby farmers had used Roundup Ready seed, Bowman "applied a glyphosate-based herbicide" and thereupon "confirmed that . . . a significant proportion of the new plants survived the treatment."[161] He "produced in their turn a new crop of soybeans with the Roundup Ready trait."[162]

To dodge the Court's holding that he infringed Monsanto's patents in Roundup Ready soybeans,[163] Bowman offered a "seeds-are-special argument."[164] Asserting that "that soybeans naturally 'self-replicate or "sprout" unless stored in a controlled manner,'" Bowman argued that the bean itself, and not the farmer,

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155. MacIntyre, *supra* note 16, at 222. *See generally* G.K. CHESTERTON, WILLIAM COBBETT (1925).

156. *See* Debra L. Blair, *Intellectual Property Protection and Its Impact on the U.S. Seed Industry*, 4 DRAKE J. AGRIC. L. 297, 304 (1999); Christopher M. Holman, *Bowman v. Monsanto Co.: A Bellwether for the Emerging Issue of Patentable Self-Replicating Technologies and Inadvertent Infringement*, 80 MO. L. REV. 665, 675-76 (2015).

157. Bowman v. Monsanto Co., 569 U.S. 278 (2013).

158. *Id.* at 280-81.

159. *Id.* at 281.

160. *See id.* at 282 n.1.

161. *Id.* at 282.

162. *Id.*

163. *See id.* at 284-85.

164. *Id.* at 288.

"made replicas of Monsanto's patented invention."[165]

Although the Court rejected this "blame-the-bean defense," Bowman's failed effort to deflect Monsanto's charge of patent infringement expressed the essence of agriculture as dumb pipe.[166] When farmers "plant seeds," Bowman asserted, "they don't exercise any control . . . over their crop" or "over the creative process."[167] There is no more succinct way of confirming that Monsanto had conferred all intelligence through plant breeding and the engineering of the soybean genome. The traditional agricultural function of devising new plant varieties, extolled by Jefferson as the greatest of agrarian virtues,[168] has yielded to molecular technologies beyond the admitted comprehension of judges.[169]

In the staggering sweep of geological time and terrestrial life, *Bowman* highlights the evolutionary consequences of legal decisions.[170] Roundup Ready soybean seed represents merely one example of the many technologies that have accelerated the treadmill on which agriculture runs.[171] Just as the Red Queen of Alice's Wonderland keeps running without seeing new terrain (because the landscape moves with her),[172] evolution routinely outpaces human intervention.[173] Although the Red Queen also stalks agriculture through resistance to pesticides[174]

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165. *Id*. On the broader implications of *Bowman* for self-replicating inventions, see generally Holman, *supra* note 156; Lim, *supra* note 154.

166. *Id.*

167. *Id.* (quoting the oral argument transcript).

168. *See* JEFFERSON, *supra* note 154.

169. *Cf.* Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 569 U.S. 576, 596 (2013) (Scalia, J., concurring in part and concurring in the judgment) (confessing the inability to "affirm" the "fine details of molecular biology," either "on my own knowledge or even my own belief").

170. *See generally* Mary Jane Angelo, *Regulating Evolution for Sale: An Evolutionary Biology Model for Regulating the Unnatural Selection of Genetically Modified Organisms*, 42 WAKE FOREST L. REV. 93 (2007); Ryan M.T. Iwasaka, Note, *Chakrabarty to Chimeras: The Growing Need for Evolutionary Biology in Patent Law*, 109 YALE L.J. 1505, 1520-26 (2000) (urging courts and the Patent and Trademark Office to consider the impact of patent law on the evolution of living organisms).

171. *See*, *e.g.*, WILLARD W. COCHRANE, THE DEPARTMENT OF AGRICULTURE: A HISTORICAL ANALYSIS 378-95 (1979); WILLARD W. COCHRANE, FARM PRICES: MYTH AND REALITY 85-107 (1958).

172. *See* LEWIS CARROLL, THROUGH THE LOOKING-GLASS AND WHAT ALICE FOUND THERE 46 (Martin Gardner ed., 1998) (1871) ("Now, *here*, you see, it takes all the running you can do, to keep in the same place." (emphasis in original)).

173. *See, e.g.*, MATT RIDLEY, THE RED QUEEN: SEX AND THE EVOLUTION OF HUMAN NATURE 63-67 (1994); Richard Dawkins & John R. Krebs, *Arms Races Between and Within Species*, 205 PROC. ROYAL SOC'Y LONDON B 489 (1979); W.D. Hamilton et al., *Sexual Reproduction as an Adaptation to Resist Parasites*, 87 PROC. NAT'L ACAD. SCIS. 3566 (1990); Jomar F. Rabajante et al., *Host and Parasite Red Queen Dynamics with Phase-Locked Rare Genotypes*, 2 SCI. ADVANCES e1501548 (2016); Jomar F. Rabajante et al., *Red Queen Dynamics in Multi-Host and Multi-Parasite Interaction System*, 5 SCI. REPS. 10004 (2015).

174. *See, e.g.*, Aaron J. Gassman et al., *Field-Evolved Resistance by Western Corn Rootworm*

and antibiotics,[175] I will illustrate the problem through herbicide resistance.

