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Chapter 2

In Situ and Ex Situ Conservation: Philosophical and Ethical Concerns

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The Natural and the Artificial

In one sense, *nature* is quite a grand word, referring to everything generated or produced. *Natura* or *physis* is the source from which all springs. If one is a metaphysical naturalist, then nature is all that there is. Metaphysical naturalists may need the word in this sense for their cosmological purposes; the contrast class might be the supernatural, which, they may argue, is an empty set. Humans and all their cultural activities are included as natural; humans are generated within nature, and they break no natural laws. Under this definition, everything agricultural or technological is completely natural. So is everything industrial, political, economic, philosophical, or religious. So is anything that happens in a botanical garden.

Such scope is problematic, however, because it prevents discriminating analysis of the differences between spontaneous nature and deliberated culture. A predicate, "natural," that includes all actual and possible properties excludes nothing; denoting everything is like denoting nothing, at least nothing in particular. The most forceful objection to this sense of nature, in the context of environmental analysis, is that such a definition allows no useful contrast with culture, but we need to analyze that contrast carefully if we are going to relate our cultures to nature, asking about nature conservation goals.

A straightforward contrast class to nature is culture. If I am hiking across wildlands, the rocks and wildflowers, the birds, and even their nests are natural, but if I come upon an abandoned boot or a candy wrapper, these are artifacts, unnatural. Expanding such examples into a metaphor, the whole of civilization is producing artifacts, in contrast to the products of wild

spontaneous nature. Wild animals, much less plants, do not form cumulative transmissible cultures, elaborating these artifacts over generations.

Humans evolved out of nature; our biochemistries are natural, and we draw our life support from the hydrological cycles and photosynthesis; we have genes and inborn traits; and we are subject to natural laws. But human life is radically different from that in wild nature. Unlike coyotes or bats, humans are not just what they are by nature; we come into the world by nature quite unfinished and become what we become by culture. Humans deliberately rebuild the wild environment and make rural and urban environments.

Information in nature travels intergenerationally on genes; information in culture travels neurally as people are educated into transmissible cultures. They learn how to build fires, or make spears, or grow wheat, or make iron plows and grow more wheat, or make trains on which to ship their wheat to distant markets. They teach this know-how to ongoing generations. Humans argue about worldviews, about whether there should be natural prairies as well as wheat fields in Kansas. The determinants of animal and plant behavior are never anthropological, political, economic, technological, scientific, philosophical, ethical, or religious.

The critical factor is the deliberated modification of nature that separates humans in their cultures from wild nature. Any transmissible culture, especially a high-technology culture, must be discriminated from nature. Boeing jets fly, as wild geese fly, using the laws of aerodynamics. The flight of wild geese is impressive; scientists can hardly be said to understand these "bird brains" and how they migrate. The information storage system in the goose genetics could, in its own way, be the equal of that by which Boeings fly. Some of the information in the geese is transmitted nongenetically, as when they learn migration routes by following other geese. Maybe we can even say that the geese deliberately build their nests or intend to fly south. But geese do not form cumulative transmissible cultures.

It is only philosophical confusion to remark that both geese in flight and humans in flight are equally natural and let it go at that. No interesting philosophical analysis is being done until there is insight into the differences between the ways humans fly in their engineered, financed jets and the ways geese fly with their genetically constructed, metabolically powered wings. Geese fly naturally; humans fly in artifacts.

Against this background, we can find some overlap and hybrids. The essential idea in calling nature a human resource is that some "source" in

spontaneous nature is taken over by human deliberation and "re-sourced," or redirected to human uses. Geese make resources of grasses and seeds; these plants make resources of sunlight and water. But the plants photosynthesize genetically; the geese build nests instinctively. Humans are differently resourceful because of what they learn about resources in their cumulative transmissible cultures. They know how to take a tomato from its natural source in an evolutionary ecosystem in Peru and redirect or "re-source" it into channels of human interest and preference, as indigenous peoples did with the wild tomato, now grown around the world. We get better at it. Horticulturists in 1962 took a different wild tomato (*Lycopersicon chmielewskii*, Solanaceae) and bred it into the standard tomato (*L. esculentum*), enhancing it for the commercial tomato industry, resulting in \$8 million a year profits (Rick 1974). In domesticated plants, nature is made over into an artifact that we can use. To use a more philosophical word, nature is transformed, its form transmuted into a more desirable humanized form. To use a scientific engineering word, human values carried by plants are synthetic.

