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Texas A&M Law Review

Volume 3 | Issue 4

Article 3

7-2016

Anthropocene Agricultural Law

James Ming Chen

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Recommended Citation

James M. Chen, *Anthropocene Agricultural Law*, 3 Tex. A&M L. Rev. 745 (2016).

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FALL 2015 SYMPOSIUM: FARM TO TABLE: AGRICULTURE LAW IN THE ERA OF SUSTAINABILITY

ANTHROPOCENE AGRICULTURAL LAW

*By: James Ming Chen**

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I. CRIME AND SACRAMENT | SAKRAMENT UND VERBRECHEN

Other claims to the distinction notwithstanding, agriculture is the oldest profession.¹ From its humble origins roughly 10,000 years ago,² agriculture has catapulted humanity from Pleistocene competitiveness to Holocene dominance and Anthropocene hegemony.³ Though starvation has stalked humanity through much of its history, modern society has scored a magnificent victory. One parochial example suffices to illustrate the scale of the triumph. The first eight decades of system-

* Justin Smith Morrill Chair in Law, Michigan State University; Of Counsel, Technology Law Group of Washington, D.C. Savannah Priebe supplied information on legal controversies involving *foie gras*. Daniel D. Barnhizer provided a helpful sounding board for a discussion of Adolf Loos and Bronisław Malinowski. Jin Jirrie offered insights into peak phosphorus and developed economies’ historical domination of agricultural inputs. Special thanks to Heather Elaine Worland Chen. All bibli- cal references are drawn from the Revised Standard Version.

1. *Contra* ERMA BOMBECK, MOTHERHOOD: THE SECOND OLDEST PROFESSION (1983).

2. Contrary to longstanding anthropological belief that plant cultivation predated animal husbandry, foragers appeared to have settled down and established agriculture in Turkey in order to raise pigs. See Constance Holden, *Bringing Home the Bacon*, 264 SCI. 1398 (1994). After being established approximately 10,000 years ago, Eurasian agriculture spread as agrarian populations diffused and interbred with foraging popu- lations. See generally, e.g., Albert J. Ammerman & L. L. Cavalli-Sforza, THE NEO- LITHIC TRANSITION AND THE GENETICS OF POPULATIONS IN EUROPE 9–33 (1984); SUSAN ALLING GREGG, FORAGERS AND FARMERS: POPULATION INTERACTION AND AGRICULTURAL EXPANSION IN PREHISTORIC EUROPE (1988); COLIN RENFREW, AR- CHAEOLOGY AND LANGUAGE: THE PUZZLE OF INDO-EUROPEAN ORIGINS 145–77 (1987); John M. Howell, *Early Farming in Northwestern Europe*, SCI. AM., Nov. 1987, at 118; Robert R. Sokal, Neal L. Oden & Chester Wilson, *Genetic Evidence for the Spread of Agriculture in Europe by Demic Diffusion*, 351 NATURE 143 (1991).

3. See generally, e.g., Jan Zalasiewicz et al., *The New World of the Anthropocene*, 44 ENVTL. SCI. & TECH. 2228 (2010). The term *Anthropocene* is derived from *ἄνθρωπος* and *καινός*, the ancient Greek words for *human* and *new* (or *recent*).

atic food and drug regulation in the United States coincided with a staggering increase of twenty-six years in life expectancy, an unprecedented actuarial leap forward not likely to be duplicated.⁴

This Essay takes stock of humanity's arguably illusory victory over its old Malthusian foe.⁵ Having staved off imminent starvation, wealthy consumers in the United States and other developed nations are now free to focus their legal and political energy on the expressive aspects of food. Such bagatelles come at the price of ignoring deeper threats to the ecological and economic underpinnings of agricultural production. Had we world enough and time, food as ornament would be no crime.⁶ The onset of the Anthropocene, however, demands more serious attention to older, more venerable sources of concern. Resource exhaustion and evolutionary biology remain poised to deliver crippling blows to the agricultural system that serves as life support for affluent, industrialized society.⁷ As existential threats loom, the continued allure of purely symbolic disputes suggests that agricultural law remains content, quite literally, to bet the farm.

Amid the "Great Acceleration" of population, affluence, and technology since the Second World War,⁸ the concurrent transformation of agriculture seems a distant afterthought. "Economic progress," on or off the farm, "is characterized by a progressive division of labor and separation of function."⁹ An economic and social landscape marked by fewer, larger, and more industrialized farms, once decried as a betrayal of conventional agrarian values,¹⁰ has become the norm in developed countries. It is idle to speak of *agriculture*, which within living memory was 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," as having any meaningful

4. See Peter Barton Hutt, *Food and Drug Law: A Strong and Continuing Tradition*, 37 FOOD DRUG COSMETIC L.J. 123, 125 (1982).

5. See generally THOMAS MALTHUS, AN ESSAY ON THE PRINCIPLE OF POPULATION (1798), <http://www.esp.org/books/malthus/population/malthus.pdf> [<https://perma.cc/6U33-HGYH>].

6. Cf. Andrew Marvell, *To His Coy Mistress* (ca. 1649–60), <https://www.poets.org/poetsorg/poem/his-coy-mistress> ("Had we but world enough, and time / This coyness, Lady, were no crime") [<https://perma.cc/C2XC-QTU7>].

7. See generally JOHN KENNETH GALBRAITH, THE AFFLUENT SOCIETY (4th ed. 1984; 1st ed. 1958).

8. See generally Kathy A. Hibbard et al., *Decadal Interactions of Humans and the Environment*, in SUSTAINABILITY OR COLLAPSE? AN INTEGRATED HISTORY AND FUTURE OF PEOPLE ON EARTH 341–75 (Robert Costanza et al., eds., 2006); cf. Elizabeth Kolbert, *Enter the Anthropocene: Age of Man*, 219 NAT'L GEO. 60 (2011) (measuring informally both human prosperity and human ecological impact according to a function of population, affluence, and technology).

9. *Farmers Reservoir & Irrigation Co. v. McComb*, 337 U.S. 755, 761 (1949).

10. See, 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).

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.”¹¹ Eleven o’clock on Sunday morning, described by Martin Luther King Jr. as “the most segregated hour in America,”¹² now marks a weekly exercise in ritual without meaning, “[p]aralysed force, gesture without motion.”¹³ Parishioners across the land may recite the Lord’s Prayer, but none of them genuinely question whether God will “[g]ive us this day our daily bread.”¹⁴

On the road to prosperity, however, something strange happened to American agricultural law. Ever greater salience attaches to agricultural issues that are essentially symbolic or expressive in nature. In Anne Barnhill’s succinct formulation, many contemporary controversies in agricultural law and policy involve “the symbolic value of food choice.”¹⁵ Labeling food according to compliance with organic production standards (including avoidance of genetically modified organisms) may be one of the most salient of these issues,¹⁶ but the category of symbolic battles over food spans far more terrain. From the 2002 failed effort to regulate retail coffee sales in Berkeley, California,¹⁷ to ongoing controversies over *foie gras*¹⁸ and the epic legal

11. 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 *id.* at 2; see also *Agribusiness*, THE NEW OXFORD AMERICAN DICTIONARY (2d ed. 2005) (defining *agribusiness*). Compare R.H. Coase, *The Nature of the Firm*, 4 *ECONOMICA* 386–405 (1937) (unifying firm-level economics, especially vertical integration, with the theory of industrial organization) with Jim Chen, *Filburn’s Forgotten Footnote—Of Farm Team Federalism and Its Fate*, 82 *MINN. L. REV.* 249, 295–305 (1997) (applying Coase’s theory of the firm to agriculture).

12. See, e.g., Richard Benjamin Crosby, *Kairos as God’s Time in Martin Luther King Jr.’s Last Sunday Sermon*, 39 *RHETORIC SOC’Y Q.* 260 (2009); John H. Patton, *A Transforming Response: Martin Luther King Jr.’s “Letter from Birmingham Jail,”* 7 *RHETORIC & PUB. AFF.* 53 (2004); Allan W. Vestal, *To Soften Their Obdurate Hearts: The Southern Baptist Convention and Marriage Equality*, 21 *TUL. J.L. & SEXUALITY* 49, 81 n.200 (2012).

13. T.S. Eliot, *The Hollow Men*, in *THE COMPLETE POEMS AND PLAYS: 1909-1950*, 56, 56 (1971).

14. *Matthew* 6:11; cf. *Luke* 11:3 (“Give us each day our daily bread.”).

15. Anne Barnhill, *Choice, Respect and Value: The Ethics of Healthy Eating Policy*, 5 *WAKE FOREST J.L. & POL’Y* 1, 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 overseeing food choices and of those agencies’ dietary recommendations).

16. 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).

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

18. 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); *Illinois Rest. Ass’n v. City of Chi.*, 492 F.

battle over Vermont's law mandating the labeling of food produced through genetic engineering,¹⁹ American food fights routinely involve disagreements over the expressive or symbolic value of food. The metaphysics of food and its consumption overrides its nutritional value and the cold equations underlying the ecology and the economics of food production.