The transgenic modification of crops has reduced the use of chemical insecticides. By the same token, it has also dramatically increased the deployment of broad-spectrum herbicides.[176] As of 2013, 71 percent of all corn, 90 percent of all cotton, and 93 percent of all soybeans planted in the United States had been genetically engineered to resist herbicides.[177]

Broad-spectrum herbicides and herbicide-resistant crops are substitutes for demoralizing physical labor. Without herbicides, the farmer must remove weeds by raw force. The chopping of cotton is particularly brutal: "In order to produce a good cotton crop, cotton should be chopped in the summertime . . . . [C]hopping or hoeing the weeds out of the rows of growing cotton . . . is a menial, unskilled task which requires no aptitude, no training, and no ability to reason."[178] In the words of James Agee: "Chopping is a simple hard and hot job . . . done with an eight- to ten-inch hoeblade. You cut the cotton flush to the ground, with a semi-blow of the blade that aches first the forearms and in time the whole spine."[179]

Glyphosate presents a singularly intense concern. Monocultures consisting of a single glyphosate-resistant variety, such as Roundup Ready soybeans, invite multiple applications, season after season, of glyphosate. The resulting selection pressure gives rise to herbicide-resistant "superweeds."[180] Almost immediately after Monsanto released its Roundup Ready technology, the first cases of glyphosate resistance in rigid ryegrass (*Lolium rigidum*) arose in Australia.[181] Glyphosate-resistant ryegrass has now been detected around the world.[182]

Glyphosate resistance has been reported in Palmer amaranth, or pigweed (*Amaranthus palmeri*);[183] hairy fleabane, or buva (*Conyza bonariensis*);[184]

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to Multiple Bacillus Thuringiensis *Toxins in Transgenic Maize*, 111 PROC. NAT'L ACAD. SCIS. 5141 (2014).

175. *See, e.g.*, Cesar A. Arias & Barbara E. Murray, *Antibiotic-Resistant Bugs in the 21st Century — A Clinical Super-Challenge*, 360 N. ENG. J. MED. 439 (2009); J.I.R. Castanon, *History of the Use of Antibiotic as Growth Promoters in European Poultry Feeds*, 86 POULTRY SCI. 2466 (2007).

176. Chen, *supra* note 147, at 259.

177. *Id* at 260.

178. Castillo v. Givens, 704 F.2d 181, 183-84 (5th Cir. 1983), *cert. denied*, 464 U.S. 850 (1983).

179. JAMES AGEE, COTTON TENANTS: THREE FAMILIES 131 (John Summers ed., 2013).

180. *See, e.g.*, Michael D.K. Owen & Ian A. Zelaya, *Herbicide-Resistant Crops and Weed Resistance to Herbicides*, 61 PEST MGMT. SCI. 301 (2005).

181. *See* Stephen B. Powles et al., *Evolved Resistance to Glyphosate in Rigid Ryegrass (*Lolium rigidum*) in Australia*, 46 WEED SCI. 604 (1998).

182. *See* Christopher Preston et al., *A Decade of Glyphosate-Resistant Lolium Around the World: Mechanisms, Genes, Fitness, and Agronomic Management*, 57 WEED SCI. 435 (2009).

183. *See* A. Stanley Culpepper et al., *Distribution of Glyphosate-Resistant Palmer Amaranth (*Amaranthus palmeri*) in Georgia and North Carolina during 2005 and 2006*, 12 J. COTTON SCI. 306 (2008); A. Stanley Culpepper et al., *Glyphosate-Resistant Palmer Amaranth (*Amaranthus palmeri*) Confirmed in Georgia*, 54 WEED SCI. 620, 620 (2006). Paul Neve et al., *Modeling*

horseweed (*Conyza canadensis*);[185] Johnsongrass (*Sorghum halepense*);[186] and goosegrass (*Eleusine indica*).[187] Glyphosate resistance in common lambsquarters (*Chenopodium album*), a weed of special concern to cotton farmers,[188] is particularly dispiriting.[189]

As resistance proliferates in geographic space and across biological taxa, we may soon reach — if we have not already surpassed — "peak glyphosate." From this biochemical apogee, we can foresee this herbicide's decline in effectiveness and its eventual commercial extinction. Whatever its other legal and economic implications,[190] the 2015 expiration of Monsanto's original Roundup Ready

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*Glyphosate Resistance Management Strategies for Palmer Amaranth (*Amaranthus palmeri*) in Cotton*, 25 WEED TECHNOLOGY 335 (2011).

184. *See* Ilias S. Travlos & Dimosthenis Chachalis. *Glyphosate-Resistant Hairy Fleabane (*Conyza bonariensis*) Is Reported in Greece*, 24 WEED TECHNOLOGY 569 (2010); José M. Urbano et al., *Glyphosate-Resistant Hairy Fleabane (*Conyza bonariensis*) in Spain*, 21 WEED TECHNOLOGY 396 (2007) Martin M. Vila-Aiub et al., *Glyphosate-Resistant Weeds of South American Cropping Systems: An Overview*, 64 PEST MGMT. SCI. 366 (2008); *see also* L. Vargas et al., Buva (Conyza bonariensis) Resistente ao Glyphosate na Região Sul do Brasil, 25 Planta Daninha 573 (2007).

185. *See* Xia Ge et al., *Rapid Vacuolar Sequestration: The Horseweed Glyphosate Resistance Mechanism*, 66 PEST MGMT. SCI. 345 (2010), *corrected*, Xia Ge et al., *Erratum: Rapid Vacuolar Sequestration: The Horseweed Glyphosate Resistance Mechanism*, 66 PEST MGMT. SCI. 576 (2010); Clifford H. Koger et al., *Assessment of Two Nondestructive Assays for Detecting Glyphosate Resistance in Horseweed (*Conyza canadensis*)*, 53 WEED SCI. 438, 438 (2005).

186. *See* Dilpreet S. Riar et al., *Glyphosate Resistance in a Johnsongrass (*Sorghum halepense*) Biotype from Arkansas*, 59 WEED SCI. 299 (2011); Martin M. Vila-Aiub et al., *Evolution of Glyphosate-Resistant Johnsongrass (*Sorghum halepense*) in Glyphosate-Resistant Soybean*, 55 WEED SCI. 566, 566 (2007); Martin M. Vila Aiub et al., *Glyphosate Resistance in Perennial Sorghum halepense (Johnsongrass), Endowed by Reduced Glyphosate Translocation and Leaf Uptake*, 68 PEST MGMT SCI. 430 (2012).