Hence we speak of agriculture, the deliberate, elaborated modification of fields and crops, or of horticulture, cultivating plants, with culture and nature in synthesis. Consider the growing of cotton. Human art has no independent powers of its own; it can only redirect natural processes. Cotton is a natural fiber, but cotton in fields is not spontaneously wild. The cotton fiber is produced genetically; the cotton is planted, fertilized, harvested, and spun by humans. In contrast to cotton, nylon is completely synthetic; no genetics produces the fibers. Of course, the chemists exploit natural properties, although these were never manifested in wild, spontaneous nature. It seems appropriate to say that cotton, though an artifact and hybrid, is more natural than nylon. We will need this relative sense of *natural* when we reach the distinction between in situ and ex situ conservation. Plants in botanical gardens become artifacts, but maybe they can be more natural than cultivars.

Plants and Intrinsic Values

In wild, spontaneous nature, a plant is a living organism with a good of its own. Alternatively put, the plant defends its life as an intrinsic value, as it is doing when it photosynthesizes, making a resource of sunlight by capturing energy and redirecting it to plant metabolism. Like all other organisms,

plants are self-actualizing. A plant is not a subject, nor is it an inanimate object, like a stone. Plants, quite alive, are unified entities of the botanical but not of the zoological kind. That is, they are not unitary organisms highly integrated with centered neural control, but they are modular organisms, with a meristem that can repeatedly and indefinitely produce new vegetative modules, additional stem nodes and leaves when there is available space and resources, and new reproductive modules, fruits and seeds.

Plants make themselves. A plant grows, reproduces, and resists death, maintaining a botanical identity. Plants repair injuries and move water, nutrients, and photosynthate from cell to cell; they make tannin and other toxins and regulate their levels in defense against grazers; they make nectars and emit pheromones to influence the behavior of pollinating insects and the responses of other plants; they emit allelopathic agents to suppress invaders; they make thorns and trap insects. They can reject genetically incompatible grafts.

From one perspective, all this is just biochemistry—the whirl and buzz of organic molecules, enzymes, proteins—as humans are from one perspective. But from an equally valid and objective perspective, the morphology and metabolism that the organism projects are a valued state. *Vital* is a more ample word now than *biological*. We could even argue that the genetic set is a normative set; it distinguishes between what is and what ought to be, not in any moral or conscious sense, of course, but in the sense that the organism is an axiological system. The genome is a set of conservation molecules. A life is spontaneously defended for what it is itself. The plant, we can say, is valuable itself: "value-able," able to protect this botanical form of life. That is, such life is intrinsically valuable.

Philosophers and even zoologists may here protest: nothing "matters" to a plant; plants do not have the minimally sentient awareness necessary to be centers of felt experience. But, although things do not matter *to* plants, a great deal matters *for* them. Botanists ask of a failing plant, "What's the matter with that plant?" If it is lacking sunshine and soil nutrients, and we arrange for these, we say the plant is benefiting from them, and everywhere else we encounter it, *benefit* is a value word. Objectively, biologists regularly speak of the selective value or adaptive value of genetic variations (Ayala 1982: 88; Tamarin 1996: 558). Plant activities have survival value, such as the seeds they disperse or the thorns they make.

Plants are not valuers with preferences that can be satisfied or frustrated. We do not say that wildflowers have rights or need our sympathy or that we

should consider their point of view. But we do claim that every organism has a good-of-its-kind; it defends its own kind as a good kind. An objector can say, "The plants don't care, so why should I?" But plants do care—using botanical standard, the only form of caring available to them. Plant conservation does not begin when someone from the Botanic Garden goes into the field to see what is threatened and needs conservation. The plant is already, by itself and on its own, a project in conservation biology. The conservation of biological identity within organisms is the first law of life.

Ethics and biology have had uncertain relations in recent centuries. An often-heard argument forbids moving from what is the case (a description of biological facts, as with these plants conserving their lives) to what ought to be (a prescription of duty, such as human caring for these plants). Any who do so commit the naturalistic fallacy. On the other hand, if spontaneous natural lives are of value in themselves, and if humans encounter and jeopardize such value, it seems that humans ought not to destroy values in nature, not at least without overriding justification producing greater value. Perhaps some of these plant kinds are bad kinds (such as poison oak), but because in their place they are adapted fits, they are presumptively well suited for life in their niches. Perhaps many of them are of no particular value to us, but it seems both unscientific and arrogant to conclude that there is nothing of value there at all.

