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Integral Ecology
AN ECOLOGY OF PERSPECTIVES

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There are many competing approaches available for responding to environmental problems and dealing with ecological issues. This article provides an introduction to Integral Ecology, an approach that takes the valuable insights from all the major schools of ecological thought and unites them in a comprehensive framework. First, the difficulty of defining "ecology" is explored. Next, the twenty-five major approaches to ecology are introduced. Finally, Integral Ecology is defined in such a way that it honors the importance of all these approaches.

Introduction

Since its inception in 1866 by Ernst Haeckel's publication of *Generelle Morphologie der Organismen,* the field of ecology has multiplied, divided, and morphed into numerous schools and sub-schools. Each expression of ecology is an attempt to capture something not included by other approaches. As new domains of inquiry and knowledge emerge, so do new approaches to ecology. Every knowledge niche seems to have a corresponding school of ecology connecting its insights to the understanding of ecological processes and environmental dynamics. With the emergence of new schools of ecology, as with most disciplines, there is a tendency for the nascent approach—the "new kid on the block"—to define itself against existing approaches in order to justify its particular position. Fences are built between approaches when bridges are needed. Of course some approaches will pair up with each other to discredit other seemingly misguided approaches. The net result, as is the case with so many of our (post)modern disciplinary divisions (e.g., psychology, literature, economics), is a fragmented field of various approaches pitted against each other or in alliance through protective politics.

Having been involved with environmental philosophy and action for over a decade, I have been aware that there are many approaches to ecology for quite some time. However, it was not until

about two years ago that I really became aware of just how many distinct conceptual approaches there are. I decided to make a list of all the major approaches: "That would be a handy list," I told myself, and I set aside a few hours to generate it. A few hours turned out to be insufficient, however. Over the following weeks, as I discovered progressively more schools of ecology, the list continued to grow. I was astonished as I watched the list expand to over one hundred. A year later, the list now includes almost two hundred unique approaches to and perspectives on ecology—most of which have their own journals, institutions, and communities of practitioners.

As I told my environmental colleagues that I was discovering so many distinct approaches, they had a hard time believing me. Most people guess that there are anywhere between 10 and 25 distinct conceptual and/or applied approaches to ecology. So what is someone concerned about the environment to do when confronted with this magnitude of variety within the field of ecology and environmental studies? How is an activist expected to be effective in the face of such multiplicity? No wonder the world of ecology is in such disarray—it has grown so big that it no longer knows itself. Hence, practitioners of *landscape ecology* have never heard of *ecophenomenology*; *environmental philosophers* do not know the difference between *population ecology* and *community ecology*; individuals working in the field of *acoustic ecology* do not know about *ecological hermeneutics*. We need a framework to help sort through these many approaches and connect them in a pragmatic way that honors their unique insights on their own terms. *Integral Ecology* provides this framework: a way of integrating the multiple fields of ecology and environmental studies into a complex, multidimensional transdisciplinary approach to the natural world and our embeddedness within it.[1] Integral Ecology achieves this by drawing on the framework associated with the Integral theorist Ken Wilber.[2] In short, this framework provides a way of understanding the relationship between *what* is perceived as nature (ontology), *who* is perceiving nature (epistemology), and *how* the perceiver uses different methods, techniques, and practices to disclose nature (methodology).[3]

In providing an Integral approach to ecology (i.e., eco-social systems), this essay will begin by examining historical and contemporary perspectives on the science of ecology. The next section will expand beyond the strictly scientific approaches to ecology and present the 25 main approaches to ecology and some representative schools associated with them. The final section will present a working definition of Integral Ecology that opens the conversation of how people might include all the valuable yet partial insights from these many different but important approaches to ecology (the scientific study of "natural" systems) and environmental studies (the interdisciplinary study of human impact and interaction with "natural" systems).[4]

Three Historical Definitions of Ecology

The history of ecology, its definitions and concepts, is a very rich domain and worth much study. In the context of this introductory article, I will confine my remarks to a brief connection to the Greek roots of ecology and then focus on the three most prominent and influential definitions of ecology.[5] The value of doing an historical survey of ecology, albeit in condensed form, is that it provides an important context for understanding the variety of approaches to ecology and environmental studies that currently exist.

Aristotle (384–322 BCE) can be considered the first western "ecologist."[6] His ideas about nature and categories of natural phenomena dominated western science for nearly 2000 years.[7] As a result of his long-standing influence, the development of ecological and evolutionary thinking was inhibited until the seventeenth century when some of his postulates were first challenged.

For our purposes, four of Aristotle's postulates were particularly important. He maintained that:

- species were eternal and therefore fixed;
- each species was fixed and had a perfect essence (eidos), so that variations in species were inconsequential;

- the Kosmos was organized along a spectrum of complexity (Scala Naturae or Great Chain of Being), according to which humans were at the top of biological complexity and perfection;
- the natural world was in perpetual equilibrium: ecological variation was unimportant.[8]

The first three postulates did much to prevent evolutionary thinking from emerging until the seventeenth century. As a result of the forth postulate, nineteenth century ecologists were mainly concerned with static patterns opposed to the fundamental process of natural systems. This gave way in the twentieth century to modern ecological thinking concerned with system dynamics.

A combination of factors undermined Aristotelian orthodoxy. These included European voyages of exploration that exposed people to new biota, fossils of extinct species, geographical evidence that the world was old, the invention of the microscope, and new taxonomies to account for the variety of nature; along with the Industrial Revolution, which demonstrated that the natural world could be altered in a relatively short period (i.e., within one human lifespan). As the Aristotelian worldview of nature gave way in the face of an expanding and exploring Europe, a new understanding of the natural world emerged.

As already indicated, the first definition of ecology ("*Oekologie*") appeared in Ernst Haeckel's book *Generelle Morpologie der Organismen*.[9] Haeckel was a German zoologist and a prolific writer who did much to popularize Darwin in Germany. This definition was inspired by Darwin's discussion of the "economy of nature" which appeared in his book *Origin of Species* and appeared in English via Allee et al's frontispiece to *Principles of Animal Ecology*:

> By ecology we mean the body of knowledge concerning the economy of nature—the investigation of the total relations of the animal both to its inorganic and its organic environment; including, above all, its friendly and inimical

> relations with those animals and plants with which it comes directly or indirectly into contact—in a word, ecology is the study of all those complex interrelations referred to by Darwin as the conditions of the struggle of existence.[10]

Here, the emphasis is often understood as underscoring the relationship of organisms with their environment, even though it includes inorganic (a biotic) and organic (biotic) aspects. This definition represents the most common lay understanding of ecology today: the study of interrelationships between organisms and their environment. That organisms were the preferred unit of study reflects the macroscopic view of the mid-nineteenth century. This neglects both the microscopic dimensions (lower scales) and wider dimensions, including ecosystem dynamics at larger scales of organization such as species or community dynamics. Moreover, Haeckel's "organism-environment" definition, in spite of its Darwinian inspiration, is situated within a non-evolutionary perspective. It was not until the 1940s that ecology began to be understood in the context of evolution when the Darwinian synthesis of natural selection and genetics occurred between the 1920s and 1950s.[11]

The term ecology became very popular in the 1890s, triumphing over the term bionomics proposed by the famous eighteenth-century naturalist Georges-Louis Leclerc, Comte de Buffon. By the early 1900s, the first scientific societies and journals appeared. In 1913, The British Ecology Society established and published the *Journal of Ecology*. Two years later, the Ecological Society of America was formed. Ironically, scientific ecology arose out of the desire to control, modify, and exploit the natural processes, not concern for the environment. Two main schools of ecology arose: plant ecology and animal ecology.