187. *See* Scott R. Baerson et al., *Glyphosate-Resistant Goosegrass: Identification of a Mutation in the Target Enzyme 5-enolpyruvylshikimate-3-phosphate Synthase*, 129 PLANT PHYSIOLOGY 1265 (2002); Lim Jung Lee & Jeremy Ngim, *A First Report of Glyphosate-Resistant Goosegrass (*Eleusine indica (L) Gaertn*) in Malaysia*, 56 PEST MGMT. SCI. 336, 336 (2000); Chin-Hong Ng et al., *Inheritance of Glyphosate Resistance in Goosegrass (*Eleusine indica*)*, 52 WEED SCI. 564 (2004).

188. *See* Christopher L. Schuster et al., *Response of Common Lambsquarters (*Chenopodium album*) to Glyphosate as Affected by Growth Stage*, 55 WEED SCI. 147, 147 (2007); Grace A. Hite et al., *Differential Response of a Common Lambsquarters (*Chenopodium album*) Collection to Glyphosate*, 56 WEED SCI.. 203, 204 (2008); Andrew M. Westhoven et al., *Characterization of Selected Common Lambsquarters (*Chenopodium album*) Biotypes with Tolerance to Glyphosate*, 56 WEED SCI. 685, 685 (2008).

189. *See generally* Chen, *supra* note 147, at 261-62.

190. *See* Benjamin M. Cole et al., *Food for Thought: Genetically Modified Seeds as De Facto Standard Essential Patents*, 85 COLO. L. REV. 313 (2014); Daryl Lim, *Self-Replicating Technologies and the Challenge for the Patent and Antitrust Laws*, 32 CARDOZO ARTS & ENT. L.J. 131, 206-14 (2013).

patent has almost certainly expanded glyphosate use and the rate at which non-crop plants evolve resistance.

"Superweed resistance to glyphosate has spurred the development of crops engineered to tolerate another organophosphorus compound with broad-spectrum herbicidal qualities, glufosinate ammonium."[191] Before the 2016 announcement of its intent to acquire Monsanto, Bayer CropScience incorporated glufosinate resistance into soybeans, cotton, corn, and canola[192] and expanded production of the herbicide itself.[193]

Bayer's acquisition of Monsanto has taken a giant step toward final legal approval. On May 29, 2018, those companies entered a consent decree with the Antitrust Division of the United States Department of Justice to resolve alleged violations of section 7 of the Clayton Act.[194] The consent decree recognized that glyphosate and glufosinate, as "foundational" herbicides acting nonselectively across a broad spectrum of plants, have no good substitutes.[195] Selective herbicides can supplement but not replace nonselective, broad-spectrum herbicides as the basis of a weed management system.[196]

Monsanto and Bayer's pre-merger duopoly on foundational herbicides looms large in the consent decree that approved their merger. Even as the decree recognizes that "glyphosate and glufosinate are the only two foundational herbicides" now available to farmers, "new foundational herbicides are in development."[197] Evolutionary pressure from herbicide use spurs further innovation. As the consent decree recognizes, glyphosate resistance among weeds had already motivated some farmers to turn to glufosinate-tolerant Liberty crop varieties.[198] The Antitrust Division expressed concern that the merger would "eliminate competition between Bayer and Monsanto to develop next-generation weed management systems," particularly "new foundational herbicides and related herbicide-tolerant traits" in crop plants.[199]

Because the "complex and hazardous" process of developing new

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191. James Ming Chen, *Agriculture, End to End* (July 24, 2018), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3218894 [https://perma.cc/3WZQ-8MRY].

192. *See LibertyLink*, BAYER CROPSCIENCE, http://www.bayercropscience.us/products/traits/libertylink/crops (last visited Oct. 21, 2019) [https://perma.cc/4NC7-HC7W].

193. *See* Bayer CropScience, *Bayer CropScience announces construction of glufosinate-ammonium herbicide facility,* FARM PROGRESS (May 15, 2013), https://www.farmprogress.com/herbicides/bayer-cropscience-announces-construction-glufosinate-ammonium-herbicide-facility [https://perma.cc/XG7G-QZHA].

194. *See* United States v. Bayer AG, Monsanto Co. & BASF SE, Pending Consent Decree No. 5631, Case No. 1:18-cv-01241 (D.D.C. filed, but not entered, May 29, 2018), reprinted in TRADE REG. REP. ¶ 51,074 (2018).

195. *Id.* ¶ II.B.2(a).

196. *See id.*

197. *Id.*

198. *See id.* ¶ II.B.2(b).

199. *Id.*

foundational herbicides is not likely to "be remedied by entry or expansion,"[200] the consent decree would require Bayer "to divest all intellectual property" and manufacturing facilities "related to glufosinate."[201] Bayer must also divest "pipeline" projects on "new herbicides and new traits that confer tolerance to those herbicides," including the nonselective herbicides ketoenole and N,O-chelator (NOC) as well as isoxaflutole, a selective herbicide blended with glufosinate in Bayer's Balance Bean product for soybeans.[202] BASF "is the only buyer" that the Antitrust Division deems "suitable to resolve the range of competitive concerns raised by the merger," which encompass issues beyond those raised by foundational herbicides and crop varieties bioengineered to tolerate them.[203]

No discussion of contemporary biotechnology can focus exclusively on transgenic techniques. The advent of CRISPR/Cas9 gene editing promises to revolutionize the legal framework for regulating bioengineered organisms in agriculture.[204] Although this subject warrants book-length treatment, a single example foreshadows the coming eclipse of transgenic technologies and the legal tools used to regulate them.

Enzymatic browning through oxidation by polyphenol oxidase (PPO) is a common reaction in fruits and vegetables.[205] It represents a major problem in fruit processing.[206] Finding no significant environmental impact, the United States Department of Agriculture (USDA) has granted preliminary nonregulated status to apples engineered to resist PPO.[207] The gene silencing of PPO in so-called Arctic Apples applied RNA interference (RNAi) technology that the USDA had already approved to suppress acrylamide levels in potatoes.[208]

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200. *Id.* ¶ II.B.2(c).

