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# Values in Nature

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Nature is examined as a carrier of values. Despite problems of subjectivity and objectivity in value assignments, values are actualized in human relationships with nature, sometimes by (human) constructive activity depending on a natural support, sometimes by a sensitive, if an interpretive, appreciation of the characteristics of natural objects. Ten areas of values associated with nature are recognized: (1) economic value, (2) life support value, (3) recreational value, (4) scientific value, (5) aesthetic value, (6) life value, (7) diversity and unity values, (8) stability and spontaneity values, (9) dialectical value, and (10) sacramental value. Each is analyzed and illustrated with particular reference to the objective precursors of value as these are described by natural science.

"The world's largest monument to the world's smallest fish!" With that hyperbole, a Tennessee governor once lamented the apparent fate of the $116 million Tellico dam, stopped first by the Supreme Court and later by the Endangered Species Committee in order to save the three-inch snail darter, *Percina tanasi.* Congress afterwards voted to finish the dam. The gates have been closed, the lake is filled, and the critical habitat is destroyed. It may be that the darter has been successfully transplanted, though the director of that project is doubtful.[1] If not, the dam will indeed be the world's largest gravestone—for which the tiny perch was sacrificed, the first deliberate extinction of one species by another—and we must then decide whether to view the dam as a monument of pride or of shame. The Dickey and Lincoln dams on the St. John River in Maine are being planned with the careful protection of the rediscovered Furbish lousewort, *Pedicularis furbishiae,* once thought extinct in the United States. A technologist may consider concern for these "lousy

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[1] See the *Endangered Species Technical Bulletin* (U. S. Fish and Wildlife Service), May, June, July 1978, January, October, November 1979, May and September 1980. Harold J. O'Conner, Endangered Species Program Manager for the Fish and Wildlife Service, reports, "We are afraid that the chances of long-term survival for these transplanted populations are not good" *(Bulletin,* October 1979). Former governor Ray Blanton is quoted in *Time,* 26 June 1978, p. 14.

louseworts" to be "total stupidity."[2] A naturalist may be glad for test cases that force us to ask whether rare life forms are not worth more than those dam(n) machines. These dramatize an increasingly insistent question about what values we meet in nature, and scientists find themselves hardly better able than anyone else to answer it.

*Value* is the generic noun for any positive predicate, and it is commonplace to notice that in a strict sense science works only with neutral, descriptive predicates. This means, however, that science cannot teach us what we need most to know about nature, that is, how to value it. A partial response, relieving the embarrassment of scientists at the incompetence of their discipline here, is to point out that values are mental and ideal, not actual or material, so that objective value is no part of nature as such, and thus forms no part of science. Values appear only in the human response to the world. To ask about values in nature is, then, to form a misleading question, for values are only in people, created by their decisions.

But that seems to err on the subjective side, for some values appear in our relationships with nature. Natural things at least become *carriers* of value. We may not want to say that the valuing of nature is a descriptive registering of properties, but neither do we value nature altogether oblivious of its descriptions. We make something a target merely by aiming at it. But our interest in apples is not so arbitrary. It depends in part on something which is found there. Philosophers of science make a traditional, if also troublesome, distinction between primary and secondary qualities. We might say that values in nature are tertiary qualities, that is, contain a still additional level of subjective contribution by the beholder. The recipient of value is more active than is the viewer of color, far more so than is the observer of motion. Nevertheless, even the participant in natural values does not compose them *ex nihilo,* for there are actual facts which are the crucial supports of these values. Such qualities in any case are properties of the natural object in the sense that, whatever the contributions made by humans in constituting worth, there are prevaluational antecedents necessary for value, if not sufficient for it. I propose here to examine the kinds of value that arise *in association with* nature, being founded on physical and biological properties there, especially as these have been unfolded by the sciences.

Notice that if we are going to talk about any natural values, we must be "in on" them, that is, "share" those values in personal experiences adequate to judge them. Indeed, the careful scientist now realizes that he always bears some relationship beyond that of passive observer to whatever he seeks to know, but the ownership features loom larger here. We are rather more "turned on" in doing evaluative judgments than in doing straightforward

[2] Quoting R. W. Scott in *World Oil* January 1977, p. 5. See the *Endangered Species Technical Bulletin,* July 1978.

empirical ones, but that can mean that we are rather more "tuned in" with what is so. That does add a dimension of biography to every report about nature, but it would be valuational solipsism to conclude that in those values which natural things seem to carry I am getting back absolutely nothing but my projections. Values are actualized in real things, often natural things, which seems to warrant the view that valuing is sometimes in part a form of knowing where we register properties—aesthetic properties of the Grand Canyon, for instance, in the appreciating mind—notwithstanding what we may add in the appreciating process. Otherwise we commit the fallacy of misplaced location, and ascribe to the viewer what is really in the scene, or at least what comes relationally. Scientists, more than others here, ought to be alert for the objective properties involved. We should also be warned that the myriad items of the natural panorama need not all be expected to carry value alike, qualitatively or quantitatively. Some may carry none at all, and some may carry disvalue. Being valuable, like being colored, takes many forms and shades.

