53. The green revolution was in fact another battlefront in the cold war, another weapons in the arsenal of the developed world to entice and control the developing world. See John H. Perkins, *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War* (New York and Oxford: Oxford University Press, 1997).

54. Manning, "The Oil We Eat," 41.

55. See also Richard Manning, *Against the Grain: How Agriculture Has Hijacked Civilization* (New York: North Point Press, 2004).

56. McNeill, *Something New Under the Sun*, 224, note 77.

57. Manning, "The Oil We Eat," 44.

58. Richard Leaky and Roger Lewin, *The Sixth Extinction: Patterns of Life and the Future of Humankind* (New York: Doubleday, 1995).

59. I have explored this spatialized/spatializing *dyke* in "Biopiracy and Bioterrorism: Banana Republics, NAFTA, and Taco Bell," forthcoming.

Chapter 2

Scape Invaders: Transgenic Animals, Nature, and the Ecoscape

Benjamin Hale

> From this I was aroused, after I know not how long, by a rustling amidst the greenery on the other side of the stream. For a moment I could see nothing but the waving summits of the ferns and reeds. Then suddenly upon the bank of the stream appeared Something—at first I could not distinguish what it was. It bowed its round head to the water, and began to drink. Then I saw it was a man, going on all-fours like a beast. He was clothed in bluish cloth, and was of a copper-coloured hue, with black hair. It seemed that grotesque ugliness was an invariable character of these islanders. I could hear the suck of the water at his lips as he drank.
>
> H. G. Wells, *The Island of Dr. Moreau*

> Our tradition has so far held that the concept of species should be taken pretty seriously and that the boundaries of a species should be respected. At a popular level, this view is reflected in the symbolism of our myths. Traditional mixed monsters—minotaurs, chimeras, lamias, gorgons—stand for a deep and threatening disorder, something not just confusing but dreadful and invasive. Although benign monsters such as Pegasus and archangels are occasionally found, in general the symbolism of mixing species is deeply uncanny and threatening. Even less mixed monsters, such as giants and three-headed dogs, are so framed as to violate the principles of construction that normally make life possible for their species. They too are usually seen as alien and destructive forces.
>
> Mary Midgley, "Biotechnology and Monstrosity"[1]

H. G. Wells' classic piece, *The Island of Dr. Moreau*, sketches a scene of gruesome and beastly science-gone-awry, in which an exiled scientist, Dr. Moreau, holed away on a tropical desert island, creates a panoply of cross-stitched human-animal hybrids, sewn together from puzzle-pieces of arms, legs, and tails. Through the device of fiction, Wells presents the unpleasant prospect that Moreau's unnatural creatures might escape from their cages and overtake their creator. While Wells' nightmare is fictional, his clear target is the aspirations and the experimentation of the natural scientists of his day. By presenting the case of Moreau, Wells creatively asks the question that we must begin now to

ask ourselves in earnest, because now, Wells' nightmare is no longer fiction. Now, we have the genetically modified hybrids of Dr. Moreau's island. More urgently, we now face the prospect that the inhabitants of Moreau's island could escape their cages, cross the ocean, and invade our environment.

It is certainly true that the allegory of Dr. Moreau introduces many questions related to current environmental and bioethical concerns, particularly with regard to genetic modification. One immediate and important question that it raises is whether it is wrong to engage in the practice of genetic modification at all. Clearly there are straightforward "right" answers to this question. Humans have inviolable, indefeasible rights, it is thought, and the practice of experimenting with human genetic material carries with it strong ethical proscriptions. Animals, too, it would seem, ought not to be subject to gross harm. Tinkering with their genetic makeup might seriously subject them to unanticipated maladies. Both of these criticisms are relatively easy to understand and well-accepted objections to genetic modification. But there are equally well-accepted responses to such criticisms, many of which seek to defend the practice of genetic modification by identifying the tremendous human benefits that such modification might provide; or even by reasoning that any individual human can assent to the use of her own genetic material for such experimentation.

There are also more complex answers to the question of whether there is anything wrong with Moreau's experimentation. Many times these relate to the environmental impacts and interactions of these creatures on the environment. Tampering with nature, it is argued, means tampering with a delicate balance, such that any deviation from this natural harmony will produce incalculable damage to the ecosystemic whole. This too is relatively easy to understand and well-accepted. But just as there are well-accepted and reasonable "benefits-oriented" responses to individual rights concerns, so are there similar instrumental responses to these system concerns. Again, the damage to the ecosystem might be tolerable, so long as benefits to the inhabitants of that ecosystem are worth it.

One glaring problem with many of these arguments is that they depend on a conception of nature that is so flimsy as to prove unhelpful. At the very least, the conception of nature to which they appeal often equivocates in use between claim, justification, and counterclaim. In the case of simple genetic modification, the claim is sometimes both that it is "unnatural," in the sense that it is artificial, and that it is "unnatural," in the sense that it upsets the delicate balance of the individual organism. In the case of the ecosystem, the claims are similar—that the introduction of a non-indigenous species is "unnatural," in the sense that it contaminates and degrades wilderness, and that it is "unnatural," in the sense that it upsets the balance of the ecosystem. For reasons like these, Kate Soper's fantastic book *What Is Nature?* addresses the issue of the meaning of the term "nature" with skepticism.[2] She begins from the supposition that "nature" is not a rigid category and investigates the dualisms that make much of nature or nurture, civilization and nature, human and non-human. But what she does not do, and I am in agreement with her here, is abandon the sense in which nature is

real. Instead, she seeks to carve a path between strict constructionist accounts of nature and more realist accounts of nature.

In a recent working paper and in earlier works, Steven Vogel also addresses the question of "nature" to argue that environmentalism would be better off without the concept altogether.[3] His negative position is that the concept of nature is so terribly muddled that it is of no practical use to the environmentalist. Instead, he seems to think that the concept of the "environs," or the *umwelt*, would suffice much more satisfactorily for such a discussion. In this paper I will argue along these lines, in Soper's and Vogel's spirit, that the concept of the ecoscape may be more appropriate to some environmental concerns than traditional conceptions of nature. I would venture that the concept of the ecoscape can play a similarly important role in many environmental debates, and that we can easily make sense of this claim if we look to the kind of problem that crops up when genetically modified organisms—particularly human-animal hybrids—escape from their cages and enter our environment.

I will tackle this problem in four sections. The first section I devote to a discussion of genetically modified animals, with the intent of identifying the debates that give rise to the confusion over the meaning of "nature." In the second section I recapitulate Soper's distinction between the metaphysical, the real, and the "lay" position on nature. Here I ask whether "nature," as conceived in any of these three ways, can appropriately give rise to the right sorts of questions with regard to genetic modification. In the third section, I introduce the peculiar problem of the invasive transgenic animal and reason that it exposes contradictions implicit in metaphysical and real conceptions of nature. In the fourth section, I argue that the "ecoscape" may be a more appropriate category for addressing some, though not all, concerns related to genetic modification and the eventual invasion of genetically modified animals into our environment.