Indeed, the presumption can be the other way around. If there is already conservation biology in the wild, if a plant is already engaged in the biological conservation of its identity and kind, long before conservation biologists come on the scene, then what conservation biologists ought to do is respect plants for what they are in themselves: projects in conservation biology. That aligns human ethics with objective biology.

We want these plants for the uses we might make of them. Given the multiple ways in which humans use plants—agriculturally, industrially, medically, recreationally, aesthetically, scientifically, as cultural symbols, as environmental indicators, and as part of the human life support system—humans are going to be helped or hurt by their flora, of which even rare plants may form a critical part. Biodiversity means opportunities of many kinds, so we save them for the benefits they may bring. But we also may be wishing to protect something of this integrity, this value, in plants in the wild.

For most people active in conservation biology this is a genuine concern. That puts *ex situ* conservation botanists in something of a bind, however, because in the form of caring they take for their plants, human

botanists have removed the wild plants from their autonomous independence in the world and brought them under their care. This careful management may, willy-nilly, have prejudiced that wild value. The plants in botanical gardens may be hybrids, relatively, and to the same degree something of this value that we want to preserve may have been lost.

Plants in Ecosystems

A plant is what it is where it is, that is, in situ. In the wild, both the individual plants and the species lines in which they stand are embedded in ecosystems. The situation of surviving plants even in their native locations may already be skewed by cultural disturbances, so that they are in marginal, not typical, habitat. Plants, autotrophs, have a certain independence that animals, heterotrophs, do not have. Plants need only water, sunshine, soil, nutrients, and local conditions of growth; animals, often mobile and higher up the trophic pyramid, may range more widely but in this alternative form of independence depend on the primary production of plants. Every form of life is what it is in a niche, shaped as an adaptive fit. The product, an individual organism, is process in a historical lineage, populations in their species lines. Such a lineage is the outcome of entwined genetic and ecological processes; the generative impulse springs from the genes, defended by information coded there, but the whole organism survives when selected by the environment in a niche occupied by the species.

At this level, conservation concerns the processes as much as the products. On evolutionary scales, these processes have involved regular species turnover when a species becomes unfit in its habitat, goes extinct, or tracks a changing environment until transformed into something else. On these timescales, species too are ephemeral. But the speciating process is not. Persisting through vicissitudes for two and a half billion years, speciation is about as long-continuing as anything on Earth can be. In that sense, evolutionary ecosystems have been the fundamental unit of survival, dynamically vital in elaborating the biota from zero to several million species. Evolutionary ecosystems conserve life, as much as do individuals in their species lines. The biodiversity on hand is a legacy of remarkable fertility and exuberance: several billion years of creative struggle. We do not yet have a complete theoretical account of this richness of life, but bioscience gives us this certainty: the evolutionary odyssey is prolific, pro-life.

Organisms defend only their own selves or kinds, but the system spins a bigger story. Organisms defend their continuing survival; ecosystems have stimulated new arrivals. Species increase their kinds, but ecosystems have increased kinds and increased the integration of kinds. The system is a kind of field with characteristics as vital for life as any property contained in particular organisms. The individuals located in species lines in ecosystemic niches are so placed with random and contingent elements, but plants in their niches are not simply in accidental aggregations. The ecosystemic matrix is the depth source and support of individual and species alike.

We argued earlier that plants are valuing organisms. Can we not now view ecosystems or, more broadly, the planetary biospheric system as value-generating systems and, in a real sense, value-able, able to generate value? Over the millennia, there is natural selection for adapted fit; there appear the myriad species filling up their habitats. There are extinction and respeciation. Forests repeatedly evolve; so do grasslands. This self-organizing has been called autopoiesis. This generativity is the most fundamental meaning of the term *nature*, "to give birth." Ecosystems are the womb of life. But are they the kind of womb that plants and animals can ever leave?

Ecosystems are both womb and matrix of life. Plants and animals live in biotic communities, and an ethic of respect for life must embrace these communities. "A thing is right," concluded Aldo Leopold, "when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (1968: 224-225). Leopold wanted a land ethic, one that included concern for individual plants, animals, and people but also and fundamentally loved and respected biotic communities.