*(1) Economic value.* The price of petroleum proves that nature has economic value, but the sense in which it does can be contested, for human labor so dramatically adds to its raw value that an economist may here see valuing as a kind of adding on of labor to what is initially valueless. "Crude" oil has no value, but a petroleum engineer may "refine" it. The sense of the prefix *re-* in *resource* is that nature can be re-fitted, turned to use by human labor, and only the latter gives it value. Valuing is a kind of laboring, more than a kind of knowing. If this were entirely so, we should not say, strictly speaking, that nature *has* economic value any more than we say that an empty glass has water in it. It only carries the value of labor. Marxists often argue that natural resources should be unpriced, for in fact resources as such have no economic value.[3] But a research scientist, mindful of the remarkable natural properties on which technology depends, may immediately add that human art has no independent powers of its own, and he may give a different valuation of this natural base.

There is a foundational sense in which human craft can never produce any unnatural chemical substances or energies. All we can do is shift natural things around, taking their properties as givens. There is nothing unnatural about the properties of a computer or a rocket; as much as a warbling vireo or a wild strawberry, both are assemblages of completely natural things operating under natural laws. This sets aside essential differences between artifacts and spontaneous nature, but it does so to regain the insight that nature has economic value because it has an instrumental capacity—and this is to say something about the material on which the craftsmanship is expended. Nature has a rich utilitarian *pliability,* due both to the plurality of natural sorts and to their splendid multifaceted powers. This is its economic value in a basic and etymo-

[3] See Karl Marx, *Grundrisse* (New York: Random House, 1973), p. 366.

logical sense of something we can arrange so as to make a home out of it. Nature is, as it were, a fertile field for human labor, but that agricultural metaphor (which applies as well to industry) praises not only the laborer but his surrounding environment. Nature is sometimes recalcitrant, but often agreeable and useful, frequently enough to build our entire culture on it.

Despite the prefix, *resource* preserves the word *source*, and recalls these generative qualities so profuse in their applications. It is sometimes thought that the more civilized we become the further we get *away from* nature, released from dependency on the spontaneous natural course. This is true, but science and technology also take us further *into* nature. A pocket calculator is, in this perspective, not so much an exploitation of nature as it is a sophisticated appreciation of the intriguing electronic and mathematical structure of matter-energy, properties enjoying an even more sophisticated natural use in the brain of the fabricator of the calculator.

To be sure, such economic value is a function of the state of science, but it is also a function of available natural properties, which often quite unpredictably mix with human ingenuity to assume value. *Penicillium* was a useless mold until 1928, when Flemming found (and much amplified) the natural antibacterial agency. The bread wheat on which civilization is based, arose from the hybridization (probably accidental) of a mediocre natural wheat with a weed, goat grass. Who is to say where the miracle foods and medicines of the future will come from? Given the striking advances of technology, an endangered ecosystem is likely to contain some members of potential use. If we accordingly conserve nature, we hope in the genius of the human mind; but we also reveal our expectations regarding the as yet undiscovered wealth of natural properties, which we may someday convert into economic value.

*(2) Life support value*. The ecological movement has made it clear that culture remains tethered to the biosystem and that the options of our arts, however expanded, provide no release from nature. Evolutionary theory adds that culture, despite its novelties, is but the latest chapter in an epic of development. Our economic wealth may be labored, but our ecologic welfare has deeper, natural roots. The ordinary currencies of economic value are much distorted when one tries to count ecological values with them, for they are poorly equipped to preserve these noncommercial values—those tied to the atmosphere, the oceans, polar ice caps, and ozone layer—which are essential to the health of the ecosystem and thus to human welfare. Such prophets as Rachel Carson or Aldo Leopold launched what has proved to be a difficult quest for better modes of "caring for" the land, forests, grasslands, soil, and rivers. This caring is for natural communities but also must be distributed into a valuing of individual members—honeybees, blacksnakes, earthworms, fungi, or alders and the nitrogen-fixing bacteria in their root nodules—all of which contribute to environmental quality and, thus, to human life support. At this point, the economist's sense of a labored value has been entirely left behind, and geological and biological qualities are in immediate focus.