Berkeley's failed coffee referendum is instructive.²⁰ The initiative would have required all coffee sold within the city to be brewed from beans certified organic, fair-trade, shade-grown, or some combination of any of those traits. 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."²¹ 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.²² For its part, shade-grown coffee represents an ecologically sensitive approach to agroforestry, insofar as growing coffee under a biodiverse canopy outperforms coffee monocultures on unshaded plantations along multiple ecological measures.²³

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—essentially,

Supp. 2d 891 (N.D. Ill. 2007), *vacated as moot*, No. 06 C 7014, 2008 WL 8915042 (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). Given this Essay's emphasis on the cultural history of the German-speaking countries, I hasten to add that Germany has specifically banned the practice of *gavage*, or force-feeding, in the production of bird livers. See *Tierschutzgesetz [TierSchG] [Animal Protection Act]*, May 18, 2006, BGBl I at 1206, § 3, art. 9, last amended by *Gesetz [G]*, Mar 12, 2015 BGBl I at 2178, art. 8 (Ger.), (Ger.).

19. See *Labeling of Food Produced with Genetic Engineering*, 9 VT. STAT. ANN. §§ 3041–3048; *Grocery Mfrs. Ass'n v. Sorrell*, 102 F. Supp. 3d 583 (D. Vt. 2015) (finding First Amendment defects in Vermont's GMO labeling statute but declining to issue a preliminary injunction against its enforcement).

20. See Chen, *supra* note 17, at 5.

21. 7 C.F.R. § 205.2 (2016). See generally *Organic Foods Production Act*, 7 U.S.C. §§ 6501–6522 (2012).

22. See, e.g., Jesús Alvarado, *Fair Trade in Mexico and Abroad: An Alternative to the Walmartopia?* 88 J. BUS. ETHICS 301 (2009); Terrence H. Witkowski, *Fair Trade Marketing: An Alternative System for Globalization and Development*, 13 J. MARKETING THEORY & PRAC. 22 (2005).

23. See, e.g., Patricia Moguel & Victor M. Toledo, *Biodiversity Conservation in Traditional Coffee Systems of Mexico*, 13 CONSERVATION BIOLOGY 11 (1999); Ivette Perfecto, Robert A. Rice, Russell Greenberg & Martha E. van der Voort, *Shade Coffee: A Disappearing Refuge for Biodiversity*, 46 BIOSCIENCE 598 (1996).

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. “Slave of the wheel of labor, what to him / Are Plato and the swing of Pleiades?”²⁴ The freedom to choose among these three forms of nonconventional coffee cultivation instead performs the expressive function of protesting less virtuous methods for growing or distributing coffee. Drink our elixir, and you are virtuous. Drink any other swill, and you are vile.

A similar sort of internal inconsistency characterizes controversies over milk from cows treated with recombinant bovine somatotropin (“rbST”).²⁵ This bitterly contested subject has devolved into a legal stalemate. Federal appellate courts have banned not only forced disclosures of rbST use,²⁶ but also state-law prohibitions of voluntary labeling by farmers who have elected not to treat their cows with rbST.²⁷ 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,²⁸ 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.”²⁹ The resulting legal equilibrium is as unhappy as it is stable. Vermont’s comprehensive GMO labeling law, if it survives an ongoing court challenge, would decisively break this logjam in favor of staunch opponents of transgenic food technologies.

Prohibitions on *foie gras* are arguably even more pointed in their castigation of offending 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. Because public values neither demand nor enforce a strictly vegan ethos,³⁰ the law tolerates animal slaughter.³¹ At the

24. EDWIN MARKHAM, *The Man with a Hoe*, in *THE MAN WITH A HOE AND OTHER POEMS* 15, 16 (1899).

25. See generally Jim Chen, *The American Ideology*, 48 *VAND. L. REV.* 809, 863–73 (1995); Jim Chen, *The Agroecological Opium of the Masses*, *CHOICES*, Oct.–Dec. 1995, at 16.

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

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

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

29. *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).

30. *Cf. National Federation of Indep. Bus. v. Sebelius*, 132 S. Ct. 2566, 2590 (2012) (rejecting congressional power over “mandatory purchases of . . . broccoli”); *id.* at 2619–20.

31. See generally *Animal Welfare Act*, 7 U.S.C. §§ 2131–2159; 7 C.F.R. §§ 2.1–2.134.

same time, the law recognizes gradations of decency. The general right to kill animals does not necessarily subsume a specific right to engage in an agricultural technique that a democratic majority may find abhorrent.³²

The labeling controversies so prevalent in contemporary agricultural law effectively treat conventional coffee, non-organic milk, *foie gras*, and (at an extreme) all foods produced through genetic engineering as food taboos. Such “prohibitions to eat certain foods” have arisen across cultures over the full span of human history.³³ Food taboos almost invariably arise from belief in “negative magic.”³⁴ These rules of sympathetic magic dictate that contact with disgusting objects constitutes permanent contamination and that visual similarity constitutes qualitative equivalence.³⁵ Food that touches a cockroach is repulsive, and so is otherwise wholesome food shaped and colored so that it resembles a cockroach. Lest food taboos prohibiting resort to “many animals and plants, wholesome enough in themselves,” be dismissed as “superstitions of the savage,”³⁶ contemporary behavioral science recognizes the persistence of superstition and magical thinking, even among educated and emotionally stable adults.³⁷ Food taboos—ranging from seasonal limitations such as Lenten avoidance of meat and the 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.³⁸

To recognize the universality and the power of food taboos, however, need not dictate their enshrinement within secular law. As I argued two decades ago, “I do not accuse American agriculture of being too Marxist.”³⁹ Rather, “American agriculture is not Marxist

32. *Contra* Arnett v. Kennedy, 416 U.S. 134, 153–54 (1974) (plurality opinion of Rehnquist, J.) (“[W]here the grant of a substantive interest is inextricably intertwined with [procedural limitations], a litigant . . . must take the bitter with the sweet.”).

33. JAMES GEORGE FRAZER, *THE GOLDEN BOUGH: A STUDY IN MAGIC AND RELIGION* 21 (1922).

34. *See id.* at 22.

35. *See* Paul Rozin, Linda Millman & Carol Nemeroff, *Operation of the Laws of Sympathetic Magic in Disgust and Other Domains*, 50 J. PERSONALITY & SOC. PSYCHOL. 703 (1986).

36. *See* FRAZER, *supra* note 33, at 238.

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

38. Of these religious food traditions, Jewish kosher rules may have received the closest scrutiny in American legal scholarship. *See generally, e.g.*, TIMOTHY D. LYTTON, *KOSHER: PRIVATE REGULATION IN THE AGE OF INDUSTRIAL FOOD* (2013); Timothy D. Lytton, *Jewish Foodways and Religious Self-Governance in America: The Failure of Communal Kashrut Regulation and the Rise of Private Kosher Certification*, 104 JEWISH Q. REV. 38 (2014); Shayna M. Sigman, *Kosher Without Law: The Role of Nonlegal Sanctions in Overcoming Fraud Within the Kosher Food Industry*, 31 FLA. ST. L. REV. 509 (2004).

39. Jim Chen, *The American Ideology*, 48 VAND. L. REV. 809, 822 (1995).

enough.”⁴⁰ In *The German Ideology*, Karl Marx argued that philosophy, drawn from “the realm of pure thought,” had no meaning absent its “relation . . . to . . . material surroundings,” particularly the physical stuff on which humans subsist.⁴¹ The German Ideology is the fallacy that civilization has any starting point besides the amassing of food, fiber, and fuel.⁴²

The work of psychologist Abraham Maslow provides a less politically charged way to express the same point. Maslow defined a hierarchy of needs, from simple physiology to love and social esteem, and arranged as layers of a pyramid.⁴³ The first of Maslow’s layers comprises basic physiological needs (such as food, hydration, and a stable body temperature), in the sense of freedom from immediate threats to health or safety.⁴⁴ At higher levels of the pyramid, Maslow placed love (in the sense of caring for family and offspring) and esteem, which he defined as achievement, reputation, prestige, and social standing.⁴⁵ Finally, Maslow placed “self-actualization” at the top of his pyramid of needs.⁴⁶ “A musician must make music,” he wrote, “an artist must paint, a poet must write, if he is to be ultimately happy” with himself.⁴⁷

Food as ornament may be summarized as the Maslowian fulfillment of Marxist philosophy. Having feasted on our daily pumpnickel, we may freely indulge exercises in German philosophy. As befits life in the affluent, information-driven, and increasingly secular societies of the industrialized world, food multitasks. It is no longer enough that food nourishes. Food that is organic, shade-grown, cruelty-free, and subject to fair trade protocols establishes the consumer’s membership in the proper social circles. For those committed to food as a way of life, ensuring its rigorous compliance with an ethical set of production protocols is a form of self-actualization. Food as secular sacrament holds special appeal for “natural Luddites,” the “Western intellectuals who have” effectively rejected “the industrial revolution.”⁴⁸ In many and various ways, our forebears strove for the infinite through religious traditions, but these days many of us seek spiritual fulfillment

40. *Id.*

41. Karl Marx, *The German Ideology: Part I*, in THE MARX-ENGELS READER 146, 147, 149 (Robert C. Tucker ed., 2d ed. 1978).

42. Chen, *supra* note 39, at 817.

43. See A. H. Maslow, *A Theory of Human Motivation*, 50 PSYCHOL. REV. 370 (1943).

44. See *id.* at 372–76 (physiological needs, based on “homeostasis” and “appetites”); *id.* at 376–80 (safety).

45. See *id.* at 380–81 (love); *id.* at 381–82 (esteem).

46. *Id.* at 382–84.

47. *Id.* at 382.

48. C.P. SNOW, THE TWO CULTURES: AND A SECOND LOOK 22 (2d ed. 1964); see also *Cultural Divides, Forty Years On*, 398 NATURE 91, 91 (1999) (observing that *The Two Cultures* “still resonates” in a world “where cultural antipathies are very much alive and kicking”).

through food.⁴⁹ Honoring some form of food-based ethic enables many members of contemporary society to achieve communion with like-minded others around a shared sacrament.