Plant ecology developed in the early twentieth century and focused on distribution because plants are sedentary and easily identified and mapped (they do not run away like animals!). One of the most important figures of plant ecology was the American prairie ecologist Frederic Clements. It was Clements who introduced the concept of vegetation climax (e.g., an "old-

growth" forest). He adhered to an organismic philosophy that embraced a view of ecology as super-organism with regional climax representing the maturity of its vegetation. In reaction to Clements's super-organism perspective, Henry Allan Gleason championed an individualistic plant ecology, which promoted the notion that plants lived where they could, and regions were best described, not as holistic communities, but as areas of continual change, competition, and probability.[12]

Animal ecology developed towards the end of the nineteenth century and focused on abundance, because animals were easier to study where they were more densely populated. Victor Sheldon from the University of Chicago applied Clements super-organism and climax notions to animal communities. In particular he focused on predator-prey relationships. Warder Allee continued and built upon the organismic approach of Sheldon at the Chicago School. Allee emphasized the mechanism of group selection and cooperation in contrast to dominance hierarchies and competitive individualism. His approach is summarized in the 1949 co-authored text *Principles of Animal Ecology*. In contrast to Sheldon and Allee's cooperation approach to animal ecology, British biologist, Charles Elton, emphasized competition. In 1927 Elton published a textbook for the field, *Animal Ecology*, which popularized the notion of "niche" and promoted an economic metaphor (competition over food) to explain fluctuating populations.[13] Much of the work in animal ecology focused on different aspects of animal populations. Both schools of ecology (plant and animal) developed along separate lines until the 1950s. However, animal ecology became more popular in the 1930s.

In 1954, H. G. Andrewartha and L. C. Birch merged the concepts of distribution (plant ecology) and abundance (animal ecology) to form the second most influential definition of ecology. They did this by defining the limits of distribution as the place where abundance falls to zero. Thus, in the now classic text, *The Distribution and Abundance of Animals,* they defined ecology as, "The scientific study of interactions affecting the distribution and abundance of organisms."[14] This

definition, like Haeckel's, emphasizes organisms as the keystone to ecology, but, by focusing on groups of organisms (their distribution and abundance), this approach has influenced community and population-centered ecologists. While offering precision by virtue of its clear parameters, this definition omits many important dimensions of ecology (e.g., abiotic components). Andrewartha and Birch also introduced a classification of four general environmental factors:

- weather (physical and chemical factors);
- food (other organisms, nutrients, inorganic compounds);
- other organisms: different species (competitors, predators, pathogens, symbionts), same species (family members, social groups, mates);
- place in which to live (nest sites, shelter, niche).

Andrewartha and Birch's definition of ecology has had a lasting effect on the field. By the 1960s experimental studies of animal distributions were well established, and by the 1970s, studies in plant demography (i.e., abundance) were fully established.

Around the same time that Andrewartha and Birch were advancing their definition of ecology, another prominent definition was gaining ground. This emerging third definition would become the most influential understanding of ecology to date. In 1946, the British trained ecologist George Evelyn Hutchinson promoted mathematical models for ecology. Building on the biogeochemical approach of the Russian V. Vernadsky (who coined the term "biosphere") he used an economic metaphor instead of the super-organism metaphor to understand and explain communities. In particular, he highlighted feedback loops, which provide system stabilization in the face of environmental change. This new metaphor was well suited to the postwar optimism that fed into the concept of a budget of nature. The United States was experiencing rapid economic growth, which supported additional scientific research and firmly established this

emerging understanding of ecology. Up and coming ecologists rejected the organismic components of ecological theory associated with Nazi Germany. Thus, North American ecosystem studies began to emphasize information theory, computers, modeling, and typically used a mechanistic model of nature. This approach promised to help manage resources through mapping the structure and function of ecosystems and predicting their responses to disturbance. The mechanistic concept mirrored the cultural zeitgeist of the United States, thereby allowing ecology studies to flourish. At first, the major source of funding for ecology came from the U.S. Atomic Energy Commission, which wanted to know the effect of nuclear weapons on organisms and food chains. During this same period, the growing importance of cybernetics (i.e., self regulating machines) led to the establishment of systems ecology. Attempting to understand the complex systems of ecology via a few variables through a machine metaphor, many ecologists moved from the study of whole ecosystems to the study of its parts and their processes. Interest eventually returned to ecosystems as a whole but mostly limited to an object such as a watershed, which had distinct boundaries and provided an experimental foundation for ecosystem studies. As the environmental movement grew in the late 1950s and early 1960s, ecologists became divided, often testifying on both sides of issues such as pollution and pesticides. Funding increased and many more ecologists emerged.

The third well-known definition of ecology is associated with Eugene Odum (and to some extent with his brother, Howard Odum), who founded *ecosystem ecology*. He relied on emergent properties and drew on the metaphor of a super-organism and emphasized the structure and function of the ecology system. Odum's widely used textbook, *Fundamentals of Ecology*, ushered into ecology discourse the concept "ecosystem," first introduced by the English ecologist Arthur Tansley in 1935.[15] Tansley's original formulation of ecosystem provided the foundation for a whole new approach to ecology:

> But the more fundamental conception is, as it seems to me, the whole *system* (in the sense of physics, including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment of the biome—the habitat factors in the widest sense).

It is the systems so formed which, from the point of view of the ecologist, are the basic units of nature on the face of the earth.

These *ecosystems*, as we may call them, are of the most various kinds and sizes. They form one category of the multitudinous physical systems of the universe, which range from the universe as a whole down to the atom.[16]

Whereas before the emphasis had been on the relationship between organisms and their environment (Haeckel) or the distribution/abundance of organisms within an environment (Andrewartha and Birch), now the emphasis was on complex systems and the energy flows that form the environment. According to Odum, an ecosystem is:

> …any entity or natural unit that includes living and nonliving parts interacting to produce a stable system in which the exchange of materials between the living and the nonliving parts follows circular paths is an ecological system or ecosystem. The ecosystem is the largest functional unit in ecology, since it includes both organisms (biotic communities) and abiotic environment, each influencing the properties of the other and both necessary for maintenance of life as we have it on the earth.[17]

Although ecosystem ecology focuses on processes (e.g., flows of energy), Odum still had a tendency to emphasize the individual organism, though less than in Haeckel's definition. Odum's textbook, along with a few other books that appeared around the same time, represent the shift

from ecology as natural history or as the abundance of organisms to a mechanistic treatment of ecosystems and organisms.