Unnatural in the Extreme: Organisms, Animals, and Hybrids[4]

Genetically Modified Organisms, or GMOs, have captured the world's attention, tickled the world's fears, and enflamed tense public debates. While many of these debates focus on the morality of genetic modification as it is performed upon individual animals, many other debates revolve around the potential impacts or consequences of the introduction of GMOs into an otherwise "natural" ecosystem. In response to public pressure, for instance, the British Government passed the Genetically Modified Organisms Regulations of 2000,[5] strengthening containment requirements for genetic technologies on fears that an uncontrolled release of GMOs into the ecosystem could have devastating consequences. Following this, in May of 2004, legal battles forced the European Union to loosen restrictions on the production and use of GMOs.[6] Not surprisingly, such public debate tends to focus either on the unnaturalness of gene-tampering or on threats

to ecosystems and crops. Discussion of matters in these terms is primarily instrumental: the emphasis is on unanticipated negative repercussions to animals or ecosystems on which humans depend. Some say, however, that such instrumental concerns are completely unfounded and mask the real issue. Members of the World Bank, for example, have charged the European Commission with ulterior motives, urging that precautionary concerns about containment amount to little more than trade protectionism.[7] Such back-and-forth discussions have become somewhat rudimentary and familiar in the literature.

More perplexing, however, are the issues that relate to Genetically Modified Animals, or GMAs, since animals also present us with the possibility that we must consider them for their own sake.[8] Animals have feelings and interests in ways that plants do not, and so we must begin now with the hard questions about whether "playing God" on these animals amounts to ethical heresy. In popular culture, the intense ethical debates surrounding the development of GMAs revolve primarily around the use of embryonic stem cells, around the morality of tampering with the divine order of things, and around the prospect of cataclysmic interruptions in the ecosystemic fabric, and so on.[9] As such, many of these debates assert an "unnaturalness" to the GMA that is supposed to imply an ethical conclusion. Such arguments suffer not only from the naturalistic fallacy, but also from an unclear sense of what the term "natural" denotes. In part, this is due to the wide variety and newness of GMAs and GMOs, though it is the claim of this author that the bigger problem lies in the definition of the term "natural." Therefore, to understand the multidimensional problem appropriately, we might begin by making a conceptual distinction between types of GMAs.

To this end, there are at least two relevant categories of GMAs: those that occur across species boundaries but do not involve the genetic material of humans; and those that involve the integration of human genetic material into the animal or plant kingdom. Generally, the first sorts of cases of genetic modification employ technologies for the purpose of developing new crops. Cows are treated genetically to produce more meat, tender flesh, more milk; pigs are treated genetically to develop lower fat and lower cholesterol meats; fish are treated genetically so that they glow underwater, and so on.[10] In almost all of these cases, non-human animals have been crossed with other non-human animals. These I will refer to as simple GMAs. In a way, the genetic modification done on these animals is not altogether different than the selective breeding modifications that have been done for centuries to produce numerous domesticated animals.[11] It is therefore subject to the same objections that have been raised against the cross-breeding and cultivation of early agricultural domestication.[12]

But the second category of GMAs treats animals as though they are organ production laboratories. These transgenic animals are used to grow *human* organs—skin, blood, livers, and so on—for transplantation into *humans*. In this case, the end-goal is xenotransplantation, and we seek not a product, but a *replacement part.* These xenotransplantation-oriented GMAs present slightly different problems for us, because the technology integrates human genetic material with animal material. I will abbreviate these sorts of GMAs as XGMAs.

With all GMAs, both simple GMAs and XGMAs, there are two moments of crossover that will concern us in this paper. In the first set of transmogrifications, genes are transferred to the healthy chromosomes of a related animal. In the second set of transmogrifications, the resultant organism begins to play a role in its broader environment. The distinction between the GMA and the XGMA here has its salience, since simple GMAs are developed primarily for the purpose of being grown and used in the environment, while XGMAs are generally intended solely for use in the laboratory and thus are frequently not subjected to the same containment requirements as simple GMAs. I will attend to the second set of transmogrifications later in the paper.

If there is one outstanding characteristic of XGMAs, it is that they are hybrid creatures: part animal, part human. In some circles, the resultant organisms are considered to be "chimeras"—mystical creatures plucked from the pages of ancient mythology—though the term "chimera" does not clearly distinguish between simple GMAs and XGMAs. By their very composition, XGMAs blur the already blurry boundary between human and non-human animals. Further, they call into question the distinction between the natural and the artificial, since XGMAs are part human, and in a way, their actions could be considered to be human-derived. This might also be thought to be true with simple GMAs, but this kind of cross-breeding species perpetuates a confusion regarding "nature" that I would like to overcome in this paper, and so I will be attending primarily to the somewhat more "unnatural" development of XGMAs. With these creatures, I believe, we can see starkly how the term "nature" is unsatisfactory for the circumstances.

In a recent article on transgenic animals in the *American Journal of Bioethics*, Jason Scott Robert and François Baylis mention four main instances of XGMA uses:

> Snyder and colleagues at Harvard have transplanted human neural stem cells into the forebrain of a developing bonnet monkey in order to assess stem cell function in development;[13] human embryonic stem cells have been inserted into young chick embryos by Benvenisty and colleagues at the Hebrew University of Jerusalem;[14] and most recently it has been reported that human genetic material has been transferred into rabbit eggs by Sheng,[15] while Weissman and colleagues at Stanford University and StemCells, Inc., have created a mouse with a significant proportion of human stem cells in its brain.[16]

Already since the printing of the article, there have been many more instances worth noting, specifically increasing the possibility that such XGMAs are not very far off into the future. Recently, for instance, scientists and doctors at Massachusetts General Hospital in Cambridge have been able to successfully transplant pig-grown GM kidneys into baboons.[17] In a recent *Mother Jones* article, Mark Dowie tells the tale of Dr. Stewart Newman, a modern day Dr. Moreau, who applied in 1998 for a patent on a human-animal Chimera.[18]

To be fair, many of the first generation of XGMAs have been used not for the purposes of developing organs for transplantation into humans, but rather to

create more accurate testing templates for human study.[19] XGM Mice, for instance, have been studied at NIH to determine the carcinogenicity to humans of certain toxins.[20] Indeed, at present, the experimental benefits are perhaps more hopeful than the somewhat futuristic claims of eventual organ development. This issue has been taken up productively by Bernard Rollin, who, citing the practical inevitability of the use of human-animal medical templates, thinks that the only ethically acceptable compromise in these cases is to generate XGMAs that have the important epidemiological characteristics of humans, but that have been decerebratized and anaesthetized to feel no pain and to have no subjective experiences whatsoever.[21]

For all of the promise of such research—which is more or less evident to those who can imagine the uses to which such nascent technologies can be put—there is also a somewhat instinctive revulsion. This has been dubbed the "Yuck" Factor by Mary Midgley, who thinks that we ought to listen to ourselves when we feel these misgivings.[22] A simple and recent example illustrates this sentiment fairly well: in April 2005, researchers at the National Institute of Agrobiological Sciences in Tsukuba, Japan, announced that they had added human genetic material to a strain of rice, thereby making it more resistant to herbicides.[23] (Human rice?!? Yuck!) Indeed, this Yuck factor is played up in popular culture, to such a degree that it is often difficult to determine what, exactly, the real ethical issues are. From a pragmatic standpoint, it may make good sense for us to listen to our intuitions. However, there are far more axiomatic and principled objections to XGMA technology than pat rejection of it.

