Malthus, Darwin, and the Descent of Economics

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Abstract. Confusion about overpopulation stems from the writings of Thomas Malthus in 1798. It was compounded by Charles Darwin and Alfred Russel Wallace, both of whom made the Malthusian "struggle for existence" the basis of natural selection in the evolutionary process. Malthus argued, without evidence, that human population growth will continue unchecked until regulated by external factors such as hunger and disease. Darwin and Wallace cemented that idea into evolutionary theory. Recent evolutionary biologists have focused on gene frequency as a way to compare the reproductive success of one individual against another within the same species. However, among humans, the true basis of reproductive success is grounded in control of the resources necessary for survival. Humans sometimes adapt to environmental stress by having more children, not fewer, which means that poverty can cause population growth, not the reverse. Recognizing this simple relationship would have helped Darwin resolve a dilemma at the heart of his theory: his expectation that the most successful members of our species would have the most children, an idea contradicted by his observation of large, poor families among the Irish. The evolutionary puzzle can be solved by observing that providing equal access to land enables humans to limit their own fertility. The problem of equal access can be addressed by implementing Henry George's idea of taxing the value of land, thereby preventing hoarding and gross inequality of wealth.

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Introduction

The Malthusian doctrine of overpopulation continues to distort both the biologic and economic sciences and to doom the problem-solving aspirations of policymakers. Malthus's (1798) *Principle of Population* masquerades as science, when—as Thomas Robert Malthus himself points out in the opening paragraphs of his famous essay—the theory is unsupported by facts.

How is it possible that a theory that was undocumented in its time—and remains without scientific corroboration in 2016—continues to inform the public debate and direct the social and economic policies of modern times? Two reasons spring immediately to mind.

The first reason the Malthusian theory remains popular, despite being wrong, is the ease with which it can be understood. It can be summed up in a sound bite that feels so intuitively correct that almost no one is motivated to conduct further research. Malthus proposed in 1798 that population grows geometrically, while food production grows only arithmetically, which leads inevitably to starvation.

The second reason for the continued acceptance of Malthusianism is less obvious, but may be just as important. Malthus's theory allows modern readers to focus on changing the reproductive behavior of *others*, namely, people in developing countries, while leaving unexamined the extractive, rent-seeking behavior of the developed world. It is always more fun to focus on controlling the sex lives of somebody else than to admit to the damaging effects of our own greed. A solution that requires those of us who live in relative affluence to make no dramatic changes to our lives is certain to gain our support. We have already reduced *our* birth rates. Therefore, the problems of poverty, income inequality, climate change, war, famine, and a host of other economic and ecological disasters can be solved if we can just convince those *other* people to stop having so many children.

Darwin Discovers Malthus

Malthus confused cause with effect. We continue to do so. Here is where the plot thickens and becomes historically more interesting. Malthus, an early political economist, and Charles Darwin, the father of modern biology, are responsible for a curious link between the two

sciences that has served neither field well. Malthus's book, *An Essay on the Principle of Population, as it Effects the Future Improvement of Society*, was published in 1798. Darwin's groundbreaking book, *The Origin of Species*, was not published until 1859. Malthus died in 1834, 25 years before Darwin's famous work was published. Malthus could not have anticipated that Darwin would give the *Principle of Population* the blessing of science.

In his autobiography (written 1876, published posthumously), Darwin (1887: 42–43) described the way in which the Malthusian principle gave rise to his sudden epiphany about the process by which natural selection takes place:

> In October 1838, fifteen months after I had begun my systematic inquiry, I happened to read for amusement Malthus on Population, and being prepared to appreciate the struggle for existence which everywhere goes on, from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favorable variables would tend to be preserved and unfavorable ones destroyed. The result would be the formation of a new species.

Darwin's claim that reading Malthus gave him the insight into the *selection pressure* driving natural selection is a convenient truth that enhanced the reputations of both men. The Reverend Malthus, a man of the cloth, was suddenly elevated by having his undocumented theory cloaked in the mantle of science. Since Malthus was a shoddy practitioner of science, this mantle became more of a magician's cape under which his biases against the Irish could be hidden. The many Malthusians who followed were likewise able to mask their prejudices against groups of poor people in the same way, by claiming to be scientific. More on that later.

Darwin—a man of both faith and science, who happened to share Malthus's opinion of the Irish—was troubled that his theory of evolution would be challenged as an attack on religion. It was fortuitous then that Darwin could emphasize the role Malthus's writings played in helping him envision the struggle for existence that would occur when populations reached their carrying capacity. In this way, Darwin acquired the support of someone who, although dead, was from the religious establishment. The Reverend Malthus had described a mechanism—

competition for food—by which Darwin could explain the theory of natural selection: in the fight over scarce resources, only the strong would survive and pass on their superior traits to their offspring.

What Malthus assumed to be true and what Darwin accepted as accurate is an example of death rate control of populations through a struggle over limited food supplies. Malthus's oft-repeated statement that "[p]opulation, when unchecked, increases in a geometric ratio, subsistence increases only in an arithmetic ratio" may sound both plausible and scientifically rigorous, but it is very difficult to document with empirical evidence. Studies done in recent years make it clear that uniform geometric increases in population size are almost as difficult to demonstrate (Galor and Weil 1998) as are human speciation events driven by death rate control of large populations (Henrich 2016).

Human populations obviously undergo dramatic demographic swings in response to external events such as droughts and pandemics. The Black Plague wiped out a third of Europe's population in the 1300s and restructured society (Cantor 2001). Populations of indigenous people in the Americas were decimated by exposure to smallpox following contact with European imperialists and settlers. However, the most easily documented *genetic* changes resulting from exposure to disease or starvation result in advantages conferred by variations in the immune system or subtle shifts in the metabolic response to caloric deprivation. They do not result in selection for the kinds of superior intellectual capability that both Malthus and Darwin claimed for the prosperous classes.

Malthus remains associated with his enduring, though misguided, predictions about demographic increase. The idea can be stated so simply and with such clarity! That alone makes it the economic theory most likely to enjoy widespread acceptance. A single sentence that is easily repeated and sounds intuitively correct quickly becomes the sort of common knowledge that is difficult to dislodge with facts. Malthus's fame as an economist is based on a theory that has never been proven empirically.

Land Rent as the Hidden Variable in Demography

There are other economic theories that could be far more useful in addressing poverty and environmental damage than the *Theory of*

Population, but those have always been associated with a lot more controversy and a lot less consensus. Malthus (1815) also wrote an essay on the nature of economic rent, which contains within it the seeds of ideas that help clarify the relationship between population, wages, and poverty. In fact—as I hope to demonstrate—if Darwin had not been led astray by Malthus's single-minded focus on numbers, an understanding of the role played by economic rent might also help explain why some human populations grow faster or slower than others. Although Malthus's (1815) *Essay on the Subject of Rent* contained flaws, its publication inspired David Ricardo ([1815] 1963) to address its inadequacies in a treatise for which he became famous.

Malthus (and before him, Adam Smith) may have initiated the scholarly discussion of economic rent, but Ricardo's treatment was the most comprehensive and internally consistent. Ricardo regarded economic rent as a surplus created by the difference between the cost and the price of natural resources. If the best land yielded 30 bushels of wheat in Ricardo's day and the worst yielded only 10, the best land received a "rent" of 20 bushels. If oil sells for $80 per barrel, and the cost of extraction in Saudi Arabia is $10 per barrel, the Saudis receive $70 per barrel in rent, while a Texas oilfield with high costs might yield rent of only $5 per barrel.

Ricardo warned of the economic distortions that result when we ignore our special relationship with land. Ricardo ([1815] 1963: Preface, BK I, §7) depicted England as being divided into three classes: capitalists, laborers, and landowners. The wealth of the nation was not equally distributed among the various groups.

The landlord held a monopoly that the other two classes did not have. In classical economics monopoly did not necessarily mean "single seller." Adam Smith ([1776] 1904: BK 1, Ch. 11, ¶70) showed that it can mean the ability to create a barrier to entry to competitors. Recent theory affirms that view (Kirzner 1978: 97; Stigler 1965: 244). That was the sense in which landlords were able to function as monopolists: by denying to others access to the raw materials necessary to life. In that way, the landlord found his interests opposed to those of the other two classes of society. Because landlords (including urban landlords) have enjoyed the unearned privileges, wealth, and power associated with their monopoly holdings, they have had the social and

political clout to influence the educational system and thereby deliberately prevent a wider understanding of how economic rent operates in a modern economy (Gaffney and Harrison 1994).

As the title of his book suggested, Ricardo described the impact of various systems of taxation on the distribution of wealth. Despite the fact that he recognized the penalty to labor that is introduced when one fails to draw a distinction between taxing land and taxing the improvements on that land, he neglected to use that distinction to provide a remedy. That task would fall to Henry George ([1879] 1979), an American economist who drew upon Ricardo's understanding of economic rent to develop some original conclusions about creating an equitable tax system. As George makes clear in his book, *Progress and Poverty*, "land" refers to all naturally occurring resources. Today we understand "land" to include not only farmland (which was the limit of Ricardo's concept of it), but also urban land, clean air, pure water, mineral reserves, virgin forests, the oceans, other naturally occurring species, and DNA. Although Ricardo did not include these diverse forms of land in his economic theory, he did—by introducing a coherent theory of economic rent—anchor economics to the earth and thus to our ecological roots.