201. *Id.* ¶ III.B.

202. *Id.* ¶ III.C.

203. *Id.* ¶ III.

204. The United States Patent and Trademark Office described CRISPR/Cas9 in vitro, in prokaryotic cells, and in eukaryotic cells in Broad Inst., Inc. v. Regents of the Univ. of Cal., Patent Interference No. 106,048, 2017 WL 657415 (P.T.A.B. Feb. 15, 2017). Other sources on CRISPR/Cas9 include JENNIFER DOUDNA & PRASHANT MALI, CRISPR-CAS: A LABORATORY MANUAL (2016); MARCY E. GALLO ET AL., CONG. RESEARCH SERV., R44824, ADVANCED GENE EDITING: CRISPR-CAS9, (2017); Carlene Dooley, Note, *Regulatory Silos: Assessing the United States' Regulation of Biotechnology in the Age of Gene Drives*, 30 GEO. ENVTL. L. REV. 547 (2018); Hannah Mosby, Note, *Biotechnology's Great Divide: Strengthening the Relationship Between Patent Law and Bioethics in the Age of CRISPR-Cas9*, 19 MINN. J.L. SCI. & TECH. 565 (2018).

205. *See* Daniel Ferreira Holderbaum et al., *Enzymatic Browning, Polyphenol Oxidase Activity, and Polyphenols in Four Apple Cultivars: Dynamics during Fruit Development*, 45 HORTSCIENCE 1150 (2010).

206. *See* M.Y. Coseteng & C.Y. Lee, *Changes in Apple Polyphenoloxidase and Polyphenol Concentrations in Relation to Degree of Browning*, 52 J. FOOD SCI. 985 (1987).

207. *See* Okanagan Specialty Fruits, Inc., 81 Fed. Reg. 53,396 (Aug. 12, 2016).

208. *See* MICHAEL J. FIRKO, U.S. DEPARTMENT OF AGRICULTURE, *Extended Determination*

These technological and legal antecedents supported the USDA's decision to grant nonregulated status to transgene-free, CRISPR/Cas9-edited white button mushrooms (*Agaricus bisporus*) whose genome has undergone small deletions to silence a specific PPO-related gene.[209] Whereas RNAi in potatoes and apples had relied on nonparent genetic material, the editing of mushrooms through CRISPR/Cas9 introduced "no foreign DNA . . . into the mushroom genome."[210]

Nonregulated status for this edited mushroom heralds two significant changes in agricultural biotechnology. First, the gene-editing relied entirely on the mushroom's own genome, without reliance on any exogenous genetic material. CRISPR-Cas9, in any organism, edits that organism's genome without introducing nonparent DNA.[211] Second, the suppression of PPO-driven enzymatic browning produced a conscious improvement in food quality at the consumer level.[212] In stark contrast, the plant-incorporated protectants and herbicide-tolerance traits that have been the subject of most transgenic modifications to date provide mostly production-level economic benefits to farmers.[213]

The story of agricultural inputs in the Anthropocene emphasizes forces beyond the economic control of farmers. From fossil fuels to plant macronutrients, resource exhaustion stalks contemporary agriculture. Bioengineered solutions against weeds and insect pests have rapidly accelerated the evolutionary treadmill on which agriculture runs.

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of Nonregulated Status for JR Simplot Company Innate™ V11 Potatoes (2016), https://www.aphis.usda.gov/brs/aphisdocs/15_14001p_det.pdf [https://perma.cc/3V9H-2R83]; Emily Waltz, *USDA Approves Next-Generation GM Potato*, 33 NATURE BIOTECH. 12 (2015). On the use of RNAi in agricultural biotechnology, see generally Satyajit Saurabh, Ambarish S. Vidyarthi & Dinesh Prasad, *RNA Interference: Concept to Reality in Crop Improvement*, 239 PLANTA 543 (2014). *See also* George L. Sen & Helen M. Blau, *A Brief History of RNAi: The Silence of the Genes*, 9 FASEB J. 1293 (2006); Xiuchun Zhang & Feng Qu, *Plant Virus Silencing Suppressors and RNA Silencing in Plants*, Wiley Online Library (Aug. 15, 2014), https://doi.org/10.1002/9780470015902.a0020710.pub2 [https://perma.cc/FYZ9-BJXD].

209. *See* Request for Confirmation That Transgene-Free CRISPR-Edited Mushroom Is Not a Regulated Article (2016), https://www.aphis.usda.gov/biotechnology/downloads/reg_loi/15-321-01_air_response_signed.pdf [https://perma.cc/T9FW-8M6N].

210. *Id.*

211. *See* Rajat M. Gupta & Kiran Musunuru, *Expanding the Genetic Editing Tool Kit: KFNs, TALENs, and CRISPR-Cas9*, 124 J. CLINICAL INVESTIGATION 4154 (2014); Patrick D. Hsu, Eric S. Lander & Feng Zhang, *Development and Applications of CRISPR-Cas9 for Genome Engineering*, 157 CELL 1262 (2014).

212. *See* Ji-Hyun Jang, Sang-Tae Kim & Kwang-Deog Moon. *Inhibitory Effects of Ultrasound in Combination with Ascorbic Acid on Browning and Polyphenol Oxidase Activity of Fresh-Cut Apple*s, 18 FOOD SCI. & BIOTECH. 1417 (2009).

213. *See* Sharlene R. Matten, Robert J. Frederick & Alan H. Reynolds, *United States Environmental Protection Agency Insect Resistance Management Programs for Plant-Incorporated Protectants and Use of Simulation Modeling*, *in* REGULATION OF AGRICULTURAL BIOTECHNOLOGY: THE UNITED STATES AND CANADA 175-267 (Chris A. Wozniak & Alan McHughen eds., 2012).

