Locating Value in Nature

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Mark Cooper, B.A., Murdoch University

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Signed: …………………………………………………………..

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Author: Mark Cooper

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I, Mark Cooper declare that this dissertation is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any university.

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Abstract

The four purposes of this research project are: [1] to examine various approaches that have been taken to the concept of value in environmental ethics; [2] to show how many of these approaches have elements in common which can be understood as different expressions of the idea that nature possesses order and directionality; [3] to suggest an explanation as to why these qualities of order and directionality are often afforded value by people; and [4] to show how scientific concepts taken from systems theory and ecology can be used to justify the idea that the order and directionality of natural systems should be valued by people. My contention is that value, in the ethical sense, can be located in living systems' tendency to create a particular kind of order and directionality in themselves and their environment. This order is not a rigid kind of order, but a kind of order that allows for adaptation and flexibility – a kind of order that is sometimes described using the word *negentropy*.

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Introduction

Environmental ethics can be thought of as the extension of ethical consideration to the biosphere, or to the organisms and non-living things that make it up. Before the advent of environmental ethics, ethicists primarily concerned themselves with human affairs, or the interests of animals via comparisons drawn between animal and human characteristics. Environmental ethics takes into consideration entire ecosystems and the complex relationships between living and non-living beings. It has its origin in the environmental protection movement, but the inclusion of the biosphere as an ethical consideration has had widespread implications for many people working outside this field, including meta-ethicists and normative ethicists for whom the expansion of ethical considerations has opened up new fields of inquiry.

If an ethicist is asked a question like "What is a good life?" or "How should I act?", the answer will differ widely depending on the ethicist's theoretical viewpoint, but if ethical considerations were simply expressions of points of view, then ethicists would have little to talk about and any ethical system they put forward would be on shaky ground (Moore 3). Ethicists try to find meaningful criteria upon which to build and defend theories. They usually point to criteria that will allow for objects or ideas to be valued or evaluated in some way. If something is valued, if it has some importance, then ethical decisions can be made on the basis that that thing should be protected or promoted, often at the expense of something deemed to have less value or no value at all. Ethics shares with aesthetics this connection with value theory (Bahm 4). Here we are literally talking about "value judgements" (Orsi 8).

Many environmental ethicists, with their roots in the environment movement, have blamed the worldwide ecological crisis and related social ills on a failure to value the natural world (Naess 68; O'Neill 8). This seems intuitive – a rainforest is smashed to make way for a palm oil plantation because the forest is not seen as valuable. Some environmental ethicists argue that we should value the forest because of its practical importance – it filters the air and produces oxygen. Others argue that the forest has value "in its own right" or "in itself". Both of these points of view involve attributing some value to the forest in order that it should not be destroyed, but they are based on very different conceptions of value (Rescher 99). Debates about the most appropriate conception of value dominate the discourse among ethicists concerned with ecology. Differing conceptions of value can lead to differing answers to particular ethical questions and to different consequent actions.

Early environmental ethicists tended to emphasise the idea that nature or natural phenomena have value in themselves without there being any need to refer to any other standard of value. This is the idea that nature has intrinsic value (Lemos 20). The concept of intrinsic value will be investigated here. Other systems of value have been put forward, and some of them will be evaluated here too, alongside variations on the intrinsic value idea that stretch the boundary of what the word "intrinsic" can mean. I believe that the search for a coherent and functional system of environmental value theory is an important one with many social and political implications. After identifying useful aspects of other approaches I will defend one particular idea toward the end of this dissertation. I will point to the tendency, possessed by living things, to build *negentropy* – negative entropy – and suggest that this property can be used to locate value.

Since these concepts are taken from the science of thermodynamics (ideas like "entropy" and "negentropy" relate to the Second Law of Thermodynamics), my approach intersects with ideas put forward by ecological economists. I am advocating for an ecological theory of value, but this is not a theory of value in the economic sense, although to a person who accepted the theory it would probably have economic implications. This is a theory of value that might fall under the heading of axiology. That is, it relates to the meta-ethical question of what should be valued and why (Orsi 6). I will utilise ideas taken from ecological economics, and the field of ecology more generally, to propose a philosophical value theory that can be applied to the environment.