Land has distinctive characteristics. Land is not created by human effort, although such effort may improve its yield. By recognizing the distinction between land and capital, Ricardo ties economics securely to its base in nature. Land and all naturally occurring resources are finite. Wealth is created by the application of human labor to nature's storehouse of materials. Free markets are not free as long as monopoly holdings in land prevent all people from having equal access to the source of wealth.

Malthus Lacks Evidence

Malthus (1798: 4) set out to demonstrate why "the power of population is infinitely greater than the power in the earth to produce subsistence for man. Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio." It all sounded scientific enough, but it was not. In the introductory paragraph, he apologized that the rush into print prevented him from supporting his argument with facts. However, the lack of empirical support for his

statement appears not to have shaken his confidence in its truth. As Malthus (1798: 1) explains, referring to himself in the third person:

> He presumes, however, that the facts which he has adduced will be found to form no inconsiderable evidence for the truth of his opinion respecting the future improvement of mankind. As the Author contemplates this opinion at present, little more appears to be necessary than a plain statement, in addition to the most cursory view of society, to establish it.

It was fortunate for Malthus, and unfortunate for impoverished people then and ever since, that his reading public demanded no more rigorous support for his statements than he, himself, did. No "scientific" theory is as easy to sell as one that plays to existing social prejudices. This seems to be especially true when the behavior viewed as reckless or damaging is associated with a social class other than the author's own. When the behavior in question is somebody else's *reproductive* behavior, any hope for a responsible investigation flies out the window.

Even in our own time, the assumption that children cause poverty is rarely challenged. Yet even casual observation suggests that the opposite may be the case: poverty causes children, at least in agrarian societies. There is plenty of anecdotal evidence that impoverished people engaged in subsistence agriculture find it advantageous to have large families because more is to be gained economically by having the added labor provided by children than by not having them. Later in this article, I will argue that increasing the birth rate when access to resources is precarious is a biologically *adaptive* response for human beings. If we want birth rates to decline, we need to address flaws in our *economic* system, not flaws in our *reproductive* response to economic and social inequity.

The Malthusian statement about the distinction between geometrical and arithmetical growth rates has long been negated by evidence of both reduced population growth rates and geometrical growth in food production. Nevertheless, a Malthusian bias continues to inform or, more accurately, *misinform* many public policy decisions. What Malthus was really saying, wrapped in the guise of pseudo-science, is that the earth is finite and people are not. There would be no debate if he

had gone no further. But he did go further. He made the silly claim that populations increase geometrically while subsistence increases only arithmetically as if this were true invariably, at all times and places.

The thoroughly discredited idea that nature imposes a fatal outcome caused by human reproduction remains at the heart of dire predictions about the dangers inherent in population growth. This way of thinking enables us to avoid addressing the root causes of poverty as well as diverting attention away from the serious threat to our environmental health caused by wasteful overconsumption. There was just enough superficial validity in the Malthusian observation about the large numbers of poor people to prevent researchers from looking any further. If only Malthus had kept his focus squarely on the finite nature of all naturally occurring resources, perhaps then we would not continue to chase the red herring of overpopulation. A far more promising approach, both in 1800 and in 2016, is to concentrate on the *artificial* scarcities created by economic hoarding. When we fail to charge the consumers of those gifts of nature the true social and environmental costs of their consumption, we encourage the hoarding that creates poverty.

Malthus (1798: 4) was not arguing for social change or economic justice. He was simply looking to elucidate the workings of a divinely-inspired system that was already in place. He assumes that the laws supporting his theory had been fixed by "that Being who first arranged the system of the universe, and for the advantage of his creatures, still executes, according to fixed laws, all its various operations." By the end of the essay, Malthus (1798: 85) observes that the apparent purpose of the Creator was not to remove evil from the world.

> Life is, generally speaking, a blessing independent of future state. It is a gift the vicious would not throw away, even if they had no fear of death. The partial pain, therefore, that is inflicted by the supreme Creator, while he is forming numberless beings to a capacity for the highest enjoyments, is but the dust in the balance in comparison to the happiness that is communicated, and we have every reason to think that there is no more evil in the world than is absolutely necessary as one of the ingredients in the mighty process.

Malthus (1798: 85) later points out that the suffering found in a world that cannot meet the needs of all people acts as "an excitement to

exertion" since the quantity of evil "diminishes or increases with the indolence of man." In other words, the hope of escaping the heavy yoke of poverty is the motivation that precedes achievement in those who are somehow able to sidestep its burdens. The poor will always be with us. Their very existence is necessary to inspire others to rise in their station in life. If Voltaire had not published *Candide* 38 years before Malthus published his *Principle of Population*, I would be certain the good reverend was the inspiration for Doctor Pangloss.

Malthus and the "Irish Question"

Malthus (1798: 1) maintained that he was motivated "solely by love of truth, and not by any prejudices against any particular set of men." His intentions may have been noble, but he was unable to hold to them throughout his career. Although Malthus (1798) gave examples of rapid increases in population in many regions of the world, he did not include statistics on Ireland. However, after the end of the Napoleonic wars, Malthus (1820) took a new tack. In *Principles of Political Economy*, he not only took the gloves off, but he also began to use conditions in Ireland for illustrative purposes. By then, he was more than ready to place much of the blame for the impoverished conditions he documented in Ireland squarely on the Irish themselves.

In fact, there is evidence that Malthus was willing to blame the victim in Ireland *much earlier*. Malthus (1808), in an anonymously published book review, might seem to place the blame for Irish poverty elsewhere by suggesting a land tax as a solution to the Irish problem. (Ó Gráda (1983:75) argues that this article was in fact published by Malthus.) Although he is clearly interested in prescriptive legislative remedies as a solution to the poverty of Irish tenants, his support for a land tax is stated briefly and includes a concern with making sure King George III of England be amply remunerated by a greater advance in rents. Malthus (1808: 339) also uses his review as a way to retroactively include Ireland among the countries he referenced in his *Principle of Population*:

> Ireland's case affords so striking an illustration of the doctrines of which Mr. Malthus has advanced in the late *Essay on Population*, that we are surprised he did not enter into it in more detail.

What happened between the publication of this anonymous book review in 1808 and the publication of the *Principles of Political Economy* in 1820? How could a man familiar with a land tax and its economic implications fail to consistently champion the right of access to natural resources? Malthus (1815) had demonstrated that he was familiar with the concept of economic rent because he gives what, at first reading, is a fairly accurate definition of economic rent:

> The rent of land may be defined to be that portion of the value of the whole produce which remains to the owner of the land, after all the outgoings belonging to its cultivation, of whatever kind, have been paid, including the profits of the capital employed, estimated according to the usual and ordinary rate of the profits of agricultural stock at the time being.

However, just a couple of paragraphs later, Malthus (1815) claims that those who write about rent make the mistake of ascribing to land ownership the characteristics of a monopoly:

> Almost all these writers [Physiocrats and Adam Smith] appear to me to consider rent as too nearly resembling in its nature, and the laws by which it is governed, the excess of price above the cost of production, which is the characteristic of a monopoly.

In short, Malthus explicitly denies that land can have the characteristics of monopoly, which allows price to be greater than cost. Malthus goes to great pains to point out the ways in which land ownership cannot be a monopoly. He entirely misses the artificial scarcity created by monopoly holdings in land and seems to confuse land with the produce grown on it.

What led Malthus astray on this important relationship between rent and scarcity? Why was he able to ignore the flaws in his own rational process? The human brain is a trickster. It is often far better at rationalization than it is at reason. It was Malthus's commitment to his *Principle of Population* that enabled rationalization to trump reason. As Malthus (1815) concluded: "The cause of the high price of the necessaries of life above the cost of their production, is to be found in their abundance rather than their scarcity." In other words, Malthus was saying that

abundance of food makes the price of food higher. Even those who argue that many variables beyond supply and demand enter into the price of commodities would have difficulty accepting any argument based on that line of reasoning.

Malthus's (1815) essay on rent was written in response to the debate over the Corn Laws—the question before the English Parliament about whether to repeal the tariffs on imported grain. Malthus favored high tariffs on grain to encourage food self-sufficiency in England. But since Malthus believed population was automatically limited by food production, he believed the restrictions on imports would limit demand and thereby prevent an increase in economic rent. Malthus's (1815) reasoning is flawed because he insists that "it is physically impossible that the number of demanders should increase, while the quantity of produce diminishes, as the demanders only exist by means of this produce." It is this erroneous understanding that allows Malthus to claim that land cannot meet the conditions of monopoly. Malthus assumes that humans exist in a state where populations increase in response to abundant food supplies. Therefore, people ("the demanders") exist only if produce is abundant.

Despite hints at wisdom, Malthus (1808) was neither looking for a corrective to existing poverty nor willing to allow that Ricardo's distinction between land and the produce grown on it might have some validity. By the end of his career, he took strong exception to Ricardo's indictment of the landlord.

Public Reactions to Malthus

Malthus's reading public largely embraced his *Principle of Population*. Although it was not until 1820, when he published the *Principles of Political Economy*, that he turned to Ireland for documentation, the social climate was ready for his line of reasoning. The English were tired of being blamed for the "Irish problem," even though English landlords had drained the economic surplus from Ireland since the 1650s, when Thomas Cromwell apportioned the lands of Ireland to his loyal followers. Malthus provided justification for ignoring the role monopoly landholding by foreign landlords had played in Irish poverty.