Standing by sharp contrast and in firm opposition to food as ornament and as sacrament is a work of Austrian philosophy bisecting the historical arc from Marx to Maslow. In 1908, architect Adolf Loos gave a lecture called *Ornament und Verbrechen*, or *Ornament and Crime* in English translation.⁵⁰ *Ornament und Verbrechen* would prove to be one of the twentieth century's most influential works of artistic criticism. Indeed, it may be regarded as the manifesto of Modernism in architecture and the visual arts. In this Essay, I hope to extend Loos's esthetic philosophy, as expressed in *Ornament und Verbrechen*, to agricultural law and policy. Call it *Crime and Sacrament*.

Ornament und Verbrechen opened by invoking the greatest intellectual achievement of the preceding century, Charles Darwin's theory of evolution and its popularization in the German-speaking world by Ernst Haeckel.⁵¹ "The human embryo in the womb passes through all the evolutionary stages of the animal kingdom," Loos declared.⁵² This opening gambit united artistic criticism with Haeckel's mantra, ontogeny recapitulates phylogeny, the idea that any individual organism's life cycle replays the entire evolutionary history of its species.⁵³ Loos then equated the "evolution of culture . . . with the removal of ornament from utilitarian objects."⁵⁴ With specific reference to food, Loos observed:

Ornament does not heighten my joy in life or the joy in life of any cultivated person. If I want to eat a piece of gingerbread I choose one that is quite smooth and not a piece representing a heart or a

49. Cf. *Hebrews* 1:1–2 ("In many and various ways God spoke of old to our fathers by the prophets; . . . but in these last days he has spoken to us by a Son, whom he appointed the heir of all things, through whom also he created the world.").

50. See JANET STEWART, *FASHIONING VIENNA: ADOLF LOOS'S CULTURAL CRITICISM* 173 (2000).

51. See Jimena Canales & Andrew Herscher, *Criminal Skins: Tattoos and Modern Architecture in the Work of Adolf Loos*, 48 *ARCHITECTURAL HIST.* 235, 242 (2005).

52. Adolf Loos, *Ornament and Crime*, in *CHINESE ORNAMENT: THE LOTUS AND THE DRAGON* 19, 19 (Jessica Rawson ed., 1984). Loos's essay in its original German appears as Adolf Loos, *Ornament und Verbrechen*, in course materials posted by Professor Jörg Gleiter for *Ornament—Kampfplatz von Theorie und Praxis* (Ornament—Battleground of Theory and Practice), his winter semester 2012–2013 seminar on architectural theory (Architekturtheorie 1+2) at Technische Universität Berlin-Institut für Architektur. See http://www.architekturtheorie.tu-berlin.de/fileadmin/fg274/1_-_Adolf_Loos__Ornament_und_Verbrechen__1908_-_Auszug.pdf [https://perma.cc/HPX3-KKRM]. Subsequent citations to Loos refer to the English translation.

53. See STEPHEN JAY GOULD, *ONTOGENY AND PHYLOGENY* 76 n.* (1977). Haeckel used this convenient but sometimes misleading maxim to popularize Darwin's work. Compare GOULD, *supra*, at 76–78 (describing Haeckel's distortions of Darwin), *with id.* at 202–06 (describing how Mendelian genetics undermined Haeckel and rehabilitated prior work by his scientific rival, Karl Ernst von Baer).

54. Loos, *supra* note 52, at 20.

baby or a rider . . . The show dishes of past centuries, which display all kinds of ornaments to make the peacocks, pheasants and lobsters look more tasty, have exactly the opposite effect . . .⁵⁵

In a modern society where utilitarian necessity has overridden all decorative impulses, “ornament on things that have evolved away from the need to be ornamented represents wasted labour and ruined material.”⁵⁶ On earth if not in hell,⁵⁷ “the form of an object lasts” only “as long as the object lasts physically.”⁵⁸ Consequently, the production of ornament (as opposed to strictly utilitarian objects) commits “a crime . . . through the fact that ornament inflicts serious injury on people’s health, on the national budget and hence on cultural evolution.”⁵⁹ Drawing its “greatness” from its inability to “produc[e] a new ornament,” our contemporary age has “fought [its] way through to freedom from ornament.”⁶⁰ That freedom has given rise to “spiritual strength.”⁶¹ The free borrowing of “the ornaments of earlier or alien cultures” liberates an advanced society to “concentrate[] [its] own inventiveness on other things.”⁶²

Especially in its own artistic domain, *Ornament und Verbrechen* remains controversial. Modernism as critique is so corrosive that it consumes itself, for any movement driven by change and crisis fulfills its own prophecy through self-destruction. “Thinking through the transitory concept of modernity can lead to the end of modernity thus precipitating the advent of postmodernism.”⁶³ As a result, “the many virtues of modern design—such as functional, modern, useful, and lawful” coexist with their “opposites in modern life: dysfunctional, primitive, useless, and criminal.”⁶⁴

Loos’s modernist esthetic nevertheless embodies an almost mathematical ambition to attain “a beauty cold and austere, . . . without [any] appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show.”⁶⁵ The closest

55. *Id.* at 21.

56. *Id.* at 23.

57. Cf. ROBERT PINSKY, *THE INFERNO OF DANTE: A NEW VERSE TRANSLATION* 24–25 (1994) (canto III) (“Dinanzi a me non fuor cose create / se non eterne, e io eterna duro.”) (“No things were / before me not eternal; eternal I remain.”).

58. Loos, *supra* note 52, at 22.

59. *Id.* at 21.

60. *Id.* at 20.

61. *Id.* at 24.

62. *Id.*

63. HILDE HEYENEN, *ARCHITECTURE AND MODERNITY* 12–13 (1999). On postmodernism, the most comprehensive response to Loos’s modernist esthetic, see generally JOSEPH RYKWERT, *THE NECESSITY OF ARTIFICE* (1982); Joseph Rykwert, *Ornament Is No Crime*, 190:977 *STUDIO INT’L* 91 (Sept./Oct. 1975); Joseph Rykwert, *Ornament: Not Vain Repetition*, 160 *ARCHITECTURAL REV.* 332 (1976).

64. Canales & Herscher, *supra* note 51, at 251.

65. Bertrand Russell, *The Study of Mathematics*, in *MYSTICISM AND LOGIC AND OTHER ESSAYS* 47–57, 48 (1918); accord Jim Chen, *Truth and Beauty: A Legal Trans-*

legal parallel to *Ornament und Verbrechen* may come from Bronisław Malinowski, whose studied custom and criminal justice in primitive societies at the same time James George Frazer documented universal mythology in *The Golden Bough*.⁶⁶ The function of law, said Malinowski, “is to curb certain natural propensities, to hem in and control human instincts and to impose a non-spontaneous, compulsory behavior.”⁶⁷ Much more recently, Kenji Yoshino has likewise subordinated the inherent “falsity, irrationality, and seductiveness” of literature and poetry to the strictly civic “functions of the state.”⁶⁸ Any reconciliation of poetry with civic governance demands that this “polluted discourse”⁶⁹ demonstrate “affirmatively . . . that it can fulfill state functions.”⁷⁰

Let us therefore get to work. The wealth of the Great Acceleration, as it happens, may be illusory. If so, the exuberance of food as ornament—as expressed through the profusion of laws facilitating labeling schemes, esthetically motivated production protocols, and consumer choice—confronts the reality of scarcity. What began as a paean to Ernst Haeckel’s edict, “ontogeny recapitulates phylogeny,” collides with the grim, double-edged blade of ecology and economics. Haeckel coined both of those terms, too, in homage to the ancient Greek word *οἶκος*.⁷¹ In a world of finite resources, the legal variant of *Ornament und Verbrechen* dictates “a type of co-operation which is based on mutual concessions and sacrifices for a common end.”⁷² This Essay now turns to those vital questions of housekeeping.

lation, 41 U. TOLEDO L. REV. 261, 265 (2010); cf. Edna St. Vincent Millay, *Euclid Alone Has Looked on Beauty Bare*, in SELECTED POEMS 52 (J.D. McClatchy ed., 2003) (“Euclid alone has looked on Beauty bare.”).

66. See FRAZER, *supra* note 33; BRONISŁAW MALINOWSKI, CRIME AND CUSTOM IN SAVAGE SOCIETY (1926).

67. MALINOWSKI, *supra* note 66, at 64; FRIEDRICH NIETZSCHE, TWILIGHT OF THE IDOLS AND THE ANTI-CHRIST 54 (R.J. Hollingdale trans., 2003) (defining vice as “the inability *not* to react to a stimulus”).

68. Kenji Yoshino, *The Poet and the City*, 114 YALE L.J. 1835, 1838–39 (2005).

69. *Id.* at 1839.

70. *Id.* at 1859; accord Jim Chen, *Poetic Justice*, 28 CARDOZO L. REV. 581, 592–93 (2006).

71. See Gary W. Barrett & Almo Farina, *Integrating Ecology and Economics*, 50 BIOSCIENCE 311, 311 (2000). In the event its definition is not evident from the context, *οἶκος* means “house.”