In the end, Robert and Baylis's article laments that the introduction of transgenic species will "introduce inexorable moral confusion in our existing relationships with non-human animals and in our future relationships with part-human hybrids and chimeras."[24] This moral confusion, one must assume, relates to a preconception of human *nature*. Their article has resulted in a flood of commentary from names throughout the bioethical establishment. Hilary Bok, for instance, rejects Robert and Baylis's worry about the confusion of the meaning of the term "species" by appealing to our intuitions about human beings. We simply know a human when we see one, she thinks, and unless there are exceptionally significant genetic similarities between XGMAs and humans, then we will have no reason to be confused at all.[25] Jill Didur points out that critical posthumanists like Donna Haraway question "the view that there was ever an originary divide between these things in the first place."[26] Still others claim, as Andrew Siegel does, that XGMAs do not actually call into question the assumption that being a human is sufficient for personhood, since this issue was already called into question long ago. But Siegel, at least, does so on grounds that it is positively clear that being a human—that is, having "one hundred percent" human genetic material—is sufficient to be considered a person. He thinks that it is far more common to encounter the position that advanced cognitive capacities, not biological humanness, are sufficient for personhood. The real test, he thinks, will be if they can think.

Indeed, many *have* already persuasively objected to biological humanness as a baseline criterion for personhood.[27] While I can certainly agree with Siegel's criticism of Robert and Baylis, I do not agree that the attribute of having advanced cognitive capacities has so clearly been established as the grounding criterion for determination of moral status. Such a point has been argued repeatedly by authors ranging from Peter Singer to Bernard Rollin to Aldo Leopold, and there is little reason to adopt the rational-anthropocentric line of argument to defend the claim that these creatures pose no new ethical problems for us.

Another line of argument works to anticipate Robert and Baylis's argument by rejecting the idea of biological humanness and pointing out that *almost all* mammalian species share a majority of genes with humans, though some clearly more than others. Chimpanzees and humans are approximately 98 percent biologically alike, for instance.[28] And mice, shockingly, share 80 percent of the same genetic code with humans.[29] The idea that the introduction of genetic material into mammals that are already "mostly" human will somehow make them more morally considerable makes little sense. From a moral standpoint, one or two more drops could not reasonably make much difference. Indeed, when statistics such as these are invoked, they are generally done with loftier intentions: to demonstrate that basing moral status on genetic composition is entirely wrongheaded. Nothing about genetic code could possibly count as an attribute or feature of a being that would make it morally considerable.

Further, such developments do in fact call into question the hard-and-fast categories of evolutionary biology. While the category of "humanness" might once have been thought an immutable and static given, in the face of human-nonhuman transgenic modification, it is subject to question in much the same way that the category of "race," in the face of miscegenation, has been called into question.[30] Where it was once thought that a race was an immutable and essential category—indeed, the term "race" was used interchangeably with the term "species" in many early biological texts—such "one drop" theories have been shown to be fallacious prejudices on the part of adherents.[31] Nobody really considers races to be hard metaphysical categories anymore. At best, they are demographic and epidemiological tools, conceptual devices that help us make sense of general tendencies within genetically similar cohorts of humans.

In an article unrelated to Robert and Baylis's, Ronnie Hawkins puts a different spin on the genetic similarities between species and argues that once we understand ourselves to belong to the evolutionary spectrum of creatures—as primates, for instance—then we will be better equipped to take responsibility for our actions ecologically.[32] This may very well be. I see no reason to quarrel with Hawkins on this point. My concerns below, however, will be to expand on his conclusion a bit, to agree that the question of XGMAs points to an untidy definition of species and, more importantly, that this untidy definition of species, is seated in some very confused conceptions of *nature*. Robert and Baylis's proposal that the development of XGMAs threatens to generate "inexorable moral confusion" by obfuscating divisions between generally accepted species bounda-

ries, which had provided clear criteria for moral delineations, might be used to show that our hitherto acceptable delineations have been wrongheaded.

How the XGMA Demonstrates the Corruptness of Nature

In a distinction that I think helpful, Kate Soper discriminates between three positions on nature: the metaphysical position, the realist position, and the 'lay' position.[33] As we see above, these three positions frequently blend together in discourses in environmental ethics, and we would do well to delineate them clearly here. According to the *metaphysical* position, she explains, nature is conceived of as that which is wild, that which is untouched by the hands of man. Here Soper identifies the sense of "nature" that distinguishes it from that which is artificial. This metaphysical sense is distinct from what she calls the *realist* sense of nature, which can be understood as the distinction between nature as conceived of according to the relationships and structures between physical entities. The realist position, for instance, might be the position of the natural scientist, the ecologist, the biologist, or the geneticist. In this case, the realist position on nature attempts to isolate the real systemic effects of tampering on ecosystems in the environment. Finally, Soper outlines the "*lay*" position on nature, which she explains as the position that distinguishes nature from human dwelling areas. Here, "nature" can refer to our backyard, the country, the mountains, or even our garden. The distinction in this case is between that which is a component of our daily human environs and that which is outside of the normal human habitat. Importantly, all three of these positions hit on some element captured by the notion of an ecoscape, about which I will say more in the fourth section.

These distinctions can be helpful in our discussion of the ways in which XGMAs have been considered to be unnatural. In the first case, *we have the metaphysical position*. This position evaluates all XGMAs as somehow distinct from nature, insofar as one might say that there appears to be nothing "natural" about their existence. XGMAs were brought about in artificial ways, created in the laboratory from the building blocks of life. On the face of it, they appear to be thoroughly artificial, man-made creations, much like the creations on Moreau's island. The position that XGMAs are artificial is common, and we can make sense of the kinds of arguments that emerge from it. But this position is also a bit stickier than it might first appear. There is also an important sense in which XGMAs are *non-artificial*, and advocates of genetic research are quick to point this out.

In many ways, XGMAs share far more with their "natural" ancestors than they do with other technological or man-made creations. Clearly, once conceived, XGMAs grow of their own mechanism; they are life-forms unto themselves. This seems natural enough. They are also birthed naturally, as frequently

they are implanted in the wombs of unadulterated surrogate mothers. Further, they are neither robots nor computers, which obviously would rank them in the artificial category. They are instead organic beings, like we are. Moreover, it is not true that otherwise so-called metaphysically "natural" beings aren't also frequently brought into existence in "artificial" ways. It is a common practice among twenty-first century humans, for instance, to bring human babies into existence through "artificial" means, but we hardly consider them to be "unnatural." Even excluding the clear cases of artificial insemination or IVF, it is arguable but true that sometimes children are brought about through extensive planning on the part of parents. Insofar as this is true, there is an argument to be made that, according to the metaphysical conception of nature, such children are unnatural.[34] It appears from this that nature as conceived metaphysically allows us little headway with regard to XGMAs.

Now take the realist position. This is the position that we would expect to hear from the natural scientist or the geneticist. The realist might view the individual XGMA as unnatural by virtue of its shared genes. He might argue that natural animals are those that exhibit characteristics maintained by animals with a certain type of DNA, or that came about through an evolutionarily understood method. That XGMAs do not share common attributes with their "natural" animal counterparts condemns them to realist unnaturalness. This too is a position on the meaning of "nature" that is common and easy to understand. But the geneticist might argue in his defense that genetic engineering is little more than an extremely complex breeding program and that there is nothing even realistically unnatural about it at all. By injecting the DNA of certain organisms with one another, his actions differ in no significant way from that of the interactions between two parents. When parents come together, they blend their DNA. So too with XGMAs.