Still, the humanistic principle seems dominant. None of these processes has any value except in its support of cultural values. Value is not always an economic predicate, but it arrives only with human interest. From one perspective that is so, but, as before, the natural scientist is entranced by the objective features of this life support, found in profusion by recent science, as with the electromagnetic light window in the atmosphere which screens harmful radiation but admits the energy to drive the ecosystem. The intricate analyses made by the ecologists sum up into an overview of the Earth suggested by photographs taken by the astronauts; we increasingly see it as a blue, white, and green jewel, a home set lonesomely in the abysses of space. In many respects, though by no means all, the earthen setup is a "happy place." Those who find value to be entirely subjective will smile and say that in that kind of remark we are only getting back our reflected emotions, as when others say that it is a "lonely place." Evolutionists may also charge that humans have necessarily been selected to fit and even to like this world, for the misfits were eliminated. But those who prefer a more objective gestalt will wonder why we find ourselves alive and well in a life support system which can, by means of natural selection, evolve such a flourishing of life. Do we not value Earth because it is valuable, and not the other way round? Is it really just a matter of our late-coming interests, or is not Earth in some puzzling way an interesting, lively place even antecedently to the human arrival?

The astronomical reaches of space can be taken as a consummate example of worthless nature. But the heavens seem to have provided the space-time place for the genesis of all the heavier elements on which everything else is built, and so the stars are the furnaces in which once was constructed the stardust now in the hand, the brain, and the pocket calculator. A pragmatic scientist may dismiss this celestial prologue as so remote from local issues as to set Earth in a value vacuum quite as nearly as it is set in a spatial one. But a philosophical scientist can reply that such a prologue is not so much "nebulous" as it is rather foundational. A tough-minded analyst can insist that nothing has value until humans arrive. One moment that may seem right, but then again is he not a provincial who supposes that his part alone in the drama in which he participates establishes all its worth?

*(3) Recreational value.* It may seem frivolous to move from labor to play, from creation to recreation, but the question is a quite serious one: why we enjoy nature even when we no longer need it for economic or life supportive reasons, when the sense of "enjoy" alters from beneficial use to pleasurable appreciation. For some, nature here is instrumental to some active human performance; they want only terrain rough enough to test a jeep, or a granite cliff sound enough for pitons. Even so, it serves as a field for skill and joy. For others, the natural qualities are crucial in contemplating an autonomous performance. They watch the fleecy cumulus building over the Great White Throne in Zion, listen for the bull elk to bugle, laud the aerial skills of the hummingbird at the bergamot, or laugh at the comic ostrich with his head in

the sand. For the first group, nature's recreational value is as a place *to show what they can do;* for the other, values are reached as they are *let in on nature's show—a* difference surprisingly close to that between applied and pure science. Even for the latter persons, nature is in a way an instrument of pleasure, but only special sorts of instruments can be enjoyed by contemplation. Music and art are like this, but we also speak of their intrinsic worth, and, even more oddly here, although appreciative skills are required, no human performance is required upon this instrument.

These two sorts of recreational value can often be combined, as when a botanist enjoys the exertion of a hike up a peak and also pauses at the Parry's primrose by the waterfall enroute. But they often need to be compromised and are sometimes irreconcilable. It will strike a sportsman as ridiculous to say that snail darters and Furbish louseworts have more recreational value than will the reservoirs behind those dams, stocked with game fish, while it will seem obscene to the naturalist to exterminate a rare life form in exchange for one more place to water-ski. These natural history values seem lately to be counting more, for every state wildlife magazine devotes more space to the nongame species than it did a decade ago, and every national park and wilderness area is under increasing visitor pressure. And what if these count still more in the next generation? We can always build a dam, but extinction is forever.

Recreational values can be in sports and popular pastimes, and thus can be humanistic, but they are not always so. They can be in sober sensitivity to objective natural characters, and here we regain our main track toward natural values in a scientific perspective. Js being a naturalist a matter of recreation or of science? Does one do it for play or for pay? Some ornithologists and mineralogists hardly ask; rather, whether avocationally or vocationally, they unite in valuing nature as an object worthwhile to be known apart from economic concerns, always caring for the fascinating natural characteristics we now attempt to unfold.

*(4) Scientific value.* Science was in its origins the leisurely pursuit of intellectuals, and a good test still for an unalloyed scientist is to ask whether he would continue his researches if he were independently wealthy and if they had no economic or life supporting consequences. The alliance of pure science with naturalistic recreation is seldom noticed, but this only reveals how far recent science has sold its soul to the economists. Like music and the fine arts, natural science is an intrinsically worthwhile activity, but scientists find this difficult to say and, sometimes with much ingenuity, sell their study short by retreating to some utilitarian subterfuge. But natural science *per se* cannot be worthwhile unless its primary object, nature, is interesting enough to justify being known. To praise cognitive science here is also to praise its object, for no study of a worthless thing can be intrinsically valuable, and, filtering out all applied

values, one reaches a residual scientific value in nature, an interest in both the natural stuff and the study of it which has enlisted the greatest human genius. Natural science is our latest and perhaps most sophisticated cultural achievement, but we should not forget that its focus is primitive nature. Valuing science does not devalue nature, for it tells us something about the absorbing complexity of the natural environment that it can serve as the object of such noble studies. There is an intellectual adventure in discerning how the tunicates and the vertebrates are so structured as to include both among the chordates, which are related to the echinoderms more closely than to the cephalopods, an accomplishment possible only because nature is a rich developmental system. Some say that we first understand things and afterwards evaluate them, but if there is anyone for whom pure science has value, then nature contains at least the raw precursors of value, and bears these in concrete particulars, in benzene molecules and ptarmigans, however one may seek universals in these particulars.

