Chapter 7
Ecology and Moral Ontology

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Abstract The "superorganism" was the first paradigm in ecology, set out by Drude in Europe and Clements in North America. It was succeeded by the "ecosystem" paradigm, set out by Tansley, developed by Lindeman and consolidated by Odum, who, at the mid-point of the twentieth century, returned it to its superorganismic roots. The analogy of ecosystems to organisms could not withstand subsequent scientific scrutiny: ecosystems are too ill-bounded, porous, dynamic and artificial to be sufficiently like organisms to qualify as superorganisms. The reverse analogy – organisms to ecosystems – is more perfect. Humans and other organisms may be fruitfully conceived as superecosystems. One's very cells host mutualistic mitochondrial organelles; one's gut hosts a huge biodiversity of bacteria, as do the surface areas of one's body. In addition to the resident biota, abiotic materials (air, water, various nutrients) flow through oneself. This superecosystemic conception of oneself implies a relational – as opposed to a monadic – moral ontology. One's relationships – to other humans, to various kinds of animals, to one's various social and biotic communities, to the biosphere – generate a set of nuanced duties and obligations. One discharges such duties and obligations in a spirit of affection and pride, not in a spirit of begrudging self-sacrifice.

7.1 The Superorganism Paradigm in Ecology

Ecology emerged as a science during the final decade of the nineteenth century. The first paradigm in ecology was consolidated by Oscar Drude, in Europe, and Frederic Clements, in North America, during the first decade of the twentieth century. The putative objects of ecological study were plant "associations" or plant

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"communities," which were conceived to be "complex organisms" or, as they eventually came to be called, "superorganisms." Then it was also common in sociology – which emerged as an academic discipline at about the same time as ecology – to conceive of human societies and communities in holistic, organismic terms. So the ecological conception of plant associations or communities as superorganisms had a contemporaneous counterpart in the social sciences, especially in the French functionalism implicit in the work of Auguste Comte and explicit in that of Émile Durkheim. The biological and sociological aspects of the concept coalesced in the portrait of haplodiploidal insect societies (ants especially) as superorganisms by the German-educated Harvard entomologist William Morton Wheeler, a younger contemporary of Drude and an older contemporary of Clements. A good history of ecology is provided by Robert P. McIntosh (1985); a good history of sociology is provided by Randall Collins (1994).

The idea that ecology is the science of superorganisms – that the proper objects of ecological study are third-order organic wholes – seems, in retrospect, wildly metaphysical and hardly an auspicious beginning for a brand new science bidding for legitimacy in the panoply of established natural sciences like physics, chemistry, and biology. Some historians attribute the holistic ontology of early ecology to the influence of Drude on Clements and the influence of German idealism and romanticism – expressed in the works of Kant, Hegel, Goethe, and von Humboldt – on Drude.

While such historical influences may have played a role, I think that the inaugural superorganism paradigm in ecology is perfectly explicable without searching for origins in extra-scientific philosophy. The parent science of ecology is biology. Provided with a coherent and comprehensive organization by the publication of *Systema Naturae* by Carl Linnaeus in 1735, descriptive natural history provided a foundation for modern biology. Building on the Linnaean system of taxonomy, biology took its place among the modern sciences in the nineteenth century, spurred on by the improvements in microscopy early in the century, and provided a unifying theory by Charles Darwin in 1859, with the publication of *On the Origin of Species*. The principal objects of biological study were organisms. And the field of organismic biology was partitioned into taxonomy, anatomy, physiology, and ontogeny (or developmental biology). A good history of the emergence of biology as a natural science is provided by William Coleman (1977).

Clements (1905), whose influence among ecologists eventually eclipsed that of Drude, seems to have organized the new science of ecology analogously to the organization of its parent science, biology. He reasoned as follows. The first life forms were single-celled organisms. In the course of evolutionary time, symbiotic relationships among such organisms became so close that they merged to form higher-order multicelled organisms. Similarly, in the course of evolutionary time, the symbiotic relationships among multicelled organisms became so close that they merged to form still higher-order superorganisms. Until the invention of the microscope, we intelligent multicelled organisms were unaware of the existence of single-celled organisms. And until the advent of ecology, which provided the lens through which we could perceive them, we were unaware of the existence of superorganisms. As cells are to multicelled organisms, so multicelled organisms are to superorganisms. As organs are to multicelled organisms, so species populations are to superorganisms. Indeed, when ecology first emerged as a science, it was, by many, considered to be a branch of physiology. Just as intra-organismic physiologists proper studied the function of the various organs in multicelled organisms, so inter-organismic physiologists studied the functions of various species populations in superorganisms.

cells : multicelled organisms :: multicelled organisms : superorganisms

organs : multicelled organisms :: species populations : superorganisms

cells > *organs* > *multicelled organisms* > *species populations* > *superorganisms*

A hierarchy of biological organization as Clements imagined it to be: cells compose organs, organs compose multicelled organisms, organisms compose species populations, species populations compose superorganisms.