V. MAIOREM HAC DILECTIONEM[214]

What constitutes agrarian virtue? Across human or even geological history, agrarian virtue subsists in the sustained production of food, fiber, and fuel without the exhaustion of finite resources or the undue disruption of evolutionary processes on which human survival depends. Contemporary agricultural law, however, often emphasizes the expressive self-actualization of food preferences. This natural sublimation of economic independence from producers to consumers epitomizes agrarian vice. Restoration of agrarian virtue demands not *telos* (*τέλος*) in its purposive sense, but rather acceptance of *kyklos* (κύκλος), or cyclicality in its full economic and ecological sense.

If there were a portrait of agrarian vice,[215] it is that of the individualistic farmer, pursuing economic independence and self-actualization with every push of the plow. An even more compelling portrait of evil may subsist in the idolization of the selfish food consumer, who embraces the solipsism of "sustainable eating" amid the ruins of the Anthropocene. Inasmuch as "the core of morality is the capacity to transcend the self along with its drives and interests, . . . moral drama resides in the conflict between self-transcendence and self-love."[216]

Farming has conventionally distinguished itself, especially within industrialized societies, by its economic independence. "These large sections of the population — those who labored with their hands and those who worked the soil — were as a matter of economic fact in a different relation to the community from that occupied by industrial combinations."[217] The related principles that "farmers should be [his] own [boss]" and that "land should be owned by the one who tills it" literally comprise the central tenet, or at least the "economic terms," of the traditional agrarian creed.[218] Even more succinctly: "[F]armers are independent — they can't be fired and don't work for someone else."[219]

By the same token, conventional legal definitions of agriculture have acknowledged the vulnerability of farmers to broader economic and social forces. "Farmers were widely scattered and inured to habits of individualism; their economic fate was in large measure dependent upon contingencies beyond their

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214. "Greater love than this." *Cf. John* 15:13 (Rev. Standard Version) ("Greater love has no man than this, that a man lay down his life for his friends.").

215. *Cf.* OSCAR WILDE, THE PICTURE OF DORIAN GRAY (Michael Patrick Gillespie ed., W.W. Norton & Co. 3d ed. 2019) (1890).

216. MOSHE HALBERTAL, ON SACRIFICE 4 (2012).

217. Tigner v. Texas, 310 U.S. 141, 145 (1940); *accord* Nat'l Broiler Mktg. Ass'n v. United States, 436 U.S. 816, 825 n.15 (1978); *see also* Liberty Warehouse Co. v. Tobacco Growers, 276 U.S. 71, 92-93 (1928). *See generally* Frost v. Corp. Comm'n, 278 U.S. 515, 538-43 (1929) (Brandeis, J., dissenting).

218. DON PAARLBERG, AMERICAN FARM POLICY 3 (1964).

219. Neil D. Hamilton, *Agriculture Without Farmers? Is Industrialization Restructuring American Food Production and Threatening the Future of Sustainable Agriculture?*, 14 N. ILL. U. L. REV. 613, 639 (1994).

control."[220]

The Capper-Volstead Act,[221] the most important statute immunizing farmers' cooperatives from antitrust scrutiny, grew out of legislative recognition that "[f]armers were . . . in a particularly harsh economic position."[222] Being "subject to the vagaries of market conditions that plague agriculture generally," farmers "had no means individually of responding to those conditions."[223] Lacking "choice about who his buyer would be and when he would sell," farmers stood to lose a "large portion of an entire year's labor devoted to the production of a crop . . . if . . . forced to bring [a] harvest to market at an unfavorable time."[224] By contrast, "processors and distributors," thanks to their superior "position in the market and their relative economic strength, were able to take from the farmer a good share of whatever profits might be available from agricultural production."[225]

In truth, no farm is an island, entire of itself.[226] Agrarian exceptionalism underlies the traditional legal understanding of agriculture. This ideological bulwark of agricultural policy is collapsing at each end of the food supply chain. Biotechnology now dominates key inputs in the production of agricultural commodities. Meanwhile, consumer preferences are driving the abandonment of many conventional cost-saving practices because of social revulsion. Together, these sources of pressure strengthen the grip of biotechnology companies and the retail sector over agricultural production. The irreversible loss of economic independence forces a fundamental reevaluation of the human contribution to agriculture from farm to fork.

Among the things that children learn on a farm, this lesson may be the coldest: "[Y]ou learn that things die. You will never belong on a farm until you learn this."[227] Pigs, pets, and pests routinely die.[228] So do entire economic

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220. *Tigner*, 310 U.S. at 145; *accord Nat'l Broiler*, 436 U.S. at 825 n.15.

221. *See* 7 U.S.C. § 291 (2010) ("Persons engaged in the production of agricultural products as farmers, planters, ranchmen, dairymen, nut or fruit growers may act together in associations, corporate or otherwise, with or without capital stock, in collectively processing, preparing for market, handling, and marketing in interstate and foreign commerce, such products of persons so engaged.").

222. *Nat'l Broiler*, 436 U.S. at 825.

223. *Id.*

224. *Id.*

225. *Id.* at 825-26.

226. *Cf.* JOHN DONNE, *XVII. Nunc Lento Sonitu Dicunt, Morieris. ("Now, this bell tolling softly for another, says to me: Thou must die."* (emphasis in original)), *in* DEVOTIONS UPON EMERGENT OCCASIONS, TOGETHER WITH DEATH'S DUEL 107-13, 108-09 (U. Michigan Press 1959) ("No man is an island, entire of itself . . .").