The Jurassic fossil *Archaeopteryx,* linking the reptiles with the birds, has great scientific value but no economic or life supporting value. The steaming pools of Yellowstone preserve an optimal thermal habitat for primitive anaerobic bacteria which, recent studies suggest, survive little changed from the time when life evolved under an oxygen-free atmosphere.[4] It is typically odd, useless, and often rare things that have high scientific values, like the finches on the Galapagos, for the clues they furnish to life's development and survival. If there had lain below the threatening flood waters of the Tellico dam an archaeological site suspected to contain hints of human origins in the West, we would not have closed those gates. And yet there does lie flooded now the ancient Indian site, *Tanasi,* from which the state of Tennessee and the little *Percina tanasi* both take their names, as well as the Icehouse Bottom (c. 7,500 B.C.), an excavation representing the oldest documented textile use in eastern North America, two sites among hundreds of unexcavated sites spoiled by the flooding. The flooded valley, in the testimony of one expert, is "undoubtedly the most interesting archaeological section in the entire Appalachian district, with some 280 sites, only a few more than 5% excavated, most wholly unexcavated."[5] Who is to say, worrying over the elimination of a snail darter or a wild stretch of an ancient river, where tomorrow's scientific values may lie? A scientist might have been pardoned a generation back for thinking the Yellowstone microhabitats and rnethanogens unimportant.

Science tells the natural tale—how things are, how they came to be. That story cannot be worthless, not only because our roots lie in it, but because we

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[4] T. D. Brock, "Life at High Temperatures," *Science* 158 (1967): 1012-19.

[5] J. Chapman and J. M. Adovasio, "Textile and Basketry Impressions from Icehouse Bottom, Tennessee," *American Antiquity* 42 (1977): 620-25. The quotation is from the testimony to the House Subcommittee on Fisheries and Wildlife Conservation made by Jefferson Chapman, anthropologist at the University of Tennessee, on 20 June 1978.

find it a delightful intellectual pursuit. The older sciences, and many abstract ones still, fastened on morphology, structure, and homeostatic processes. That itself was engaging, but now no natural science, whether astrophysics or ecology, escapes the evolutionary paradigm, and mankind is only beginning to understand what, in a sometimes despised term, *natural history* is all about. That history has an epic quality—a considerable wandering notwithstanding—and it is surely a story worth telling. But the scientist can be beguiled into severing values from nature at the same time that he finds his principal intellectual entertainment in unraveling an account of the physical and biological saga. Those who are humanistically inclined can still claim that nature is valueless and that all the cleverness of science is an artifact, for science too is an art. But there is this difference between the cleverness of a scientist and that of an artisan: the latter mostly creates, while the former partly creates but also largely discovers the satisfactions in his subject matter.

*(5) Aesthetic value.* We value the Landscape Arch of the Canyonlands for the same reason that we value the Winged Victory of Samothrace; both have grace. Every admirer of the Tetons or of a columbine admits aesthetic value in nature, and the photographs in *Audubon* or *National Wildlife* bring out well this natural aesthetic value. Yet justifying such value verbally is as difficult as is justifying the experience of pure science. The intrinsically valuable intellectual stimulation which the scientist defends is, in fact, a parallel to the aesthetic encounter which the aesthetician defends, for both demand a distance from everyday personal needs and yet a participatory experience which is nontransferable to the uninitiated. Sensitivity in both pure science and in natural art helps us see much further than required by our pragmatic necessities. In both, one gets purity of vision.

In discovering such aesthetic value, it is crucial to separate it from both utility and life support, and only those who recognize this difference can value the desert or the tundra. The mist that floats about an alpine cliff, spitting out lacy snowflakes, tiny exquisite crystals, will increase the climber's aesthetic experience there, although the gathering storm may be dangerous to him. The glossy chestnut, half covered by the spined husk, is pretty as well as edible, and we lament its vanishing; but the head of a much too common weed, *Tragopogon,* is just as shapely. The distance that a scientist cultivates, as well as the habit of looking closely, fits him to see the beauty that the coldblooded scientist is supposed to overlook. But it keeps turning up, and in unsuspected places, as in the stellate pubescence on the underside of a *Shepherdia* leaf or in a kaleidoscopic slide of diatoms. No one who knows the thrill of pure science can really be a philistine.