Ecology needed an eco-taxonomy, in addition to an eco-physiology in order for it to mirror its parent science, biology. Accordingly, Clements set out to provide such an eco-taxonomy by classifying the world's various superorganisms into types – arctic tundra, boreal coniferous forest, temperate mixed hardwood forest, sphagnum-tamarack, tupelo-cypress swamp, alpine meadow, prairie, steppe, etc., etc. Eco-anatomy then would be the study of the physical structure of the world's various superorganisms – for example, the oak-hickory forest floor, its understory, its canopy; the underground root system, the above-ground biomass, and the flowers and seed heads of a prairie; etc.; etc. Clements himself specialized in eco-ontogeny, the developmental sequence of a mature superorganism, which he termed "succession." After a ground-clearing natural disturbance like a wildfire or an anthropogenic disturbance like a clear-cut, "pioneer" species, mostly weedy annuals, would colonize the site, followed by brushy woody vegetation, followed by trees requiring full sunlight for germination and growth, followed by trees whose seeds and seedlings can grow in the shade of other trees. At such a point in the successional series, the superorganism would be fully mature and would reproduce itself until destroyed by an exogenous disturbance.

Biological/ ecological sub-fields	Organismal biology	Superorganismal ecology
Taxonomy	Genera (e.g. *Ursus*)	Genera (e.g., forests)
	Species (*arctos*, *maritimus*, etc.)	Species (taiga, oak-hickory, etc.)
Anatomy	Structure of bones, muscles, nerves, etc.	Forest floor, understory, canopy, etc.
Physiology	Functional interrelations of organs	Functional interrelations of species populations

(continued)

Biological/ ecological sub-fields	Organismal biology	Superorganismal ecology
Ontogeny	Organismal development: larva→pupa→imago	Successional development: weeds→shrubs→light-loving trees→shade-tolerant climax

7.2 The Ecosystem Paradigm in Ecology

The superorganism paradigm in ecology, however, could not withstand closer, more systematic, and longer-term examination of the phenomena it was supposed to represent. Unlike multicelled organisms, superorganisms had no clear spatial boundaries, one putative type gradually merging and mixing with another. The posited developmental stages of superorganisms often failed to follow the expected sequence of stages similar to organisms that develop in a regular and determinate way – from say larva to pupa to imago. Nor had these putative "seres," as Clements called them, clear temporal boundaries – as one stage (or "sere") gradually merged into another. Nor did the whole successional process terminate, as Clements predicted, in a mature climax. Rather, change appeared to be unending, directionless, and stochastic. Paleo-ecologists finally delivered the *coup de grâce* to the superorganism paradigm in ecology. Upon examining pollens preserved in peat bogs and other anaerobic sediments, they discovered that past plant associations were constituted by different cohorts of species. The superorganism would have had to form, like Empedocles's man-faced ox and other similar phantasmagoria, with it organs (species populations) existing separately and then coming together in haphazard ways, existing thus for a time, then being driven apart (primarily by climate change), scattering away, and reassembling in novel combinations at a subsequent time.

The superorganism paradigm in ecology was eventually replaced by the ecosystem paradigm, which British ecologist Arthur Tansley sketched in his 1935 paper, "The Use and Abuse of Vegetational Concepts and Terms." By then, Charles Elton had made animal ecology a robust part of general ecology, and distinctive plant-animal assemblages were called "biotic communities." In other words, the plants *and* the animals living together and interacting with them and with one another constitute the biota of a place. Tansley's principal innovation was to add the abiotic materials cycling through the food chains of the trophic pyramid that Elton had so clearly described in his book, *Animal Ecology*. Inert elements – such as hydrogen, carbon, nitrogen, oxygen, phosphorous, potassium, calcium, and iron – are absorbed by the roots of plants from the soil and ultimately from the rocky substrate and combined with atmospheric carbon dioxide and water to assemble their living tissues. When herbivorous animals consume the tissues of plants, these elements in their new, complex chemical compounds pass into the bodies of animals. When those animals are, in turn, eaten by omnivores and carnivores, some of these materials pass into their bodies as well. Of course, all living organisms eventually die, whether consumed by others or not, and their bodies decompose with the help of saprophagous organisms. Thus these elements are returned to the soil; and from there, once again, they are incorporated into the living tissues of plants, thus completing a "nutrient cycle." Such processes of materials organization, metabolism, and decomposition formed, according to Tansley, "systems in the sense of the physicist." He dubbed them "ecosystems."