72. MALINOWSKI, *supra* note 66, at 64.

II. HUMANITY'S TWILIGHT | MENSCHENDÄMMERUNG⁷³

A specter is haunting humanity, the specter of the Anthropocene.⁷⁴ The human footprint on the global environment has become so deep that some scientists have urged the redesignation of our moment in geological time. We have passed, so it has been argued, from the Holocene epoch to the Anthropocene.⁷⁵ Although formal recognition of an Anthropocene epoch remains elusive as a matter of stratigraphy,⁷⁶ the concept provides a vivid, salient reminder that human activity has had a profound impact on every physical and biological aspect of the planet.⁷⁷ One proposal aligns the onset of the Anthropocene with the rise of agriculture:

Defining the onset of the Anthropocene in terms of the initial domestication of plants and animals world-wide 11,000–9000 years ago . . . resolves the serious challenge of satisfying geological standards for establishing a new epoch in a much more compelling manner than . . . alternative starting dates . . . , including the Industrial Revolution⁷⁸

Shifts in geological time are typically associated with mass extinction events. The Phanerozoic Eon, a span of 542 million years beginning with the emergence of hard-shelled animals,⁷⁹ has witnessed at least five catastrophic collapses in biodiversity: the Ordovician-Silurian, the late Devonian, the Permian-Triassic, the Triassic-Jurassic, and

73. Cf. NIETZSCHE, TWILIGHT OF THE IDOLS, *supra* note 67. Nietzsche's original title of *Twilight of the Idols* in German was GÖTZEN-DÄMMERUNG, ODER WIE MAN MIT DEM HAMMER PHILOSOPHIERT (1889).

74. Cf. Marx & Engels, *Manifesto of the Communist Party*, in THE MARX-ENGELS READER, *supra* note 41, at 331, 335 (“A spectre is haunting Europe—the spectre of Communism.”).

75. See Paul J. Crutzen, *Geology of Mankind*, 415 NATURE 23 (2002); Paul J. Crutzen & Eugene F. Stoermer, *The Anthropocene*, GLOBAL CHANGE NEWSLETTER, May 2000, at 17; *The Human Epoch*, 473 NATURE 254 (2011).

76. See Jan Zalasiewicz et al., *Stratigraphy of the Anthropocene*, 369 PHIL. TRANSACTIONS ROYAL SOC'Y A 1036 (2011); Jan Zalasiewicz, Mark Williams, Will Steffen & Paul Crutzen, *The New World of the Anthropocene*, 44 ENVTL. SCI. TECH. 2228 (2010).

77. Compare Whitney J. Autin & John M. Holbrook, *Is the Anthropocene an Issue of Stratigraphy or Pop Culture?*, 22 GSA TODAY 60, 60–61 (2012), with Jan Zalasiewicz et al., *Response to Autin and Holbrook on “Is The Anthropocene an Issue of Stratigraphy or Pop Culture?”*, GSA TODAY ONLINE: COMMENTS & REPLIES (Oct. 2012), <http://www.geosociety.org/gsatoday/comment-reply/pdf/i1052-5173-22-10-e21.pdf>.

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

79. See, e.g., Alexander V. Markov & Andrey V. Korotayev, *Phanerozoic Marine Biodiversity Follows a Hyperbolic Trend*, 16 PALAEOORLD 311 (2007); Kenneth G. Miller et al., *The Phanerozoic Record of Global Sea-Level Change*, 310 SCI. 1293 (2005). The term *Phanerozoic* is derived from the ancient Greek words φανερός and ζωή, which together mean “visible life.”

the Cretaceous-Paleogene.⁸⁰ Strictly as a quantitative matter, the current rate of biodiversity loss constitutes a sixth great extinction spasm.⁸¹

Given the biological thinness of the human larder—barely 100 species account for nine-tenths of plant matter consumed globally⁸²—biodiversity loss weighs heavily on agriculture. Despite some progress in forestalling specific extinctions⁸³ and in conserving some swaths of critical habitat,⁸⁴ specific indicators such as vertebrates,⁸⁵ tropical forests,⁸⁶ and coral reefs⁸⁷ indicate severe declines in biodiversity. Anthropogenic climate change drives much of the destruction.⁸⁸

“But climate change is only the tip of the iceberg.”⁸⁹ As earth rapidly approaches certain limits on its carrying capacity, the Anthropocene epoch compels respect for a “spaceman economy,” or a view of the planet as “a closed system necessitating consideration and careful planning of the consequences of human economic activity.”⁹⁰ 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.”⁹¹

80. See, e.g., David M. Raup & J. John Sepkoski, Jr., *Mass Extinctions in the Marine Fossil Record*, 215 SCI. 1501, 1501–02 (1982); Robert A. Rohde & Richard A. Muller, *Cycles in Fossil Diversity*, 434 NATURE 208, 208–09 (2005).

81. 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 SCI. 1164 (2010).

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

83. See Taylor H. Ricketts et al., *Pinpointing and Preventing Imminent Extinctions*, 102 PROC. NAT'L ACAD. SCI. 18,497 (2005).

84. See Güven Eken et al., *Key Biodiversity Areas as Site Conservation Targets*, 54 BIOSCIENCE 1110 (2004).

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

86. 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. NAT'L ACAD. SCI. 9439 (2008).

87. 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).

88. See, e.g., Douglas H. Erwin, *Climate as a Driver of Evolutionary Change*, 19 CURRENT BIOLOGY R575 (2009); Camille Parmesan, *Ecological and Evolutionary Responses to Recent Climate Change*, 37 ANN. REV. ECOLOGY EVOLUTION & SYSTEMATICS 637 (2006); Andreas Schmittner et al., *Climate Sensitivity Estimated from Temperature Reconstructions of the Last Glacial Maximum*, 334 SCI. 1385 (2011).

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

90. Douglas A. Kysar, *Sustainability, Distribution, and the Macroeconomic Analysis of Law*, 43 B.C. L. REV. 1, 10 (2001) (citing Kenneth E. Boulding, *The Economics of the Coming Spaceship Earth*, in VALUING THE EARTH: ECONOMICS, ECOLOGY, ETHICS 297 (Herman E. Daly & Kenneth N. Townsend eds., 1993)).

91. Steffen et al., *supra* note 89, at 843.

Put bluntly, sheer exhaustion of basic inputs jeopardizes agriculture as we know it.

Perhaps the best known problem of resource exhaustion involves petroleum, the cheapest, most abundant, and most versatile of earth's fossil fuels. The "peak oil" concept originated in geologist M. King Hubbert's prediction that peak production of petroleum would signal its eventual depletion.⁹² Subsequent work has elaborated peak oil as a singularly alarming problem for a world still hooked on fossil fuels.⁹³ If only as a matter of methodology, no other problem of resource depletion has loomed larger in the scientific and economic imagination. Hubbert's model of peak production underlies the long-term forecasting of the ultimate exhaustion of a depletable resource.⁹⁴

The distributive implications of peak oil bode ill for poorer countries. The supply of petroleum must "keep pace with demand if the large developing countries are to repeat the pathway" paved by today's wealthiest economies "in their post-World War II economic expansion, when oil was plentiful and inexpensive."⁹⁵ That smooth developmental track, propelled by "plentiful, cheap fossil fuel . . . and large expanses of productive land," now lies beyond the reach of "the 75-80% of the human population" that seeks "trajectories out of poverty" and has begun "to compete with today's wealthy countries for increasingly scarce resources."⁹⁶

Despite the Great Acceleration, "[m]ost of our fellow human beings . . . are underfed and die before their time."⁹⁷ Although "that is the social condition," the "loneliness" accompanying its wealth tempts the developed world "to sit back, complacent in [its] unique tragedy, and let . . . others go without a meal."⁹⁸ Exacerbating already difficult circumstances, the "new economic giants of Asia [are] mov[ing] to se-

92. See M. KING HUBBERT, *NUCLEAR ENERGY AND THE FOSSIL FUELS* 22, 22–23 (1956), <http://www.hubbertpeak.com/hubbert/1956/1956.pdf>; M. King Hubbert, *Energy from Fossil Fuels*, 109 *SCI.* 103 (1949).

93. See JACQUES GRINEVALD, *LA BIOSPHERE DE L'ANTHROPOCENE: CLIMAT ET PETROLE, 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).

94. See Alfred J. Carvallo, *Hubbert's Petroleum Production Model: An Evaluation and Implications for World Oil Production Forecasts*, 13 *NAT. RESOURCES RES.* 211 (2004); Steve Sorrell & Jamie Speirs, *Hubbert's Legacy: A Review of Curve-Fitting Methods to Estimate Ultimately Recoverable Resources*, 19 *NAT. RESOURCES RES.* 209 (2010); cf. Jean Laheirère, *Distributions de Type "Fractal Parabolique" dans la Nature*, 322 *COMPTES RENDUS DE L'ACADEMIE DES SCI. IIA (SCI. DE LA TERRE ET DES PLANETES)* 535 (1996) (reviewing the mathematical relationships between the logistic function, the Hubbert curve, the normal distribution, and parabolic fractals).

95. Steffen et al., *supra* note 89, at 854.

96. Will Steffen et al., *The Anthropocene: From Global Change to Planetary Stewardship*, 40 *AMBIO* 739, 739 (2011).

97. SNOW, *supra* note 48, at 6.

98. *Id.* at 6–7.

cure food resources in non-Asian territories,” particularly through a “‘land grab’ in relation to Africa.”⁹⁹ As tempting as it may be for rich countries to dismiss their poorer counterparts’ desire for economic development, global equality is likely to pay dividends in political stability and perhaps even improved economic performance around the world.¹⁰⁰

“Less well known” than peak oil “is the potential shortage of the mineral phosphorus.”¹⁰¹ Along with nitrogen and potassium, phosphorus is one of three macronutrients in plant fertilizers.¹⁰² Global supplies of phosphorus are expected to peak in 2030 and to be exhausted within another thirty to eighty years.¹⁰³ As global population continues to increase, and especially “as diets change with the rapid development of China, India, and other large developing countries,” phosphorus production will probably peak before demand for this element reaches its apex.¹⁰⁴ “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 the peak oil problem predicts, but also “a deterioration of food security” traceable to peak phosphorus.¹⁰⁵

The Supreme Court of the United States long ago recognized the significance of macronutrients in plant fertilizer. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*¹⁰⁶ 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.¹⁰⁷

99. Steffen et al., *supra* note 96, at 739; see also Saturnino M. Borrás Jr. et al., *Towards a Better Understanding of Global Land Grabbing: An Editorial Introduction*, 38 J. PEASANT STUD. 209 (2011).