A prosaic scientist will complain that the admirer overlooks as much as he sees, chestnuts aborted by the fungal blight, fractured snowflakes, imperfections everywhere. Contingencies sometimes add beauty, for a skein of geese is not less moving if one is out of line, nor is the cotton wood silhouetted against

the wintry sky any less dramatic for the asymmetries within its symmetrical sweep. Still, every natural thing is marred by accidents and eventually destroyed by them. Doesn't the aesthetician repair nature before appreciating it? He sometimes does, but in so doing, if we consider the case of organic beauty, he may see that ideal toward which a living thing is striving, and which is rarely reached in nature. So, the artist paints a perfect lady-slipper orchid. Perhaps we could say, in the language of the geneticists, that the artist portrays that phenotype producable by the normal genotype in a congenial environment. Or, borrowing from the computer scientists, the artist executes the program built into a thing, although that has not been executed in nature, owing to environmental constraints. Such an ideal is, in a way, still nature's project. In a distinction going back to Aristotle, it is true to the poetry of a thing, though not true to its history, and yet the poetry directs its history.[6] The form, though not wholly executed, is as natural as is the matter. Some will simply insist that all this is not true to the plain facts of nature; others will realize that this is not so much fiction as a way of getting at what one might call a natural essence only partly expressed in any individual existence.

It is sometimes said that science tells the story like it actually is, art like it ideally ought to be. But that is not entirely so. Art can enjoy the conflict and resolution in the concrete particular expression of a natural thing. On the other hand, science typically seeks a universal law to which no particular ever quite conforms. The physicist who rounds out his slightly erratic lab data into a symmetrical sine wave and the botanist who describes a generic type in his herbarium specimens, ignoring anomalies, both think they are truer to nature by overlooking some data. Again, art may abstract from nature in order to help us see it better. Impressionistic painters, such as Cezanne and Monet, have often said that by exaggeration they reeducate our perceptions to help us capture qualities *in nature,* as with the flair in an elm, chromatic qualities in a sandstone mesa, or the intricacy of a fern leaf. They may even abstract out lines, edges, solidity, or luminous qualities. But the scientist need not say that this is unrealistic, for theoretical science also abstracts in order to appreciate generic qualities illustrated in particular things. Both science and art have the capacity to help us see much further than our everyday economy requires.

*(6) Life value.* Reverence for life is commended by every great religion, and even moralists who shy from religion accord life ethical value. John Muir would not let Gifford Pinchot kill a tarantula at the Grand Canyon in 1896, remarking that "it had as much right there as we did."[7] A thoroughgoing humanist may say that only personal life has value, making every other life form tributary to our interests, but a sensitive naturalist will suspect that this is a callous rationalization, anthropocentric selfishness calling itself objective hard science. The first lesson learned in evolution was perhaps one of conflict,

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[8] Aristotle, *Poetics* 1451b.

[7] Gifford Pinchot, *Breaking New Ground* (New York: Harcourt, Brace and Company, 1947). p. 103.

but a subsequent one is of kinship, for the life we value in persons is advanced from, but allied with, the life in monkeys, perch, and louseworts. Mixed with other values, this Noah principle of preserving a breeding population is powerfully present in the Endangered Species Act. But if life generically is of value, then every specific individual in some degree instances this value, and this is why, without due cause, it is a sin to kill a mockingbird.

This organic value has various components. We have already noticed how life is an artist; indeed, it is always a tribute to a work of art to say that it has organic unity. A further component that recent science is unfolding is what we may call life's intelligibility. Inorganic things have a passive intelligibility, as when minerals crystallize into thirty-two mathematically deducible classes or the elements form an atomic table, so that rational legibility, like aesthetic value, is broader than life. Beyond this, living things are active information systems, as is proved by genetic and biochemical "linguistics." The purines and pyrimidines of the DNA and RNA helixes serve as an "alphabet," organized by codons, word units, into chains rather like sentences and paragraphs. The double helix can be unzipped and "read"; one stereospeeific molecule can "recognize" another and by this "coded messages" are "communicated." Life continues by a steady "problem solving." and evolution accumulates a sophisticated "memory," as organisms are better programmed by natural selection to "deal with" their environment. The bio-*logical* chemistries have such a cybernetic power that, though it is precognitive, the information content routinely in every human cell is more than that in any human book.

A book can be read, but so too can a chambered nautilus. The microscopic ribs, typically thirty in a chamber, seem to be secreted daily in relation to the lunar-tidal cycle, forming a logarithmic spiral known as the Fibonacci series. With its complex physiology and ecology, *Nautilus pompilius* is an intelligible organic system quite as impressive as the atomic submarine named for it, and the beauty of its pearly orange and white spiral vault is greater. Under X-ray photography exquisite subsurface symmetries appear. We congratulate Leonardo Fibonacci for discovering that series, but why not value the *Nautilus for* so exquisitely graphing it? Intelligible things do not have to be produced intentionally, any more than aesthetic ones do. The *Nautilus'* history is interwoven with the whole, and here lie unsuspected scientific values. Across half a billion years and numerous species in a stable genus, the number of ribs in a N*autilus* chamber gradually decreases to eight or nine, which, if anciently keyed to the lunar cycle, suggests that the moon circled the Earth more rapidly.[8] Its evolution may hide clues to the story of our planet and to ecological stability. There is even romance here; Oliver Wendell Holmes could find much poetry in this "ship of pearl."