Now we reach the conclusion that the appropriate unit for concern is the fundamental unit of development and survival. But zoos and botanical gardens are not ecosystems. And what if the preservation of individuals is impossible without the preservation of ecosystems? In wild nature, there are no organisms in isolation; there are only organisms in ecosystems. Perhaps we were too hasty in locating those intrinsic values in plants, forgetting that a plant is not self-contained, despite its being an autotroph, but situated in an ecosystem. So when we, in culture, move the plant to a botanical garden, *ex situ*, it may first seem that we have transplanted the whole plant and that the plant is flourishing in its new home. We first think we have the whole plant, but then we realize that we do not have the whole in which it was planted. We forget that the plant is at home only in its ecology; that is the root meaning of *ecology*, the logic of a home. In that sense,

the animal in the zoo and the plant in the garden no longer have any ecology; they are not at home.

Botanists are concerned to save genetic resources; they may believe they have done this when they have seeds in their seed banks, when they have plants in their botanical gardens. But plants and their seeds evolved in ecosystems, and they can continue only in ongoing ecosystems. In the current debate among biologists about the levels at which selection takes place—individual organisms, populations, species, genes—the recent tendency to move selective pressures down to the genetic level forgets that a gene is always emplaced in an organism that is emplaced in an ecosystem. The molecular configurations of DNA are what they are because they record the story of a particular form of life in the macroscopic, historical ecosystem. What is generated arises from molecular mutations, but what survives is selected for adaptive fit in an ecosystem. We cannot make sense of molecular life without understanding ecosystemic life. One level is as vital as the other.

Captive Plants

Nevertheless, halfway between the molecular genetic and the evolutionary ecosystemic levels, we have these plants, the phenotype organisms, in botanical gardens, *ex situ*. The plants are also halfway between nature and culture, we could say. We have what I will call—analogously to animals in zoos, if also a little provocatively—captive plants. You might wish to say "managed" plants instead, objecting that whereas animals can be held in captivity, plants cannot. The idea of captivity deprives an organism of its locomotive freedom, which animals have. They want to move beyond the bars but cannot. Plants, by contrast, have no locomotive freedom; therefore, they cannot be held captive. "Captive plants" is a category mistake. Ask the question another way. Have you deprived these plants of their autonomy? Are they still defending goods of their own, on their own? Alternatively put, Are they still wild? Or are they hybrids of nature and culture? You probably do not think of what goes on in a cotton field as being "wild." "Natural," yes, when the rains come and the plants take up water, when the sun comes out and the plants photosynthesize. But the plowing and the fertilizer, the managed care, mean that the cotton plants are no longer wild. Hybrids have not lost their naturalness entirely, but they have lost their wildness. They are domestics. Some of these domestics, such as

maize, have been so modified genetically by long selective breeding that they can no longer survive in the wild. Most of them, such as tomatoes, have altered genomes that are hybrids of nature and culture.

Yes, you may say, that is true of cultivars that have been bred for human purposes. But it need not be true of plants that, though taken under human care in botanical gardens, are not selectively bred but left to themselves. But are they left to themselves? A new, controlled environment has been selected for them; water and nutrients are supplied, and they are watched over while left to themselves in this environment believed to be artifacted to mimic the wild. One needs only to move a few feet or a few inches away from the plant, and it is evident that this is no wild ecosystem. The plants no longer have to, or can, disperse their seeds, for example, but this is a first priority for any wild plant. This is a managed botanical garden.

Maybe the problem is that the plants are left all by themselves, isolated from the webworks of ecosystems. They have been removed from their co-adapted gene complexes, perhaps those of the insects that pollinate them, or the fungi in the soil in which they root. They have no niche. Once a dynamic organism is severed from its functional context, it ceases to be that thing. Aristotle (1961) has a memorable analysis in which he comments of a hand severed from a body that it used to be a hand, but is no more because of the disconnection (*De partibus animalium*, 640-641). We see that with organs in organisms, but it is equally true of organisms in ecosystems. By this analysis, a wolf in a zoo used to be a wolf. The brains of lions in zoos rapidly disintegrate. A bear without a forest is a compromised bear. It has lost what Aristotle calls—rather provocatively for us—its "soul," its psyche or anima. Very few of the animals in zoos could be returned to the wild, even if we wanted to do so. They have become dependent on humans; they never developed the needed survival skills. They may no longer have the genetic competence for such skills, as with all the Siberian tigers in zoos today. Returning a zoo monkey to the wild is like turning a cocker spaniel loose in the wilderness.