100. See generally RICHARD WILKINSON & KATE PICKETT, *THE SPIRIT LEVEL: WHY GREATER EQUALITY MAKES SOCIETIES STRONGER* (2009); cf. Duncan Sindel, *The Limits of Hegemonic Stability Theory*, 39 INT'L ORG. 579 (1985) (describing the constraints on the competing hypothesis that international stability depends on the presence of a single, dominant state).

101. Steffen et al., *supra* note 96, at 739.

102. See Harri Kiiski et al., *Fertilizers, 2. Types*, in ULLMAN'S ENCYCLOPEDIA OF INDUSTRIAL CHEMISTRY 2 (7th ed. 2011).

103. See Stuart White & Dana Cordell, *Peak Phosphorus: The Sequel to Peak Oil*, PHOSPHORUS FUTURES, <http://phosphorusfutures.net/the-phosphorus-challenge/peak-phosphorus-the-sequel-to-peak-oil/> [<https://perma.cc/WB8E-AUG5>]; Dana Cordell et al., *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 GEOCHEMISTRY S307 (2011).

104. Steffen et al., *supra* note 89, at 854.

105. See *id.*

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

107. See *id.* at 131–32.

As *Funk Bros.* is to peak phosphorus, the 2013 case of *Bowman v. Monsanto Co.*¹⁰⁸ presages peak glyphosate.¹⁰⁹ *Bowman* is best known for holding that the patent exhaustion doctrine—the principle 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.¹¹⁰

In an agricultural vision befitting the Anthropocene, however, *Bowman* epitomizes the need to consider the evolutionary consequences of legal decisions in light of the “staggering sweep of geological time and the sheer extent of life on earth.”¹¹¹ Many technologies have accelerated the treadmill on which agriculture runs.¹¹² This treadmill runs in evolutionary as well as economic terms. Just as the Red Queen of Alice’s Wonderland keeps running without seeing new terrain (because the landscape moves with her),¹¹³ evolution routinely outpaces human intervention.¹¹⁴ Although the Red Queen also stalks agriculture through resistance to pesticides¹¹⁵ and antibiotics,¹¹⁶ I will illustrate the problem through the example of herbicide resistance.

108. *Bowman v. Monsanto Co.*, 133 S. Ct. 1761 (2013).

109. The following discussion of “peak glyphosate” draws heavily from 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, 259–63.

110. *Bowman*, 133 S. Ct. at 1764. See generally Daryl Lim, *Living with Monsanto*, 2015 MICH. ST. L. REV. 559.

111. Jim Chen, *Legal Mythmaking in A Time of Mass Extinctions: Reconciling Stories of Origins with Human Destiny*, 29 HARV. ENVTL. L. REV. 279, 283 (2005). See generally Ryan M.T. Iwasaka, Note, *From 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 patenting decisions on the subsequent evolutionary development of living organisms, whether or not subject to the patent at issue).

112. 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).

113. See LEWIS CARROLL, *THROUGH THE LOOKING-GLASS AND WHAT ALICE FOUND THERE* 46 (Martin Gardner ed., 1998) (1st ed. 1871) (“Now, *here*, you see, it takes all the running you can do, to keep in the same place.”).

114. 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, R. Axelrod & R. Tanese, *Sexual Reproduction as an Adaptation to Resist Parasites*, 87 PROC. NAT’L ACAD. SCI. 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).

115. See, e.g., Aaron J. Gassman et al., *Field-Evolved Resistance by Western Corn Rootworm to Multiple *Bacillus Thuringiensis* Toxins in Transgenic Maize*, 111 PROC. NAT’L ACAD. SCI. 5141 (2014).

116. 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).

The transgenic modification of crops has occasioned a decrease in the application of chemical insecticides, coupled with a dramatic increase in the deployment of broad-spectrum herbicides.¹¹⁷ The overwhelming focus in contemporary debates over genetically modified food crops involves putative threats to food safety and human health. Arguments over the economic impact of these crops on farmers (especially organic farmers and others seeking to avoid annual purchases of patented seed) run a close second in passion. But these concerns obscure the potential for ecological and evolutionary damage from the nearly universal adoption of herbicide-resistant crops. As of 2013, 85% of all corn, 82% of all cotton, and 93% of all soybeans planted in the United States had been genetically engineered to resist herbicides.¹¹⁸

Broad-spectrum herbicides and herbicide-resistant crops are substitutes for demoralizing physical labor. Without herbicides, the farmer must remove weeds by raw force. In the case of cotton, the alternative of chopping 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.”¹¹⁹ Or 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.”¹²⁰

Glyphosate, the active ingredient in Monsanto’s Roundup herbicide, 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-tolerant and herbicide-resistant “superweeds.”¹²¹ Almost immediately after Monsanto released its Roundup Ready technology, the first cases of glyphosate resistance in rigid ryegrass (*Lolium rigidum*) were documented in Australia.¹²² Glyphosate-resistant ryegrass has been de-

117. See Graham Brookes & Peter Barfoot, *Key Environmental Impacts of Global Genetically Modified (GM) Crop Use 1996–2011*, 4 GM CROPS & FOOD 109, 109–10 (2013).

118. See USDA, *Acreage*, NAT’L AGRIC. STAT. SERV., 33, 33–34, 36–37 (June 28, 2013), <http://www.usda.gov/nass/PUBS/TODAYRPT/acrg0615.pdf> [<https://perma.cc/5U78-XPAL>].

119. *Castillo v. Givens*, 704 F.2d 181, 183 (5th Cir. 1983) (footnote omitted).

120. JAMES AGEE, *COTTON TENANTS: THREE FAMILIES* 129 (John Summers ed., 2013).

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

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

tected around the world.¹²³ Glyphosate resistance has been reported in Palmer amaranth, or pigweed (*Amaranthus palmeri*);¹²⁴ hairy fleabane, or buva (*Conyza bonariensis*);¹²⁵ horseweed (*Conyza canadensis*);¹²⁶ Johnsongrass (*Sorghum halepense*);¹²⁷ and goosegrass (*Eleusine indica*).¹²⁸ Glyphosate resistance in common lambsquarters (*Chenopodium album*), a weed of special concern to cotton farmers,¹²⁹ is particularly dispiriting.¹³⁰ Glyphosate replaced older herbicides affected by voluntary cancellation and termination of use of organic arsenicals under § 6(f)(1) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).¹³¹

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. Pesticides and herbicides, however, “do not go gentle into that good night.”¹³² Despite its notorious reputation as an endocrine disruptor

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

124. See A. Stanley Culpepper et al., *Glyphosate-Resistant Palmer Amaranth (Amaranthus palmeri) Confirmed in Georgia*, 54 WEED SCI. 620, 621 (2006).

125. See Martin M. Vila-Aiub et al., *Glyphosate-Resistant Weeds of South American Cropping Systems: An Overview*, 64 PEST MGMT. SCI. 366 (2008); L. Vargas et al., *Buva (Conyza bonariensis) Resistente ao Glyphosate na Região Sul do Brasil*, 25 PLANTA DANINHA 573 (2007).

126. See Xia Ge et al., *Rapid Vacuolar Sequestration: The Horseweed Glyphosate Resistance Mechanism*, 66 PEST MGMT. SCI. 345 (2010), corrected, 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 (2005).

127. See Martin M. Vila-Aiub et al., *Evolution of Glyphosate-Resistant Johnsongrass (Sorghum halepense) in Glyphosate-Resistant Soybean*, 55 WEED SCI. 566 (2007).

128. Lim Jung Lee & Jeremy Ngim, *A First Report of Glyphosate-Resistant Goosegrass (Eleusine indica (L) Gaertn) in Malaysia*, 56 PEST MGMT. SCI. 336 (2000).

129. See generally BILL CURRAN ET AL., *BIOLOGY AND MANAGEMENT OF COMMON LAMBSQUARTERS* (2007), <http://glyphosateweeds crops.org/Info/GWC-11.pdf> [<https://perma.cc/AYB3-GANG>].

130. See Stephen R. King et al., *Differential Response of Common Lambsquarters (Chenopodium album) Biotype to Glyphosate*, 44 WEED SCI. 68 (2004); Christopher L. Schuster et al., *Response of Common Lambsquarters (Chenopodium album) to Glyphosate as Affected by Growth Stage*, 55 WEED SCI. 147 (2007); Andrew M. Westhoven et al., *Characterization of Selected Common Lambsquarters (Chenopodium album) Biotypes with Tolerance to Glyphosate*, 56 WEED SCI. 685 (2008).