[8] P. G. K. Kahn and S. M. Pompea, "Nautiloid Growth Rhythms and Dynamical Evolution of the Earth-Moon System," *Nature* 275 (1978): 606-11.

Those who cannot find these organic, aesthetic, or intelligible justifications for valuing life cannot deny to it an interest value. Mind is the most interesting and, presumably, the rarest thing in the universe, but life is the second most rare phenomenon, which ought alone to prove it of interest. And all life is natural. We can bring ourselves to say that the culture which unfolds from mind is artificial, but we can never say that life is anything but natural, which makes it an unequivocal natural value. If a space probe were to find on Mars life of the complexity of the Yellowstone thermophiles, to say nothing of those "lousy louseworts," this would be the most epochal discovery in the history of science, and we would value there what is daily despised on Earth. Lower life may be sacrificed for higher forms, of course; still, a principal task in ethics is for humans to find a suitable place for the integrity of other life forms.

*(7) Diversity and unity values.* We may next harness a pair of complementary values. The sciences describe much natural *diversity* and also much *unity*, terms which are descriptive and yet contain dimensions of value. The physical sciences have revealed the astronomical extent of matter coupled with its reduction into a few kinds of elements and particles, which dissolve into interradiating wave fields. The taxonomist has enlarged the array of natural kinds, while the biochemist has found only the materials of physics organized everywhere in parallel chemistries, such as glycolysis and the citric acid cycle or the DNA and UNA at the core of life. Evolution has traced every life form back to monophyletic or a few polyphyletic origins, while ecology has interwoven these myriad forms to connect them at present as fully as they have been related by paleontology. This macroscopic web is matched by the unity revealed by the electron microscope or the X-ray spectrometer. The natural pageant is a kind of symphony of motifs, each interesting, often orchestrated, sometimes chaotic, and all spun from a few simple notes.

The story of science is the discovery of a bigger universe with more things in it, and the finding of laws and structures to explain their common composition and kinship. One need not defend every species or reduction to prize the natural collectivity as always absorbing and often agreeable. A few centuries ago we supposed this universe to have far less spatiotemporal and biological diversity, and its structural unity was unknown or denied. Everywhere there was dualism and opposition—in heaven mid earth, mind and matter, life and nonlife, man and nature, gods and demons. No scientist would return to that universe, if he could, for it was oppressively small, less diverse, and yet also superstitious and lacking in the natural unity that we now know it to possess. Nature is sometimes locally poor, as in a lodgepole forest with its sparse *Vaccinium* undercover, but in the ensemble the natural sorts are lush and many splendored. This greatly entertains the naturalist, widened as his acquaintance with it is by lenses, voyages, and books, and it will be perceptibly sacrificed if we trade snail darters or louseworts for a few more generating machines. This diversity will be substantially threatened if the present rate of

extinction, accelerated by human intervention perhaps a thousand times over natural rates, continues unabated. The same naturalist will enjoy realizing how these natural kinds have an ecosystemic connectedness, with their autonomous integrities balanced by interdependences, but with this immediately comes a concern how often these are upset by ill-considered human interventions.

If this is too metaphysical, then perhaps one need only notice how both this diversity and unity feed the human mind. Mind cannot be formed under the homogeneity of a blank wall nor before the heterogeneity of a bewildering jungle. A complex mind evolves in order to deal with a diverse world, yet one through which unifying relationships run. That was true in Pleistocene times in the Olduvai Gorge, and it is true now, for our minds are still developing. Emerging out of nature, we have become geniuses by confronting nature's plurality-in-unity, both historically and scientifically. But do we then say that these features are of no value until thickened by the addition of human interest? Or do we wonder that just this system, evolving so, did thicken human interest to form the mind prehistoricaily and that it continues to do so now? The mind is a mirror of these properties in nature, and there is even a sense in which the mind, founded on the cerebral complexity and integrating capacities, is a product of nature's inclination both to diversify and to unify." When this mind reflects, in turn, on the natural world, it can assign value at once to diverse particulars and to the universal and global regularities which underlie and permeate these particulars.

*(8) Stability and spontaneity values.* A pair of complementary natural values rests on a mixture of ordered stability with what, rather evasively, we must call the appearance of spontaneity, counterparts which are not only descriptive but also valuational. That the natural processes are regular—that gravity holds, rains come, and oaks breed in kind—yields laws and trends rooted in the causal principle, and means that nature is dependable, as well as being unified and intelligible. Every order is not a value; but some order supports value, and why is not this natural dependability a quite basic value? A requisite of any universe is that it be ordered, but we need not despise a necessary good, nor does such minimum essential order account for the ecological and biochemical constancy that supports life and mind, upon which all our knowledge and security depend.