Also, during the 1950s, the Darwinian synthesis was complete and the role of evolution began to be more thoroughly considered by ecologists. V. C. Wynne-Edwards, a British zoologist, began proposing, like Alle before him, that selection could occur at the level of the group and not just through individuals. Because the emerging new field of ecosystem ecology did not examine natural systems with any kind of time-space relations, this presented a major challenge. Two distinct schools of ecology began to emerge: *ecosystem ecology* and *evolutionary ecology*. New ecologists became trained in the latter and slowly gained influence in journals and the academy. One reason evolutionary ecology gained prominence is that ecosystem ecology did not fit into the university system very well since its techniques of research required a team of scientists and the academy prized individual scholarship. Thus, students could not easily take ecosystems as a topic of dissertations and papers. In spite of these pressures, ecosystem ecology has maintained itself as a distinct approach in North America, though it has not been able to establish itself in other countries.

Although there have been other important definitions of ecology, the aforementioned three have had the most historical influence.[18] Haeckel's "organism-environment" definition, which claims that ecology studies the relationships between living organisms and their environment, is the most commonly understood definition by the general public. The second, Andrewartha and Birch's "distribution and abundance" definition, is still in wide circulation and guides much research. The third view, Odum's "systems" definition, which emphasizes cybernetic (self-regulating) processes, continues to guide much ecological understanding. These three definitions have had a large influence on the variety of contemporary definitions in the field of ecology. Each definition has its strengths and limitations, often associated with the particular historical horizon out of which each emerged.

It is interesting and important to note that all three definitions emerged out of a desire to more scientifically exploit the environment rather than a concern for protecting it. The science of ecology as a basis for *respect* towards Nature is very recent. It was not until the 1960s that the science of ecology became associated with environmental protection. Most of ecology's history has been managerial. Consequently, many of the concepts, terms, and metaphors that have informed the development of ecology as a scientific discipline are actually at odds with the holistic notions of protecting Nature. The science of ecology went from being descriptive in the nineteenth century, with naturalists describing what and when, to a functional ecology in the early twentieth century, with more of an emphasis on experimentation (in the lab and field), to a theoretical ecology in the mid-twentieth century using calculus, models, and simulations to explain why it evolved as it did.

Interestingly, the three major metaphors (super-organism, economy, machine) that have guided ecological theory and supported both holistic-community and reductionistic-individual approaches all share an industrial ontology.[19] This industrial ontology views Nature as a great interlocking order of exterior sensory datum. As a result, even those individuals and schools that are championing a holistic view of ecology are doing so in the context of an approach that is inadvertently denying the existence of interiors (individual and collective). If they do recognize interiors then they are forced to explain them through the industrial grid of functional fit, thereby reducing them to their interobjective correlates. As I will demonstrate when I provide a definition of Integral Ecology, this subtle reductionism can be avoided.

Six Contemporary Schools of Ecology

While the three historical definitions, outlined in the previous section, represent influential currents within ecology, they by no means capture the variety of contemporary definitions and scientific schools of ecology. In the post-war years, from 1945-1960 the number of ecologists doubled, and then doubled again in the 1970s following the emergence of the environmental

movement. With this exponential growth in ecologists, there was a correlative expansion over the last fifty years of distinct approaches to ecology and a diversification within the field that was hitherto unmatched. Multiple theoretical schools emerged, each critical of their rivals, each with a unique perspective.

Thus, the study of ecology can be approached from a multitude of angles, perspectives, scales, units of analysis, topics, and methods depending on the goals and orientation of its scientists. These variables can lend themselves to unending distinctions between definitions of schools of ecology. For example, you can place the term "ecology" after every plant, insect, animal or type of habitat and quickly arrive at over 1000 distinct ecologies (e.g., beetle ecology, oak ecology, tundra ecology).

In response to this dizzying situation, zoologist Stanley Dodson identifies four major ways of defining ecological approaches: perspective, organism, habitat, and application.[20] First, there are kinds of ecologies defined by the organizing *concept* or *perspective* held by the scientist (e.g., Landscape, Ecosystem, Physiological, Population, Behavioral, Community). Next, there are kinds of ecologies defined by the *organism* under study (e.g., plant, animal, microbe, zooplankton, human, deer, tree). In addition, there are branches defined by the *habitat* being studied (e.g., terrestrial, lakes and streams [limnology], marine, artic, rain forest, benthic thermal vents, urban). There are also kinds of ecologies defined by the *application* the research serves (e.g., Theoretical, Conservation, Agricultural, Public Policy, Academic, Management, Restoration). These different ways of approaching ecology can be and have been combined to create distinct and sometimes overlapping approaches (e.g., a landscape ecologist specializing in arctic tundra for restoration purposes). Nevertheless, these four types of definitions allow for an effective way of sorting through the main components of any given approach.

Dodson uses the above listed major perspectives to organize his excellent anthology. He chooses perspectives as the organizing framework because they represent the foundational differences

between ecological schools. The following are the definitions of each perspective as provided by Dodson. In addition to a definition, I have provided a representative question each approach would ask about a rural North American landscape as well as an example of the tools and techniques used by each approach to answer such questions. [21]

Landscape Ecology: The landscape can be thought of as being made up of different patches, characterized by different organisms and environments. Landscape ecology examines the interaction between this pattern of patches and ecological process—that is, the biological causes and consequences of a patchy environment.

- *Typical Question*: How does the two-dimensional pattern of forest, field, and farm buildings affect the ability of deer to move from one forest patch to another?
- *Tools and Techniques*: Satellites, photos, maps, and computers are essential, especially for geographic information systems (GIS).

Ecosystem Ecology: Ecosystem ecology is the study of the interactions of organisms with the transport and flow of energy and matter. Ecosystem size and shape depends on the specific questions being asked about energy flow or chemical cycling. The "system" part of an ecosystem is a description of how energy or matter moves among organisms and parts of the environment.

- *Typical Question*: In this watershed, how much phosphorous is stored in the soil of the forest and fields, how much is applied to the fields each year, and how much moves annually into the stream?
- *Tools and Techniques*: Calorimeter pressure bomb, quantitative chemical analysis.

Physiological Ecology: Physiological ecology is the study of how individual organisms interact with their environment to carry out the biochemical processes and express the behavioral adaptations that accomplish homeostasis and survival. Homeostasis involves the maintenance of time, matter, and energy budgets that allow for growth and reproduction by the individual.

- *Typical Question*: Is the local climate optimal for the genetic strain of the corn growing in the fields?
- *Tools and Techniques*: Respirometer, treadmill, infrared gas analyzer (IRGA), stable isotope chemistry, light sensors, thermocouples.