131. 7 U.S.C. § 136d(f)(1) (2012); see Organic Arsenicals: Product Cancellation Order and Amendments to Terminate Uses, 74 Fed. Reg. 50,187 (Sept. 30, 2009) (including monosodium methanearsonate (MSMA), disodium methanearsonate (DSMA), calcium acid methanearsonate (CAMA), and cacodylic acid and its sodium salt), amended, Organic Arsenicals, 78 Fed. Reg. 18,590 (Mar. 27, 2013). Notably, the EPA exempted the use of MSMA on cotton.

132. See generally DYLAN THOMAS, *Do Not Go Gentle into That Good Night, in THE POEMS OF DYLAN THOMAS* 207 (Daniel Jones ed., 1971).

and an emasculator of frogs,¹³³ atrazine remains America's leading herbicide.¹³⁴ In its own time, glyphosate will "[r]age, rage against the dying of the light."¹³⁵ Whatever its other legal and economic implications,¹³⁶ the 2015 expiration of Monsanto's original Roundup Ready patent¹³⁷ will almost certainly expand glyphosate use and the rate at which non-crop plants evolve resistance.

Meanwhile, superweed resistance to glyphosate has spurred the development of crops engineered to tolerate another organophosphorus compound with broad-spectrum herbicidal qualities, glufosinate.¹³⁸ Bayer CropScience, a leading rival to Monsanto, has incorporated glufosinate resistance into soybeans, cotton, corn, and canola,¹³⁹ and intends to expand production of the herbicide itself.¹⁴⁰ Atrazine yesterday, glyphosate today, glufosinate tomorrow.

Resource exhaustion and a rapidly accelerated evolutionary treadmill pose formidable challenges to Anthropocene agriculture. Although food law fetishists keep framing legal issues surrounding the use of genetically modified organisms in agriculture as matters of consumer rights or awareness, the real issues involve agriculture's productive capacity—or, even more urgently stated, its destruction.

133. See Tyrone Hayes et al., *Atrazine-Induced Hermaphroditism at 0.1 ppb in American Leopard Frogs (Rana pipiens): Laboratory and Field Evidence*, 111 ENVTL. HEALTH PERSP. 568, 572, 574–75 (2003); Tyrone B. Hayes et al., *Atrazine Induces Complete Feminization and Chemical Castration in Male African Clawed Frogs (Xenopus laevis)*, 107 PROC. NAT'L ACAD. SCI. 4612 (2010); Janet Koprivnikar et al., *Contaminant Effects on Host-Parasite Interactions: Atrazine, Frogs, and Trematodes*, 26 ENVTL. TOXICOLOGY & CHEMISTRY 2166 (2007); Kaori Mizota & Hiroshi Ueda, *Endocrine Disrupting Chemical Atrazine Causes Degranulation through G_{q/11} Protein-Coupled Neurosteroid Receptor in Mast Cells*, 90 TOXICOLOGICAL SCI. 362 (2005).

134. See Frank Ackerman, *The Economics of Atrazine*, 13 INT'L J. OCCUPATIONAL & ENVTL. HEALTH 437 (2007); U.S. Env'tl. Prot. Agency, *Atrazine: Chemical Summary, TOXICITY & EXPOSURE ASSESSMENT FOR CHILD HEALTH* (2007), https://archive.epa.gov/region5/teach/web/pdf/atrazine_summary.pdf [<https://perma.cc/YBZ2-3KCR>].

135. THOMAS, *supra* note 132, at 207.

136. See generally Benjamin M. Cole et al., *Food for Thought: Genetically Modified Seeds as De Facto Standard-Essential Patents*, 85 U. 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) (discussing Monsanto and DuPont's patent infringement and antitrust disputes over Monsanto's Roundup Ready patent).

137. *Newsroom*, MONSANTO, <http://www.monsanto.com/newsviews/pages/roundup-ready-patent-expiration.aspx> [<https://perma.cc/G8DL-XLNP>].

138. See generally UNITED STATES ENVTL. PROT. AGENCY, DOCKET NO. EPA-HQ-OPP-2008-0190, GLUFOSINATE SUMMARY DOCUMENT REGISTRATION REVIEW: INITIAL DOCKET MARCH 2008.

139. See *All Crops*, BAYER CROPSCIENCE, <http://www.bayercropscience.us/products/traits/libertylink/crops> [<https://perma.cc/YDB4-B62Z>].

140. See *Growing Weed Resistance Drives Demand for Alternative Technologies: Bayer CropScience Announces Intention to Construct a State-of-the-Art Facility for Glufosinate-Ammonium Herbicide*, SEEDQUEST, http://www.seedquest.com/news.php?type=news&id_article=36923 [<https://perma.cc/KW7Q-2YXC>].

At a minimum, and as an economically tractable starting point, the impact on food prices alone should provide cause for legal concern. The interaction of prices with production, imports, and exports “is a dynamic system with many feedback loops,” spanning such factors as “demand dynamics (including biofuels), slowing production, increasing cost of production, currency valuations, physical product shocks (weather, disease or political instability), aggressive purchase by countries, financial speculation and export restrictions.”¹⁴¹ Although price shocks pose a greater challenge to poorer countries, natural ecology and human economy also collide in the richer lands of the Anthropocene. Paradoxically, “human well-being has reached high levels in many countries while our planetary life support system is simultaneously being eroded.”¹⁴²

Existing economic and legal institutions are poorly adapted to manage the challenges of the Anthropocene. The “increasing complexity” accompanying the exponential growth of population, affluence, and technology since the Great Acceleration means that “it is no longer useful to concentrate on environmental challenges and variables individually.”¹⁴³ The real challenge facing global governance “lies in the intertwining of multi-scale challenges across sectors,” such as “environment, demographics, pandemics, [and] political unrest.”¹⁴⁴ If left unchecked and allowed to “continue unabated through this century,” these “ultimate drivers of the Anthropocene . . . may well threaten the viability of contemporary civilization and perhaps even the future existence of *Homo sapiens*.”¹⁴⁵

141. ALED JONES & BRADLEY HILLER, REVIEW OF THE RESPONSES TO FOOD PRODUCTION SHOCKS 28 (2015) (report of the United Kingdom Global Food Security Programme), <http://www.foodsecurity.ac.uk/assets/pdfs/review-of-responses-to-food-production-shocks.pdf> [<https://perma.cc/HU9R-U5L9>]. See generally Gal Hachman et al., *Quantifying the Causes of the Global Food Commodity Price Crisis*, 68 BIOMASS & BIOENERGY 106 (2014).

142. Steffen et al., *supra* note 96, at 749. 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).

143. Steffen et al., *supra* note 96, at 752; cf. Elizabeth Kolbert, *Enter the Anthropocene: Age of Man*, 219 NAT'L GEO. 60 (2011) (measuring informally both human prosperity and human ecological impact according to a function of population, affluence, and technology).

144. Steffen et al., *supra* note 96, at 752. See generally PANARCHY: UNDERSTANDING TRANSFORMATIONS IN HUMAN AND NATURAL SYSTEMS (Lance H. Gunderson & C.S. Holling eds., 2002); MARTEN SCHEFFER, CRITICAL TRANSITIONS IN NATURE AND SOCIETY (2009); Brian Walker et al., *Looming Global-Scale Failures and Missing Institutions*, 325 SCI. 1345 (2009).

145. Steffen et al., *supra* note 89, at 862.

III. BETTING THE FARM |
NICHT GOTT SONDERN MENSCH WÜRFELT

Nicht Gott sondern Mensch würfelt mit dem Universum: It is not God, but rather humanity, that plays dice with the universe.¹⁴⁶ No less than natural language, risk-taking is a species property of human beings, comparable to “echolocation in bats or stereopsis in monkeys.”¹⁴⁷ Though human choices under risk and uncertainty may “not always [be] rational in the traditional sense,” those choices take an “orderly” rather than “chaotic and intractable” path.¹⁴⁸ Human risk-taking arises from the same material as universal grammar and the atoms of language.¹⁴⁹

The extreme conditions of the Anthropocene epoch, however, put the innate decision-making mechanisms of humans under severe stress. Even in the absence of environmental considerations such as global climate change and impending resource exhaustion, economic history is pockmarked with extreme tail events exceeding traditional forecasts.¹⁵⁰ September 1939, the opening month of World War II, recorded a 9σ departure from the history of correlations between market returns and beta from 1955 through 1968.¹⁵¹ Smaller, less liquid markets reveal even greater shocks. A fifty-year survey of oil prices, from 1960 through 2010, has revealed a 37σ event in 1973.¹⁵² 37σ ! It would not have been unreasonable to surmise that “the economic world as we knew it was coming to an end.”¹⁵³ The expected time

146. “Gott würfelt nicht,” or “God does not play dice with the universe,” a saying attributed to Albert Einstein, arises from a December 4, 1926, letter to Max Born: “Die Quantenmechanik ist sehr achtungsgebietend. Aber eine innere Stimme sagt mir, daß das noch nicht der wahre Jakob ist. Die Theorie liefert viel, aber dem Geheimnis des Alten bringt sie uns kaum näher. Jedenfalls bin ich überzeugt, daß *der* nicht würfelt.” MAX BORN, *PHYSIK IM WANDEL MEINER ZEIT* 244 (3d ed. 1983); ALBERT EINSTEIN, HEDWIG UND MAX BORN: BRIEFWECHSEL 1916–1955, at 97 (Bertrand Russell preface, Werner Heisenberg intro., 1972). In my English translation: “Quantum mechanics is certainly impressive. But an inner voice tells me that it’s not yet the real McCoy. The theory says a lot, but it barely gets us closer to the secrets of God. Anyway, I am convinced that *He* does not play dice.”