Where Robert and Baylis have argued above that the introduction of XGMAs creates inexorable moral difficulties because it blurs the boundary between human and non-human, their argument can be said to further lay bare the corruptness of the scientific/biological sense or the realist position on nature. Robert and Baylis rely on the realist position to make their case, reasoning that what sets us apart from non-human animals is our genetic make-up. We can see from the above discussion that many theorists simply do not accept this realist position, partly because we generally do not consider ethical questions to pertain to humanness, but rather to personhood—the metaphysically relevant counterpart of humanness.

Finally, take the lay position. Nature under the lay position is not problematized by the conceptual precision of philosophers. Nature under this conception designates only a place somehow distinct from civilization and the amenities of technology. Under this picture, nature might include National Parks, Forest Service Land, or more aptly, that which was brought about through "mostly" non-chemical or non-technological means. In the case of human babies, we can comfortably say under the lay position that we begot our child naturally, even if we artificially tempered our actions by employing the benefits of ovulation test

kits, pre-natal vitamins, basal temperature plotting; or, benefited from the usage of a doula or a midwife, did not take an epidural, and refused pain killers. (Think of the common claim that one has chosen to birth one's child "naturally," meaning "without anesthetic.") The lay interpreter of GMO might want to draw a strong distinction between apples that have been cultivated through grafting, teacup Chihuahuas that have been brought about through selective breeding, and the considerably more technologically complicated methods that are utilized in the GMO and GMA industries. The "lay" position is therefore also a somewhat romantic conception of nature, based on preconceptions of what does not constitute the human dwelling space. But still, there are difficulties.

The relationship between the natural and the unnatural in this case is so hazy and seamless as to be unhelpful, for here the distinction between the natural and the unnatural is only a matter of degree—the arbiter of this degree is the speaker. It would appear that the lay position on nature allows us freedom to distinguish between that which is truly built—say, the genetic creations of Dr. Moreau—and that which is only modified slightly by human intervention—say, with our own children. But, it also does not provide the conceptual precision that would lend stability to ethical claims one way or the other about XGMAs.

It appears that some conceptions of nature and the XGMAs are terribly inappropriate for assessing the problem of XGMAs. If we take the metaphysical stance, then we end up with a world in which the XGMA is either thoroughly artificial, because it is manmade, or thoroughly metaphysically natural, as it is only a more efficient, but natural, development of human civilization. This falls on its face. There is a strong case to be made for a qualitative difference between an animal brought about through genetic engineering and an animal brought about through selective breeding. The same goes for the realist stance. Either the XGMA is thoroughly constructed, in the sense that it is made up of unnaturally begotten genetic material, or it is thoroughly natural, in the sense that it is an organic self-replicating system. This too is clearly incorrect. Again, there is a strong qualitative case to be made. Finally, the lay position also does not give us the theoretical stability that we might be looking for in order to come to determinations about XGMAs.

So, what do we observe here? The creation of XGMAs breaks open the otherwise rigid categories of the metaphysical, realist, and "lay" positions on "nature," much in the way that Darwin's observations about natural selection broke open the rigid ontological category of a species. When this happens, the concept of nature as distinct from human artifact begins to lose its usefulness, and appeals to "nature" as a means of arguing one way or the other on the question of what is morally acceptable fall apart altogether. We are left with very shaky foundations. It is important to see that *all three positions* on nature are called into question by the advent of XGMAs, but that only one or two of them—perhaps the metaphysical and the lay position—become really stark concerns at any given time with any given aspect of XGMA introduction. We will see when we investigate the invader species that, where in the case of the welfare of the XGMA the metaphysical position appears to take precedence, the realist position appears to take greater precedence with the invasion of an ecosystem. That there is a fluctuation between emphasis on one of these three conceptions of nature is the primary reason that investigating the case of invasive transgenic animals simultaneously—as opposed to investigating solely transgenic animals or solely invader species—is so important.

Any one of these positions seems to have relevance to a discussion on XGMAs apart from their threat of invasion, but on the face of it, the metaphysical argument seems most appropriate. Indeed, it is the conception toward which many opponents of XGMAs gravitate readily. XGMAs are eerily *artificial*, and one might think that this artificiality is just, well, *wrong*. What is less clear with XGMAs is that the realist position, the position that views nature as a rigid preexisting and balanced system, is also called into question. Of course, sometimes the XGMA *is* explicitly challenged for its realist unnaturalness, though when it is, it is often challenged on grounds that it will bring about hideous, unpredictable, and devastating suffering in creatures. This is not so much a challenge to the realist unnaturalness of the XGMA, but to the precautionary principle. Avoiding such outcomes is just a matter of technical proficiency.

The "lay" position might also be thought to bring some clarity to the issue, but it too is saddled with the peculiarity that its definition is dependent upon the romantic inclinations of a given community. Investigating XGMAs as a singular matter, therefore, obfuscates the equivocation in the use of the term "nature." For this reason, we should expand our investigation and turn our attention to the case of the GM invader species. The case of the invader species is more automatically a question about the *realist* conception of nature than it is about the metaphysical conception of nature, and does not pose as stark a challenge to the metaphysical conception. Examining this case in tandem with the case of the XGMA calls into question the other primary conception of nature outlined by Soper.

This understandable hopping around in the use of terminology should underline the need to find another background category that circumvents the confusions implicit in the term "nature." It is my contention that the concept of the "ecoscape" might provide this background for us. I will argue in the fourth section that the concept of the ecoscape enables a way to address the troubling aspects concerning XGMAs without deferring to a muddled concept of nature. That is, one can speak intelligently of the present ecoscape as threatened by the XGMA.

Chimeras on the Loose: The Problem of Invasive XGMAs

According to United States Executive Order 13112, an invasive species is defined as a species both "non-native (or alien) to the ecosystem" and a species "whose introduction causes or is likely to cause economic or environmental harm or harm to human health."[35] There are many notorious cases of invader species. Classic cases include the infestation of the Russian zebra mussel in

Great Lakes waterways, the introduction of the wild boar into the ecosystems of Hawaii, the proliferation of the monitor lizard in the Florida region, the colonization by cane toads in Australia, and the plague of click beetles along the East Coast of the United States. Sometimes the introduction of a species is accidental, as was the case with the zebra mussel in the Great Lakes region. Sometimes the introduction of the species is deliberate, and its proliferation is simply unanticipated, as was the case of the *sus scrofa*, the wild boar, in Hawaii. (In Hawaii, boars were introduced into the ecosystem to provide food for passing sailors.) In all of these cases, of course, the species is considered "natural" only by virtue of its organic make-up. It is "unnatural" because it is in a place to which it does not "naturally" belong.

The concern over species invasion is particularly relevant to questions of genetic modification. It has been employed to great effect by anti-GMO activists. However, the question of invasive genetically altered species is typically only raised regarding GMOs, and only recently in reference to simple GMAs. This is probably due to the newness of advanced vertebrate genetic technology. Until recently, very few GMOs and GMAs posed any real risk to naturally occurring ecosystems.[36] Alarm spread in 2001, however, when the Boston-based company Aquagenics proposed to begin farming transgenic *AuqAdvantage*™ Atlantic salmon in coastal waters. The Union of Concerned Scientists immediately implored the U.S. Government to take a good hard look at the salmon before approving their edibility.[37]

Such alarm is well-founded. The National Research Council of the National Academy of Sciences released a report in early 2004 that found that "while there are many techniques being developed to prevent genetically engineered organisms or their genes from escaping into the wild, most techniques are still in early development and none appear to be completely effective."[38] Gregory Jaffe of the Center for Science in the Public Interest said the report's conclusion that there is no foolproof bioconfinement method suggests that "there is a need to have a better regulatory system that assesses whether there are any risks to begin with."[39]

The possibility of GMAs and GMOs escaping into the environment threatens serious consequences that most farmers and developers of genetically modified technologies would like to prevent. Raymond Carruthers, the head of one of the largest U.S.D.A. biological control facilities, has recently characterized invasive species as a "horrific and increasing problem."[40] David Lodge and Kristin Shrader-Frechette have argued that there is little disagreement about the problems with non-indigenous species but that the main ethical and policy issue lies in the sorts of risk assessment protocols that could be acceptable to a large constituency.[41] In fact, it is important to recognize that most objections to any sort of invader species are consequential and based on a realist conception of nature.