Behavioral Ecology: The goal of behavioral ecology is to understand how a plant or animal's behavior is adapted to its environment; behavior is understood as the result of an evolutionary process.

- *Typical Question*: How does the size, condition and age of male redwing blackbirds affect their ability to defend breeding territories along the stream bank, and how, in turn, does this impact their breeding success?
- *Tools and Techniques*: Sampling traps, computer, greenhouse.

Population Ecology: A population is a collection of individuals from the same species that occupy some defined area. Population ecology focuses on how and why populations change in size and location over time.

- *Typical Question*: What factors control the size of the trout population in the stream?
- *Tools and Techniques*: Video equipment, event recorder, binoculars, radio tags, geographic position satellites, computer, DNA fingerprinting.

Community Ecology: Community ecologists examine the patterns and intersections seen in groups, or aggregations of different species. The distributions of species are influenced both by biological interactions (such as predation and competition) and by environmental factors (such as temperature, water, and nutrient availability).

- *Typical Question*: How many species of native plants and insects live in the woodlot, and are there enough pollinators to maintain the plant diversity?
- *Tools and Techniques*: Quadrant sampling, species identification book, enclosures.

As one reads through these six definitions (let alone the 200 that could be generated using the Appendix!), it becomes quite clear how each of these approaches represents a different perspective on ecology and the environment. It is important to keep in mind that all of these perspectives simultaneously *reveal* and *conceal* different aspects of the environment and what is considered to be part of its ecology. None of them has the last word because each one highlights various phenomena, relationships, and dynamics, while remaining silent on, and sometimes even unaware of, others. *As a result, there is no single ecology! Ecology is not a domain in nature to study, it is a way of studying (logos) the environment (wild, rural, urban)*. Thus, ecosystems are not lying around out there waiting for ecologists to find them. They are the result of the concepts, perspectives, questions, tools, and techniques that ecologists bring to bear on the natural and social world. Dodson explains:

> Because the perspectives are different, they produce different questions, require different techniques, and result in different conclusions about the relationships, distribution, and abundance of organisms, or groups of organisms, in an environment.[22]

He goes on to highlight that:

> Whatever perspective is used to view it, ecology is often assumed to be something that exists "out there." While it is true that things, such as birds and bees and trees and mountains do exist, ecology exists only in our language. Ecology is an interpretation of our perceptions of organisms and the environment. As with any interpretation, ecology depends completely on the history and culture of the people making the interpretation.[23]

Given the variety of prominent schools of ecology, the issue of a unified ecology has been raised by many ecologists (e.g., Allen and Hoekstra) attempting to unite the various scientific approaches to ecology.[24] One of the problems with this "unifying" approach is that while ecologists generally agree that there are basic ecological principles underlying ecology, they disagree on what those principles are! This has led ecologists such as Dodson to take up a perspectival approach, according to which each school of ecology represents a valid perspective that should be considered and honored on its own terms.

Although the six contemporary schools of scientific ecology mentioned above represent different perspectives, they are the same in an important respect: they all focus on the exterior realities of individuals (behaviors) and/or collectives (systems). In other words, these six schools of ecology are all capable of making scientifically valid assertions about the domains that they examine. However, there are also many approaches to ecology that do not take their starting point from science but rather draw their inspiration from subjective (e.g., psychology or art) or intersubjective dimensions of reality (ethics or religion). This exclusion of essential aspects of reality highlights another problem with the attempts thus far at arriving at a unified concept of ecology. Previous attempts typically have tried only to unify natural scientific approaches to ecology that focus on objective (and interobjective) realities. Cultural ways of doing ecology, for instance, are rarely included. This is what sets Integral Ecology apart from other integrative or

unifying approaches to ecology. Integral Ecology unites objective, interobjective, subjective, and intersubjective approaches to the environment in an Integral embrace. Integral Ecology recognizes the rich variety of schools of ecology and provides a framework to coordinate their perspectives in a comprehensive and effective manner.

25 Main Approaches to Ecology

The first step in Integral Ecology is to identify the various perspectives that need to be included in a comprehensive approach to the environment and its ecology. As I mentioned in the introduction, over the last two years I have compiled a list of around 200 distinct perspectives of and approaches to ecology (see Appendix). Once this list began to reach beyond fifty, I explored a classification system that would allow me to group these schools into more general approaches. In other words, I wanted, like Dodson above, to find a means to sort and organize this maddening multiplicity of ecologies. At this point, I have identified 25 main approaches among the 200 various perspectives on ecology, the natural world, and the environment (see figure 1 below).

Scientific	Social	Philosophical
Economical	Technological	Cultural
Acoustic	Evolutionary	Ethical
Medical	Ecological	Religious
Aesthetic	Psychological	Esoteric
Behavioral	Agricultural	Somatic
Representational	Geographical	Therapeutic
Historical	Complexity	Spiritual
	Linguistic	

Figure 1. The 25 Main Approaches to Ecology

Each of these approaches contains a number of distinct schools or perspectives (up to 20 in some cases!) that serve as examples of each approach. See figure 2 below for three representative schools for each of the 25 main approaches for a total of 75 unique approaches to the natural

world and its ecological processes. If you are not convinced of the need for an Integral Ecology by this point, then look at the even longer list in the Appendix. The categories of the 25 main approaches are not meant to serve as exclusive distinctions. In fact, many of them overlap with several other categories. Rather, they are a heuristic device meant to highlight general themes and groupings between various schools and perspectives. Feel free to adjust, augment, and change the list to suit your needs. The 25 main approaches serve as a quick reminder of the variety of complex perspectives that must be considered in any truly Integral approach to ecology and environmental studies.

Scientific
Chemical Ecology
Physiological Ecology
Biophenomenology /Autopoesis

Economical
Natural Capitalism
Eco-economics
Sustainable Development

Acoustic
Acoustic Ecology
Acoustic Ethnology
Bioacoustics

Medical
Ecological Medicine
Medicinal Ecology
Ecotoxicology

Aesthetic
Ecopoetics
Environmental Aesthetics
Romantic Ecology

Behavioral
Behavioral Ecology
Ecological Activism
Environmental Psychology

Representational
Mathematical Ecology
Theoretical "Pure" Ecology
Ecological Modeling