We might criticize the British of 1820 for their narrow-mindedness and failure to reckon with their role as beneficiaries of English imperialism in Ireland. But the colonization of Ireland became a model for other countries as well. It is no mere coincidence that in the 21st century, the regions of the world we identify as having population "problems" are former European or American colonies whose traditional systems of land tenure were destroyed by foreign imperialists interested in privatizing the region's natural resources for their own benefit. It is easier not to think about these injustices. Guilt is an uncomfortable emotion. How much simpler to blame the Irish, to blame the poor, for their failure to practice the necessary restraint in "indoor activities" and for their "very general prevalence of habits of indolence." Scientific theories are not immune to infection by the social prejudices of their time.

By the time Malthus's *Principles of Political Economy* was published, his emphasis was focused squarely on the dangers of excessive population growth. In fact, he goes so far as to argue that not all segments of society could enjoy economic plenty and uses formulations drawn from early models of the "law of rent" to justify a theory of wages that makes the minimum cost of subsistence an acceptable wage standard. Malthus incorrectly believed that given the means, human populations would rapidly increase beyond what ecologists now call the carrying capacity of the environmental niche of the population in question.

Ricardo saw land as a factor of production—along with labor and capital, but Malthus considered land largely in terms of the rate at which it can be brought *into* production. Economics was headed for the first of its wrong turns, for that distinction is an important one. Land is not simply another form of capital. Unlike other forms of capital, no naturally occurring resource is created by human labor. Every naturally occurring resource is, like land, absolutely finite.

Not only is land finite, but the speculative withholding of land from full and productive use actually *reduces* the amount of land available for cultivation. In order to keep land fully productive and able to feed the human population, it is necessary to hold firmly to the distinctive nature of land as one of the three factors of production in classic economic theory. For when that distinction is honored and understood, it becomes apparent that the speculative withholding of land from full and productive use can be countered only by the *public* collection of

the economic rent. In what could almost be called a self-fulfilling prophecy, Malthus took economics down an errant path by blaming the poor for the damage caused by the rich.

Unfortunately, that wrong turn was given the weight of scientific authority when Charles Darwin, arguably the father of modern biology, allowed a flawed understanding of Thomas Malthus to inspire the greatest scientific theory of its time. Only Einstein's subsequent theory of relativity can claim to have had as great an impact on the general public's understanding of the world as Darwin's theory of natural selection had.

Darwin and Wallace: Incorporating Malthus in Evolutionary Theory

We are all familiar with the story of how Darwin, after 20 years of scrupulous research and data collection was forced into publication of *The Origin of Species* (1859) only when he learned that Alfred Russel Wallace had independently formulated his own theory of natural selection. Unfortunately, Wallace, like Darwin, claimed that the writings of Thomas Malthus provided the flash of insight that revealed the mechanism through which species would be shaped and selected. As a result, during the crucial early years in which the public was confronted by a new theory of human origins, the Malthusian view was allowed to shape popular interpretations of natural selection. Wallace (1866), in a letter to Darwin, suggested that it would be better to adopt Spencer's phrase "survival of the fittest" in order to make clear to the public what was intended. This terminology reinforces the Malthusian view that nature forces humans to fight to survive.

Eventually, however, Wallace saw evolution in a different light. Wallace (1885: 369), in an interesting aside to evolutionary theory, admits that he now regards the causes of poverty as having a political, not a natural, origin:

> I hold with Henry George, that at the back of every great social evil will be found a great political wrong. Let us seek out the wrong thing, and fearlessly put it right; and we shall then find that man is not so completely out of harmony with the universe in which he exists that thousands must starve in the midst of plenty, and that the actual producers of

> wealth in the wealthiest country in the world must continue to live without enjoying a fair and adequate share of the wealth which they create.

Unfortunately, by the time Wallace came to this view, the Malthusian distortion in evolutionary theory was well established.

Just as economics was losing its base in biology, the theory of evolution was incorporating the very worst of economic thought as one of its underlying tenets. It is an error that remains unchallenged by modern biologists, even though Darwin himself was aware of the uncomfortable corner into which his embrace of Malthusian theory had forced him. The social thought of the time was infecting its scientific theories. Interestingly enough, all three men—Malthus, Darwin, Wallace—understood that when it came to humans, there were exceptions to the unlimited population growth predicted by Malthusian theory.

Evaluating the Empirical Evidence for Malthusianism

Malthus claimed to base his theory on data from the real world, but a close examination of his data reveals more contradictions than we would comfortably accept from science today. The Irish were indeed impoverished. Population growth in Ireland appeared to be explosive. However, just because two events occur together in time, one cannot assume a causal relationship. As for overpopulation causing death rate control of the Irish people, those who have examined demographic fluctuations in Ireland at the time point out that mortality rates in Ireland were not inconsistent with demographic statistics in Switzerland, Austria, southern Germany, and northern Italy (Ó Gráda 1983). In addition to the million people who died during the famine years, Ireland lost another 2.1 million, one-fourth of the island's population, to *emigration*. "An entire generation virtually disappeared from the land: only about one out of three Irishmen born about 1831 died at home of old age" (Miller 1985: 291). This is a dramatic reduction in population, but not one that demonstrates the control of overpopulation by a rise in the death rate. Instead, it shows the need for a people rendered landless in their own land to seek their fortunes elsewhere. Considering themselves exiles, they left reluctantly, their passage on "coffin ships" often financed by British landlords who saw this as one way to solve the "Irish problem."

Malthus was pushed to some interesting conclusions in his efforts to prove that population pressure causes poverty. At the time he conducted his research, the Irish peasants were subsisting almost entirely on potatoes. Malthus ([1820] 1921: 211) concluded that it was this subsistence diet that made the increase in the number of peasants possible.

> With regard to potatoes, we have very near to us an opportunity of their becoming the vegetable food of the great mass of people. The population of Ireland has increased faster during the last hundred years than that of any other country of Europe: and under its actual government this fact cannot be rationally accounted for, but from the introduction and gradual extension of the use of the potato. I am persuaded, that had it not been for the potato, the population of Ireland would not much more than doubled, instead of much more than quadrupled, during the last century.

Malthus is on very shaky ground here. He starts with an assumption that human populations will increase given the means. Then he looks at the inferior and unvaried diet the Irish had been forced to adopt after land monopolies by absentee English landlords had severed the natural connection between the Irish people and their access to good nutrition. On that basis, he concludes that the inferior diet had made population growth possible. The potato was a subsistence diet. The Irish continued to produce more varied foodstuffs, but those products were raised for export to England and were not available for consumption by those who worked the land without owning it. During the famine years, the grain that the English government sent to replace the loss of the primary foodstuff of a nation of disenfranchised peasants was a matter of too little, too late. Even if the first cornmeal had arrived in a timely fashion, it alone lacked the range of nutrients found in the potato and would have only postponed the tragedy, not prevented it.

It is not as if the British role in alienating the Irish from their right to their native land and the foodstuffs such access would have provided was unknown in England at the time. The Penal Laws, initiated in1695, were designed to accomplish just such a shift from Irish Catholic autonomy to Irish dependency. As Woodham-Smith (1962: 27) notes:

> No Catholic could vote, hold any office under the Crown, or purchase land, and Catholic estates were dismembered by an enactment directing

> that at the death of a Catholic owner his land was to be divided among all his sons, unless the eldest became a Protestant, when he would inherit the whole. ... Catholics might not attend school, nor keep schools, nor send their children to be educated abroad. The practice of Catholic faith was proscribed; informing was encouraged as "an honorable service" and priest-hunting treated as a sport.

The Penal Laws were not repealed until Catholic emancipation in 1829, but by then the damage was entrenched. Even the Irish language had been suppressed and was largely replaced by English. Despite widespread familiarity with the effects of the Panels Laws, neither Malthus's nor Darwin's derogatory descriptions of the uneducated, slothful Irish appear to have been subject to significant challenges by their British colleagues.

In fact, prior to their alienation from their land, the Irish had fished, tilled the fields, raised barley, oats, cattle, chickens, pigs, sheep, and fed themselves quite well. However, the British demand for Irish beef, pork, butter, and livestock monetized these commodities. Small farmers could no longer afford to eat the milk, butter, eggs, and pork they had formerly consumed at home (Miller 1985: 35). Critics claimed the Irish lacked ingenuity when faced with starvation during the famine years. They pointed out that Ireland was surrounded by oceans filled with fish, but the Irish failed to catch them. There was a clear explanation, and, once again, the lack of reliable access to their own land provides it. Fishing was a seasonal activity. During the months the seas were not navigable, the potato fed the people. When that subsistence crop failed, fishermen were forced to sell their boats and tackle in order to pay rents and survive the winter (Campbell 1994: 20).

The Potato Famine

When the first of the widespread potato famines hit Ireland in 1845, it seemed to affirm the dire predictions of Malthus. Ireland appeared to be a perfect example of selection through death rate control of a population that had grown so large that its people could no longer find an adequate supply of food. Small wonder that Darwin and Wallace looked at the potato famine and found in the writings of Malthus the mechanism by which natural selection would operate. Here was a

population that had expanded beyond the means of support, thereby allowing the blind hand of nature to weed the fit from the unfit. Malthus, having died in 1834, was not around to claim validation for his theory in the Irish tragedy.