plants + animals = biota (à la Elton)
biota + abiotic materials = ecosystems (à la Tansley)

In 1942, in "The Trophic Dynamic Aspect of Ecology," Raymond Lindeman measured the radiant solar energy falling on the surface of a small pond – Cedar Bog Lake in the American state of Minnesota – and how much of it was converted by the autotrophs or primary producers (the green plants) of the lacustrine ecosystem into potential chemical energy available to the phytotrophes (the herbivores) that ate them. And so for each successive level of consumers in the pond and its many tangled food chains, Lindeman measured and tracked the flow of energy up to the large carnivores at the apex of the food web and finally down to the saprophagous organisms (the fungal and ultimately bacterial decomposers) in the pond's mud that garnered the residual chemical energy in the organic matter remaining in the dead tissues of plants and animals. In so doing, the decomposers made the elemental nutrients available for the autotrophs once again to synthesize into complex organic molecules, using the steady incidence of radiant solar energy to power the process of photosynthesis. Ecosystem ecology thus basically divided itself into two new sciences: (i) biogeochemistry, the quantitative study of the cyclical movement of elemental matter through ecosystems: and (ii) bio-thermodynamics, the quantitative study of the one-way flow of energy through ecosystems from solar source to ambient sink.

7.3 The Rise and Fall of Ecosystems as Superorganisms

The departure of Tansley from the superorganism paradigm of Clements has been greatly exaggerated by some historians of ecology, especially by Donald Worster (1977, 1985, 1994). To be sure, Tansley denied that ecosystems were literally big, spatially diffuse *organisms*, but he repeatedly characterized them as "quasi-organisms," and claimed that they existed in states of "dynamic equilibrium" and had evolved that highly organized condition of dynamic equilibrium by means of natural selection. In an influential paper published in 1969, "The Strategy of Ecosystem Development," the dean of mid-twentieth-century Anglo-American ecology, Eugene Odum, returned ecosystem ecology to its Clementsian organismic roots. Odum claimed, just as did Clements half a century prior, that "ecological succession involves the development of ecosystems; it has many parallels in the developmental biology [ontogeny] of organisms, and also in the development of human society." As Clements before him, Odum claimed that succession was determinate, directional, and predictable. The "mature" ecosystem attains the power to "control" its environment, by modulating its microclimate; by "closing" or "tightening" its biogeochemical cycling, thus arresting the loss of nutrients; by regulating the species populations of the organisms internal to it through competition and predation; by balancing production of organic matter or biomass with respiration, thus stabilizing its biomass; and by reducing entropy and increasing information (whatever that may mean). According to Odum, "The intriguing question is, Do mature ecosystems age, as organisms do? In other words, after a long period of relative stability or 'adulthood' do ecosystems again develop unbalanced metabolism and become more vulnerable to diseases and other perturbations?" (1969, 266).

Odum's (1969) representation of ecosystems is more the product of a vivid scientific imagination and wistful thinking than of sound empirical science. Succession is not, as a matter of fact, determinate, directional, and predictable. Ecosystems are not closed, self-regulating, and equilibrial. Yes, plant roots stabilize soils, retain moisture, slow nutrient loss, and plants modulate the microclimate, but ecosystems as such do not "control" their environments in any comprehensive way. The species populations within ecosystems are not balanced and constant; rather they oscillate wildly and are subject to frequent immigration, emigration, and extirpation. No more than the plant associations of Clements, the Tansleyan-Lindemanian-Odumesque ecosystems are hardly superorganisms. Further, by the time the ecosystem idea had been introduced into ecology by Tansley and completed by Lindeman, the Modern Synthesis of Mendelian genetics with Darwinian evolution-by-natural-selection had occurred in evolutionary biology. Unlike organisms, ecosystems have no genes for natural selection to sort, and thus they could not have emerged by means of the same evolutionary process, then widely accepted in evolutionary biology, by means of which organisms evolved. A good account of the current understanding of ecosystems is provided by Steward Pickett and Richard Ostfeld (1995); the putative consequences of the Modern Synthesis for natural selection operating beyond the organismic level of biological organization are set out by George C. Williams (1966).