Historical
Paleo "Ancient" Ecology
Historical Ecology
Ecological Anthropology

Social
Political Ecology
Social Ecology
Environmental Sociology

Technological
Ecological Design
Industrial Ecology
Architectural Ecology

Evolutionary
Developmental Systems
Ecology
Evolutionary Ecology
Neodarwinism

Ecological
Ecosystem Ecology
Population Ecology
Community Ecology

Psychological
Ethnology
Ecopsychology
Organic Psychology

Agricultural
Agricultural Ecology
Industrial Agriculture
Permaculture

Geographical
Earth Energies Ecology
Geo-Ecology
Landscape Ecology

Complexity
General Systems Theory
Complexity
Developmental Systems
Theory

Cultural
Ethno Ecology
Cultural Ecology
Place Studies

Linguistic
Biosemiotics
Ecosemiotics
Linguistic Ecology

Philosophical
Postmodern Ecology
Ecological Hermeneutics
Philosophy of Ecology

Ethical
Animal Rights
Environmental
Justice/Racism
Environmental Ethics

Religious
Spiritual Ecology
Ecological Theology
Process Ecology

Esoteric
Deva Ecology
Archetypal Ecology
Interspecies
Communication

Somatic
Feminist Ecology
Ecological Phenomenology
Architectural
Phenomenology

Therapeutic
Wilderness Therapy
Shamanic Counseling
Ecotherapy

Spiritual
Deep Ecology
Nondual Ecology
Transpersonal Ecology

Figure 2. 25 Main Approaches to Ecology and Some Representative Schools

Many schools can be placed in several different approaches depending on which author, book, or research project one has in mind. The point is not to freeze any school or perspective into one approach, but rather, to use the framework of the 25 main approaches as a way of helping to organize the hundreds of distinct perspectives on and approaches to ecology. The goal is to include as many perspectives as possible in any given situation regardless of where one might place them in an organizing schema.

The sheer volume of approaches to ecology presents an interesting challenge to anyone wanting to provide a meaningful definition of ecology that is general enough to account for all 25 main approaches to ecology and specific enough to honor the essential distinctions between these various schools of thought. Integral Ecology offers a solution to this quagmire.

Defining Integral Ecology

Integral Theory provides a number of conceptual tools for holding together a rich tapestry of distinctions within any discipline or field of inquiry. In the context of ecology, it allows the insights from 200 distinct perspectives to contribute to a more comprehensive understanding of eco-social systems. In order to effectively work with these various perspectives and approaches, we need a definition of Integral Ecology. The definition must be robust enough to contain the myriad of approaches to ecology while at the same time having enough thrift to support meaningful discourse.

Before offering an Integral definition of ecology, I want to provide a definition of "Integral" from Ken Wilber:

> *Integral:* the word means to integrate, to bring together, to join, to link, to embrace. Not in the sense of uniformity, and not in the sense of ironing out all of the wonderful differences, colors, zigs and zags of a rainbow-hued humanity, but in the sense of unity-in-diversity, shared commonalities along with our wonderful

> differences. And not just in humanity, but in the Kosmos at large: finding a more comprehensive view—a Theory of Everything (T.O.E.)—that makes legitimate room for art, morals, science, and religion, and doesn't merely attempt to reduce them all to one's favorite slice of the Kosmic pie.[25]

Thus, an Integral approach to ecology can be summarized as one that unites the art of ecology: the Beautiful (environmental aesthetics); the morals of ecology: the Good (environmental ethics); and the science of ecology: the True (environmental science). These three domains of reality are discernable in all major languages through pronouns that represent first-, second-, and third-person perspectives and are referred to by Wilber as "the Big Three": I, You/We, and It/s.[26] These three spheres can also be characterized as self, culture, and nature.

One of the key elements of Integral Theory that serves this integration and provides the framework for defining Integral Ecology are the quadrants, which represent four irreducible perspectives that can be taken by anyone: subjective, intersubjective, objective, and interobjective. The other elements of an Integral approach occur within each quadrant and include: *levels* of depth and complexity (e.g., evolutionary hierarchies: Salthe's scalar hierarchy or animal consciousness); *lines* of development (e.g., evolutionary clades: beetles, wasps, moths, flies); temporary *states* (e.g., seasons, weather patterns); and various *types* (e.g., biomes: steppe, tundra, tropic, temperate).[27]

The quadrants express the simple recognition that everything has an inside and an outside and can be both singular and plural. All individuals (from atoms to humans) have interiors (some form of subjective experience) as well as exteriors (various behaviors and physiological components). In addition, individuals are never just alone but are members of collectives, which also have interiors (cultural realities) and exteriors (eco-social systems). These four dimensions are represented as: individual interiors (Upper-Left quadrant: UL), individual exteriors (Upper-Right quadrant: UR), collective interiors (Lower-Left quadrant: LL), and collective exteriors

(Lower-Right quadrant: LR). The quadrants can be referred to as Experience, Behavior, Culture, and Systems, respectively. This all-inclusive intention is often represented by figure 3 below, which highlights many terms associated with the quadrants.

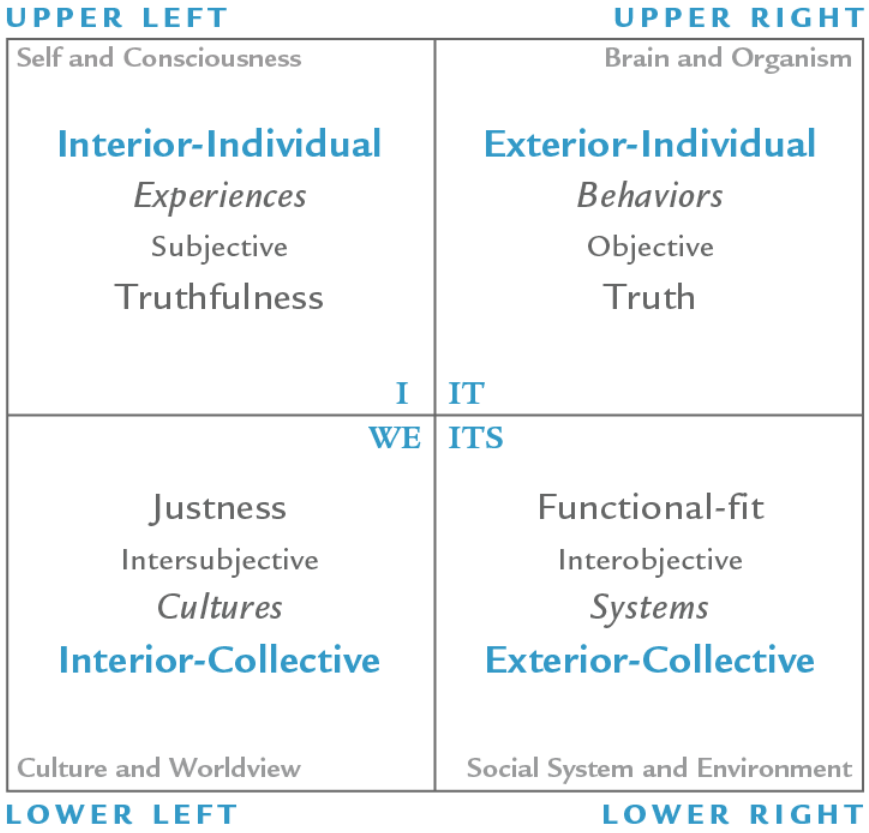

Figure 3. Some Aspects of the Four Quadrants

Integral Theory insists that you cannot understand one of these realities (any of the quadrants or their levels of complexity) through the lens (or *logos*) of any other. Integral Theory avoids any form of reductionism, especially *gross reductionism*: the reduction of all interiors and systems to material atoms; and *subtle reductionism*: the reduction of all interiors to systems of interwoven "its." The science of ecology typically exemplifies the latter form of reductionism.