A half dozen species endemic to San Clemente Island, off the coast of California, were threatened with extinction because they were being eaten by feral goats. The goats were introduced by sailors as a fresh meat supply a century and a half ago. New concern for the conservation of these plants arose after the Endangered Species Act was passed. Some were transplanted to the Santa Barbara Botanic Garden. By this account, we would have to say of a San Clemente Island bushmallow (*Malacothamnus*

clementinus, Malvaceae) translocated to Santa Barbara that it used to be a *Malacothamnus clementinus* but is no more. It is an amputated species.

U.S. Fish and Wildlife authorities and the U.S. Navy, which controls the island, have eliminated the goats by translocating and killing them. About 14,000 live goats were moved to the mainland; about 15,000 goats were shot. This was to protect the endangered plants and to restore ecosystem health more generally to the island. They did this despite protests, including lawsuits, from animal rights advocates that this was cruel and that the welfare of the goats ought to take priority over that of a few endemic plants. Several dozen goats were shot for each known surviving plant. The rationale is that this restores an ecosystem in which *Malacothamnus clementinus* can continue to be *Malacothamnus clementinus* because the plant is at home in its ecology (Ottie 1982; Mohlenbrook 1983:183-184; C. Winchell, pers. comm., 1991).

Eliminating natural selection at once begins to alter a species, even if no artificial selection is intended to replace it. Species formerly under selection pressures may undergo random drift. More likely, there will be unintended artificial selection pressures. Geneticists have found that endangered fish, kept in hatcheries to be bred for reintroduction programs, are genetically different in two or three generations (Meffe 1986). In an effort to eradicate a cattle pest, the screwworm fly was mass reared to produce males that could be sterilized by gamma rays. Researchers found that the lack of natural competition inadvertently selected genome changes in a few generations such that males had reduced competitive ability (Bush et al. 1976). Similarly in fruit flies: "even 'properly managed' populations of captive *Drosophila* lost 74 per cent of their reproductive fitness after 11 generations and had lower genetic diversity than large wild populations. Captive animals rapidly adapt genetically to captivity. Animals adapted to captivity are likely to reproduce more poorly in the wild. (Ralls and Meadows 1993: 690; Frankham and Loebel 1992).

Even if the lack of competitive natural selection pressures in the zoo or botanic garden is insignificant, there seems to be a strong possibility of putting captured animals and plants, even when soon returned to the wild, through a genetic bottleneck, or inbreeding depression. Another problem is that if plants are needed for reintroduction to the wild, the seeds that are grown will be selected for maximum reproductivity in gardens, but selecting the most fecund plants in the garden may not be the same as selecting maximum reproductivity in the wild, which is tested in a different environment and over the entire lifespan of the plant.

Or, realizing the dangers of genetic bottlenecks and small population samples, conservation biologists may go to extra effort to preserve and to mix plants from multiple locations, thereby increasing genetic diversity, as they intend, but inadvertently reducing a plant's fitness in the particular locales in which it is subsequently reintroduced. "Active management to maintain maximum genetic diversity may ironically be at odds with rapid adaptation to local conditions" (Guerrant 1996:186). Plants are subject to outbreeding depression, and mixing stocks (perhaps in the well-intended interests of increasing diversity) can be counterproductive, disrupting evolutionary and ecological adaptation to local conditions,

Plants seem to be adaptively fine-tuned to their particular localities, and translocating them disrupts this idiographic adaptation {Guerrant 1996: 199}. One cannot manage without a strategy, and whatever the strategy, it is likely to relax natural selection pressures. The idea of managed, wild plants is a contradiction in terms.

For example, plant succession never takes place in botanic gardens or seed banks, yet every species is more or less affected by whatever tendencies toward succession are present in its natural habitat Or if one prefers the more chaotic accounts of recent ecology, chaos is not present in botanic gardens or seed banks. Processes of dynamic change, omnipresent in ecosystems, are absent in botanic gardens. Or perhaps we should say that the processes of dynamic change are cultural rather than natural. To this extent, the captive plants become artifacts.

Wild, Compromised, and Faked Nature

The question we finally reach is whether ex situ conservation will complement or undercut in situ conservation. An answer likely to be given is that in situ conservation is best; but where it is not possible, ex situ conservation is third best. Second best is interim ex situ conservation prospective to in situ restoration. In a general way, one can hardly disagree with such pragmatism, but there are pitfalls to such compromise that must be analyzed.