The polar value, really a sort of freedom, is hardly known to science by any such name; indeed, it is with some risk of offense and oversimplification that we here touch the long-debated issues surrounding determinism. Still, nature sometimes provides an "appearance" of contingency. Neither landscapes nor aspen leaves are ever twice the same. In the laboratory, science abstracts out the regularly recurring components in nature to attain predictive control, while in the field nature always remains in part unique and particular, nonrepetitive. What happens there is always something of an adventure, as the way the cottontail evades the coyote, or just when the last leaf is tossed from this

maple and where the gusting wind lands it. We hardly know how to give a complete account of this. Rigorous determinists insist that nothing in nature (or in culture) can be either of chance or of choice, believing that to say otherwise is to destroy the fundamental axiom of all science. But others require a less rigidly closed system, finding that science still prospers when positing statistical laws which need not specify every particular. Physics and chemistry contain more highly probable, if not absolute, causal laws, while the life and historical sciences are likely to use generalizations intermixed with more unexceptionable laws, and even to recognize that nature is at some points contingent.

If there are real natural possibilities in excess of what actually comes to pass, the possible event which does happen can be selected by chance or by choice or by some intermediate autonomy for which, we hardly yet have an adequate model. Genetic experimentation seems to rest partly on microscopic contingencies, as in crossing-over or mutation affected by random radioactivity, and these effects are sometimes amplified into phenotypic expressions. The macroscopic level to a large degree suppresses any microscopic contingencies, and yields in consequence those stabilities which we also value, but the scene of natural history is on occasion a place of emergent surprises.

We are not sure whether *Australopithecus* had to develop in Africa, or whether giraffes had to mutate so as to develop long necks, although both events may have been probable. Did the first ancestral birds storm-blown to the Galapagos Islands absolutely have to be finches? For the conservatives, it is safest to say theoretically that here we only reveal our ignorance of nature's detailed determinism, that nature's surprises are only apparent, though perhaps we cannot now or ever escape this appearance. For the liberals, it is bolder and more satisfying, as well as true to practical experience, to say that nature sometimes allows the real appearance of spontaneous novelty. What the Darwinian revolution did to the Newtonian view was to find nature sometimes a jungle and not always a clock, and many have disliked this." Contingencies do put a bit of chaos into the cosmos. But you can have a sort of adventure in Darwin's jungle which you cannot have in Newton's clock. This openness brings risk and often misfortune, but it sometimes adds excitement. Here nature's intelligiblity, aesthetic beauty, dependability and unity are checked by the presence of spontaneity and contest, and this can sometimes be valued too.

Eventually, as a product of chance mixed with natural stabilities and with evolutionary trends that we dimly understand, living things gain a partial integrity to go on their own. Causality is not here altogether denied, but it is put to a pliable organic, rather than a mechanistic use, as a self-caused, functional organism seeks helps and avoids hurts in a mixedly stable and contingent environment. Psychical, deliberate freedom seems largely to be reserved for persons, but this capacity evolved out of choice-like precedents in the proto-psychologies of animal behavior. A nearsighted person will value

only the climaxing, epiphenomenal human freedom, but a farsighted person may cherish these lesser precedents, if only as a glowing of what is fully ignited in humans. That a lioness is "born free" is part of the romance of nature, not of science, but this does not make her freedom any less real. Such poetry, again, helps us to get at the facts. Indeed, as even scientists better observe such animals, and trace their kinships with us, it becomes increasingly difficult to say why we should value human freedom so much, and animal freedom so little.

Nor are these features of constancy and contingency in nature beyond our capacity to affect them. One of our fears is that technology with its manipulations and pollutants, including radioactive ones, will destabilize long-enduring ecosystems; another is that unabated human growth will transgress virtually the whole domain of natural, spontaneous wildness; another is lest we should make the Earth a bit less autonomous by losing snail darters. Alas, we sometimes hate to stem even inanimate wildness, and the Little Tennessee River was among the last really wild rivers in the East. A river is, of course, free only in the sense that it is unconstrained, for it is without chance or options in its flow. It has none of those organic features of animate freedom which preface our own. Still, the thoughts that come when pondering a really ancient river flowing on forever unhindered are thoughts deep enough to make us wonder whether we humans have abused our freedom in deciding to dam one of the last of such streams.

*(9) Dialectical value.* We are not really bounded by our skin, but life proceeds within an environmental theater across a surface of dialectic. The leg muscles are the largest in the body, and we need room to roam down by the river or along the seashore. The hands have evolved for grasping natural things, but so has the brain, and sentient experience underruns mental life. The crafting of an arrow point, a rifle, or a rocket is an environmental exchange. Society and artifacts are also requisite for mind, as is abstract thought, but nature is the most fundamental foil and foundation for mind, and this diffuses the human/natural and the value/fact line. Culture is carved out *against* nature but carved out *of* nature, and this is not simple to handle valuationally. Superficially, so far as nature is antagonistic and discomforting, it has disvalue. Even here a subjectivist must take care lest nature gain objective value first on the negative side of the field, only later to require it positively. We cannot count the hurts in nature as objectively bad unless we are willing to count its helps as objectively good.