Thus, a definition of Integral Ecology, one that avoids the reductionism associated with all other definitions of ecology, can be summarized as a transdisciplinary approach that recognizes that

ecosystems have levels of complexity in at least four dimensions or terrains: Systems, Behavior, Experience, and Culture. Respectively:

- Ecosystems are comprised of and influenced by natural and social systems;
- Ecosystems involve the individual behaviors of organisms, at all scales (including microbes and humans). These organisms are understood as being members (not parts) of ecosystems;
- Members of ecosystems have various degrees of interiority (perception, experience, intentionality, and awareness); and
- Members of ecosystems interact within and across species to create horizons of shared meaning and understanding.

These four terrains of an occasion co-arise and mutually influence each other in complex ways; none of them are granted ontological priority. Notice that ecosystems only represent one of the terrains of any given occasion. Thus, an Integral approach to ecosystems would not only study the systems terrain of any given environment but also the other three terrains of that environment and its members (Behavior, Experience, and Culture). Integral Ecology recognizes that different approaches to ecology and the environment (wild, rural, and urban) focus on diverse aspects and levels of complexity within these four dimensions and they do so from a spectrum of perspectives and worldviews using a variety of methods and techniques. Given the multiplicity of positions available on any environmental situation, Integral Ecology highlights the importance of humans developing worldcentric and planetcentric capacities for perspective taking.[28] The cultivation of people's ability to hold multiple perspectives is an important step towards fully honoring the complexity and mystery of nature.

As a result of this comprehensive definition of ecology, the 25 main approaches to ecology can be organized within the four quadrants or four terrains of ecology (see figure 4) as can their respective schools (see figure 5). The four terrains serve as a reminder that any occasion has four distinct facets, one of which is an ecological or a systems dimension. The other three terrains of any occasion include the cultural terrain of the members who comprise the ecosystem as well as the terrains of their individual experiences and behaviors.

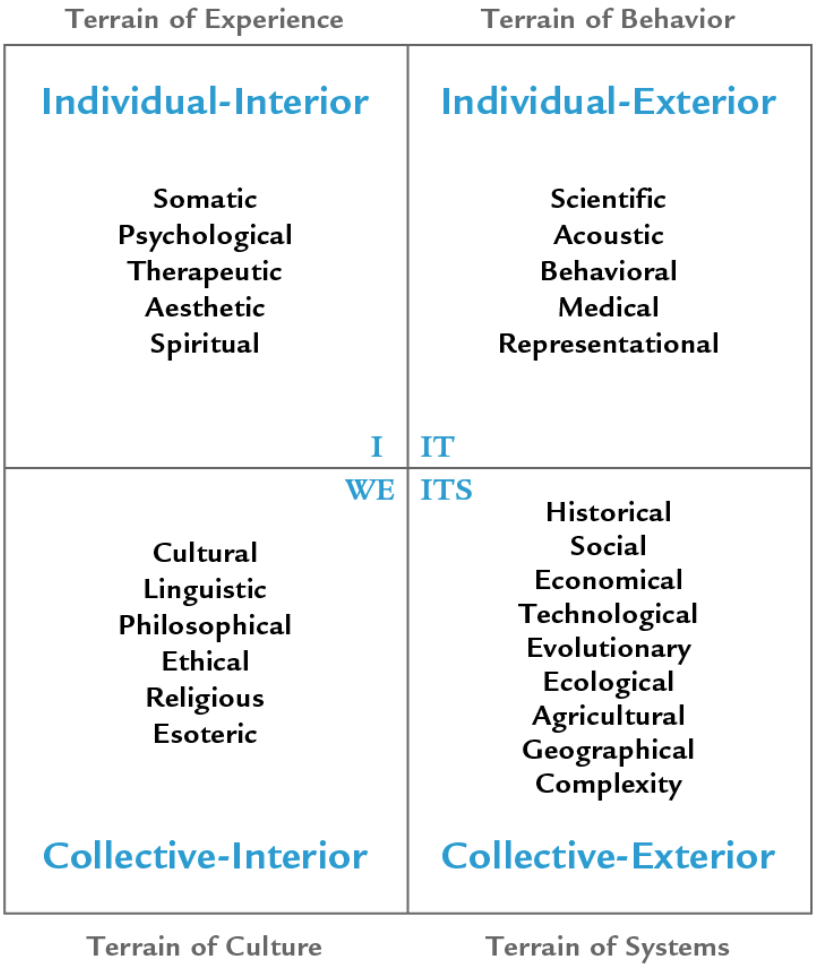

Figure 4. The Four Terrains of Ecology and Their Respective Approaches

Figure 5. The Four Terrains of Ecology and Some Respective Schools

Integral Ecology is a transdisciplinary approach that recognizes the ecosystem as the Lower-Right dimension of any environmental phenomena. Thus, an Integral approach to any ecosystem must consider the other three terrains (quadrants) since an ecosystem (regardless of how it is defined by any school of ecology) represents only one-quarter of the occasion being studied. In other words, when one studies an ecosystem from a scientific perspective he or she is only studying a fraction of any given environmental phenomena.

In short, environmental phenomena have four dimensions: ecological and social relationships (systems); these systems are comprised of individual members with movements, activities, and physiological functions (behaviors); these members of ecosystems have various forms of perception, sentience, and awareness (experience); these members also interact with each other to create shared understanding at various levels of complexity (culture). Thus, Integral Ecology is the study of the four terrains of environmental phenomena at all levels of complexity. In addition, Integral Ecology recognizes that different approaches to ecology, the environment, and the natural world focus on different aspects of these four terrains and they do so from a spectrum of perspectives using a variety of methods.

Integral Ecology allows for a comprehensive understanding of how the many ecological approaches available to us can be united to inform and complement each other in a coherent way. This Integral framework honors the multiplicity of environmental perspectives. It allows individuals to become proficient at identifying how various methods focus on specific ecological concerns, and from which perspective those concerns are being explored. Integral Ecology is ideal for anyone who wants to better understand the interconnection between environmental approaches, and is especially useful for change agents at all scales of action and concern: environmental leaders, community organizers, educators, and social activists. Environmental phenomena are so complex that anything less than an Integral approach will deliver temporary solutions at best and ineffective results at worst. What is needed is an ecology of

perspectives—one that combines the insights, approaches, concerns, techniques, and methods from the 200 distinct perspectives of our environment. We need an Integral Ecology: a meta-perspective that can assess, rank, and organize the various eco-perspectives in a truthful, sincere, just, and functional way that avoids being just another perspective.[29] This is the task to which the Integral Ecology Center at Integral Institute is committed. Join us and become part of this pioneering approach to ecology (www.integralinstitute.org).