Set ideals aside and get real, one might object. When one is faced with win-or-lose decisions, especially in political democracies and capitalist economies, win all you can and be realistic about what you must lose. In actual decision-making contexts, the best rule is compromise. But this is not necessarily true; this depends on the contexts of opportunity and jeop-

ardy. Compromising politically and compromising botanically are two different activities, and they relate with uncertainty. Compromises often put at risk what they propose to save. An old saying is that "Half a loaf is better than none," and this is true for those who are arguing over bread. But what if they are arguing over a horse? Some values do not compromise without being devalued, even destroyed. A dozen rare plants in a botanical garden, rescued and transplanted there prospective to relocation, though seemingly flourishing in their new location, may be doomed the moment their site is bulldozed over for a new dam.

Compromises must be set in the perspective of what has already been lost. Perhaps the rare plants are taken from an area that might have been set aside as sanctuary. Whereas some plants are naturally rare, many have been made artificially rare through habitat loss. Possibly a sanctuary of a few thousand acres would have been only 1 or 2 percent of the regional habitat the species once occupied. In dispute, we might be tempted to compromise, save the plants in a garden, and plan to relocate them elsewhere. But such a compromise only further skews the imbalance of nature and culture, and if no viable population is saved, compromise loses both sanctuary and species.

"In politics compromise is the name of the game," So? Where there is choice against choice, one can expect that positive values will be at stake on both sides, and in a pluralist democracy we can often expect that compromise will optimize such values. Compromises can be fair and equitable. We incline to compromise when issues are complex, when there is evidently some value on both sides, when a decision is needed that is impossible to postpone or when postponing will result in value loss for both sides. Often, too, the facts and projections are uncertain, which makes us less sure of our position. Compromise can win something, and uncompromising purity is a sure route to defeat. Better to have some of the plants in gardens, with a chance of reintroduction, than to have no plants at all.

But those alert to the logic of compromise also know that compromises can mean destruction. Compromise is likely to cast the solution in terms of who has interests to adjudicate and is noisy about them. But the better question is, What is of value in the world, and how ought we behave so as to optimize those values? Compromise is likely to mean that decisions are made in courts (or outside courts lest courts be invoked), but this means that those who have power to do adversarial work succeed; this may not always be the best way to reach decisions. Adversaries are not always the

best optimizers; there is no invisible hand that guides adversarial relations into optimal solutions. There are values here to be discovered, not just interests to be defended.

If the rationale for conservation is largely humans and their plant resources, compromising conservationists will argue that we have what we want in the botanical gardens and the seed banks: the genetic resources of interest to humans. Any ongoing dynamism of wild plants in their habitats is on evolutionary scales, too iffy and indiscernible to make any difference to what we want, 99 percent of which we can get with the present genetic diversity on hand in *ex situ* storage. We can compromise, save the genetic diversity, and build the new ski area.

Such a reply is likely to prove in error on several counts. Seed banks and botanic gardens can preserve only an infinitesimal fraction of the allelic diversity and evolutionary potential in wild nature—the genetic bottleneck problem. Rich potential resources in wild nature will lapse into extinction while we labor under the illusion that we have what we want in the gardens and banks.

Furthermore, evidence already cited shows that genomes can change more rapidly than often supposed. If fishes, fruit flies, and tomato plants can respond to altered selective pressures as quickly as they have, this suggests that the dynamism of natural selection in the wild is significant on similar timescales. True, the altered selective pressures of culture may be more dramatic than changes to be expected on evolutionary timescales. But the domesticated plants may soon have less genetic diversity than we thought. There is high probability that the results of our compromise, taking the plants into managed care, even intending their restoration, will be different from what we thought.

Much environmental law allows for mitigation. Developers who encounter endangered plants in their way will consider mitigation. That seems common sense. Move the plants. Create a new wetland, or riparian zone, or translocate to a similar habitat in the next county, where a nature reserve is possible at a third of the cost. Botanic gardens and seed banks will be seen as sources of mitigation. But as everyone familiar with mitigation efforts knows, these sources have been notoriously unsuccessful. Therefore, *ex situ* conservation, even when it is claimed to be prospective to restoration, will be used to justify the increased invasion of areas that, without *ex situ* conservation, would not have been so readily invaded. Zoos and botanical gardens will undermine the imperative to conserve existing sites.