227. Susan Machler, *People with Pipes: A Question of Euthanasia*, 16 U. PUGET SOUND L. REV. 781, 782 (1993).

228. *See* E.B. WHITE, CHARLOTTE'S WEB 1 (1952) ("'Where's Papa going with that ax?' said Fern . . . . 'Out to the hoghouse,' replied Mrs. Arable. 'Some pigs were born last night.' / 'I don't see why he needs an ax,' continued Fern . . . .").

systems. Modern agribusiness peals the bell of economic progress in multiple ways, from exhaustion of phosphorus to peak glyphosate and the bourgeois virtue signaling of affluent food aficionados. Farmer, "never send to know for whom the bell tolls; it tolls for thee."[229]

Neither agriculture nor its legal definition remains static. Although agriculture "includes more than the elemental process of planting, growing, and harvesting crops," the classification of any activity as "agricultural depends, in large measure, upon the way in which that activity is organized in a particular society."[230] On or off the farm, "[e]conomic progress . . . is characterized by a progressive division of labor and separation of function."[231] Rigid specialization spells doom for the agrarian equivalent of the all-purpose "econowives" in Margaret Atwood's dystopic novel, *The Handmaid's Tale*.[232] Unlike conventional farms, which "have to do everything; if they can," modern agricultural enterprises are meticulously "divided into functions."[233]

A landscape marked by fewer, larger, and more industrialized farms, once decried as a betrayal of conventional agrarian values,[234] has become the norm in developed countries. *Agriculture*, once a "self-contained industry" generating "food, fuel, shelter, draft animals, feed, tools, and implements and even most of [the] clothing" for a "typical farm family," no longer has any meaningful distinction from *agribusiness*, "the sum total of all operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them."[235]

As economic evolution overtakes agriculture, the law eventually reclassifies certain functions as nonagricultural, "even if [such] activity is necessary to

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229. DONNE, *supra* note 226, at 109.

230. Farmers Reservoir & Irrigation Co. v. McComb, 337 U.S. 755, 760-61 (1949).

231. *Id.* at 761.

232. MARGARET ATWOOD, THE HANDMAID'S TALE 24 (Houghton Mifflin Harcourt 1986) ("[S]triped dresses, red and blue and green and cheap and skimpy, . . . mark the women of the poorer men. Econowives, they're called.").

233. *Id.* In Atwood's fictional Republic of Gilead, the wealthiest segments of society sharply separate the sexual and reproductive functions of women from their familial and societal roles. Rigid specialization thus characterizes the tyrannical industrialization of womanhood. *See generally*, *e.g.*, VALENTINA ADAMI, BIOETHICS THROUGH LITERATURE: MARGARET ATWOOD'S CAUTIONARY TALES (2011); Pamela Cooper, *"A body story with a vengeance": Anatomy and struggle in* The Bell Jar *and* The Handmaid's Tale, 26 WOMEN'S STUD. 89 (1997).

234. *See generally*, *e.g.*, MARTY STRANGE, FAMILY FARMING: A NEW ECONOMIC VISION 131-34 (1988); INGOLF VOGELER, THE MYTH OF THE FAMILY FARM: AGRIBUSINESS DOMINANCE OF U.S. AGRICULTURE 170-85 (1981); THE NEW AGRARIANISM: LAND, CULTURE, AND THE COMMUNITY OF LIFE (Eric T. Freyfogle ed., 2001).

235. JOHN H. DAVIS & RAY A. GOLDBERG, A CONCEPT OF AGRIBUSINESS 2, 4 (1957). This book is credited with introducing the word *agribusiness* into the English language. *See* OXFORD ENGLISH DICTIONARY.

farmers and replaces work previously done by farmers."[236] Shortly after World War II, the Supreme Court of the United States recognized that the "production of power and the manufacture of fertilizer are independent productive functions, not agriculture."[237]

Other functions remain within agriculture's economic and legal core. Human labor and transport within farm facilities, without which "land could not be cultivated and the [crop], after harvest, would spoil in the fields and be lost," remains within the legal definition of agriculture.[238] Even comprehensive, "pervasive . . . control over the raising of . . . chicks, [the] ownership of . . . chicks, [the] assumption of the risks of casualty loss and market fluctuations" have not persuaded the law to regard such conduct "as agricultural activity of an integrated farmer," at least where independent contractors actually oversee the growing out of poultry from hatching until slaughter.[239]

Section 3(f) of the Fair Labor Standards Act distinguishes between "primary" and "secondary" definitions of agriculture.[240] The primary definition "includes farming in all its branches," ranging from "the cultivation and tillage of the soil" and "dairying" to "the production, cultivation, growing, and harvesting of any agricultural or horticultural commodities."[241] The secondary definition embraces "any practices . . . performed by a farmer or on a farm as an incident to or in conjunction with such farming operations."[242]

In its most recent examination of these definitions, the Supreme Court refused to grant agricultural treatment to live-haul crews, which transport seven-week-old broiler chickens to slaughter.[243] Diverse practices, from truck driving to poultry-skinning and the raising of worms for fishing bait, have fallen on either side of these legal definitions.[244] Generally speaking, suggestions "that agriculture has changed in the intervening" decades since the adoption of these statutory definitions invite legislative rather than judicial reform.[245]

In short, legal understandings of agriculture emphasize the production of food, fiber, or fuel commodities as an economic function independent of

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236. Farmers Reservoir & Irrigation Co. v. McComb, 337 U.S. 755, 761-62 (1949).

237. *Id.* at 762.

238. Maneja v. Waialua Agric. Co., 349 U.S. 254, 263 (1955).

239. Bayside Enters., Inc. v. Nat'l Labor Relations Bd., 429 U.S. 298, 302 (1977).

240. 29 U.S.C. § 203(f) (LexisNexis 2020).

241. *Id.*

242. *Id. See generally* Holly Farms Corp. v. Nat'l Labor Relations Bd., 517 U.S. 392, 398 (1996); *Bayside*, 429 U.S. at 300, n.7; Farmers Reservoir & Irrigation Co. v. McComb, 337 U.S. 755, 762-63 (1949).

243. *See Holly Farms Corp.*, 517 U.S. at 403.