The case of invasive XGMAs presents an especially complex problem, however, because we have historically placed asymmetrically heavy emphasis on the moral priority of humans, and on the natural, untamperedness of nature. Almost instinctively, one is inclined to revert to the Yuck objections that Midgley discusses, since the image evokes fears of alien, half-human monsters roaming the once-pristine landscape. Indeed, the outlandish and unnatural oddity of the invader GMAs is an incredibly appropriate objection to the development of GMAs and their invasion of the landscape. It is not, however, an objection that resonates with those who support the realist position on nature.

At a certain level, invader species have always been considered to be "unnatural." The U.S. Federal Government defines an invader species as "a species that is 1) non-native (or alien) to the ecosystem under consideration *and* 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health."[42] If GM corn infiltrates a crop of maize, for instance, we can then argue that the naturally occurring corn has been tainted. What constitutes the "natural" or "baseline" state of the ecosystem is left up to experts and specialists, and is certainly open for dispute. Farmers take steps to eradicate this invader species in order to preserve the organic purity of the natural crop. Invasive species on these grounds can only be thought to be invasive if the plants or animals produce reproductive offspring.[43] (It is a pleasant irony that corn itself has never been natural, but is a hybridized grain.) They must, in other words, colonize, or attempt to colonize, a given ecosystem. As they do this, of course, they gradually become naturalized themselves, and the ecoscape of the given ecosystem shifts, calling into question the very idea of what is a natural feature of the ecosystem.

Return for a moment to the three conceptions of nature discussed above. In the case of the metaphysical conception of nature, an environmentalist might argue that nature ought to be protected by virtue of its intrinsic value. This, presumably, rests at the heart of many environmentalist concerns about the tampering with nature that accompanies criticisms of invader species. When we introduce non-native species into an ecosystem, whether that species is "natural" or genetically-modified, the naturalness with which we are concerned primarily is realist, since the environmentalist is most frequently concerned that damage will be done to evolutionary balance.

This problem of this realist unnaturalness is amplified, however, when human-animal chimeras invade nature. In this case, the concern is twofold. First, the concern is that we have no control over what happens to the environment, such that alterations to nature are not willed but happen "naturally." In this sense, realist nature is corrupted by creatures that would not normally belong to it. It is also true, however, that XGMAs are considered to be metaphysically "unnatural" by their very development, as we discussed above. Thus, however, they modify the environment or the ecosystem, this further transforms the ecosystem into a *metaphysically* unnatural ecosystem. What is metaphysically natural on this basis is considered to be anything that has evolved or emerged without the intervention of humans. One might say that invasive XGMAs are therefore twice unnatural, because they are both unwelcome in their particular ecosystem and unnatural in the sense that they have been modified by humans.

At first blush, the case of the invasive XGMA is very much *unlike* the case of a naturally conceived invasive species, like the *sus scrofa* or the zebra mussel. In

these simpler cases, the animal is completely "natural," in the sense that it evolved of its own doing, but what is unnatural about the animal is its presence in a given ecosystem. Here the environmentalist is concerned primarily that the invader will do untold damage to the unique ecosystem. Concerns about the unnaturalness of the invader are concerns about its threat to the notion of the "natural ecosystem." Thus, metaphysical and realist conceptions of nature overlap again here, where anti-GMO activists have concerns primarily about the robustness of a given ecosystem and must rely on cases of metaphysically natural entities to make their case; and pro-GMO advocates maintain that ecosystems, by their nature, are always in flux.

Without intending so, activists therefore carve a fine line between natural environments and natural individuals. They effectively attempt to distinguish between natural individuals, which we could call "Natural-I" entities—which might include "naturally occurring" pigs and kangaroos and other such critters—as apart from natural environments, or "Natural-E" entities. In all cases, whether Natural-I or Natural-E, "natural" can be conceived to apply according to either the metaphysical, realist, or lay picture that we discussed above. Thus, the *sus scrofa* of Hawaii might be considered Natural-I, even though it is Unnatural-E; whereas GM corn, Aquadvantage Salmon, or any other invasive XGMA is both Unnatural-I and Unnatural-E. Add the three conceptions of nature outlined by Soper to the mix, and you have a cocktail of confusion.

Not only is such a system of speaking so contrived as to prove uncannily unhelpful, but notice what happens here. It turns out that many of the same complaints that were lodged against the Unnaturalness-E of Natural-I invaders apply to the Unnaturalness-E of Unnatural-I invaders. In this case, the dubiousness of the term "nature" pops further into stark relief, and it appears that we can make little headway in our attempts to argue one way or the other for or against GMAs. However, if we look at the GMAs *and* their constituent relationship to the environment—that is, apart from their systemic impacts and apart from their metaphysical designation—then I think we can begin to make some claims about what might or might not be wrong with GMAs.

What is needed in the case of invasive XGMAs is a reference point that incorporates the intentionality of the individuals that make up the ethical landscape—one that is alert to the constructed nature of nature, but one that also does not turn a blind eye to nature in the realist sense. As Steven Vogel intimates in his work on nature,[44] a more phenomenological construct like the *umwelt* can bear fruit for those of us who hope to argue that something intangible has gone awry when the XGMA escapes its cage. It makes sense to me that this construct might be the ecoscape.

Why the Ecoscape is a More Appropriate Category

The ecoscape as defined by authors in this volume avoids altogether the obtuse essentialism of "nature."

> Ecoscape can be defined as the organizational shape of a habitat for life, which manifests as the configural shape of environmental interrelations and relations. How does this word compare and contrast with ecosystem? An ecosystem involves the interrelation between a living community and its environment, which forms a functional whole. The most insightful answer is that ecoscape concerns the geographicity of the ecosystem. Ecoscape makes thematic the spatial configuration (shape) of the interrelations and relations comprising some life-sustaining world.[45]

As Gary Backhaus explains in the above paragraph, the ecoscape integrates elements of metaphysical nature, real nature, and "lay" nature into a single category. It views metaphysical nature skeptically, and instead supplants metaphysical concerns with geographical concerns. It views realist nature relationally, and integrates the interrelations and relations of functioning ecosystems with the geographicity of the ecosystem. It provides a category for a more stable articulation of "lay" conceptions of nature without appealing to the tired and overly romantic dichotomies of the countryside and the city.

Where environmental problems are concerned, say, for instance, as with the invasion of a territory by XGMAs, the concern here, ultimately is what kind of habitat we are going to be living in. What kind of "being" is our being going to encounter? And it can be agreed that it is precisely this kind of concern that is at issue when we speak of XGMAs and/or invader species. For starters, many of the claims made against XGMAs are claims about how unnatural they are, how their existence alters our experiences with nature. This is true with invader species as well.