Although I am a philosopher, not a biologist, if I read the literature correctly, reintroductions, though sometimes successful, have often proved more complex than anticipated. Most reintroductions over the last century have failed; most of the time the causes of failure (or success) are unknown. With better conservation biology, reintroduction success is improving, still with formidable unknowns (Guerrant and Pavlik 1997:92-93,104). That does not bode well for compromises that settle for ex situ conservation interim to recreated in situ conservation. One will always be trading the absolute certainty of existing populations against the high uncertainty of replacement populations. At a minimum that places a high burden of proof on those who propose mitigation.

If and when the compromised plants are successfully restored to the wild, we might have what some have called "faked nature" (Elliot 1998; Kate 1992). The restored plants have suffered the loss of temporal continuity by having been removed from the wild to the managed garden, even if they are later restored to the wild. They do not cease to be artifacts when they are cleverly put back in place by restoration biologists. When you take visitors to reintroduction sites, you probably do not say, "Here, let me show you some wild plants." You say, "Here, let me show you our successful reintroduction." But by that you reveal that these plants are different from wild ones, different because of the human intervention.

Standing before a Torrey pine (*Pinus torreyana*, Pinaceae) along the coast of southern California, the proper response is not, "Wow, there is a rare species, surviving across millennia!" but "Hurrah for the U.S. Forest Service!" Their biologists in 1986 collected 30,000 seeds from 150 trees for ex situ storage and propagation and reintroduced the pine, producing nearly 6,000 trees. Besides this, they had to control an outbreak of the ips beetle. One admires not so much the trees as the skills of the restoration biologists who put them there. The pines are not really wild. Once upon a time, they were, but now, though apparently in situ, the truth is that they exist thanks to biologists and their ex situ facilities.

This objection can be met, though perhaps only partly. One has to recognize that nature returns. Nature is still in situ, and if we situate the plants there, they grow wild again. The compromise is not forever. Notice that there are all kinds and degrees of restoration. At the one extreme, if a forest has been clearcut or stripmined, there is nothing there; the landscape is blitzed, so any new forest is a replacement; a replica. This would be like replicating the *Nina*, one of Christopher Columbus's ships. The replica is

made from scratch and has no historical continuity with the original. This is not really restoration; it is replication.

On the other end of a spectrum, if a few of the trees in the forest have been cut by selection and new trees replanted to substitute for them, there is restoration. If some of the Torrey pine is removed and the Forest Service put others back, this is restoration, the original, once damaged and now restored. A replica is a new creation, without continuity to the old one. Replicas can exist simultaneously with originals. Restorations cannot. Nature restored need not be nature faked.

Restoration in nature, unlike restoration in art, is really rehabilitation. A restored painting, which is an artifact; does not heal itself when restored; it is a passive object. One does not rehabilitate paintings. But once we put the parts back in place, nature may heal itself. One can revegetate after a strip mine, but one cannot rehabilitate it because there is nothing to rehabilitate. One can rehabilitate a prairie that has been not too badly overgrazed. Overgrazing allows many introduced weeds to outcompete the natives; perhaps all you have to do is pull the weeds and let nature do the rest. That is undoing as much as doing.

Overgrazing allows some native plants to outcompete other natives, those that once reproduced in the shade of the taller grasses. So perhaps, after the taller grasses return, you will have to dig some holes, put in some seeds that you have gathered from the missing plants, held *ex situ* in the botanic garden, cover them up, go home, and let nature do the rest. Perhaps you can just put the seeds in the weed holes. The naturalness returns. The restoration ceases to be an artifact.

In the days before high-tech medicine, physicians who were congratulated on their cures used to say, modestly, "Really, I just treated you, and nature healed you." A physician who sets a broken arm just holds the pieces in place with a splint, and nature does the rest. The doctor is not really to be congratulated for his or her skills at creating arms. The doctor arranges for the cure to happen naturally. One does not complain, thereafter, that one has an artificial limb. Likewise with restoration. It is more like being a midwife than being an artist or engineer. You arrange to get the raw materials back on site and place them where they can do their thing.

The point is that restorations of this kind do not fake so much as facilitate nature, help it along, mostly by undoing the damage humans have introduced and then letting nature do for itself. As the restoration is completed, the wild processes take over. The sun shines, the rains fall, the for-

est grows. Birds arrive on their own and build their nests in the restored pines. Natural selection takes over. The adapted fits survive in their niches.

Succession resumes. In due course, lightning will strike and wildfire burn the forest again, after which it will regenerate itself. Even a new species could evolve. If such things happened decades, centuries, millennia after some thoughtful humans had once facilitated a restoration, it would seem odd to label all these events as artifacts, lies, fakes. Perhaps the best way to think of it is that the naturalness of a restored area is time bound. Any restoration is an artifact at the moment that it is deliberately arranged, but it gradually ceases to be so, and spontaneous nature returns—as long as humans back off and let nature take its course.