Appendix: 200 Perspectives on Ecology

Aesthetic Ecology	Ecological Evolution	Liberation Ecology
Acoustic Ecology	Ecological Genetics	Lithopuncture
Acoustic Ethnology	Ecological Hermeneutics	Linguistic Ecology
Agricultural Ecology	Ecological Medicine	Mathematical Ecology
Archetypal Ecology	Ecological Modernization	Macroecology
Animal Liberation Front	Ecological Postmodernism	Microecology
Animal Rights	Ecological Psychology	Media Ecology
Animal Welfare	Ecological Rationality	Metaphysical Ecology
Applied Conservation Ecology	Ecological Sustainable Medicine	Molecular Ecology
Applied Ecology	Ecological Theology	Monkey Wrenching
Architectural Phenomenology	Ecophenomenology (Ecological	Morphic Fields
Architecture Ecology	Phenomenology)	Multiple Chemical Sensitivity
Artificial Ecology	Ecopoetics	Music Ecology
Arts & Craft Movement	Ecophysics/Ecological Physics	Natural Capitalism
Autopoesis Theory	Ecopscyhology	Natural Farming
Autopoetic Systems Theory	Ecosemiotics	Neo-Darwinism
Ayahuasca Journeying	Ecosocialism	Neopagans
Behavioral Ecology	Ecosystem Ecology	New Biology
Bioacoustics	Ecosystem Modeling	New Cosmology, The
Biocentrism	Ecotage	New Ecology
Biocomplexity	Ecoterrorism	Network Ecology
Biodiversity	Ecotheology	Nondual Ecology
Biodynamic Agriculture	Ecotherapy	Nonequilibrium
Biogeochemistry	Ecotourism	Thermodynamics
Biogeography	Eco-Utopias	Teilhard's Noosphere
Biomimicry	Ecotoxicology	Nutritional Ecology
Biomusicology	Elementals (and Nature Spirits)	Organic Psychology
Bionomics (Bioeconomics)	Engaged Buddhism	Paleoecology (Ancient Ecology)
Biophilia	Environmental Communication	Panpsychism
Biophenomenology	Environmental Education	Permaculture
Biopiracy	Environmental Engineering	Participatory Ecology

Foucault's Bio-power	Environmental History	Physiological Ecology
Biomusic	Environmental Illness	Planetary (Global) Ecology
Bioregionalism	Environmental Justice	Plant Neurobiology
Biosemiotics (also	Environmental Law	Political Ecology
Physiosemiotics & Pansemiotics)	Environmental Monitoring	Population Ecology
Buddhist Ecology	Environmental Phenomenology	Postmodern Ecology
Building Biology	Environmental Pragmatism	Process Ecology
Catastrophe Theory	Environmental Psychology	Psycho Acoustics
Cellular Automata Theory	Environmental	Psychogeography
Chaos Theory	Psychophysicology	Radical Ecology
Chemical Ecology	Environmental Racism	Rangeland Ecology
Clinical Ecology (Environmental	Environmental Sociology	Reconciliation Ecology (Win-
Medicine)	Ethnoecology	Win Ecology)
Cognitive (and Emotional)	Evolutionary Ecology	Restoration Ecology
Ethology	Evolutionary Psychology	Reverential Ecology
Cognitive Ecology	Evolutionary Systems Theory	Romantic Ecology
Community Ecology	Functional Ecology	Sacred Ecology
Comparative Ecology	Gaia Hypothesis	Sacred Geography
Morin's Complex Thought	Galactic Ecology	Shamanism
Conservation Biology	Geoecology	Sigmatism
Conservation Medicine	Geomancing	Social Ecology
Conservation Psychology	Geopsychology	Soil Ecology
Construction Ecology	Geosociology	Somatic Ecology
Cosmic Ecology	Generational Amnesia	Spatial Ecology
Creation Spirituality	General Systems Theory	Spiritual Ecology
Cultural Ecology	Gleason's Plant Ecology	Systems Ecology
Cybernetics	Globalization	Sustainable Development
Cyber Ecology	Goethian Science	Terrapsychology
Deep Ecology	Hierarchy Theory	Theoretical ("pure") Ecology
Design Ecology	Historical Ecology	Therapeutic Horticulture
Deva Gardening & Ecology	Home Ecology	Traditional Knowledge
Developmental Systems Theory	Horticultural Therapy	Transpersonal Ecology
Developmental Systems Ecology	Human Ecology	Urban Ecology

Dowsing	Human Dimensions	Urban Planning
Dynamic Ecology	Infodynamics	Universe Story
Dynamic Systems Theory	Industrial Ecology	Virtual Ecology
Earth Liberation Front (ELF)	Integrated Ecology	Vision Quests
Ecocentrism	Integrative Ecology	Voluntary Simplicity
Ecocriticism	Interdisciplinary Ecology	Wicca
Ecofeminism	Interface Ecology	Wildlife Ecology
Ecolinguistics	Interplanetary Ecology	Yoga Ecology
Ecological Aesthetics	Interspecies Communication	Zoopharmacognosy
Ecological Agriculture	Invasion Ecology	Zoomusicology
Ecological Anthropology	Leopold's Land Ethic	Zoosemiotics
Ecological Design	Landscape Ecology	
	Landscape Studies	
	Ley Lines	

Endnotes

[1] The need for integration within the field of ecology has been recognized by many theorists and practicing ecologists. However, attempts thus far have focused primarily on exteriors (e.g., behavioral and systems-based approaches). For example: Hierarchy Theory identifies various scales of complexity within ecosystems that different approaches take as primary. Once these scales are acknowledged their respective approaches can be unified into a single ecological framework (consult Allen & Hoekstra, *Toward a unified ecology*, 1992). But it is important to note that scientific understanding decreases as the scale increases. A number of graduate programs in ecology (e.g., University of California at Davis, USA; Helsinki University, Finland; and University of Southampton, England) are based on Integrative ecology, which allows students to combine various methods, theories, disciplines, data sets, scales, and disciplines. The field of Ecological modeling has pioneered efforts to identify patterns across ecological approaches in order to provide a comprehensive ecosystem theory, consult Jorgensen & Muller, *Handbook of ecosystem theories and management*, 2000; Jorgensen, *Integration of ecosystem theories: A pattern*, 1997. Ecologist Stanley Dodson has overseen the development of an ecology text which provides a very helpful overview of the various perspectives in ecological science, consult Dodson et al., *Ecology*, 1998, and its companion volume of primary source readings, Dodson et al., *Readings in ecology*, 1999.

[2] Consult Wilber, *Sex, ecology, spirituality: The spirit of evolution,* and *Integral psychology: Consciousness, spirit, psychology, therapy*; Excerpts at http://wilber.shambhala.com/html/archive/archive.cfm/.