Not only were the boundaries of ecosystems fuzzy and indistinct, they shift depending on the way ecosystems are interrogated by ecologists. In the first half of "The Trophic-Dynamic Aspect of Ecology," Lindeman essayed to measure and track the annual flow of energy through the Cedar-Bog-Lake ecosystem, the boundaries of which were thus marked by the pond's shoreline. In the second half of that article he essayed to account for its centuries-long succession from oligotrophic lake to eutrophic pond, eventually to become first a tamarack-sphagnum bog and finally a grassy moist meadow. The boundaries of the same Cedar-Bog-Lake ecosystem – which Lindeman was interrogating regarding the process of ecological succession – were thereby constituted by the surrounding watershed, from which nutrients and sediments washed into the pond, stimulated plant growth, and gradually filled it in. The very ontology of ecosystems thus seems shifting and elusive, driven by the vagaries of ecological inquiry. Ecosystems therefore appear to be artifacts of the methods of the science investigating them, not robustly existing independent entities (Allen and Starr 1982).

7.4 Organisms as Superecosystems

The stage is now set for a reverse metaphor. Ecosystems are not superorganisms. Rather, *organisms are superecosystems*. I first stumbled across this idea after a lecture I gave at the University of Maryland's Chesapeake Biological Laboratory in 1998. In response to my discussion of the superorganism paradigm in ecology the distinguished American ecologist Robert Ulanowicz agreed that ecosystems are not superorganisms; rather, he said, organisms were superecosystems. I replied that Ulanowicz was perhaps unwittingly trading on an ambiguity of the prefix "super." It was only later that I realized that he had made a profound and deeply significant observation. So, before explaining why the organism-as-superecosystem metaphor is both plausible and fruitful, let me note that ambiguity. In the ecosystem-as-superorganism metaphor, the prefix "super" means both (i) large – as in *super*market or as when you might go into McDonald's and say "*super*size me" – and (ii) of a hierarchically superior order of biological organization, a transorganismic order of biological organization. In the organism-as-superecosystem metaphor, the prefix "super" means superior in kind, not superior in size (bigger), nor superior in a conceptual hierarchy, as a genus is superior to a species or as a family is superior to a genus. In the organism-as-superecosystem metaphor, the sense of "super" is similar to that in *Super*man, the comic-book hero. Superman is a man, but a man superior to others in the manly physical virtues of strength, locomotive speed, jumping ability, and, indeed, in the manly moral virtues of justice, courage, chivalry, modesty, and general benevolence. Organisms may be plausibly and fruitfully considered to be superecosystems in the sense that organisms exhibit in a particularly superior way both the actual and imagined characteristics (virtues) classically attributed to ecosystems.

As to actual characteristics attributed to ecosystems, their metabolic processes and functions are carried out by organisms that are members of a variety of species populations – carried out, that is, by a diverse complement of plants and animals. Now, consider one's own organismic "self." Each one of one's own billions of cells is inhabited by other organelles called mitochondria, with their own DNA and enclosing membranes – and thus their own organismic identities and phylogenies. They are symbionts – more precisely mutualists, not parasites-and they supply our cells with adenosine triphosphate, the source of our cellular energy; and they also provide many other functional biochemical services. The endogenous human gut microbial community is so diverse and so well organized that it may be well said to be a smaller, internal superecosystem within the larger superecosystem that is a human organism (Zimmer 2011). And this too is typical of the conventional ecosystems that are the objects of ecological study – *macroecosystems* as we may now begin to call them. They too are hierarchically organized; that is, smaller ecosystems are nested within larger ones. For example, small geyser pools in Yellowstone National Park are ecosystems comprised of thermophilic bacteria. They are located in the much larger Greater Yellowstone Ecosystem – defined by the home ranges of its largest mammals (grizzly bears, wolves, bison, and elk) – which spills beyond the national park's political boundaries. A good account of the relationship between human cells and their mitochondrial symbionts is provided by Alberts et al. (2002); a good account of human intestinal ecology is provided by Marchesi and Shanahan (2007); a good account of hierarchy theory in ecology is provided by Allen and Starr (1982).

The human organism as superecosystem is similarly hierarchical. It is comprised of many other subsystems, outstanding among them the aforementioned intestinal superecosystems composed of a bewildering biodiversity of bacteria – up to 250 known philotypes, yet unresolved into narrower Linnaean taxa. And the sheer number of the population of individual bacteria residing in the roughly 10-meter-long human gut exceeds the number of individual human cells in the whole human organism by an order of magnitude (Sears 2005). In a healthy human superecosystem, many of the resident intestinal microbes are mutualists aiding in the digestion of food, while others are commensals, and still others parasites. And the whole microbial community is constantly resisting invasive pathogens – just as a healthy macroecosystem is believed by ecologists to do.