However, Malthus would have been wrong had he been alive to make such claims. The famine began with a natural disaster in the form of a potato blight, a blight whose spread was made all the more rapid and devastating by the lack of diversified planting. What happened in Ireland resulted from the collision of a natural disaster with a political one, and the biased hand of politics was more responsible for all those deaths than was the unbiased hand of natural selection. The fact is that the Irish continued to grow enough to feed themselves throughout the potato famines. Ireland remained a net exporter of food all during those famine years, but the Irish crops went not to feed her own people, but to feed others. Since they did not own their own land, their survival choices were limited.

Famines had occurred periodically in Ireland. Describing the situation, M. F. Sullivan (1881: 184) writes:

> Irish famines ... are not *natural* famines, they are *artificial* famines; they are made, not by the Lord, but by the landlord; they are not famines of food—there is always plenty of that in Ireland—but famines of money with which to buy food from landlords who have taken the fruits of the soil as rent for the land to which they generally have no moral title.

Land Monopoly, Economic Rent, and Poverty

Malthus was aware of the economic distortions produced by land monopoly in Ireland. As noted earlier, he claimed a relationship between population growth and the potato. Malthus ([1820] 1921: 211) continued that analysis by discussing the way in which population growth affected property values and ultimately ended up depressing wages.

> This increase of population has prevented lands from being thrown out of cultivation, or given greater value to natural pasture, at the same time it has occasioned a great fall in the money wages of labor. This fall,

> experience tells us, has not been accompanied by a proportionate rise in profits, and the consequence is a considerable rise in rents. The wheat, oats, and cattle of Ireland are sold to England, and bear English money prices, while they are cultivated and tended by labor paid at half the money price; a state of things which must generally increase the revenue derived from profits, or the revenue derived from rents; and practical information assures us, that it is the latter which has derived the greatest benefit from it.

The effects of an increase in economic rent were easier to document empirically than was the assertion that population growth inevitably outruns the food supply. Even when Malthus looked at his native England, exceptions to his theory about population were everywhere. If his hypothesis that populations will expand geometrically given the means was correct, then the greatest population increases should have been evident where the greatest means of subsistence were available. In fact, Malthus found just the opposite to be the case. What did he do with this conflicting evidence? He explained it away. Malthus ([1820] 1921: 226) argued that an increase in real wages or in the power to command "a large portion of the necessities of life" could actually have two vastly different results. The first was the previously mentioned increase in population; the second was "a decided improvement in the modes of subsistence, and in the conveniences and comforts enjoyed without a proportionate acceleration in the rate of increase." Malthus ([1820] 1921: 227) further acknowledged that "among the circumstances which contribute to the character first described, the most efficient will be found to be despotism, oppression and ignorance: among those which contribute to the latter character, civil and political liberty and education."

If Malthus wanted a hypothesis that would be validated by measurements based on empirical observation, he would have done well to stick with his investigations into the nature of economic rent. Ricardo understood the importance of access to land. Whenever the political structures of society encourage monopoly holdings in land or the other natural resources necessary to life, poverty will increase even in nations otherwise characterized by extreme wealth. The American economist Henry George, building on the work of Ricardo, developed this theory with flawless logic and eloquence in his 1879 classic, *Progress and Poverty*. George's hypothesis is completely testable. The failure of modern

social and economic theorists to undertake the studies that would demonstrate its truth may in large part be due to a psychological tendency to believe that one's own good fortune is the result of superior ability, hard work, and perhaps just a measure of luck. Those blessed with the leisure and resources necessary to conduct economic research unconsciously buy into the Horatio Alger myth of individual economic achievement. If social prejudices were not actively distorting scientific thought, they almost certainly had a hand in influencing the topics selected for research.

Malthus's Prejudices

At this point, let us return to the social prejudices of the Reverend Malthus. Although he acknowledges that at least some of the blame for population increase can be attributed to the political systems, Malthus ([1820] 1921: 227) continually returns to the "very general prevalence of habits of indolence" in Ireland to make the case for his overpopulation hypothesis. Malthus's statistics carelessly slipped between claiming that the potato made the population increase possible and faulting the Irish character for the nation's poverty.

Malthus may have had no trouble convincing himself of the validity of his theory when he examined the Irish situation, but the water got a lot muddier when he looked at his native island. During the first half of the 18th century, the price of wheat in England and Scotland fell at the same time wages rose. The worker could now buy a full peck (two gallons) of wheat with a day's wages as contrasted to only two-thirds of a peck in the 60 years preceding this time period. According to Malthus's own theory, population should have increased, but it did not. As Malthus ([1820] 1921: 228) himself points out, increased resources "did not produce an increase in population, but a great alteration for the better in the food, dress, and houses of the lower classes of society, in that country."

Access to Land: The Natural Regulatory Mechanism

If Darwin had to be influenced by an economist, how much better for both economics and biology if that economist had been Ricardo. The vital link between economics and biology is land. As one of the three factors of production in classic economics, the degree of access to land

is the regulating mechanism that holds both population growth and environmental destruction in check. Let us consider how this works in detail.

A person with access to enough land to grow food for family needs can be said to receive the full wages from work. "Wages" here means the physical product of labor. Once a person's *natural* right of access to the resources on which life depends is distorted by systems of ownership that create landless classes, then the alienated classes can be forced to work for subsistence wages. Since wages of workers are diminished by absentee ownership, the Malthusian theory would anticipate a reduction in population.

The Malthusian theory, however, ignores an important variable: the biological response to a threat to survival. In humans, a natural, *biologically adaptive* reaction to land deprivation is to *increase* the sheer numbers of their offspring so that at least some of them have a chance of reaching adulthood. This is a complete reversal of Malthusian thought. Whereas Malthus predicted that hunger would lower birth rates, modern theories based on adaptation predict the opposite: hunger will increase birth rates.

Modern biologists define reproductive success in terms of gene frequency, but this is not a formula that works for humans. In agrarian communities, children increase the size of the workforce dedicated to the family's well-being. Among impoverished people everywhere, childhood mortality is high and in order for at least some of the children to survive long enough to enter the reproductive generation, the number of children born must be relatively large. Poverty and famine therefore can cause an increase in fertility, not a decline. This brings us to the heart of the Malthusian dilemma. Both Malthus and Darwin considered the wealthy to be the most successful members of the human community. Since they had ample access to food, the well-to-do ought to have had the largest families. But this expectation failed to accord with the observations made by both men. It would seem that an increase in childhood survival associated with caloric adequacy enabled rich parents to make heavy material investment in just a few children.

Malthus tied expanding populations to material progress at a time when the English citizenry was awed by the dawning of the industrial age. It was not difficult to convince the general public that the increase

in productivity made possible by the mushroom-like growth of technological advance was also responsible for the growth of population that was so apparent in the industrial cities. However, no one bothered to question why the population growth was largely exhibited in the classes working at subsistence level while those whose fortunes were expanding demonstrated a *decrease* in family size.

Malthus found in England a receptive audience for his *Principle of Population*, and few people bothered to question the predictive value of his statistics. Once Darwin gave the theory the weight of scientific respectability by claiming it had inspired his understanding of the mechanism of natural selection, it was too late to turn back. While the pious may have been distressed by the uncomfortable notion that they were descended from apes, the budding social Darwinists were only too happy to seize on Darwin's own confusion between possession of wealth and biological success. The ruthless exploitation of the landless classes in the factories and mills could be justified. This was "nature red in tooth and claw." This was Darwin's "struggle for existence." The wealthy somehow deserved the excess rewards that fell their way. All this was proof of their biological superiority.

The Malthusian principle was, however, hard to document empirically, especially in humans. What early researchers clearly documented was a correlation between poverty and large populations. Is there a predictive hypothesis somewhere in all of this? I suspect that variations in the amount of land freely accessible to workers could better explain the situation than the Malthusian principle of population growth. In any country where one-sixth of the population controls five-sixths of the property, there is going to be poverty. Where we find poverty, we also have traditionally found high birth rates. Not only that, but such a situation makes excellent evolutionary sense. When conditions are extreme, when humans lack a control of resources adequate to ensure that at least some of their offspring will survive to reproductive maturity, the biologically adaptive response is to have more children.

Darwin and the *Descent of Man*

In *The Origin of Species*, aware of the controversy his theory would provoke, Darwin omitted explicit discussion of the origin of humankind.

He saved that topic for his later book, *The Descent of Man and Selection in Relation to Sex*. Bear the full title in mind. It is often referred to simply as *The Descent of Man*, but in this book, Darwin made a strong case for the role of sexual selection in human evolution. That is, he emphasized the idea that the reproduction of favorable traits can occur much more rapidly than random variation if potential mates choose partners on the basis of those traits. Darwin's emphasis of this idea has unfortunately been dismissed. By restoring sexual selection to its central place in human development, Darwin can be saved from the dilemma into which his reliance on Malthus forced him. We shall return to this idea of sexual selection below. For now, we seek to understand how Darwin went astray by following the Malthusian formula.

What was Darwin's Malthusian dilemma? The conclusion to which the Malthusian dependence on population size forced Darwin was squarely at odds with Darwin's observations of human reproductive behavior in the world around him. Malthus had not been concerned with evolution; he had been concerned with overpopulation. His approach was not scientific. It was based on sweeping generalizations that resisted empirical documentation.