I will proceed by examining various approaches that have been taken to the concept of value in environmental ethics and I will propose that many of these approaches have elements in common which can be understood as different expressions of the idea that nature possesses order and directionality. I will suggest an explanation as to why these qualities of order and directionality are often afforded value by people and use scientific concepts taken from thermodynamics, systems theory and ecology to justify the idea that the order and directionality of natural systems should be valued by people. My contention is that value can be located in living systems' tendency to create order and directionality in themselves and their environment. This kind of order can be understood scientifically, and it can also serve as a way to understand just what it is about nature that is important and valuable.

Before proceeding it is important to define some terms. Environmental ethicists refer to various forms of value. For the purposes of this research project, "intrinsic value" is defined as value that an object has that depends exclusively on the intrinsic nature of that object. "Extrinsic value" depends on an object's relationship to another object or objects (Orsi 31). "Instrumental value" is value that an object has as a means to an end (Orsi 25-6). "Non-instrumental value" is value that an object has that is not related to its value as a means to an end.

In Chapter One of this dissertation, I will examine the utilitarian approach to ethics and how it relates to environmental questions. Utilitarianism is examined here because it was one of the first ethical schools of thought that extended ethical consideration to non-human beings. I will argue that utilitarianism's focus on the maximisation of utility for sentient beings makes the utilitarian approach to ethics unsuited to the problems that environmental ethicists seek to solve.

In Chapter Two I will focus on the ideas of Aldo Leopold, who was an important figure during the birth of the modern environmentalist movement. His emphasis was on particular qualities of natural communities of living beings. I contend that these qualities are examples of what I call *systemic values* – that is, value being afforded to qualities or attributes common to both individual beings and whole ecosystems, rather than just to the qualities or attributes of individual beings. This is an important break with earlier ethical traditions.

In Chapter Three, the ideas behind Arne Naess's Deep Ecology movement are understood as an extension of the ideas put forward by Leopold. Naess contends that nature has intrinsic value, and he posits a system of relationships between the attributes of ecosystems that supports his conception of intrinsic value. I contend that the attributes Naess points to are systemic values, similar to the values of Leopold. I also contend that Naess's conception of intrinsic value is conflated with non-instrumental value, limiting the usefulness of his approach.

Chapter Four is an examination of Environmental Virtue Ethics, with emphasis placed on the work of John O'Neill. O'Neill's work is useful because it offers a novel approach to the idea of intrinsic value. He posits an 'objective' version of intrinsic value, based on particular states-of-affairs in nature, which allows him to avoid some of the problems associated with other versions of intrinsic value. I argue that O'Neill's objective intrinsic value is essentially based on systemic values, and that his approach offers a way toward understanding what is meant when the word "intrinsic" is used to describe value. However, I am not convinced by his argument that objective states-of-affairs in the natural world should be evaluated subjectively.

Chapter Five introduces the pragmatist approach to environmental ethics. Pragmatists like Hugh P. McDonald and Anthony Weston have proposed environmental ethical approaches based on the work of John Dewey. Dewey contended that value is something that develops from a web of relations between different human understandings of the world. Dewey's pragmatism is generally understood to preclude the idea of intrinsic value, and some environmental philosophers have rejected pragmatism on the basis that a rejection of intrinsic value might lead to anthropocentric values that diminish the value of nature. Pragmatists have replied by suggesting that nature can be highly valued without value necessarily having to be intrinsic to particular beings or even to nature as a whole. I will suggest that the pragmatists' rejection of intrinsic value is not necessarily problematic, and that the pragmatist web of relations can be understood in terms of value being placed on diversity and coherence, qualities which I regard as systemic values.

In Chapter Six, I will put forward the idea that all of the ethical theories that point to the value of ecosystems are assigning value to what I have referred to as systemic values – concepts like integrity, stability, diversity and symbiosis. These qualities or states-of-affairs are studied by systems scientists, and I will examine the relationship between systems theory and environmental values.

Chapter Seven is a brief exploration of the relationship between systems science and thermodynamics. Living systems, including individual organisms and ecosystems, are self-organising, complex and adaptive to their environment. Their direction and order contrasts with the tendency toward collapse and decay that characterises the non-living world. This direction and order can be understood as negentropy, or negative entropy.

These scientific ideas may seem divorced from philosophical questions, but in Chapter Eight I point out that the systemic values that characterise many approaches to environmental ethics all represent value being placed on states-of-affairs that involve the maintenance or increase of negentropy in the natural world. Negentropy is associated with creativity and development. We humans are natural systems ourselves, and we seem to place value on creativity and development while regarding destruction and decay as undesirable.