Healthy human skin is colonized by bacteria belonging to 19 different phyla, 205 genera, and some 1,000 species (Grice et al. 2009). The US National Institutes of Health has recently created a new Human Microbiome project (Proctor 2011). In a recent report (Grice et al. 2009) the authors expressly invoke the organism-as-superecosystem metaphor: "The skin is … an ecosystem, harboring microbial communities that live in a range of physiologically and topographically distinct niches," the study authors write. "For example, hairy, moist underarms lie a short distance from smooth, dry forearms, but these two niches are as ecologically dissimilar as rainforests are to deserts." The human superecosystem is comprised of multicelled as well as single-celled organisms. Our eyebrows and eyelashes, for example, are the habitats to two species of parasitic mites, among the smallest of known arthropods, invisible to the naked eye (Rufli and Mumcuoglu 1981).

As to imaginary characteristics of macroecosystems, organismic superecosystems are homeostatic and self-regulating, maintaining a constant internal body temperature, a relatively narrow blood pressure gradient, a constant abundance and balance of electrolytes in the blood, a constant blood pH and salinity, a constant resting heart rate that elevates with exercise within a relatively narrow gradient, and so on (Buchman 2002). Organismic superecosystems resist and repel invasive exotic organisms that attempt to establish populations in them. They are spatially well-defined with clear boundaries. They develop in a determinate and predictable way. While most species of superecosystems do not control their environments, they resist the tendency of inorganic material structures toward entropic equilibrium with their environments. They exhibit low entropy and high information content.

Despite their ontological ambiguity, macroecosystems remain among the objects of investigation by ecologists. They are known to be open, not just to radiant solar energy and rainwater, but to the ingress and egress of various motile organisms and various aerosols and chemical pollutants. They are regularly buffeted by various natural and anthropogenic disturbances – by fire, wind, flood, drought, ice, pestilence, and disease – sometimes rebounding and recovering from these perturbations, sometimes being driven to alternate ecological phase states. That is, sometimes they "flip" into another type of ecosystem altogether. Macroecosystems are regulated not only by the climates in which they are located, but also by many other processes external to themselves as well as by processes, such as predator-prey dynamics, internal to themselves. For example, the El Niño/La Niña oscillation in the Pacific Ocean affects the drought and monsoon cycles of the American Southwest; and soil blown off of parched African fields is carried by winds to South America, thus supplying precious nutrients to the nutrient-poor tropical soils of the Amazon.

We organismic superecosystems are similarly open. We breathe in the atmosphere momentarily; we daily ingest water and metabolize the bodies of other organisms as food; would-be pathogens, parasites, and commensal microorganisms continually enter and leave our bodies. Put biogeochemically, the larger natural environment is flowing through us all the time. Put thermodynamically, we are dissipative systems, slowly burning the potential chemical energy stored in the organisms that we consume, thus to maintain a highly and hierarchically organized complex structure of elemental materials – hydrogen, carbon, nitrogen, oxygen, phosphorus, potassium, calcium, iron, and many others. Put metaphysically, we are as vortices in a flow of materials structured by the radiant energy of the sun; our identity as individual physical entities is as substantively indistinguishable from the physical environment as a whirlpool or standing wave is substantively indistinguishable from the water flowing through it. The individual identity of a watery vortex or standing wave is a matter of organizational structure, not of substance, and therefore a matter of internal, not external relationship to its environmental matrix.

7.5 Classical and Recent Expressions of the Organism as Superecosystem Concept

The conception of organisms – including, especially, human organisms – as superecosystems has had a fairly long run in environmental philosophy. It was expressed a quarter century or so ago by the late Norwegian philosopher Arne Naess (1979) as “Self-realization.” Naess uses a capital “S” to distinguish his metaphysical notion of Self-realization from the popular idea of narcissistic self-realization repeated ad nauseam in pop psychology. A true understanding of oneself involves the continuity of oneself with one’s environment, according to Naess. Thus for Naess, environmental ethics is less a matter of respecting the environmental Other than of *enlightened* Self-interest. A decade or so before Naess, the American human ecologist Paul Shepard expressed the notion of the self as a superecosystem in terms of a pond metaphor, almost surely alluding – whether deliberately or not – to Lindeman’s sketch of a macroecosystem in his field-defining paper on the ecology of Cedar Bog Lake. According to Shepard (1969, 260):

> Ecological thinking . . . requires a vision across boundaries. The epidermis of the skin is ecologically like a pond surface or a forest soil, not a shell so much as a delicate interpenetration. It reveals the self ennobled and extended, rather than threatened, as part of the landscape and the ecosystem, because the beauty and complexity of nature are continuous with ourselves.