147. Steven Pinker & Paul Bloom, *Natural Language and Natural Selection*, in *THE ADAPTED MIND: EVOLUTIONARY PSYCHOLOGY AND THE GENERATION OF CULTURE* 451, 451 (Jerome H. Barkow, Leda Cosmides & John Tooby eds., 1992).

148. Amos Tversky & Daniel Kahneman, *Advances in Prospect Theory: Cumulative Representation of Uncertainty*, 5 *J. RISK & UNCERTAINTY* 297, 317 (1992).

149. See generally MARK C. BAKER, *THE ATOMS OF LANGUAGE: THE MIND’S HIDDEN RULES OF GRAMMAR* (2002).

150. See William D. Nordhaus, *The Economics of Tail Events with an Application to Climate Change*, 5 *REV. ENVTL. ECON. & POL’Y* 240, 242–43 (2011) (identifying 10σ events in both directions within the record of monthly fluctuations in American stock market prices from 1871 through 2010).

151. See Juan Salazar & Annick Lambert, *Fama and MacBeth Revisited: A Critique*, 1 *AESTIMATIO* 48, 64 (2010).

152. See Nordhaus, *supra* note 150, at 243.

153. *Id.*

between 25σ events—roughly 1.309×10^{136} years—spans “more millennia than the universe has number of particles.”¹⁵⁴

Loss scenarios of a magnitude befitting the Anthropocene epoch force us to contemplate appropriate responses to “infinite disutility.”¹⁵⁵ The presence of fat tails, especially when they are fat enough to push probability distributions toward the intractable extreme of infinite variance, thrusts us into “ignorance about both the exact form of the distribution (e.g., normal, Pareto, or exponential) and the exact parameters of the distribution.”¹⁵⁶

Probabilities and losses sufficiently grandiose to portend the end of civilization, possibly even the survival of humans as a species, have given rise to a “dismal theorem”: The “catastrophe-insurance aspect of such a fat-tailed unlimited-exposure situation, which can never be fully learned away, can dominate the social-discounting aspect, the pure-risk aspect, and the consumption-smoothing aspect.”¹⁵⁷ In plainer language, the dismal theorem posits that “under limited conditions concerning the structure of uncertainty and societal preferences, the expected loss from certain risks . . . is infinite and that standard economic analysis cannot be applied.”¹⁵⁸ “Every year if not every day we have to wager our salvation upon some prophecy based upon imperfect knowledge.”¹⁵⁹

What role does ornamentation, or any other form of personal expression, retain within a decision-making framework befitting the fog of ignorance and extreme outcomes that define the Anthropocene? A plausible answer emerges from a contemporary reassessment of the most expressive pinnacle of Abraham Maslow’s hierarchy of needs.¹⁶⁰ In elevating the self, Maslow erroneously disconnected “the desire to fulfill one’s own unique potential” from the biological foundations of human motivation.¹⁶¹ Self-actualization fails on strictly sociological grounds, since “any self-inflating tendencies that were not calibrated

154. Peter Conti-Brown, Commentary, *A Proposed Fat-Tail Risk Metric: Disclosures, Derivatives, and the Measurement of Financial Risk*, 87 WASH. U. L. REV. 1461, 1465 (2010).

155. See Nordhaus, *supra* note 150, at 253–54.

156. *Id.* at 255–56.

157. See Martin L. Weitzman, *On Modeling and Interpreting the Economics of Catastrophic Climate Change*, 91 REV. ECON. & STAT. 1, 18 (2009).

158. Nordhaus, *supra* note 150, at 240.

159. *Abrams v. United States*, 250 U.S. 616, 630 (1919) (Holmes, J., dissenting).

160. Cf. SNOW, *supra* note 48, at 70 (heralding the rise of “a third culture” of social scientists “concerned with how human beings are living or have lived”); Frank Wilczek, *The Third Culture: Is Quantum Physics, Like Science and Literature, in a World of Its Own?*, 424 NATURE 997, 997 (2003) (urging a synthesis of the “basic facts” of science with the literary culture’s “canon of works and expressive techniques”).

161. Douglas T. Kenrick et al., *Renovating the Pyramid of Needs: Contemporary Extensions Built upon Ancient Foundations*, 5 PERSP. ON PSYCHOL. SCI. 292, 297 (2010).

to others' respect could have maladaptive consequences for success in social groups."¹⁶²

What the social psychologist calls self-actualization may prove to be nothing more impressive than overconfidence or, given a sufficiently large departure from social acceptance, unfiltered narcissism.¹⁶³ Contemporary psychological sources informing have therefore "remov[ed] self-actualization" from a revised version of Maslow's pyramid, as a concession to the reality that the "privileged position" once accorded to self-actualization "cannot be compelled [or] justified by the functional logic of human evolutionary biology."¹⁶⁴ Even Maslow himself, in later elaborations of his own theory, felt compelled to add altruism, spirituality, and a sense of something outside or larger than the self to the top layer of his pyramid of needs and motivations.¹⁶⁵

As we saw with even the briefest of glances at contemporary thought in design and architecture, Adolf Loos's strict separation of utilitarian and ornamental elements has proved too doctrinaire. Likewise, some vitality remains in Abraham Maslow's notion of self-actualization. Even amid the impending calamity of the advancing Anthropocene epoch, a desire for some shot at greatness remains intact. Appropriately enough, agricultural economics opens a back door by which personal ambition and self-expression may reassert themselves within the risk-taking calculus of existential struggle.

During the formative stages of modern behavioral economics, agricultural economists leapfrogged the rest of the "axiomatically minded" profession in acknowledging both "risk and risk aversion" and in connecting "behavior . . . to need by a simple rule called the safety-first principle."¹⁶⁶ Agricultural economics thereby became one of the first branches of economics to embrace Arthur Roy's safety-first criterion, a financial optimization rule that minimizes the

162. *Id.* at 298; see also Robert Kurzban & C. Athena Aktipis, *Moodularity and the Social Mind: Are Psychologists Too Self-ish?*, 11 PERSONALITY & SOC. PSYCHOL. REV. 131–49 (2007).

163. See Hersh Shefrin & Meir Statman, *Behavioral Capital Asset Pricing Theory*, 29 J. FIN. & QUANT. ANALYSIS 323, 331 n.21 (1994) (defining overconfidence as a product of the failure to "search[] for evidence that would disconfirm [one's] beliefs"). See generally, e.g., Kent D. Daniel, David Hirshleifer & Avanidhar Subrahmanyam, *Overconfidence, Arbitrage, and Equilibrium Asset Pricing*, 56 J. FIN. 921 (2001); Simon Gervais & Terrance Odean, *Learning to Be Overconfident*, 14 REV. FIN. STUD. 1 (2001).

164. Kenrick et al., *supra* note 161, at 298.

165. See ABRAHAM H. MASLOW, *Critique of Self-Actualization Theory*, in FUTURE VISIONS: THE UNPUBLISHED PAPERS OF ABRAHAM MASLOW 26–32 (1996); Abraham H. Maslow, *The Farther Reaches of Human Nature*, 1 J. TRANSPERSONAL PSYCHOL. 1 (1969).

166. Lola L. Lopes, *Between Hope and Fear: The Psychology of Risk*, 20 ADVANCES EXPERIMENTAL SOC. PSYCHOL. 255, 287 (1987); see also, e.g., Quazi Shahabuddin & David Butterfield, *The Impact of Risk on Agricultural Production Decisions: Tests of a Safety-First Model in Bangladesh*, 14 BANGLADESH DEV. STUD. 13 (1986).

probability that an investor would realize actual returns below some minimally acceptable baseline.¹⁶⁷ Under the influence of Roy's safety-first criterion, behaviorally mediated investment portfolios depart considerably from the recommendations of the neoclassical capital asset pricing model. By and large, human investors bowing to their innate heuristics and cognitive biases assemble portfolios that combine large, relatively safe positions (often in fixed-income instruments) with a few highly speculative investments with immense upside potential.¹⁶⁸

This “bonds and bullets” approach to risk-taking may be a human universal. It certainly is prevalent across economic and cultural boundaries. Affluent investors in developed economies are not alone in blending defensive, risk averse strategies with all-or-nothing bets.¹⁶⁹ Similar behavior has been observed among subsistence farmers, for whom risk is such a stark “fact of [the] physical and social environments” that “one’s livelihood can be literally threatened from all sides (by floods, by pests, by invading armies).”¹⁷⁰ The portfolio optimization problem in subsistence agriculture is one of allocating extremely scarce resources between two assets with radically different risk profiles. “Food crops provide food for the table and have low variance of return, but their expected return is also low.”¹⁷¹ In other words, food crops provide the closest thing to a guarantee of survival, but at a level of abject poverty. “Cash crops,” by contrast, “are more variable but have higher expected return.”¹⁷² Saving seed corn while simultaneously shooting for the moon appears to be the innate, modal financial strategy of humankind.

The myriad solutions to this problem “all boil down to a simple rule: first take care of subsistence needs (food for the larder and seed for the coming season) and then plant cash crops.”¹⁷³ Subsistence farmers’ portfolio strategy consists of planting low-return food crops “to the point where . . . subsistence needs are met,” but remaining

167. See A. D. Roy, *Safety First and the Holding of Assets*, 20 *ECONOMETRICA* 431 (1952).

168. The Author has developed two book-length treatments of this subject. See JAMES MING CHEN, *POSTMODERN PORTFOLIO THEORY: NAVIGATING ABNORMAL MARKETS AND INVESTOR BEHAVIOR* (forthcoming 2016); JAMES MING CHEN, *FINANCE AND THE BEHAVIORAL PROSPECT: RISK, EXUBERANCE, AND ABNORMAL MARKETS* (forthcoming 2016). For a shorter, article-length treatment of this subject, see James Ming Chen, *Momentary Lapses of Reason: The Psychophysics of Law and Behavior*, 2016 *MICH. ST. L. REV.* (forthcoming).