I will conclude by proposing an ecological theory of value based on the concept of negentropy. I will situate my theory among other approaches to the idea of value in nature, to give it context and to show how it might be used as a guide to action. I believe that any worthwhile approach to environmental ethics must provide a useful guide to action.

Chapter 1: Animal Rights and the Problem With Utilitarianism

The first Western philosophers to systematically extend ethical consideration to non-human beings belonged to the tradition of utilitarianism (Singer 6-7). For this reason, it is important to consider utilitarian ideas and investigate their usefulness in dealing with questions of environmental ethics. Utilitarian arguments are frequently employed to defend the idea that animals should be afforded greater moral standing.

Utilitarians strive for the maximisation of utility. For hedonistic utilitarians, utility is defined as the absence of suffering or the presence of pleasure in the lives of sentient beings (Moore 63). Accordingly, an action is good if, of the available options, the action leads to the greatest possible decrease in pain or increase in pleasure for the sentient beings affected. Preference utilitarians urge the maximisation of the number of sentient beings who have their preferences fulfilled (Harsanyi 626). The focus on outcomes marks utilitarianism as a consequentialist ethical system – an action is a good action if it leads to maximised utility.

The idea that animals should be afforded greater moral standing appeared early in utilitarian thought. Jeremy Bentham, considered a founding figure, wrote the following:

> The day may come, when the rest of the animal creation may acquire those rights which never could have been withholden from them but by the hand of tyranny… What … is it that should trace the insuperable

> line? Is it the faculty of reason, or perhaps, the faculty for discourse?...the question is not, Can they reason? nor, Can they talk? but, Can they suffer? (311).

In more recent times, utilitarian arguments for the moral standing of animals have been put forward by Peter Singer and others. Utilitarian proponents of animal rights extend their consideration to any being that can experience pain and pleasure, or to any being that can have preferences (Singer 3). This is justified by way of analogy – if we value the pleasure, absence of pain in, or preferences of human beings, then we should afford value to the similar experiences of other beings which are able to experience pleasure, pain or preferences (Singer 13).

At first glance this approach seems suited to environmental ethics in that it extends consideration beyond the human. Indeed, the idea that non-human beings should be afforded similar standing to human beings is very common among advocates of environmentalism. However, the utilitarian approach of maximising utility is not very well suited to the ecological considerations inherent in environmental ethics, for three reasons: [1] It is difficult to use as a guide to action in complex environments, [2] It is focused on individual organisms – the utilitarian calculation is the sum or the average of individual beings' utility, [3] It is focused on a limited range of beings – sentient beings only make up a small fraction of the life on Earth.

For example, when considering a management policy regarding a rainforest, a utilitarian ethicist might point to the utility of the forest to its inhabitants, such as indigenous people and "higher" animals. She must decide on the type or types of beings whose preferences or wellbeing (in terms of utility) must be promoted. Much has been written on how the set of considered beings should be defined, but most utilitarians draw a line based on the degree of sentience possessed by a being (Singer 12). A rainforest serves as a home and as a life-support system to living beings, including sentient ones, so a utilitarian is likely to value the utility of a forest to its sentient inhabitants.

All of the elements of an ecosystem, sentient and non-sentient alike, are interacting. An ecosystem cannot be understood by isolating its constituent parts (Naess 78-80). A utilitarian can claim that utility for sentient beings is what is valuable, but she cannot use this as a guide to action in the context of an ecosystem. Even a seemingly small or insignificant action performed upon an ecosystem will cause the whole system to change (Drake *et al* 60-1). The relationships among species are so complex and interwoven that the consequences of an action are unpredictable (Drake *et al* 61).

The forest system includes non-living things, such as soil and water, and non-sentient life including plants and so-called “lower” animals. All of these are integral parts of the system, connected to the others in a web of relationships including symbiosis, predation and co-evolution. In the context of an ecosystem, valuing utility for sentient beings leaves us desiring particular consequences, but with no way to reliably determine which actions will facilitate or hinder those outcomes (O’Neill 110).

This unsuitability of utilitarianism for complex environments also manifests as a failure to account for the value that many people place upon the health and diversity of ecosystems, which are made up of multiple beings. Ecologists tell us that ecosystems are healthy and robust when they are diverse and complex. A utilitarian is focused on utility for individual beings, whereas most environmentalists will tend to emphasise the value of healthy communities (or ecologies) of living things. Indeed, a utilitarian ethical system can be employed to argue for industrial development which may be harmful to ecosystems, with value being placed on utility for human beings and none being placed on diverse ecosystems which might not contain many sentient beings, such as wetlands (O'Neill 102).