Darwin, on the other hand, paid exquisite attention to detail. He was an excellent researcher, a meticulous gatherer of data, one who corresponded widely with other naturalists and added their observations to his own. His books offer a brilliantly developed case of how, under a system of natural selection, one could account for the variation seen between members of closely related species. He relied heavily on statistics gathered while working as a naturalist on the sailing vessel, the *H. M. S. Beagle*. It was here that he got his exposure to the now famous Galapagos Islands. He was fascinated to observe how geographic isolation resulted in species that, while obviously related to those on land, were distinctly different from their cousins.

In the opening pages of *The Origin of Species*, Darwin ([1859] 1888: 3) writes:

> This is the doctrine of Malthus, applied to the whole animal and vegetable kingdom. As many more individuals of each species are born than can possibly survive; and as, consequently there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner

> profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving and thus be naturally selected.

Darwin claimed that Malthus's principle of population provided the insight that inspired his understanding of evolution. Yet, what we see on the Galapagos Islands is not evidence of how *large* populations competing with each other for food drive evolution through survival of the most fit. Instead, the Galapagos Islands are evidence of how quickly evolution happens in *small*, geographically isolated populations. Add the kinds of assortative mating made possible by sexual selection and speciation events go into overdrive.

Because of his Malthusian mistake, Darwin's view of natural selection heavily depended on population size and the number of survivors with particular characteristics. He recognized that there are random variations in form, and he pointed out that natural selection works on these variations through competition for scarce resources. The more favorably adapted forms survive, while the earlier or ancestral forms disappear. It is purely a numbers game. The best adapted have more offspring and crowd out and replace those less fertile.

Almost everywhere he looked, Darwin found support for his new theory. Humans were the lone exception, and it puzzled and dismayed him. Natural selection favored the most fit, the best adapted. Humans were obviously high on the evolutionary scale. We were, in the eyes of his fellow Victorians, the crowning glory of God's creation. Darwin, however, rejected notions of divine intervention in the human condition. He insisted that we are animals shaped by the same forces of nature that shape the complex and teeming world of flora and fauna surrounding us. How then to explain our failure to follow the rules of his new game? Why did large human populations not show the signs of superior fitness that his model predicted?

Darwin ([1871] 1874: 156–157) is obviously troubled as he summarizes, in *The Descent of Man*, the findings of his own research and that of some of his contemporaries:

> A most important obstacle in civilized countries to an increase in the number of men of a superior class has been … the fact that the very poor and reckless, who are often degraded by vice, almost invariably marry early, while the careful and frugal, who are otherwise virtuous,

> marry late in life, so that they will be able to support themselves and their children in comfort. Those who marry early produce within a given period not only a greater number of generations, but, as shown by Dr. Duncan, they produce many more children. The children, moreover, that are born to mothers during the prime of life are heavier and larger and therefore probably more vigorous, than those born at other periods. Thus the reckless, degraded, and often more vicious members of a society, tend to increase at a quicker rate than the provident and generally more virtuous members. Or as Mr. Gregg puts the case: "The careless, squalid, unaspiring Irishman multiples like rabbits; the frugal, foreseeing, self-respecting, ambitious Scot, stern in his morality, sagacious and disciplined in his intelligence, passes his best years in struggle and in celibacy, marries late and leaves few behind him. Given a land originally peopled by a thousand Saxons and a thousand Celts—and in a dozen generations five sixths of the population would be Celts, but five sixths of the property, of the power, of the intellect, would belong to the one sixth of the Saxons that remained. In the eternal struggle for existence, it would be the inferior and less favored race that had prevailed–and prevailed not by virtue of its good qualities but of its faults."

Those worrisome Irish and their exploding populations were causing trouble again! The social and political biases of the day were not limited to the Reverend Malthus.

What was going on here? Whatever it was, it was not natural selection as inspired by Malthus and envisioned by Darwin. According to the theory of natural selection, a large population should be constituted by the fittest members of a species, the ones who had won the struggle for survival by having the most adaptive characteristics. Since the teeming masses of landless Irish peasants did not fit the model, Darwin was puzzled. Darwin could only conclude that this aberrant behavior must be fairly recent in our history and that humans would have to adjust for this anomaly, or our species would "retrograde." Darwin ([1871] 1874: 159) says: "We must remember that progress is no invariable rule."

What was Darwin's major contribution to the theory of evolution? Was it to present the exact mechanism whereby evolution occurred? No. Darwin was unaware of the work of Gregor Mendel. Although he argues that natural selection acts upon variations that afforded the individual possessing them some advantage, he knew nothing of genes as the unit of inheritance and the source of variation. Although his theory led to an understanding of evolutionary success as measured by

numbers of offspring, Darwin's Malthusian approach led to a paradox when applied to human populations because the largest populations should be the healthiest ones, and yet they were not. Darwin's main contribution was to initiate widespread acceptance of the fact that the earth was very much older than previously assumed. He demonstrated that there was ample opportunity within this expanded time frame for the kind of gradual adaptation to the environment that resulted in distinct species. No longer did we need to rely on the notion of divine intervention to explain the previously unexplainable. The proper study of the origins of life was removed from the sphere of religion and placed in the hands of science. There is no small irony in the fact that Malthus, the man Darwin claimed inspired him and the man I claim led him astray, was a member of the clergy.

Darwin looked at human behavior and concluded, not that there was something missing in his theory, but that humans are somehow operating against their own evolutionary self-interest, and that if we fail to correct this aberrant behavior, it will be to the detriment of us all. But there *was* something missing in his theory. It was an understanding of the importance of human economic behavior. If Darwin had not been led astray by Malthus's misguided economic ideas regarding population growth, Darwin might have been able to develop a better understanding of the processes by which natural selection operates.

A New Economic Paradigm for Understanding Natural Selection

The insistence that evolutionary change occurs as a result of competition over scarce resources, with victory going to those who produce the *most* offspring, may actually interfere with our ability to grasp the way natural selection works in humans. The force of the assumption that natural selection operates via reproductive success as determined by numbers of progeny is so strong that we refuse to abandon it even when we are unable to document it empirically. In order for the basic tenets of natural selection to be supported in all species, we would have to confirm the evolutionary advantage of maximizing numbers of offspring as well as establish that rising death rates control large populations in ways that result in speciation events.

Very few animals actually achieve their full reproductive potential. There appear to be internal regulating factors that hold population size in check before it reaches Malthusian proportions. It is unfortunate that we find it so difficult to abandon the hard-to-prove assumptions of both Malthus and Darwin because the theory of evolution will be strengthened, not weakened, by any understanding that increases its descriptive and predictive value. The *fact* of evolution by natural selection is well established. It is the *process* by which natural selection works that would benefit from some fine tuning.

By failing to fully understand the intricacies of the evolutionary *process*, especially as it applies to humans, we seriously hamper our efforts to find solutions to real-world problems such as poverty, environmental destruction, ecological imbalance, economic dysfunction, and unchecked population growth in some segments of society. The problems I have listed are, at heart, *biological* problems, and unless we get our biology straight, economists and social planners may make things worse before they make them better.

Gene Frequency, Not Population Size

One of the first problems that modern biologists had to address in evaluating the Darwinian hypothesis that population size represented evolutionary success was how to explain the evolution of sexual reproduction at a time when only asexual reproduction existed.

Once biologists understood the mechanism of the gene, the simple mathematical formula for reproductive success was this: reproductive success = gene frequency (R. S. = G. F.). By the time this simple formula came into play, consensus had formed around the idea that the unit on which selection pressure operates is not a species, nor a population, nor even the individual. Instead the gene is the unit of interest; hence the formula R. S. = G. F.

The R.S. = G. F. formula works very well in species characterized by asexual reproduction. It breaks down when it is applied to sexually reproducing species. Why is that? Because meiosis, a special type of cell division found in gamete production, consists of two stages and one of them is *reductional*. In other words, each sperm or egg cell contains only half of the total number of genes of the parent.

If evolutionary success is determined by gene frequency, it is hard to explain the evolution of a reproductive strategy that effectively throws away half of its genes before it even begins reproducing. This is the famous, and problematic, cost of meiosis.

The puzzle has been to explain our success as a species in light of our failure to play by Darwin's rules in the numbers game. Part of the problem has been that we have tried to explain a qualitative phenomenon by recourse to a quantitative one. Reproductive success in the Darwinian sense is defined by the number of offspring. Evolutionary success for most species is not a tally of how many there are but a description of the behavior of the successful members of that species. If we measured evolutionary success in terms of sheer numbers, the members of the marine plankton would rank far ahead of us, even though they remain nearly identical to their ancestors in the English chalk.

There is a solution. We simply have to introduce an adjustment into the formula for reproductive success. R. S. = G. F. x R. A. O. Reproductive Success equals Gene Frequency multiplied by the "Resource Accruing Opportunity" of the gene in question. The species for which this adjustment is most necessary is our own (Remoff 1980: 81). (There are many other species, particularly among birds and mammals, in which the survival skills of a low number of offspring are more relevant than sheer size of birth cohorts in determining which genes are transmitted. But here we shall focus only on humans.)