With deeper insight, we do not always count environmental conductance as good and environmental resistance as bad, but the currents of life flow in their interplay. An environment which was entirely hostile would slay us; life could never have appeared within it. An environment which was entirely irenic would stagnate us; human life could never have appeared there either. All our

culture, in which our classical humanity consists, and all our science, in which our modern humanity consists, has originated in the face of oppositional nature. Nature insists that we work, and this laboring and even suffering is its fundamental economic pressure. The pioneer, pilgrim, explorer, and settler loved the frontier for the challenge and discipline which put fiber into the American soul. One reason we lament the passing of wilderness is that we do not want entirely to tame this aboriginal element in which our genius was forged.

But this is of a piece with the larger natural process of conflict and resolution. Half the beauty of life comes out of it, as do the yellow flowers of those nearly extinct louseworts or the exquisite nautilus shell secreted against its environment. The cougar's fang sharpens the deer's sight, the deer's fleetfootedness shapes a more supple lionness. We admire this element of fight even in the maimed and blasted, even in the inanimate as with the gnarled timberline fir. The coming of Darwin is often thought to have ruined nature's harmonious architectures, but the struggles he posits, if sometimes overwhelming, are not always valueless. None of life's heroic quality is possible without this dialectical stress. Take away the friction, and would the structures stand? Would they move? And when we recognize how we humans are emplaced within such stress, do we then say that we only wrest values from valueless nature, or has this necessary dialectical context of life and of mind no value? That we should struggle against storm and winter is not here denied, nor that we may need to oppose wolves and thistles, rattlesnakes and the malaria mosquito. But we add that we can respect the alien not only in its autonomous otherness, but even in its stimulus, provocation, and opposition. The hardest lesson in all ethics is to learn to love one's enemies.

*(10) Sacramental value.* Nature generates poetry, philosophy, and religion, not less than science, and at its deepest educational capacity we are awed and humbled by staring into the stormy surf or the midnight sky, by peering down at the reversing protoplasmic stream in a creeping myxomycete plasmodium. Like the theories of science, these values do not lie on the empirical surfaces of nature, though prompted there, but are found more deeply in asking for the realities to which the phenomena point, for the universals which the particulars instantiate, but now taking things as signs, or sacraments, of meaning. The *significance* of nature is one of the richest assignments of mind, and this requires detection, imagination, participation, and decision. It forces us at length to ask about the significance of the observing mind itself, the most complex of nature's projects. Those thoughts struck in contemplation of nature are just thoughts about who and where we are, about the life and death which nature hands us, and our appropriate conduct in this environment This exceeds not only applied but even strict science; yet the purer a naturalist's inquiry is into the constitution of the universe, the more likely he is to enjoy this further search for philosophical experiences generated as nature is met.

If we may put it so, nature is a philosophical resource, as well as a scientific, recreational, aesthetic, or economic one. We are programmed to ask why, and the natural dialectic is the cradle of our spirituality. Humans are symbolic beings, which might be thought to divorce rational thought from the natural world, but the mind has for millennia evolved in association with nature, and we always interact with nature to discover and to create those symbols by which we understand. In metaphysics, we puzzle over whether it is best to conceive of nature as an organism, a jungle, an egg, a machine, or a mind-informing matter, models drawn from our experiences of nature and of its dynamisms and products. In religion, the fundamental themes of life and death are both natural givens. For some, the natural history is most fundamentally in suffering, but even they must ask whether it is not of more value for life to be tragic than for it not to be, or to be nothing. But others hope in some blessed, sacred point; and bread, water, wine, paths, fatherhood, motherhood, mountains, rivers, light, and darkness are not incidentally among our richest sacramental elements.

We cannot escape confrontation with nature; still modem life can be lived at such remove from this naturalness that our wisdom is artificially led astray. The wilderness is as necessary as the university for our valuational education, and we can sometimes value snail darters sacramentally rather than economically, just because in their wildness they have a different sort of generating power from those machines which would exterminate them. The struggling life essence emerging overlaid on physical existence, the arrival of intelligence and whether it has any evolutionary point, the intellectual adventure in beholding the natural scene, the complementarity of spirit and matter—these remain puzzles never completely worked out, for we are always entering deeper waters than we can fathom. We can count that a disvalue; nature outgoes and disappoints us. We can even count it a value that nature breeds a creative discontent, keeps a distance from us, supplies a further question with each answer, and is so rich and demanding as to be at length inaccessible in the whole, knowable only in part. We are kept pilgrims and pioneers on a frontier, and to travel hopefully is better than to arrive. Meanwhile, this much at least we do value: that nature is endlessly stimulating to the mind, and bores only the ignorant or the insensitive.