[3] Consult Esbjörn-Hargens, "Integral ecology: A post-metaphysical approach to environmental phenomena," 2006

[4] Charles Krebs, the animal ecologist, introduced the distinction between "ecology" and "environmental studies," where the latter analyzes human impact on the earth's environment.

[5] For an overview of the development of the discipline of ecology and 18th–19th century science, consult any number of the following sources: Bowler, *The earth encompassed: A history of the environmental sciences,* 1992; Bramwell, *Ecology in the 20th century: A history*, 1989; Golley, *A history of the ecosystem concept in ecology: More than the sum of the parts*, 1996; Worster, *The ecology of order and chaos*, 1993; Worster, *Nature's economy: A history of ecological ideas,* 1994/1997; McIntosh, *The background of ecology: Concept and theory,* 1985/1988; Keller & Gollev (Eds.), *The philosophy of ecology: From science to synthesis*, 2000; Grove, *Green imperialism: Colonial expansion, tropical island Edens, and the origins of environmentalism 1600-1860,* 1995; Merchant, *The death of nature: Women, ecology and the scientific revolution*, 1980; Porter (Ed.), *The Cambridge history of science, Vol. 4: 18th-century science,* 2003; Mitman, *The state of nature: Ecology, community, and American social thought, 1900-1950*, 1992

[6] For Arisotle's own works consult Barnes (Ed.), *The complete works of Aristotle* (Vols. 1-2), 1984. For a short overview of Aristole's relationship to ecology consult, Palmer (Ed.), *Fifty key thinkers on the environment*, 2001. In addition there are a number of great anthologies that explore Aristotle's and other Greek philosopher's contribution to ecology, consult, Westra & Robinson (Eds.), *The Greeks and the environment,* 1997; Westra & Robinson (Eds.), *Thinking about the environment: Our debt to the classical and medieval past*, 2002; Boudouris & Kalimtzis (Eds.), *Philosophy and ecology* (Vol. 1), 1999; Roberts (Ed.), *Approaches to nature in the Middle Ages*, 1982. A number of other articles exploring Aristotle's contribution have also appeared recently: Foster, "Aristotle and the environment," 2002; Garrett, "Aristotle, ecology and politics: Theoria and praxis for the twenty-first century"; Peden & Hudson (Eds.), *Communitarianism, liberalism, and social responsibility*, 1991; Glazebrook, "Art or nature? Aristotle, restoration ecology, and flowforms," 2003. Lastly, an interesting dissertation explores the relationship between Aristotle, Heidegger and nature: Monti, "Origin and ordering: Aristotle, Heidegger, and the production of nature," 1997.

[7] There are a number of excellent surveys of attitudes towards nature over the last 2000 years. Consult Glacken, *Traces on the Rhodian shore: Nature and culture in western thought from ancient times to the end of the eighteenth century*, 1973; Torrance, *Encompassing nature—A sourcebook: nature and culture from ancient times to the modern world*, 1998; Coates, *Nature: Western attitudes since ancient times*, 1998; Marshall, *Nature's web: An exploration of ecological thinking*, 1992; as well as a number of books that focus on notions of nature: Collingwood, *The idea of nature*, 1945/1960; Huth, *Nature and the American: Three centuries of changing attitude*, 1957; Teich, Porter & Gustafsson (Eds.), *Nature and society in historical context*, 1997; Nash, *Wilderness and the American mind,* 1967/1982; Oelschlaeger, *The idea of wilderness: From prehistory to the age of ecology*, 1991; Williams, *Wilderness and paradise in Christian thought*, 1962.

[8] Kosmos is a Pythagorean term that refers to the interior and exterior aspects of the universe.

[9] Haeckel, *Generelle Morpologie der Organismen*, 1866.

[10] Dodson, *Ecology*, 1998, p. 2
[11] For more information on the Darwinian synthesis consult Mayr & Provine (Eds.), *The evolutionary synthesis: Perspectives on the unification of biology*, 1998
[12] For more information on the historical dynamics between Clements' holistic approach and Gleason's reductionistic approach, consult Barbour, "Ecological fragmentation in the fifties,"1995/1996.
[13] Elton was also known for defining ecology as "scientific natural history."
[14] Krebs, *Ecology: The experimental analysis of abundance and distributions*, 1994, p. 3
[15] This usage appeared in Tansley, "The use and abuse of vegetational concepts and terms," 1935
[16] Tansley, "The use and abuse of vegetational concepts and terms," 1935, p. 299
[17] Odum, *Fundamentals of ecology*, 1953, p. 9
[18] The above discussion on the three definitions and their relationships is based on Institute of Ecosystem Studies, "Defining ecology," (n.d.); Golley, *A history of the ecosystem concept in ecology,* 1996; McIntosh, *The background of ecology*, 1985/1988; Bowler, *The earth encompassed: A history of the environmental sciences*, 1992
[19] It is worth noting that Lovelock's Gaia Hypothesis stretches the systems view (cybernetics) so far as to reintroduce the living organism view (one big super-organism). For more information on the Industrial ontology and its relationship to ecology and environmentalism consult Wilber, *A brief history of everything*, 2000
[20] Dodson, *Ecology,* 1998, p. 4
[21] Each definition is taken from Dodson, *Ecology,* 1998, p. 6; the representative question each approach would ask about a rural North American landscape is taken from p. 8; and the tools and techniques used by each approach to answer such questions is taken from p. 15.
[22] Dodson, *Ecology,* 1998, p. 3
[23] Dodson, *Ecology,* 1998, p. 7
[24] Much of the work towards a unified ecology has been done in the context of Hierarchy Theory, which has developed an increasingly complex epistemological position around perspectives. Consult Allen & Starr, *Hierarchy: Perspectives for ecological complexity*, 1982; Salthe, *Evolving hierarchical systems: Their structure and representation,* 1985; O'Neill, DeAngelis, Waide & Allen, *A hierarchical concept of ecosystems*, 1986; Allen & Hoekstra, *Toward a unified ecology*, 1992; Ahl & Allen, *Hierarchy theory, a vision, vocabulary and epistemology*, 1996
[25] Wilber, *A brief history of everything*, 2000, p. 2
[26] Second-person perspective is used here to include first-person plural pronouns: "We."
[27] Note all the examples given here are from the Lower-Right (systems) quadrant. I have chosen these examples since they quickly illustrate how these elements of Integral Theory can be applied to ecological and environmental considerations.
[28] "Worldcentric" is used to refer to the ability to take other human perspectives whereas "planetcentric" is used to refer to the ability to take human and non-human perspectives.
[29] This goal is accomplished through the use of the Integral framework including recognizing developmental waves and their holoarchical dynamics as well as Integral Methodological Pluralism. For an overview discussion of how these serve this integration, consult, Esbjörn-Hargens "Integral ecology: A post-metaphysical approach to environmental phenomena," 2006.

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