In all species, with the primary exception of humans, the resource accruing opportunity is pretty much a constant among members of the species. Resource accruing opportunity in most species is limited to the amount an individual consumes in food or in nesting materials. In any formula containing a constant, the constant can be dropped without affecting the solution. So Darwin's *implied* formula would work for most species except *Homo sapiens*. Darwin failed to take into account the mind-boggling difference between human resource accruing behavior and the resource accruing behavior of all other species. If we want to understand why birth-rate success is not the only game in town for humans, we need to consider the difference in R.A.O. among different humans. It is so great as to be almost incomprehensible. Recent focus on the fortunes of the 1 percent as compared to those of the

99 percent brings the difference into the headlines, but it does not make it any easier to understand.

By introducing resource accruing opportunity into the formula, we free ourselves from a narrow concern with sheer numbers and force consideration of qualitative factors, particularly the types of systems that magnify differences in human accrual capacities. But more important, we are able to understand why dominant humans, who have a reliable control of resources, are able to lower their birth rates and thereby enhance, not endanger, their reproductive success. Human reproductive decisions are always subject to economic considerations. Once societies are sufficiently developed, such that heavy investment in a small number of children is the best hope of both survival and success, humans are very good at switching away from the numbers game. In an attempt to address demographic decline, China has recently made headlines by reversing its one-child policy and allowing couples to have a second child. "But many eligible couples declined to have a second child, citing the expense and pressures of raising children in a highly competitive society" (Buckley 2015).

The reproductive strategy of investing heavily in a few children is easy for most of us to understand. More difficult to grasp is why some small percentage of the world's population seems to feel the need to accrue resources far beyond anything reasonably needed to ensure their own survival or that of their descendents forever into the future.

Darwin need not have worried that the human species "would retrograde" when those he considered "the most successful" had fewer children than "the poor and the reckless." First of all, only the very rich seem confident in assuming that there is a correlation between wealth and superior physical and mental attributes. Darwin's bigger concern should have been how environmentally devastating the behavior of his "most successful" individuals would shortly prove to be. A species that destroys the ecosystem on which it and all life depends is not "successful" in an evolutionary sense. Instead of worrying about controlling birth rates among the disenfranchised, contemporary neo-Malthusians and neo-Darwinians should focus their attention on controlling the destructive forces of overconsumption.

What is the mechanism behind the human switch from the strategy of quantitative fertility to qualitative investment in offspring?

Interestingly enough, Darwin suggested the answer in his discussion of sexual selection as the evolutionary force driving the development of the traits which differentiate us from other species. We may not be the stuff of divine intervention, but there is something that sets us apart from our nonhuman ancestors and relatives.

Sexual Selection

Darwin writes at length about sexual selection in *The Origin of Species*, but holds that it is responsible largely for differences in secondary sex characteristics (such as body hair, musculature, fat deposits, and voice pitch). In this, his first book, he helps the reader gain comfort with the notion of evolutionary change by focusing on familiar, nonhuman, examples. He also spends many pages documenting the role of animal husbandry in creating varieties within a species. We are all well acquainted with how rapidly such externally imposed selection shapes distinct breeds of dogs, for instance.

Modern biologists are mistaken to dismiss the difference between natural and sexual selection. Natural selection determines which members of a species survive. Sexual selection determines which members get born and with what traits. It helps to think of it as a system similar to the one imposed by animal breeders. However, under an authentic system of sexual selection, the animal itself gets to pick the traits important to the survival of its offspring. This is what humans do. This is what humans have done throughout our evolutionary history. We have gone animal husbandry one better. We have made the selection force internal rather than external. We control our own destiny, and we do it with sexual selection operating through a system of female choice (Remoff 1984). The loss imposed on us by the cost of meiosis is nothing compared to the gain made possible by a reproductive strategy based in sexual selection as practiced by the female of the species.

Neo-Darwinians largely dismiss the importance of sexual selection. Darwin did not. In the preface to the second edition of *The Descent of Man and Selection in Relation to Sex*, Darwin ([1871] 1874: iv) states:

> It has been said by several critics that when I found that many details of structure in man could not be explained through natural selection, I invented sexual selection; I gave, however, a tolerably clear sketch of

> this principle in the first edition of the *Origin of Species*, and I there stated that it was applicable to man. This subject of sexual selection has been treated at full length in the present work, simply because an opportunity was here first afforded me. I have been struck by the likeness of the many half-favorable criticisms on sexual selection, with those which appeared at first on natural selection; such as it would explain some few details, but was certainly not applicable to the extent to which I have employed it. My conviction of the power of sexual selection remains unshaken; but it is probable, or almost certain, that several of my conclusions will hereafter be found erroneous; this can hardly fail to be the case in the first treatment of a subject. When naturalists have become familiar with the idea of sexual selection, it will, as I believe, be much more largely accepted; and it has already been fully and favorably received by several capable judges.

It is unfortunate that Darwin was wrong on this last point. Sexual selection never achieved the acceptance afforded the more Malthusian concept of natural selection. Natural selection, with its dependence on a push against the limits of subsistence, won the favor of 19th-century thinkers. Sexual selection did not. Was it easier for the Victorian mind to accept the moral tone of a theory that sketched doom in unchecked population growth, especially as evidenced by the supposedly morally lax Irish, than it was to accept the innate power of the female in the process of sexual selection? Darwin was very clear that it is the female of the species whose tastes shape those traits molded by sexual selection.

Not even Darwin, however, was willing to grant his female contemporaries this power. He concluded that although female choice had no doubt been an evolutionary force in our distant forebears or even among "primitive" tribes, it no longer operated in "civilized" society. He did not think modern women were smart enough to make appropriate choices that would enhance the ability of the human species to adapt successfully to new environmental conditions.

Darwin saw sexual selection as resulting almost exclusively in sex-linked traits, such as the peacock's tail. His failure to understand that it could influence many traits that are not sexlinked forced him to some interesting conclusions. He believed that advanced intelligence is what sets us apart from other species. Since sexual selection driven by female choice is the force that shaped human intelligence, and since women select for intelligent men, he noted that the average mental ability of

men can be expected to be above that of women. However, Darwin ([1871] 1874: 644) backtracked a bit:

> It is indeed fortunate that the equal transmission of characters prevails with mammals; otherwise it is probable that man would have become as superior in mental endowment to woman, as the peacock is in ornamental plumage to the peahen.

Since the underlying genetic architecture associated with various physical and behavioral traits was unknown at the time Darwin wrote, he occasionally speculated on the possibility of the inheritance of acquired characteristics. Shortly after expounding on differences between male and female intelligence, Darwin ([1871] 1874: 645) described the difficulties that would be encountered in any attempt to erase that gap.

> In order that woman should reach the same standard as man, she ought, when nearly adult, to be trained to energy and perseverance and to have her reason and imagination exercised to the highest point; and then she would probably transmit these qualities chiefly to her adult daughters. All women, however, could not be thus raised, unless during many generations those who excelled in the above robust virtues were married and produced offspring in larger numbers than other women.

This passage demonstrates that Darwin remained hopelessly mired in the Malthusian belief that evolutionary success was based on producing a large number of offspring. Given his concerns about the possible decline of our species unless we reversed the trend of the "most successful" having fewer children than those of the lower classes, the solution he proposed was only bound to compound what he viewed as our problem. The irony, of course, is that we now know that the surest way to reduce birth rates in any population is to educate and empower women. Darwin fails to see that only by eliminating the structural causes of poverty can we hope to eliminate the problem of children being born into families unable to invest enough to guarantee survival of the individual child. In segments of the population where childhood mortality is high, a rational response is to have more children.

Reproductive Strategies as Economic Behavior

Humans are the economic animal. We have large brains. We have opposable thumbs. We have upright posture. We have language, a way with symbols, a way with words. We paint on cave walls, on canvas, and on subways. We make music. We sing. We dance. We are tool-makers, weapon-makers even. Our technological skills are legendary. How did we acquire all of these marvelous attributes? Most of them started with genetic mutations. However, our species did not have to wait for some limiting factor to push us to the razor's edge of survival in order for natural selection to blindly determine which of the new traits best adapted us to find a way around disaster. It is hard to explain how music could save us from a Malthusian end, but observe any rock musician surrounded by screaming groupies, and we begin to understand the role of sexual selection in driving the evolution of artistic ability.

It is not just secondary sex characteristics that are shaped by sexual selection. It is physical and behavior traits of every description. It is any trait that might make a male more attractive to a potential sexual partner. (As noted in Remoff (1984), the asymmetry between males and females in sexual selection is a function of the lower cost of and investment in reproduction by males, which forces females to be selective.) The first economic trade could well have been an exchange of meat for sexual access. The reproductive success of females dictates that they should be able to make precise calculations regarding a male's resource accruing abilities and opportunities. Birds do it. *Anolis garmani* (a lizard endemic to the West Indies) do it (Trivers 1979). Women also do it. Really well. As a result, economic virtuosity is a hallmark of our species. All animals exhibit some type of economic behavior, but in the rest of the animal kingdom, this activity is practiced at the most primitive level. Only humans have the ability to control a far greater share of resources than we can ever personally use in an immediate survival sense. This ability has been selected for by thousands of generations of women choosing mates who are best able to control resources needed for survival.

In most species, an individual's economic functioning is basic. Its physical interaction with the world is limited to the food it eats, the air it breathes, the water it drinks, and the materials it uses to modify the world to provide shelter or nest sites. What humans do is so bizarrely

complex as to appear to be a totally different order of behavior. But we should not be so smitten with our technological cleverness that we lose sight of its underlying purpose. Our species has elaborated on a very primitive design, but the underlying biological functions of survival and reproduction are what are being served.