Alan Watts, a British-born practitioner and popularizer of Zen Buddhism in the United States, expressed the organism-as-superecosystem idea a decade or so before Shepard – now about a half century ago:

> Theoretically, many scientists know that the individual is not a skin encapsulated ego but an organism-in-environment field. The organism itself is "focused" so that each individual is a unique expression of the behavior of the whole field . . . [But] there is a colossal disparity in the way in which most individuals experience their own existence, and the way in which the individual is described in such sciences as biology, ecology, and physiology. The nub of the difference is this: the way the individual is described in these sciences is not as a freely moving entity within an environment, but as a process of behavior which is the environment (Watts 1963, 55).

The conception of organisms – including, especially, human organisms – as superecosystems has been reprised by *à la page* social scientists and post-humanistic humanists who are developing a "vital materialism" and a "political ecology of things." Among the first to do so, Bruno Latour (1999), author of *Politiques de la nature*, is cognizant of the development of Deep Ecology, eco-philosophy, and environmental ethics among Anglophone philosophers, but digs deeper to challenge the residual modernist dichotomies that they have only critically glossed – such as the Nature/society dichotomy, the fact/value dichotomy, the subject/object dichotomy, and the primary-quality/secondary-quality dichotomy.

Jane Bennett, author of the much acclaimed *Vibrant Matter: A Political Ecology of Things*, is an American political scientist who writes as one recently woken from her dogmatic slumber – by Latour, among other "continental philosophers." Her erstwhile dogmatic slumber was imbued with dreams of Cartesian ratio-centrism, humanism, and the rightful human mastery of Nature. Her book illustrates and celebrates the "agency of matter" and the "force of things." Bennett (2010, ix) now recognizes that "the image of dead or thoroughly instrumentalized matter feeds human hubris and our earth-destroying fantasies of conquest and consumption. It does so by preventing us from detecting (seeing, hearing, tasting, smelling, feeling) a fuller range of nonhuman powers circulating around and within human bodies . . .. The figure of an intrinsically inanimate matter may be one of the impediments to the emergence of more materially sustainable modes of production and consumption." As a relatively recent migrant from humanism to "post-humanism," Bennett seems to be unaware of the explorations of Watts, Shepard, Naess, and other environmental philosophers who blazed the trail that she is now widening.

While fully informed by "theory," as contemporary "continental philosophy" is known among scholars of literary criticism and culture studies, Stacy Alaimo, an ecocritic, richly illustrates the idea of "trans-corporeality" as it is concretely and personally experienced in the lives of human superecosystems – especially in women's lives and as expressed in women's performance art. "By emphasizing the movement across bodies, trans-corporeality reveals the interchanges and interconnections between various bodily natures," writes Alaimo (2010, 2). "But by underscoring that *trans* indicates movement across different sites, trans-corporeality also opens up a mobile space that acknowledges the often unpredicted and unwanted actions of human bodies, nonhuman creatures, ecological systems, chemical agents, and other actors." Alaimo's work, synthesized in *Bodily Natures: Science, Environment, and the Material Self*, explores, as do the twenty-first century works of Latour and Bennett, the political implications of a conception of human organisms as superecosystems – although, of course, not by that name, which is Ulanowicz's casual coinage. The work of these authors indicates how the organism-as-superecosystem concept, by whatever name, is a point of convergence for a wide variety of communities of discourse – sociology (Latour), political science (Bennett), literary criticism (Alaimo) in the twenty-first century and environmental philosophy (Naess and others) in the twentieth century.

7.6 From a Modern to a Post-modern Moral Ontology

I turn now to the implications of the organism-as-superecosystem concept for moral ontology. In all these thinkers – from Watts and Shepard in the 1960s to Latour, Bennett, and Alaimo in the second decade of the twenty-first century – the Cartesian subject is the foil for a more ecological and vitally material sense of self and individuality. Watts (1963) characterizes the Cartesian subject as "a skin encapsulated ego," while Shepard (1969) characterizes the "self" somewhat more materially as "an arrangements of organs, feelings, and thoughts – a 'me' – surrounded by a hard body boundary: skin, clothes, and insular habits." And for him "the alternative is a self as a center of organization, constantly drawing on and influencing the surroundings, whose skin and behavior are soft zones contacting the world instead of excluding it." More abstractly expressed, oneself and other persons (which certainly would not exclude other animals) are nodes or nexuses in a skein of relationships – relationships with organisms both internal and external to one's superecosystem. Through one's superecosystem circulate water, various materials (both nutritious and poisonous) and the biogenic air. The material world, both in the form of inert matter and living matter – to invoke a distinction drawn by Vladimir Vernadsky (1929) – crosses the fuzzy and penetrable boundaries of the superecosystem that is oneself. Through the pores of one's skin, on the air one breathes into one's lungs, in the water one drinks, and in the food one eats.