Where before we were concerned about nature as somehow metaphysically tainted by human tampering, this concern falls into the background. There is no primordial standard bearer against which to measure the naturalness of a given entity. Rather, we must turn our focus onto the question of what kind of world we would like to live in and what nature is in relation to us. We are not concerned so much with whether XGMAs or their invasive counterparts introduce radically artificial elements to nature. There is no moral import to such a concern at all. Instead, we are released from this question to focus on more primary matters: *What kind of influence do humans have on their metaphysical backdrop? And how does the understanding of essence of a given environment change in the face of this influence?* The very notion of inauthenticity in nature implies some objective essentialism. But because with the concept of the ecoscape the discussion focuses on the experiencing of nature, and not on nature as it is in itself, the inauthenticity of the invasive XGMA can be captured in the mapping of the altered ecoscape.

The reason for this is that the ecoscape implies a kind of *Umwelt* or, more accurately, an *umweltmässige Lebenswelt*. It suggests that there is some surrounding scape—not necessarily essential, in the sense that it is pre-given by the Gods, and not necessarily systemic, in the sense of an eco-system—but rather a *scape*, that is both horizonal and environmental—always maintaining an infinitude that is inaccessible to the mere mortal; but also always immediately around us, in the sense that we are *caught up* in it.

Similarly, the ecoscape supplants realist concerns about ecosystems and the impacts of humans on *real* nature. We are not concerned so much with doing "damage" to the environment, in the sense that the environment is an ecosystem that is somehow damaged unalterably by the activities of ecosystemic invaders. In this case, an "ecosystem" is a rough category used by us to describe relations between entities that we stipulate in order to make clearer sense of trends in the environment. That an ecosystem is one particular way over another does not dictate how that ecosystem *should* be. Says Backhaus:

> Analogously, the science of ecology, which deals with the relations between various kinds of entities comprising environments, cannot be reduced to any one of the scientific fields that constitute it. Biology, chemists, etc. have their own parameters that demarcate fields of their concern, but the ecologist, who is apprised of those fields, must transcend them in order to contextualize their findings in a science that takes the relational moment of concrete environmental wholes as its guiding principle. Much of the content of the research in our new interdisciplinary science likely lies outside of the professional research interests of the geographer. The content belongs to the fields of the various sciences and their rather specific subdivisions, but through the geographical turn, practitioners of the new science thematicize phenomena under the purview of their discipline on the basis of geographicity.[46]

One might be worried, at this point, that the concept of the ecoscape does violence to the real and important claims of scientists and ethicists regarding XGMA invasion. It is true, after all, that the invasion of some species could have devastating effects on an ecosystem, and this, in turn, could have devastating effects upon the people that depend on or are a part of that ecosystem. But Backhaus and other authors in this volume reassure us that this is not the case with the ecoscape:

> This is not to claim that science merely creates its own artifacts, meaning reality *is* the outcome of artificiality, although this does happen and there is always this danger. The function of controls in science, such as the understanding of wild types as distinct from laboratory mutants, provides the background from which operational manipulations give us certain forms of knowledge.[47]

These scientific questions remain at the ready, always important regarding the health and well-being of individuals that make up the ecosystem. Yet the ecoscape's emphasis on the geographicity of the system implies that we can maintain concerns about the *interrelations* of the environment—indeed, interrelationality is the true innovation of the "ecosystem" as well, is it not?—but do so without relying on the rigid conception of a pre-established universal order. After all, negative ethical claims about XGMAs invading the ecoscape ought not *depend* solely on the concern that they will do damage to the ecosystem, though this certainly is an important question. Instead, what they ought to depend on is what the world will *be like* when such beings enter our ecoscape.

Regarding "lay" nature, the ecoscape encapsulates the notion of a habitat and allows the researcher to address concerns about place-bound human and non-human dwellings. Further, it is relative to a given time period and not static with regard to some aspect of the world "out there." The ecoscape is quite clearly both a human and non-human concept; and it quite clearly pertains to that which we take to be humanly valuable around us. Thus, it can include environments like shopping malls, parking lots, suburban parks, and nature preserves, as well as beings that would not "naturally" exist in these environments. Exploring and mapping an ecoscape can open the door for us to voice concerns about the transformation of our suburban environments by any entity: artificially introduced mussels, genetically altered lab rats, or genetically modified invaders. XGMAs on this view could invade our downtown areas as well as our wilderness areas, just as they do in science fiction movies like *Jurassic Park: The Lost World*. In this way, Moreau's monsters can be understood as just as much a threat to our *way* of life as to the *conditions* of our way of life.

Not only this, but we can see alone that whatever we choose as our meaning of the term "natural," we seem to have little way of getting around the naturalistic problem of what is and what ought to be. The naturalistic fallacy depends very heavily on any one of these conceptions of nature. By contrast, the concept of the ecoscape proposes that the environment is already lived and occupied by us. We can then ask with normative force: what is it to live in our world? At present, it is to exist among a series of objects, none of which are substantially different than any other objects. Some flit, some dart, some sit still. But these objects are purportedly unthematized and independent of us.

Employing the notion of the ecoscape in our discussions of genetic modification will allow us to speak about these thematized relations without having to rely on an ossified conception of what "nature" really is. So, if XGMA animals invade the ecoscape, they do so from the perspective of these many ways of understanding and perceiving our environment. Where ecosystemic claims assess environmental damage from a third-person, God's-eye point of view, ecoscapic claims assess damage from a perspectival point of view. How might adopting the notion of the ecoscape enrich the discussion on genetic modification? It will embolden discourse that exploits the sense in which genetic modification alters our understanding and comprehension of nature. This discourse is already sneaking around in the background of many of these GM debates anyway, but it lacks fertile ground in which to take seed. With a phenomenological perspective upon which to base such claims, the discourse can begin.

The question here, then, re-orients the debate away from circular discussions about the nature of nature, and from instrumental discussions about the costs and benefits to ecosystems, into an intentional and directional discussion: What kind of world do we want to live in? What kinds of changes will the introduction of XGMAs into our ecoscape involve? In many ways, this is the question that has always been at the heart of much of this debate, as Midgley rightly notes. The debate has not exclusively been about whether XGMAs are metaphysically natural or unnatural. Clearly, there are strong arguments on both sides. It has also not

solely been about whether XGMAs are natural or unnatural in a realist sense. There are similarly strong arguments on both sides. The *consequences* of invader species, both on real ecosystems and on metaphysical nature, are only partly at issue. What has also been at issue is our *relationship* to the world in which we live.

What is immediately apprehendable about the XGMA in contemporary discourse is that XGMAs are somehow unreal, created from whole cloth, but nevertheless real and organic. Talk like this gives the impression that underlying nature is mutable and alterable, that we humans can construct nature from the bottom up. It often also results in pronouncements and objections that genetic modification is a twenty-first century version of "playing God." This appears to be a common claim in many activist discourses on the matter. Because the charge of "playing God" is so abstract and seemingly baseless, however, opponents commonly go no further than to issue this charge as an unreflective condemnation. In response, these same opponents are accused of fear-mongering, progress-thwarting, overly-cautious obstructionism by less risk-averse, scientific, and commonly secular, progressives. The secular retort is a curt ad hominem that misses the point of the claim by environmentalists concerned about the world in which they live.