Clever creatures that we are, we are skilled at making appraisals of the reliability of our access to necessary resources and at adjusting our birth rates in response to those assessments. The goal is to ensure that at least some of our children have a chance of reaching the age when they will be capable of passing our genes into the gene pool of the next generation. The formula that works for humans is not R. S. = G. F., but R. S. = G. F. x R. A. O. It makes excellent biological sense for a species whose economic behavior varies widely among individuals to increase fertility when economic control is tenuous and to decrease it when it seems guaranteed.

Malthus, by his failure to understand human reproductive strategies, got both economics and biology off on the wrong foot. Economics fails to take our biological natures into account, and biology fails to incorporate appraisals of economic control into its calculations of reproductive success. For those who ignore the power of sexual selection and worship at the shrine of natural selection, large numbers of offspring indicate a superior adaptation to the environment. But when it comes to skill at having and not having babies, humans are a case apart. This does not mean that we are less animal in nature, but that the very speed of our evolution indicates a unique shift in the strategy of reproductive competition from quantity to quality. For us, runaway population growth screams of unreliable access to the natural world, not superior adaptation to it.

Greed-Driven Environmental Destruction

Those who are quick to blame overpopulation for environmental destruction fall back on Malthusian explanations because they enable us to point the finger at others and ignore the part the developed world plays in our escalating ecological tragedy. David Funkhauser (2012) summarizes a report, "People and the Planet," prepared by the Royal Society, which begins by listing statistics that we would do well to

heed. "A child from the developed world consumes 30–50 times as much water as one from the developing world … CO2 emissions are up to 50 times higher in high income than in low income countries." Funkhauser (2012) concludes by quoting Sir John Sulston, a fellow of the Royal Society and chairman of the working group that produced the report.

> The World now has a very clear choice. We can choose to address the twin issues of population and consumption. We can choose to rebalance the use of resources to a more egalitarian pattern of consumption, to reframe our economic values to truly reflect what our consumption means for our planet and to help individuals around the world to make informed and free reproductive choices. Or we can choose to do nothing and to drift into a vortex of economic, socio-political, and economic ills, leading to a more unequal and inhospitable future.

It is clear that our environmental woes spring not from the reproductive behavior of people in impoverished regions but from the greed of those in affluent ones. What is the best way to go about rebalancing "the use of resources to a more egalitarian pattern of consumption?" Perhaps it is time to return to Ricardo's theory that economic rent reflects relative scarcity and abundance. Perhaps it is time to seriously consider applying the solution that Henry George ([1879] 1979: BK VIII, Ch. 2) suggested. The most efficient way to address social and economic inequality is to impose a tax on the value of land and thereby extract from private hands the surplus created by social activity. In addition, putting a price on the wasteful monopolies of naturally occurring resources is an excellent way to address the events leading to climate change and environmental destruction.

Disruption of the Ecological Balance

Population problems are symptomatic of a breakdown in the distributive function of human economic systems. Runaway population growth in any segment of the world's population is our dead canary in the coal mine, the early warning that humans are not quite as clever at mastering nature as we had once assumed. The solution is not to be found in mandating birth control. The solution is to be found in addressing the root cause of poverty and growing inequality.

In fact, the solution to our economic woes is the same as the solution to our environmental ones. We are a species out of ecological control. We poison the air, the water, the soil. We watch in horror as our numbers double, triple, and quadruple. We destroy rain forests and deal carelessly with the fate of other species without understanding their place in the chain of life in which we may well prove to be the weakest link. The vital connection between economics and biology is land. Land is the regulating factor that holds both population growth and environmental destruction in check. What has happened to distort our innate relationship with the land and with all the natural resources on which life depends? Where did we go astray?

Although some degree of privatization of land has occurred in all civilizations around the world, there were generally loopholes that allowed the poor to glean grain left in fields after the harvest, to catch fish in rivers, or to collect firewood for cooking and heating. But in recent centuries those exceptions have been closed off, leaving the poor with less access to nature than was previously the case. The process of enclosure began in England in the mid-16th century and—despite often violent protests by those disenfranchised of their access to pastures, forests, and other common ground—continued through the mid-19th century. By the time the process was complete, exclusive rights to the private ownership of land were formalized in law.

Today, most people accept the unrestricted private ownership of natural resources as an inevitable part of living in society, but, in fact, it is a violation of our deepest biological needs and rights. Some critics propose to rectify this condition by placing all land under public ownership or management. However, private property in land and other natural resources does not need to be abolished in order to correct the injustice.

There is a simple remedy that allows the value of land to be shared with everyone, even as owners continue to manage it privately. It requires nothing more than a tax on land values, offset by a reduction in other taxes. When public expenditures are financed entirely through fees levied against environmental destruction, as in the imposition of a tax on carbon emissions, it becomes too expensive to destroy the environment. When monopoly holdings in natural resources are similarly

taxed, it becomes too expensive to own more land than one can productively use. Such charges make natural resource consumption costly and serve as a market-driven impetus to use nature's gifts efficiently and productively. Such charges also counteract the *artificial* scarcity of land resulting from the practice of speculatively withholding land from use. With monopoly destroyed, land regains its power as the regulating factor that supports human ecological balance. In addition, by innovating practices that maximize the efficient use of natural resources, we boost actual productivity. This drives an increase in *real* wealth (as opposed to paper assets) and raises the universal standard of living without unduly stressing the environment.

Economic rent is determined by the differential value produced by any unit of land compared to the value that the same amount of effort can secure from the least productive land in use. That differential value is a condition created by nature and by society, not by improvements made by an individual landowner. Increases in that value over time raise the price of well-situated land without any effort on the part of the owner. Unless the rise in economic rent is countered by the *public* collection of that rent through a system of fees/taxes, any increase in productivity will go not to labor in the form of wages, but to landlords in the form of rent. Henry George recognized this and proposed a land value tax as a means of offsetting the economic distortions produced by monopoly holdings in natural resources.

Malthus and Wallace

Alfred Russel Wallace, who came so close to being the father of the theory of evolution, claimed, as Darwin did, that Malthus inspired his understanding of how natural selection shaped the development of new species. However, toward the end of his life, Wallace rejected both Thomas Malthus and the idea that natural selection was sufficient to explain the human tendency toward progress. While never entirely abandoning his earlier interest in science, he turned increasingly to spiritualism in his attempts to understand the world. He had not been completely convinced by Darwin's discussion of animal husbandry and sexual selection. That is regrettable because had he followed Darwin's arguments on sexual selection to their logical conclusions, he would

have found a mechanism to explain the fact that evolution appeared to have been purposive, not the result of chance. He felt human development in particular showed evidence not of mere design but of intention. In that he is correct, but it is a system of sexual selection powered by female choice that is driving what Wallace perceived as intent!

Wallace's embrace of spiritualism may have satisfied his personal need to see the universe as beneficent, but it did nothing to solve the puzzles of science. We tend to relegate to the realm of religion that which science cannot explain. Religious insight is based in faith, and faith does not offer many testable hypotheses when it comes to our attempts to understand the workings of the physical world around us. Those who invoke a "god of the gaps" (a theological explanation to fill in holes in scientific theories) may imagine they advance human knowledge, but they actually denigrate both theology and science in the process.

Wallace's *eventual* rejection of Malthus was more interesting because, in it, he did so based on data based in observations of the world around him. The shift in his thinking came about because of his concern about poverty. Unlike Henry George, who advocated land value taxation to shift wealth from landowners to workers, Wallace (1880) proposed to achieve the same result by nationalizing land. This was his response to the policy of allowing starvation during the potato famine in Ireland, which was the logical result of following the Malthusian philosophy.

In an interview, Frederick Rockwell (1912: 662–663) asked Wallace about his embrace of socialism. Wallace waxed so poetic about the prosperity that land nationalization would yield that the interviewer attempted to pull him back from the brink of utopia:

> Rockwell: Under such a scheme, where plenty reigned, would not the population so increase that poverty would eventually come up again?
>
> Wallace: The theory propounded by Malthus is the greatest of all delusions. As man develops toward a higher type: as he becomes more civilized, so his fecundity decreases. Low down in the scale of life, birth is limited only by available sustenance. But the higher grows the type, the less is the fecundity. This is true, not only of ascending types in the evolutionary scale, but it is also true of ascending man. The fecundity of the slums is much greater than that of Mayfair. As man progresses in comfort

> and refinement, he tends to have fewer progeny; as witness the millions in China and India, compared with the almost stationary population of England, and the declining population of France.

Darwin, unlike Wallace, never publicly denounced the Malthusian principle of population. However, Wallace (1881) wrote to Darwin to recommend that he order a copy of Henry George's *Progress and Poverty*, which was first published in 1879. Darwin (1881) replied, saying that he would order the book.

> But I read many years ago some books on Political Economy, & they produced a disastrous effect on my mind, viz utterly to distrust my own judgment on the subject & to doubt much everyone's else judgment.

It is tempting to suggest that he was here referring to the work of Malthus. Unfortunately, at least for the linked sciences of biology and economics, the economist Darwin failed to understand may well have been David Ricardo. Remember, despite being wrong, Malthus's theory is easy to understand!