244. *Compare* Sanderson Farms, Inc. v. Nat'l Labor Relations Bd., 335 F.3d 445 (5th Cir. 2003) (applying *Holly Farms* to exclude truck drivers in contract poultry operations from the definition of "agriculture") *with* Rodriguez v. Whiting Farms, Inc., 360 F.3d 1180, 1187 (10th Cir. 2004) (defining poultry-skinning as part of agriculture) *and* Barks v. Silver Bait, LLC, 802 F.3d 856, 865 (6th Cir. 2015) (defining vermiculture as a branch of agriculture).

245. Nat'l Broiler Mktg. Ass'n v. United States, 436 U.S. 816, 827 (1978).

upstream inputs and downstream processing. Over the course of economic evolution, conventional expectations of agrarian independence have accommodated increasing levels of outside control.

Industria est omnia divisa en tres partes. Like ancient Gaul and the modern natural gas industry,[246] all conduits are divided three ways between production, transmission and distribution. The creation of networks to deliver "power and light and fuel" to "ultimate consumers" demands the "trinitarian fusing of . . . three distinct operations: (1) making; (2) going to market; and (3) selling in packages suitable to the needs of individual customers."[247]

Every conduit consists of a physical layer, a logical layer, and a content layer.[248] The conscious decision to render an end-to-end network "stupid" by "emphasiz[ing] transmission over switching" gives users control over "the vast processing power at the network's edges."[249] Dumb pipe with hyper-intelligent edges has enabled the contemporary information-based economy to spur the creative destruction of its industrial antecedents.[250]

Agriculture likewise operates within distinct physical, logical, and content layers. Stockyards numbered among the "great national public utilities" that dominated the industrial era's "flow of commerce from the ranges and farms of the West to the consumers in the East."[251] Commodity trading platforms such as Chicago's Board of Trade modulated "the flow of wheat from the West to the mills and distributing points of the East."[252] Even the production of chrysanthemums follows a three-way division of functions among breeders, self-

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246. *Compare* JULIUS CAESAR, THE GALLIC WAR 1 (Carolyn Hammond trans., 2008) ("The whole of Gaul is divided into three parts") *with* Phillips Petroleum Co. v. Wis., 347 U.S. 672, 691 (1954) (Clark, J., dissenting) ("The natural gas industry, like ancient Gaul, is divided into three parts. These parts are production and gathering, interstate transmission by pipeline, and distribution to consumers by local distribution companies.").

247. Thomas Reed Powell, *Physics and Law — Commerce in Gas and Electricity — Interstate or Local — Connecticut Light & Power Co. v. Federal Power Commission*, 58 HARV. L. REV. 1072, 1083 (1945); *cf.* Public Utils. Comm'n v. Attleboro Steam & Elec. Co., 273 U.S. 83, 90 (1927) (characterizing electricity transmission as "not local" to either the transmitting or the receiving state, but rather "essentially national in character").

248. *See* Yochai Benkler, *From Consumers to Users: Shifting the Deeper Structures of Regulation Toward Sustainable Commons and User Access*, 52 FED. COMM. L.J. 561, 562-63 (2000).

249. David S. Isenberg, *The Dawn of the "Stupid Network*," 2.1 ACM NETWORKER 24, 26 (Feb.-March 1998), available at https://www.isen.com/papers/Dawnstupid.html [https://perma.cc/8FLH-TLSY].

250. *See generally* JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY (3d ed. 1975); CLAYTON M. CHRISTENSEN, THE INNOVATOR'S DILEMMA: WHEN NEW TECHNOLOGIES CAUSE GREAT FIRMS TO FAIL (1997).

251. Stafford v. Wallace, 258 U.S. 495, 516 (1922).

252. Bd. of Trade v. Olsen, 262 U.S. 1, 36 (1923); *see also* Lemke v. Farmers' Grain Co. 258 U.S. 50, 53-54 (1922); Dahnke-Walker Milling Co. v. Bondurant, 257 U.S. 282, 290-91 (1921); Munn v. Ill., 94 U.S. 113, 130-31 (1877).

propagators, and retail florists.[253] The production of food, fiber, and fuel commodities represents yet another of the "intricate and pervasive systems which furnish light, heat, power, water, transportation, and communication."[254]

At a higher level of biological abstraction, *all* problems of coordinated group behavior may be evaluated according to cooperation, defection, and other evolutionary dynamics.[255] The serial endosymbiosis hypothesis attributes the cellular structure of eukaryotes (which includes mitochondria and, in plants, chloroplasts) to the invasion of ancient prokaryotes by beneficial parasites.[256]

Social structures among insects reprise the evolution of cooperation: "[C]lose genetic relatives" can sometimes "reproduce more effectively if they [do] so vicariously, delegating the task to germ cells . . . or to a queen, in the case of bees."[257] Symbionts, such as plants and rhizobia, use biochemical tools to allocate resources (nitrogen) and to prevent excessive dominance by either partner.[258] Information science has described itself as "scarcely more than a philosophical anticipation of . . . cell theory," by analogy to "the Portuguese man-of-war" as "a complex structure of differentiated coelenterate polyps, where the several individuals are modified in different ways to serve the nutrition, the locomotion, the excretion, the reproduction, and the support of the colony as a whole."[259]

At long last I part company with Alasdair MacIntyre, whose conception of virtue and vice inspired this article. Consider the following English-language sentence: *Things happen for a reason*. The English word *reason* belies an ambiguity. Do things happen *for a reason*, in the sense that there is some ultimate purpose (presumably ordained by a divine or at least superhuman power)? Or do

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253. *See* Yoder Bros., Inc. v. Cal.-Fla. Plant Corp., 537 F.2d 1347, 1352 (5th Cir. 1976), *cert. denied*, 429 U.S. 1094 (1977).