The concept of the ecoscape provides a possible avenue to understand the concern of "playing God." The ecoscape does not distinguish between the natural and the unnatural, as we have said, but only between that which is here, before us, experienced by us. What objecting environmentalists are really after in a debate like this is a sense in which the ecoscape can fluctuate with the innovations and aspirations of humankind, but also the way in which the underlying ecosystem can remain scientifically predictable, understandable, and at risk from genetic modification. This sense would call attention to our human relationship with the environment, such that our role—either as a God or as a human component of the environment—is a real consideration. When our *relationship* to the environment is otherwise glossed over—as it is if we attempt to employ the metaphysical, real, or lay conception of nature to do our dirty work—such that it appears that it is only our environment and its ecosystems that are changing, our understanding of ourselves shifts from exploiters to developers, from dependents to Gods. This opens the door for the above critics to make charges that the claim of "playing God" is baseless. The notion of the ecoscape re-asserts the role that humans play in the shaping of their environment while abstracting far enough from the underlying ecosystemic relationships to avoid the impression that humans play a thoroughgoing manipulative role in the control of their environments.

To put this another way, when nature is viewed from the objective stances of the metaphysical, realist, or lay worldview, and considered in light of XGMA developments, nature appears as infinitely manipulable and transient. This apparent manipulability opens the door to misunderstand nature, and more importantly, to misunderstand the laws that govern nature, as somehow subject to the whimsy of humans. Further, the apparentness of this manipulability is masked

by the supposition that nature is existent apart from our relationship *to* it. If it is the case that we humans can manipulate our environs such that ecosystems exist under our managed care, then humans emerge, or appear to emerge, at the helm of the universe. If, on the other hand, one investigates the *relationship* between humans and nature from a geographical perspective, the vicissitudes of human experience are always at issue and there is room to understand underlying nature as always at play in the foreground.

Far from giving us the sense that our natural surroundings are fluidly manipulable in the ways in which many would like to believe them to be manipulable, the threat of XGMAs escaping into the environment creates a troubling rupture in the eco*scape*, not just in the eco*system*. Where before our understanding was that of a secure perch at the top of a rigid metaphysical arrangement, genetic technology challenges this understanding, both of ourselves in regard to nature, but also of nature itself. This both induces us to respond with greater forms of control, by building taller walls, stronger cages, and greater safeguards in order to preserve whatever metaphysical order might be understood to exist, but it also forces us to face down the possibility that we are not in nearly as much control as we think we are. The concept of the ecoscape allows for us to explore the ways in which humans take up a role *in* nature; and in doing so, overcomes the potential misunderstandings that can arise in the face of the patently false supposition that we exist *apart from* nature.

Conclusion

This paper has sought to discuss the rather unpleasant prospect that the human-animal chimeras cooked up on Dr. Moreau's ocean-based biological station might escape that island and alter our current ecoscape. It interrogated the concept of "nature" that lies at the heart of many such concerns to find that when nature concerns are invoked, the debate over XGMAs becomes intolerably muddled. In its stead, this paper argues that philosophers and geographers might redirect the discussion about nature to emphasize its more phenomenological counterpart, the ecoscape. Doing so, it has concluded, opens the discussion of XGMAs to further criticisms that are both already current in the discourse, but also easily masked by any one of the three stances on nature.

When one begins to adopt the position that many debates about the environment are not just debates about what is healthy for nature conceived of realistically (though many debates, like those involving global warming, resource depletion, habitat encroachment, and so on, are debates of this kind), nor debates about what is authentically natural and what is not natural (as some environmentalists of a "deeper" green seem inclined to argue), nor even "lay" debates of a Frankenstein nature (similar to the Yuck arguments advocated by Midgley) but instead debates about the world in which we want to live, the environs and our relationship to those environs, then we have a whole new avenue open to us.

The ecoscape incorporates intentionality into the experience of nature. It implies directedness. An analysis of the ecoscape may not provide us with clear conclusions necessarily about what kind of world we want to live in, but it may at least *open* the question of what kind of world we want to live in. In this case, the ecoscape's appeal is not to some pre-existent metaphysical entity, nor to a real ecosystem, but rather to an environment that we experience and understand. What such analyses of the ecoscape would look like, I cannot say. That is partly the objective of this volume. What is clear, however, is that a concept that encapsulates and describes the environment through phenomenological observation—the ecoscape—is critical to these debates.

Notes

1. Mary Midgley, "Biotechnology and Monstrosity: Why We Should Pay Attention to the 'Yuk Factor,'" *The Hastings Center Report* 30, no. 5 (Sept. 2000): 7-15.

2. Kate Soper, *What Is Nature?* (Cambridge, Mass.: Blackwell, 1995).

3. See Steven Vogel's "Why Nature Has No Place in Environmental Philosophy," (paper presented at the Applied Philosophy Group meeting, New York University, Mar. 24, 2005).

4. Portions of this section were presented at the *Ecoscapes* conference held in 2004 at Towson University. It stems in part from an article, "The Moral Considerability of Invasive Transgenic Animals," which appears in the *Journal of Agriculture and Environmental Ethics* 19, no. 2, 2006. On the whole, however, this chapter presents a dramatically different thesis, and the portions of the journal article that are replicated here have been revised accordingly.

5. M2 Presswire, December 23, 2004, "UK Government: Amendments to **Genetically Modified Organisms** (Contained Use) Regulations 2000," M2 Communications, LTD, 1994-2004.

6. Jeremy Smith, "EU to Push Approving GMOs, Could Come in Next Few Weeks," *Reuters*, Mar. 22, 2005.

7. Lawrence A. Kogan, "Ducking the Truth about Europe's GMO Policy: Trade Protectionism," *International Herald Tribune*, Nov. 27, 2004, 6.

8. I am sympathetic with the notion that one must consider plants for their own sake, but for the purposes of this paper, I am depending on the slightly less contentious position that animals must be considered for their own sake.

9. B. E. Rollin, *The Frankenstein Syndrome: Ethical and Social Issues in the Genetic Engineering of Animals* (New York: Cambridge University Press, 1995).

10. See, for instance: Steve Conner, "Scientists Could Make GM Beef with Healthy Fish Oils," *The Independent*, Feb. 5, 2004; Roger Highfield, "How I chopped the fat from bacon. . . . Wilbur the 300kg boar will help farmers to breed leaner, tastier, more profitable animals," *The Daily Telegraph*, London, Nov. 26, 2003, 20; Andrew Pollack, "So the Fish Glow, but Will They Sell?" *New York Times*, Jan. 25, 2004 pBU5 Col. 01.

11. Note that there is perhaps a subcategory of GMAs. That is, some animals are transgenic by means of splicing organisms of differing taxonomic kingdoms together (as opposed to animals that are crossed with other members of the animal kingdom), such as the famous *FlavrSavr*™ tomatoes that have been spliced with the fish gene, mice that have been crossed with the malaria virus to produce a vaccine in their milk, and goats that have been crossed with spider genes to produce fantastically strong spider webs. See, for instance, A. W. Stowers, et al., "A recombinant vaccine expressed in milk of transgenic mice protects Aotus monkeys from lethal challenge with Plasmodium falciparum," *Proceedings of the National Academy of Sciences*, Early Edition online (Dec. 17, 2001).

12. This, of course, is not entirely true; but insofar as it is plausible, proponents of GM have made much hay. There is an arguable point that a qualitative difference between GM breeding and "natural" breeding, but the terms of this qualitative difference have yet to be successfully spelled out.

13. V. Ourednik, J. Ourednik, J. D. Flax, et al., "Segregation of human neural stem cells in the developing primate forebrain," *Science* 293 (2001): 1820-24.