This skein of relationships – the node or nexus of which is oneself – most importantly, for moral ontology, includes one's socio-cultural and economic relationships, as well as one's relationships with other-than-human organisms, and abiotic materials. One is the son or daughter of particular parents, possibly the brother or sister of particular siblings, possibly the parent of a son or daughter oneself. One is born in a particular country and learns to speak a particular language, absorbs a particular culture, and possibly learns to practice a particular religion. One is educated well or poorly, extensively or rudimentarily. One pursues a line of work and possibly embarks upon a life-long career or moves from job to job and possibly from place to place. After all such material, social, cultural, geographic, and economic relationships are catalogued in all their detail and nuance – something only to be conceived of as an ideal limit to an approximation – there is nothing left over. There is no Cartesian thinking thing, no Kantian transcendental ego, no Pythagorean-Platonic psyche, no Christian soul. That's it. That just is oneself, considered as a biogeochemical/ sociocultural/ economic superecosystem. Consciousness itself – the brute fact that the ego/ psyche/ soul was supposed to account for – is itself an epiphenomenon, an emergent property of the relationships among the neurological components of the sub-superecosystem, called the nervous system.

Remembering that Descartes is often called "the father of modern philosophy," modern moral ontology is based on a doctrine of external relations among moral monads – the psychological analogue to externally related material atoms. It is also based on an implicit theory of moral essences and accidents. Each such thinking thing – each ghost in its machine – is what it is independently of its relationships to other thinking things, from which it is absolutely separated by its own bodily cladding and that of the other thinking things. Notoriously, for Descartes (and conveniently for his follower, Malebranche) only the human body was inhabited by a thinking thing – a soul – while all other animals were mechanical automata, divinely crafted uninspirited machines. Thus they could be treated with moral indifference, just as one might treat a humanly crafted machine. While not going to such Cartesian-Malebranchean extremes, Kant made reason the essential attribute for the desert of moral regard, implicitly granting that, while other animals might be conscious, lacking reason they failed to qualify for moral regard or ethical consideration. Kant's contemporary Bentham took the bait and argued that the capacity for sentience was the essential capacity qualifying a being for moral treatment. And so an essence-accident template for moral ontology was established by both Kant and Bentham. One or another psychological essence – reason, sentience, conativity, etc. – qualified a being for moral consideration or ethical regard, and all other characteristics – gender, ethnicity, race, species – were morally irrelevant accidents. All beings possessing the moral essence are entitled to equal consideration of their equal interests by all moral agents. A good discussion of modern moral ontology is provided by Bernard Williams (1981).

Relationships, no less than gender, ethnicity, race, and species, are also moral accidents. A moral agent should be strictly impartial and give equal consideration to the equal interests of all moral patients, the class of which is defined exclusively by the moral essence. The prevailing essence-accident moral ontology of ethical theory from the late eighteenth through the late twentieth-century has become strained to the breaking point in the globalized world of the twenty-first century. More than seven billion people are presently affected, to one degree or another, by one's every choice through the global supply chain – purchasing an I-phone affects factory works in China, eating shrimp contributes to the destruction of a mangrove shoreline in Vietnam. Everyone everywhere is affected by simply turning on a lamp or driving a car – which contributes, however minisculey, to global climate change. Thus one may be partially responsible for flooding the atoll home of a Maldivian or Micronesian. And the mention of global climate change brings to mind the fact that one's present choices will affect not only spatially distant people and animals but temporally distant future people and animals as well – billions and billions of them – to all of whom one owes equal consideration of their equal interests. Or so requires the prevailing modern monadic moral ontology. The thought is mind numbing. Either we become morally overwhelmed and incapacitated or we re-envision moral ontology. A good discussion of the normative implications of the modern essence-accident moral ontology is provided by Catherine Wilson (2004).

7.7 Post-modern Ecological Moral Ontology: Toward an Erotic Ethic

Reflect instead on your own actual superecosystemic ethical practice. You will find that your social and environmental relationships generate the duties and obligations that you actually feel and to which you actually respond – with pleasure. The modern essence-accident moral ontology generates a one-size-fits-all ethics. The post-modern superecological moral ontology generates a finely nuanced hierarchical system of ethics. Consider familial duties and obligations to parents and children. One owes the former respect, deference, care in their old age; one owes the latter love, attention, material and financial support until they reach an age of independence, and perhaps a college education to boot. One discharges such duties with pride and pleasure, not begrudgingly. Further, one is certainly not under the same obligations nor has one the same duties toward other elders and other children. But one may have different duties and obligations to other elders and other children, depending on one's relationships with them. To elder neighbors, one should look in on them from time to time and run errands for them if they are sick or incapacitated. To elder fellow-citizens of our nation states, collectively, we owe a public pension, paid for by taxation, to pay for life's basic needs – shelter, food, medicine. One is obligated temporarily to take in and look after neighbor children when their parents are stranded at work or have an automobile accident and must spend the night in a hospital. To the children of our fellow citizens collectively we owe a public elementary and secondary education, also paid for by taxation. One has duties and obligations to one's colleagues that are different from those one has to family members and to unrelated neighbors – perchance to teach a class for them when they are off to a conference or sick in bed, maybe to read or comment on their scholarly writing.