254. FELIX FRANKFURTER, THE PUBLIC AND ITS GOVERNMENT 81 (1930); *accord* William Boyd, *Public Utility and the Low-Carbon Future*, 61 UCLA L. REV. 1614, 1638 (2014). *See generally* William J. Novak, *Law and the Social Control of American Capitalism*, 60 EMORY L.J. 377 (2010).

255. *See* David Sloan Wilson & Elliot Sober, *Reintroducing Group Selection to the Human Behavioral Sciences*, 17 BEHAV. & BRAIN SCI. 585 (1994).

256. *See* LYNN MARGULIS, SYMBIOSIS IN CELL EVOLUTION: LIFE AND ITS ENVIRONMENT ON THE EARLY EARTH 2-14 (1981). For a critical evaluation of serial endosymbiosis in eukaryotic evolution, see Amparo Latorre, Ana Durbán, Andrés Moya & Juli Peretó, *The Role of Symbiosis in Eukaryotic Evolution*, *in* ORIGINS AND EVOLUTION OF LIFE: AN ASTROBIOLOGICAL PERSPECTIVE 326-39 (Muriel Gargaud, Purificación López-Garcìa & Hervé Martin eds., Cambridge University Press 2011).

257. MATT RIDLEY, GENOME: THE AUTOBIOGRAPHY OF A SPECIES IN 23 CHAPTERS 232 (1999).

258. *See, e.g.*, E.M. Lodwig et al., *Amino-Acid Cycling Drives Nitrogen Fixation in the Legume*-Rhizobium *Symbiosis*, 422 NATURE 722 (2003); William C. Ratcliff, Supriya V. Kadam & Robert Ford Denison, *Poly-3-hydroxybutyrate (PHB) Supports Survival and Reproduction in Starving Rhizobia*, 65 FEMS MICROBIOL. ECOL. 391 (2008); Janet Sprint, *Mutual Sanctions*, 422 NATURE 672 (2003).

259. NORBERT WIENER, CYBERNETICS: OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE 155 (2d ed. 1961).

things happen *for a reason*, in the sense that there is an underlying causative explanation? The former sense presupposes *teleology*, the study of ultimate purposes. The latter sense confines itself to *etiology*, the study of causes.

MacIntyre unequivocally embraces teleology as a *sine qua non* of virtue and the good life: "Human beings, like the members of all other species, have a specific nature; and that nature is such that they have certain aims and goals, such that they move by nature towards a specific *telos*."[260] He blames the failure of the Enlightenment's moral project on ". . . the elimination of any notion of essential human nature and with it the abandonment of any notion of a *telos*."[261] Moral redemption awaits, not for the coming of an existential Godot, "but for another — doubtless very different — St Benedict."[262]

Ora et labora: St. Benedict's prescription of prayer and work[263] has a very specific agrarian manifestation. It finds, ironically and satirically, its best expression at the conclusion of Voltaire's *Candide*:

> Candide, as he was returning home, made profound reflections on the Turk's discourse. "This good old man," said he to Pangloss and Martin, "appears to me to have chosen for himself a lot much preferable to that of the six kings with whom we had the honor to sup." . . . "Neither need you tell me," said Candide, "that we must take care of our garden." "You are in the right," said Pangloss; "for when man was put into the garden of Eden, it was with an intent to dress it: and this proves that man was not born to be idle." "Work then without disputing," said Martin; "it is the only way to render life supportable."[264]

If this is the *telos* underlying agrarian virtue, it is a grim prescription. A tour of the best of all possible worlds, punctuated by murder, rape, and senseless cruelty, concludes with a command to keep the garden. Earth after Eden is cursed ground that humanity is destined to till for all its days.[265] As it was in the beginning, so shall it be in the end.[266]

The fault lies in treating human destiny as linear rather than circular. Not for naught have writers in the apocalyptic tradition, within and beyond law, projected visions of humanity across the scale of centuries or even millennia. *A Canticle for Leibowitz* spans 1800 years. In placing *The Case of the Speluncean Explorers* nearly 2400 years ahead of his own time, Lon Fuller noted "that the centuries which separate us from the year 4300 are roughly equal to those that have passed

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260. MACINTYRE, *supra* note 16, at 148.

261. *Id.* at 55.

262. *Id.* at 263.

263. *See* ANSELM GRÜN & LINDA M. MALONEY, BENEDICT OF NURSIA 30 (2006); LONNI COLLINS PRATT & DANIEL HOMAN, BENEDICT'S WAY: AN ANCIENT MONK'S INSIGHTS FOR A BALANCED LIFE 47 (2001).

264. VOLTAIRE, CANDIDE 81 (Nicholas Cronk ed., Third Norton Critical Edition 2016).

265. *See Genesis* 1:15, 3:17 (Revised Standard Version)

266. *Cf. Matthew* 24:37 (Revised Standard Version) ("As were the days of Noah, so will be the coming of the Son of man.").

since the Age of Pericles."[267] Virtue, agrarian or otherwise, arises not from the assertion of a purposeful *telos* (*τέλος*), but in the acceptance of *kyklos* (κύκλος).

Quoting Heraclitus, Eliot began his *Four Quartets* with the epigraph, ὁδὸς ἄνω κάτω μία καὶ ὠυτή.[268] The way up and the way down are one and the same. Survival in the present without compromise of future generations' capacity to thrive has remained the lone agrarian virtue. Self-actualization through the expressive elements of food culture is its corresponding vice. That tale represents another variant of "the never-ending contest in ourselves of good and evil."[269] As John Steinbeck realized, "evil must constantly respawn, while good, while virtue, is immortal."[270] For "[v]ice has always a new fresh young face, while virtue is venerable as nothing else in the world."[271]

267. Lon L. Fuller, *The Case of the Speluncean Explorers*, 62 HARV. L. REV. 616, 645 (1949).

268. ELIOT, *supra* note 1, at 11.

269. JOHN STEINBECK, EAST OF EDEN 413 (1952; reprint 2016).

270. *Id.*

271. *Id.*