Wallace recognized the folly in Malthusian predictions of ever-expanding populations. He saw that distortions in the equitable distribution of land led to poverty, which, in turn, led to high rates of fertility. However, he failed to incorporate these two observations into a scientific theory but turned instead to spiritualism and to land nationalization. Spiritualism is no substitute for science. Land nationalization is a less efficient route to economic justice than that proposed by Henry George, whose definition of land referred to all naturally occurring resources. Today we are as concerned with environmental destruction as we are with monopoly holdings of the ground under our feet. Those who pollute the air, foul and deplete water supplies, and destroy ecosystems must also be held accountable and charged accordingly. Land nationalization simply does not go far enough.

Solutions

We of the 21st century continue to struggle with the twin problems of poverty and population increase. We fail to recognize that what we view as population problems are a biologically adaptive response to

economic distortions. Poverty fails to yield to economic solutions, because our economic theories fail to embrace the biological imperative in which they should properly be grounded. The idea that economic rent should be distributed equitably is not some outdated theory that works only in preindustrial economies.

Both biology and economics will remain flawed disciplines until they break with their dependence on a theory of population that is based more in social bias than in scientific observation. Ecology may be the field of scientific endeavor best suited to highlighting the role land plays as an innate connection between economics and biology. Evolutionary biology will be strengthened when our understanding of reproductive success is adjusted to reflect the ways in which economic institutions shape adaptive behavior by serving as an intermediary between environmental conditions and individual choice. By acknowledging the importance of access to land, we can break the chains that hobble world economies and condemn some segments to live in poverty while others enjoy material progress. When that happens, economics will no longer be seen as the dismal science, but will flourish under a system of growth that enables all people to receive full and fair compensation for their efforts.

Thomas Robert Malthus was wrong in 1798, and he is *still* wrong. Those who think the solution to inequality and environmental destruction lies in controlling population growth are wrong. Social biases continue to misinform the debate. Malthus wanted to blame the reproductive habits of the much-maligned Irish for their poverty. Darwin was and is just as bad. His fears in 1859 about the Celts outbreeding the Saxons do not sound much different from arguments going on in the Middle East in 2016.

The distorting effects of Malthusian thought also show up in concerns expressed over the birth rates of immigrant populations, and in dire warnings about population growth in India, in some African countries, and among certain religious groups. Still influenced by the flawed view that overpopulation creates poverty, rather than the reverse, we see population growth as the problem that must be addressed before we can hope to solve serious issues such as climate change, habitat loss, extinction events, and poverty. Enough already. These are not problems of reproductive excess. They are economic problems. Fix the flaws in our economic systems, and the problem of high birth rates

among the disenfranchised will correct itself. It is not runaway population growth that we need to control; it is the environmental devastation caused by policies that reward unbridled greed. The place to look for solutions is in the mirror, not in bedrooms halfway around the world from us, not in neighborhoods on the "wrong" side of our own tracks.

References

Buckley, Chris. (2015). "China Ends One-Child Policy, Allowing Families Two Children." *New York Times* October 29.

Campbell, Stephen J. (1994). *The Great Irish Famine.* County Roscommon, Ireland: Famine Museum.

Cantor, Norman F. (2001). *In the Wake of the Plague: The Black Death & the World it Made.* New York: Simon & Schuster.

Darwin, Charles. ([1845] 1912). *Journal of Researches into the Geology & Natural History of the Various Countries Visited During the Voyage of HMS BEAGLE round the World*, 4th ed. New York: E.P. Dutton & Company.

———. ([1859] 1888). *The Origin of Species by Means of Natural Selection*, 6th ed. New York: Hurst & Company.

———. ([1871] 1874). *The Descent of Man and Selection in Relation to Sex*, 2nd ed. New York: A.L. Burt Company.

———. ([1876] 1887). *The Life and Letters of Charles Darwin.* London: John Murray.

———. (1881). "Letter to Alfred Russel Wallace." DCP-LETT-13243. July 12. https://www.darwinproject.ac.uk/letter/?docId=letters/DCP-LETT-13243. Text of letter: http://darwin-online.org.uk/content/frameset?pageseq=1&itemID=F1592.1&viewtype=text on page 318.

———. (1996). *Charles Darwin's Letters: A Selection.* ed. by Frederick Burkhardt. New York: Cambridge University Press.

Dawkins, Richard. (1976). *The Selfish Gene.* New York: Oxford University Press.

Funkhauser, David. (2012). "Population, Consumption, and the Future." *State of the Planet.* New York: Earth Institute, Columbia University. April 27. http://blogs.ei.columbia.edu/2012/04/27/population-consumption-and-the-future/.

Gaffney, Mason, and Fred Harrison. (1994). *The Corruption of Economics.* London: Shepheard-Walwyn Ltd.

Galor, Oded, and Weil, David N. (1998). "Population, Technology, and Growth: From the Malthusian Regime to the Demographic Transition and Beyond." National Bureau of Economic Research Working Paper. http://www.nber.org/papers/w6811.

George, Henry. ([1879] 1979). *Progress and Poverty.* New York: Robert Schalkenbach Foundation.

Henrich, Joseph. (2016). *The Secret of Our Success: How Culture is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*. Princeton: Princeton University Press.

Kirzner, Israel M. (1978) *Competition and Entrepreneurship*. Chicago: University of Chicago Press.

Li, C. C. (1968). *Population Genetics*. Chicago: University of Chicago Press, 1968.

Malthus, Thomas Robert. (1798). *An Essay on the Principle of Population, as it Affects the Future Improvement of Society*. London: J. Johnson. http://www.socserv2.socsci.mcmaster.ca/~econ/ugcm/3113/malthus/popu.txt.

———. (1808). "A Statistical and Historical Inquiry into the Progress and Magnitude of the Population of Ireland, by Thomas Newenham, Esq." *Edinburgh Review* July: 336–355 (published anonymously).

———. (1815). *An Inquiry into the Nature and Progress of Rent, and the Principles by Which it is Regulated*. London: John Murray. http://avalon.law.yale.edu/19th_century/rent.asp.

———. ([1820] 1951). *Principles of Political Economy*. New York: Augustus M. Kelly.

Maynard Smith, John. (1971). "What Use is Sex." *Journal of Theoretical Biology* 30:319–335.

Miller, Kerby A. (1985). *Emigrants and Exiles: Ireland and the Irish Exodus to North America*. New York: Oxford University Press.

Ó Gráda, Cormac. (1983). "Malthus and the Pre-Famine Economy." *Hermathena* 135: 75–95.

Remoff, Heather Trexler. (1980). "Female Choice: An Investigation of Human Breeding System Strategy." Ph.D. dissertation, Rutgers University. Registration 692-164. Ann Arbor, MI: University Microfilms International.

———. (1984). *Sexual Choice: A Woman's Decision: Why and How Women Choose the Men They Do as Sexual Partners*. New York: E.P. Dutton.

Ricardo, David. ([1815] 1963). *The Principles of Political Economy and Taxation*. Homewood, IL: R.D. Irwin.

Rockwell, Frederick. (1912). "The Last of the Great Victorians; Special Interview with Dr. Alfred Russel Wallace." *Millgate Monthly* 7: 657–663. http://people.wk.u.edu/charles.smith/wallace/S750.htm.

Smith, Charles H. (1999). "Alfred Russel Wallace on Evolution: A Change of Mind?" Presented February 26 at the Symposium on the History of Medicine and Science at the University of Southern Mississippi, Hattiesburg, MS. http://people.wku.edu/charles.smith/essays/WALLTALK.htm.

Stigler, George J. (1965). *Essays in the History of Economics*. Chicago: University of Chicago Press.

Sullivan, M. F. (1881). *Ireland of Today: Causes and Aims of Irish Agitation*. Philadelphia: J. C. McCurdy & Company.

Trivers, Robert L. (1979). "Sexual Selection and Resource Accruing Ability in Anolis Garmani." *Evolution* 30(2): 253–269.

Wallace, Alfred Russel. (1866). "Letter to Charles Darwin." DCP-LETT-5140. July 2. http://www.darwinproject.ac.uk/DCP-LETT-5140.

———. (1880). "How to Nationalize the Land: A Radical Solution of the Irish Problem." *Contemporary Review* 38: 716–736. https://books.google.com/books?id=TrkIAAAAIAAJ&pg=PA265#v=onepage&q&f=false.

———. (1881). "Letter to Charles Darwin." DCP-LETT-13238. July 9. https://www.darwinproject.ac.uk/letter/?docId=letters/DCP-LETT-13238. Text of letter: http://darwin-online.org.uk/content/frameset?pageseq=1&itemID=F1592.1&viewtype=text on page 317-318.

———. (1883). "The Why and How of Land Nationalization." *Macmillans Magazine* 48: 357–368, 485–493. http://people.wku.edu/charles.smith/wallace/S365.htm. Paginated text at: https://babel.hathitrust.org/cgi/pt?id=mdp.39015027356198;view=1up;seq=6.

———. (1885). "How to Cause Wealth to be More Equally Distributed." *Industrial Remuneration Conference: The Report of the Proceedings and Papers*, page 369. http://people.wku.edu/charles.smith/wallace/S375.htm.

Williams, George C. (1966). *Adaptation and Natural Selection*. Princeton: Princeton University Press, 1966.

———. (1975). *Sex and Evolution*. Princeton: Princeton University Press.

Woodham-Smith, Cecil Blanch. ([1962] 1991). *The Great Hunger*. New York: Penguin.