Nevertheless, the unbroken historical continuity in natural systems is important. That we, after restoration, back off to let nature take its course proves that we could wish that the course of nature had never been broken on the landscape we now conserve. We are glad to have a broken arm healed; we would just as soon never have broken it. Although the spontaneity of natural systems might all return, the historical discontinuity can never be repaired. In that respect, the restored area does suffer permanent loss of natural value. Natural systems, like human beings, are not replaceable in their historical identity and particularity. They are characteristically idiographic and deliver their values in historical process, diminished in value if interrupted. Restoring does not restore this interruption.

If one is appreciating the present spontaneity of wild nature—the plant or animal in its ecology—it can be returned, and after complete restoration it will be present undiminished. But if one is appreciating the evolutionary history—the plant or animal in its historical lineage—even though the genetics may be back in place, there has been interrupted wildness. The forest is not virgin, not pristine. It is less real. The danger is that ex situ conservation, in its admirable zeal for restoration and refining its skills at this, will discover that it has made more attractive this second-best solution. This would be something like a physician discovering that he was so skilled at resetting broken arms that his patients were more careless and that he was resetting twice as many as before.

If nature means absolutely pristine nature, totally unaffected by human activities, past or present; there is little remaining on Earth if our detection instrument are keen enough. One can undoubtedly detect various human-introduced pollutants in the plants in Yellowstone or note that the vegetation is different because of fire suppression. Invasive, exotic plants are

a problem, and they threaten to make the flora unnatural. Global warming threatens to shift natural patterns. Everything in nature has been compromised, they say; it is useless to seek real nature.

Taken to its logical conclusion, this argument holds that the slightest human intervention has a totalizing effect and brings straightaway the end of nature. This is like saying that the whole moon is pristine no more because the astronauts took a few steps on it or that the sky is not natural because some jet planes have flown through it. It is true that certain human actions have unintended consequences that spread everywhere; there are contagious effects that eventually interrupt everything, that seep into the nooks and crannies of all nature.

However, most human activities do not have such far-reaching effects. The world is too pluralist for that. Not everything is that tightly bound up to everything else. For instance, is it the case that, because humans first removed and then restored the bison and the wolves in the Yellowstone Park ecosystem, we have lost any possibility of letting the park be natural? In an absolute sense this is true because there is no square foot of the park in which humans, disturbing the predation pressures, have not increased and not shifted the patterns of ungulate grazing. That affects the grasses and the forbs, the willows and the beavers.

But it does not follow that nature has absolutely ended, everywhere compromised because it is not absolutely present. It does not follow that there is no native vegetation at all, because all of it has detectable human effects. Answers come in degrees. Events in Yellowstone can remain 99.44 percent natural on many a square foot, indeed on hundreds of square miles, in the sense (recalling the language of the Wilderness Act) that they are substantially "untrammelled by man." We can put the wolves back and clean up the air, and we have recently done both, and both will have effects on the flora. Where the system was once disturbed by humans and subsequently restored or left to recover on its own, wildness can return. *Mutatis mutandis*, this applies to restored plants. After a generation or so, the plants do not know their interrupted history, even if we recall it in our history books.

Ex situ conservation is always a means, never an end. Sometimes the conserved plants are human resources for profit or pleasure; some of the resulting human experiences in botanical gardens, such as enjoying the orchids there or conducting scientific studies of their genetics, could be considered ends in themselves. But such pleasures and studies ought

also motivate us to lament this compromising captivity unless this is also a means to their reintroduction into the wild. By contrast, in situ conservation can be an end in itself, in more ways than one. Humans on wild sites conserve these plants for their intrinsic value, not instrumentally to some human uses of them. They respect the integrity these plants have on their own. Conservationists can and ought to take pleasure in this, too, but this human conservation biology complements the autonomous plant conservation biology. These goods-of-their-kind, restored, continue dynamically to defend their forms of life as good kinds, and they do so as good adapted fits in their ecosystems.

The biodiversity of life on Earth is remarkable indeed, but this is still more remarkable: biologists committed to the care and conservation, the restoration and rehabilitation of such value in nature. Defending the goods of one's kind, a fact of nature, passes over to defending the goods of others, not one's kind, an environmental ethic unique to the human.

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