14. R. S. Goldstein, M. Drukker, B. E. Reubinoff, and N. Benvenisty, "Integration and differentiation of human embryonic stem cells transplanted to the chick embryo," *Developmental Dynamics* 225 (2002): 80-86.

15. C. Dennis, "China: Stem cells rise in the East," *Nature* 419 (2002): 334-36.

16. L. M. Krieger, "Scientists put a bit of man into a mouse," *Mercury News*, Dec. 8, 2002. Available from: www.bayarea.com/mld/mercurynews/4698610.htm.

17. "Breakthrough in GM Organ Transplant," *The Guardian*, Dec. 11, 2003, 7.

18. Mark Dowie, "Talking apes, flying pigs, superhumans with armadillo attributes, and other strange considerations of Dr. Stuart Newman's fight to patent a human/animal chimera," *Mother Jones* 29, issue 1 (Jan.-Feb. 2004): 48.

19. Articles on this matter are too numerous to note. A brief search of *ScienceDirect*.com yields over 2000 articles detailing experiments conducted on transgenic animals.

20. R. W. Tennant, S. Stasiewicz, J. Mennear, J. E. French, and J. W. Spalding, "In The Use of Short- and Medium-term Tests for Carcinogens and Data on Genetic Effects in Carcinogenic Hazard Evaluation," IARC Scientific Publications, no. 146, International Agency for Research on Cancer, Lyon (1999): 123-50.

21. Rollin, *The Frankenstein Syndrome*.

22. Midgley, "Biotechnology and Monstrosity." Midgley spells "yuck" without the "c," though Webster's Revised Unabridged Dictionary (1998) indicates that spellings can go either way. I prefer "yuck," as "yuk" connotes to me a jocular laugh.

23. Geoffrey Lean, "GM Industry Puts Human Gene into Rice," *The Independent*, April 24, 2005.

24. Jason Scott Robert and François Baylis, "Crossing Species Boundaries," *The American Journal of Bioethics* 3, no. 3 (2003): 1-13.

25. Hilary Bok, "What's Wrong with Confusion?" *The American Journal of Bioethics* 3, no. 3 (2003): 25-26.

26. Jill Didur, "Re-embodying Technoscientific Fantasies: Posthumanism, Genetically Modified Foods, and the Colonization of Life," *Cultural Critique* 53 (2003): 101-2.

27. Andrew Siegel, "The Moral Insignificance of Crossing Species Boundaries," *The American Journal of Bioethics* 3, no. 3 (2003).

28. Justin Leiber, *Can Computers and Animals Be Persons?* (Indianapolis: Hackett, 1985).

29. CNN reports: "About 99 percent of genes in humans have counterparts in the mouse," said Eric Lander, Director of the Whitehead Institute Center for Genomic Research in Cambridge, Massachusetts. "Eighty percent have identical, one-to-one counterparts." Marsha Walton, "Mice, men share 99 percent of genes," CNN.com, Dec. 4, 2002, www.cnn.com/2002/TECH/science/12/04/coolsc.coolsc.mousegenome/.

30. Daniel Dennett explains that one of Darwin's first, and arguably most important,

contributions to biology was to challenge the idea that "species" was an immutable, timeless given. See Daniel Dennett, *Darwin's Dangerous Idea* (New York: Touchstone, 1995), 35-39.

31. Stephen J. Gould, *The Mismeasure of Man* (New York: W. W. Norton & Company, Inc., 1981).

32. Ronnie Zoe Hawkins, "Seeing Ourselves as Primates," *Ethics & the Environment* 7, no. 2 (Autumn 2002): 60-103.

33. Soper, *What Is Nature?*, 155.

34. Vogel makes precisely this argument in his recent work.

35. Executive Order 13112 of February 3, 1999. Federal Register/Vol. 64, No. 25/ Monday, February 8, 1999/Presidential Documents, 6183.

36. For reference, see "Purdue Scientists: Genetically Modified Fish Could Damage Ecology," *AScribe Newswire*, Feb. 23, 2004.

37. Union of Concerned Scientists, "Genetically Engineered Salmon," February 1, 2001, www.ucsusa.org/food_and_environment/biotechnology/page.cfm?pageID=327.

38. Andrew Pollack, "No Foolproof Way Is Seen to Contain Altered Genes," *The New York Times*, Jan. 21, 2004, pA10 Col. 05.

39. Pollack, "No Foolproof Way."

40. Raymond I. Carruthers, "Biological Control of Invasive Species: A Personal Perspective," *Conservation Biology* 18 (Feb. 2004): 54-58.

41. D. M. Lodge, and K. Shrader-Frechette, "Nonindigenous Species: Ecological Explanation, Environmental Ethics, and Public Policy," *Conservation Biology* 17 (Feb. 2003): 31-38.

42. Executive Order 13112. For an incredibly comprehensive website related to U.S. Government policy on the matter of invasive species, visit: www.invasivespecies. gov.

43. D. M. Richardson, P. Pyšek, M. Rejmánek, M. G. Barbour, F. D. Panetta, and C. J. West, "Naturalization and Invasion of Alien Plants: Concepts and Definitions," *Diversity and Distributions* 6 (March 2000): 93-107.

44. See, for instance, Steven Vogel, *Against Nature* (Albany: State University of New York Press, 1996) and his working paper "Why Nature Has No Place in Environmental Philosophy."

45. Gary Backhaus, "An Introduction to the Conceptual Formation of Ecoscapes," in *Ecoscapes: Geographical Patternings of Relations*, eds. Gary Backhaus and John Murungi (Lanham, Md.: Lexington Books, 2006), xvii.

46. Gary Backhaus, "Preface: Geophilia: A Transdisciplinary Science Formed of the Basis of Geographicity," in *Ecoscapes: Geographical Patternings of Relations*, eds. Gary Backhaus and John Murungi (Lanham, Md.: Lexington Books, 2006), xi.

47. Backhaus, "An Introduction," xiv.

Chapter 3

Cultivating Famine: In Search of the Miracle Seed

Azucena Cruz

Introduction

As we begin a new century, and a new millennium, we face the paradox of landscapes of affluence from which the seeds of famine are sown. Machines and technology bred out of a Cold War arsenal allowed us to harvest plentiful crop yields but it is now apparent that it has also radically altered the landscape to the point where we may in fact be eroding the agricultural foundation that sustains us. This new arsenal has transformed seeds and food into another weapon for a new kind of war: a biotechnological war. This war is being fought on the soil that human beings depend on for their sustenance and the major aggressor is the agro-chemical industry that produces genetically modified (GM) seeds that severely alter the "scapes of life" (agriculture, political, economic, cultural, and social). An enormous strain is being placed on the planet by human beings who are eating away at every resource that can be harvested and mined as they maintain the assumption that the environment does not require anything from them. Human beings and the environment in which they live are clearly two distinct kinds of *beings*; nevertheless, they still remain locked in an interdependent relationship which engenders an ethics of its own. Formulating and analyzing what this ethics has been is of primary concern for environmentalists who wish to call attention to the irreparable damage that is being done to the planet we depend upon. While this is an important topic in and of itself, I would like to address the larger issue of the geographic web of relations shaping the ecoscape. I focus on the environment (agriculture), its ecosystem, which entails the socio-economic political relationships between individuals and how these relationships then shape the ecological environment that they inhabit and depend upon for their existence—i.e., the dialectical relationship between human beings, the en-