One has duties and obligations to other animals that are similarly nuanced. Household pets are like second-class family members. One is obligated to feed them, to show them affection, to provide them with veterinary care when they are sick or injured. Within the constraints of pet ethics, one may, however, euthanize them when they are so old and infirm as to be a burden to themselves as well as to oneself. One has no such duties to farm animals, unless one is a farmer. But if one is a farmer, those duties are not the same as to one's household pets or to one's non-human fellow-workers – the sheep dog, the barn cat, the draft horse. Among the duties farmers have to farm animals is to feed them, shelter them, protect them from predators, and to slaughter them humanely and painlessly, if they are raised for the table or the market. One has duties to proximate wild animals, such as songbirds – among such duties is to prevent one's household pets from harassing or killing them.

As a citizen of a municipality and of a nation-state one has duties and obligations to our fellow citizens not owed to non-citizens. One has duties to our countries themselves, not reducible to those one owes one's fellow citizens – among them to serve in the armed forces if called to do so or in such alternative national services as the Peace Corps. And one has duties and obligations to one's fellow denizens of the global village, among them to oppose tyranny, to refuse to be complicit in human trafficking and other forms of egregious exploitation; and one has a duty to demand that one's own national government support international efforts to achieve economic and environmental justice for all. If Aldo Leopold (1949) is to be believed, one has duties and obligations to the fellow-citizens of our biotic communities *and* to those communities as such.

The threat of global climate change has become the greatest moral challenge of the twenty-first century. The modern monadic moral ontology implies a dreary zero-sum ethic of self-sacrifice for the sake of each and every one of the nameless and faceless global billions *and* to the indeterminate as well as the anonymous billions more to come in the coming centuries and millennia. To do one's bit to mitigate global climate change, one is called upon to curtail one's consumption so radically as to adopt a lifestyle that would make that of a cloistered Medieval monk seem voluptuous – or so argue such contemporary climate ethicists as Peter Singer, Henry Shue, Stephen Gardiner, and others committed to the modern monadic, essence-accident moral ontology. Equal interests must be treated equally, from this point of view, and thus to privilege one's own interests, in choosing among courses of action, is to be guilty of what Gardiner calls "moral corruption." Modern moralists hope to shame themselves and everyone else into attempting to give equal consideration, in choosing a course of action, to everyone's equal interests, even in a hyper-connected global economy and civilization. That hardly seems a path to achieving an ethical outcome; rather it has proved to be a path to ethical paralysis.

In sharp contrast, a post-modern moral ontology implies an inclusive ethic of care and concern for those people, institutions, places, and things that define oneself and give meaning to one's life. Why would one want, desire, long for, lust for a future world beyond one's own lifetime that resembles the one into which one was born? One wants that because that is the world one loves and that is the world one wants to exist for those particular persons that one loves most – one's children, grandchildren, and younger friends, colleagues, and associates. If the world's climate radically changes – as well it might if concerted and effective international action to curb the emission of greenhouse gases does not happen soon – the possibility is very real, perhaps imminent, that the global economy will soon collapse and, following that, the collapse of global civilization. The prospect of a new and irreversible Dark Age looms ominously on the horizon if concerted action to curb the emission of greenhouse gases is postponed much longer. One certainly does not want one's children and grandchildren to live in a world of increasingly violent weather, flooded coastal metropolises, shrunken continents, expanding deserts, desiccated crops – a world ripe for rule by war lords leading predatory gangs, struggling over shrinking stocks of food, energy, and the other necessities of contemporary life that most of us take for granted. And one cringes at the prospect of the destruction of the things that have given one the most joy and reached into the very core of one's being – the art, literature, science, philosophy that we have inherited as the legacy of 5,000 golden years of global civilization. Almost as horrible is the prospect of these currents of global civilization coming to the end of their development, even if somehow they are preserved as relics of a stagnant history. These are all the things that one loves as one's life itself. These are the things one wants to preserve and will gladly work with energy and resolve to perpetuate. This is the ethic of desire, the ethic of love – the post-modern erotic ethic. It stands in sharp contrast to the abstemious, zero-sum, self-sacrificial, guilt-driven – and ultimately ineffectual – ethic of the modern moral monadology.

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