169. See generally JOHN KENNETH GALBRAITH, *THE AFFLUENT SOCIETY* (4th ed. 1984).

170. Lopes, *supra* note 166, at 287.

171. *Id.*

172. *Id.*

173. *Id.* See generally Jock R. Anderson, *Perspective on Models of Uncertain Decisions*, in *RISK, UNCERTAINTY, AND AGRICULTURAL DEVELOPMENT* 39–62 (James A. Roumasset et al., eds., 1979).

willing to “allocate the remainder of [available] land to cash crops.”¹⁷⁴ It is tempting to restate this strategy in simple fashion: “farmers gamble on cash crops because they aspire to escape poverty.”¹⁷⁵

Critically, however, subsistence farmers do not view themselves as gambling.¹⁷⁶ Paraphrasing a subsistence farmer’s “preference for subsistence over starvation” as “a preference for X chance of Y income over X . . . totally misrepresents his options.”¹⁷⁷ It is more honest and accurate to visualize food crop and cash crop allocations in subsistence agriculture as the simultaneous satisfaction of the same emotions of fear, hope, and aspiration that motivate wealthier actors. Although “*fear* of falling below subsistence motivates the allocation to food crops” in what must be considered a truly compelling application of the safety-first criterion, the enduring “*aspiration* of escaping poverty motivates the allocation of the remainder to cash crops.”¹⁷⁸ Indeed, under sufficiently dire conditions, “it is quite rational” for subsistence farmers “to devote relatively greater acreage to cash crops,” since such a strategy represents their sole “hope to maximize their chances of survival.”¹⁷⁹

Similar incentives motivate diamond miners in desperately poor countries such as Sierra Leone.¹⁸⁰ Lacking *ex ante* capital of their own, African artisanal diamond miners “typically work on credit and share [any] profits” from mining “with their creditors.”¹⁸¹ Because these miners “do not refund any part of the credit that cannot be recovered from their earnings” in the event of a loss from a mine’s failure to recover diamonds, miners engage in a form of “gambling for resurrection” akin to the “excessive risk taking” that characterizes financially distressed firms on the verge of default in developed economies.¹⁸²

174. Hersh Shefrin & Meir Statman, *Behavioral Portfolio Theory*, 35 J. FIN. & QUANT. ANALYSIS 127, 137 (2000).

175. *Id.*

176. See Howard Kunreuther & Gavin Wright, *Safety First, Gambling, and the Subsistence Farmer*, in RISK, UNCERTAINTY, AND AGRICULTURAL DEVELOPMENT, *supra* note 173, at 213–30; Lopes, *supra* note 166, at 287.

177. Sutti Ortiz, *The Effect of Risk Aversion Strategies on Subsistence and Cash Crop Decisions*, in RISK, UNCERTAINTY, AND AGRICULTURAL DEVELOPMENT, *supra* note 173, at 231–46, 235; accord Lopes, *supra* note 166, at 287.

178. Shefrin & Statman, *supra* note 174, at 137.

179. Quazi Shahabuddin, *Farmers’ Crop Growing Decisions Under Uncertainty—A Safety-First Approach*, 10 BANGLADESH DEV. STUD. 95, 95 (1982).

180. See generally Victor A.B. Davies, *Sierra Leone: Ironic Tragedy*, 9 J. AFRICAN ECONOMIES 349 (2000); Victor A.B. Davies, *Sierra Leone’s Economic Growth Performance, 1961–2000*, in 2 THE POLITICAL ECONOMY OF ECONOMIC GROWTH IN AFRICA, 1960–2000: COUNTRY CASE STUDIES 660–96 (Benno J. Ndulu et al. eds., 2008).

181. Victor A.B. Davies, *Alluvial Diamonds: A New Resource Curse Theory* 3 (Feb. 2009), <http://www.csae.ox.ac.uk/conferences/2009-EDiA/papers/128-Davies.pdf> [<https://perma.cc/9NV8-4UEP>].

182. *Id.* See generally George A. Akerlof & Paul M. Romer, *Looting: The Economic Underworld of Bankruptcy for Profit*, 2 BROOKINGS PAPERS ON ECON. ACTIVITY 1 (1993); Michelle J. White, *The Corporate Bankruptcy Decision*, 3 J. ECON. PERSP. 129 (1989).

The lopsided allure of a huge payoff for the luckiest miners contributes to the “resource curse” that stunts the economic development of some of the world’s countries holding immense amounts of mineral wealth and other natural resources.¹⁸³

Wealthier investors combine low and high aspirations similar to those of subsistence farmers and diamond miners in the developing world: Affluent people “want to avoid poverty,” to be sure, “but they also want a shot at riches.”¹⁸⁴ True to Maslowian psychology, such investors build “layered pyramids” that “divide . . . current wealth between a bottom layer, designed to avoid poverty, and a top layer, designed for a shot at riches.”¹⁸⁵ In the special case of “cautious optimism,” fear predominates asset allocation “except for the upper end of the range.”¹⁸⁶ By “overweight[ing] the probabilities attached to both the worst and best outcomes,” a cautious optimist produces “a weighting scheme with thicker tails than the underlying distribution.”¹⁸⁷ In the language and logic of statistical moments, this is kurtosis preference. Thus arises the all-or-nothing structure, or at least the ubiquitous bonds-plus-bullets allocation associated with behavioral portfolio theory. “A cautious optimist,” being “inclined to extremes in the two layers of his portfolio,” chooses “a risk-free bond for his low aspiration account,” and then searches on the basis of “[i]ncreased hope” for “the maximum possible payoffs in [the] high aspiration . . . accounts.”¹⁸⁸

To the extent that preparedness for a disaster the size of the Anthropocene “is about assembling the best portfolio of legal rules to deal with catastrophic risks,”¹⁸⁹ agricultural and behavioral economics both predict that human decision-makers will strive simultaneously for subsistence and a shot at greatness. Survival and strict utilitarianism, to be sure, represent the first order of business. But a desire for ornament and expression also endures. Despite threats to its productive capacity, agriculture in the developed world devotes extraordinary energy to ornamental and sacramental concerns, to the detriment of the global interest in staving off resource exhaustion and evolutionary checkmate. Those who can afford to do so, fetishize food. Those who cannot, starve. This is the iron law of food security in the Anthropocene. Though burdened by a suddenly palpable risk of extinction,

183. See, e.g., Roy Maconachie & Tony Binns, *Beyond the Resource Curse? Diamond Mining, Development and Post-Conflict Reconstruction in Sierra Leone*, 32 RESOURCES POL’Y 104 (2007).

184. Shefrin & Statman, *supra* note 174, at 141.

185. *Id.*

186. *Id.* at 145.

187. *Id.*

188. *Id.*

189. DISASTER LAW AND POLICY, at xxi (Daniel A. Farber et al., eds., 3d ed. 2015); accord Susan S. Kuo & Benjamin Means, *Corporate Social Responsibility After Disaster*, 89 WASH. U. L. REV. 973, 975 n.11 (2012).

Anthropocene humanity still responds, with all the romance that it can muster, to “the rift of dawn, the reddening of the rose.”¹⁹⁰

Ontogeny recapitulates phylogeny. If we are foreordained by evolution and natural history to gamble, we should at least take well informed risks. American journalist Damon Runyon (1880–1946) once advised the risk averse, “[t]he race is not always to the swift nor the battle to the strong, but that’s the way to bet.”¹⁹¹ For his part, Níkos Dándolos (1883–1966)—better known as Nick the Greek—celebrated the “[r]isk seekers” who “dog the long shots, waiting . . . for ‘that one streak of luck, properly ridden and encouraged,’ to compensate them for all the bad times.”¹⁹² “Ships at a distance have every man’s wish on board. For some they come in with the tide. For others they sail forever on the horizon, never out of sight . . .”¹⁹³ For “riches” do not fall “to the intelligent, nor favor to [people] of skill; but time and chance happen to them all.”¹⁹⁴

If humanity does survive the Anthropocene and the ecological crises of its own creation, “the planet itself, the whole planet, would be [our] monument.”¹⁹⁵ Until that moment of glory arrives, some decades or even centuries beyond an age that is as unsustainable as it is gilded, we are well advised to prioritize survival and resource conservation in policies regarding food and agriculture. The prosperity that marks humanity’s rise during the Anthropocene masks an abiding menace of extinction. In humanity’s new and final chapter, we may yet lie “down to die in the midst of [our] victory.”¹⁹⁶

190. MARKHAM, *supra* note 24, at 16.

191. Daniel Ellsberg, *Risk, Ambiguity, and the Savage Axioms*, 75 Q.J. ECON. 643, 644 (1961); accord Lopes, *supra* note 166, at 276.

192. Lopes, *supra* note 166, at 276 (quoting TED THACKREY, JR., GAMBLING SECRETS OF NICK THE GREEK 67 (1968)).

193. ZORA NEALE HURSTON, THEIR EYES WERE WATCHING GOD 3 (1937).

194. *Ecclesiastes* 9:11.

195. Isaac Asimov, *Founding Father*, in THEMES IN SCIENCE FICTION: A JOURNEY INTO WONDER 76, 81 (Leo P. Kelley ed., 1972).

196. *Id.*