In a different type of scenario, animal rights activists may find themselves at odds with environmentalists when their utilitarian tendencies butt up against environmentalists' desire to destroy exotic pest animals for the sake of an ecosystem's health. This conflict might be especially difficult to overcome if a sentient species is destroying an ecosystem that contains few sentient constituents. An ecosystem that contains mostly plants and invertebrates may seem to be of little significance to a utilitarian, but ecosystems are interconnected, so the destruction of an ecosystem that contains few sentient beings, and might therefore be considered less valuable, can lead to damage to ecosystems or beings considered more valuable.

Issues of interconnectivity and unpredictability make it difficult to utilise utilitarian criteria as a guide to action, even if one is prepared to accept utility as the marker of value in the natural world. Then it is important to consider whether or not the value of a forest lies only in its usefulness to sentient beings. Many people would find it difficult to accept that plants and invertebrates are no more valuable than rocks or other non-living things. The utilitarians draw a boundary at sentience, which leaves no differentiation between a rock and a plant. In defence of plants, and in reply to Singer's work, Holmes Rolston III writes:

> A plant, like any other organism, sentient or not, is a spontaneous, self-maintaining system, sustaining and reproducing itself, executing its program, making a way through the world … Something more than merely physical causes, even when less than sentience, is operating within every organism. There is *information* superintending the causes; without it the organism would collapse into a sand heap ... In nature there are, if we consult physics and chemistry, two kinds of things, matter and energy; but if we consult biology there is a third thing: information (250).

There is something about life that is valuable. It seems to have something to do with the complexity, or amount of information in living things. Concepts like complexity and the information content of living things will be important in Chapter Seven this dissertation. Sentience cannot be the only criteria of inclusion when considering living things – there has to be a "level" between a rock and a sentient being. A rock is very simple. A plant is not. And a plant is part of an ecosystem that supports sentient and non-sentient life alike.

The next four chapters are an investigation of ethical theories that have developed since the modern science of ecology was developed, so they are informed by an understanding of the interconnectedness of ecosystems. Utilitarianism seems unsuited to ecological questions, at least in its standard "act utilitarian" form. An examination of its unsuitability reveals some elements that must be required of an environmental ethical system; it must be able to cope with ecosystems that are interconnected and unpredictable, it must be a guide to action in this ecological context, and it should value the qualities that environmentalists point to, like diversity and complexity and ecosystem health. These qualities, these *systemic values*, will be important throughout the remainder of this dissertation.

Chapter 2: The Land Ethic and Systemic Values

The idea that non-human beings should be afforded ethical consideration has a long history, but environmental ethics as a distinct field with an ecological focus has its origin in the years immediately following World War II. At that time nature conservation movements were becoming aware of the rapidly developing science of ecology and a synthesis of conservation and ecology was occurring. What we think of today as environmentalism was developing. The pre-war conservation movements had been motivated by aesthetics and the desire to preserve hunting stocks. A synthesis with ecology led to a different way of viewing nature, with human beings being seen as part of a community of beings rather than as rulers or stewards of the land.

The thinking at that time is best exemplified by the American author Aldo Leopold's 1949 book, *A Sand County Almanac.* Leopold's writing retains the pre-war conservationists' preoccupation with the beauty of nature, but his book is also an ecologist's manifesto for what he calls a 'Land Ethic'. Leopold was trained as an ecologist rather than as a philosopher, but his book combines science with aesthetics and ethics. Prefiguring later environmental ethicists, he seeks to formulate an ethic which values ecosystems. To do this, he points to the kinds of qualities I have referred to as systemic values. The most well-known formulation of the Land Ethic reads as:

> A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise (262).

Here, the systemic values are integrity, stability and beauty. Like diversity, complexity and ecosystem health, they are attributes that an ecosystem can have, but they are difficult to measure or define clearly. Some of these systemic values are interchangeable – integrity and stability might equate with health in this context. Some of them represent things that can be understood in more than one way depending on which sense of a word we choose to employ. For example, stability might refer to a stable number of organisms, or a stable system that does not fluctuate, or a system that fluctuates but maintains its integrity in the long term. We know that ecosystems display a kind of stability and integrity (Kondoh 624-9), but we don't know precisely what kind of stability and integrity we are talking about when we attempt to locate value.

One is left with the feeling that there is something that Leopold is trying to "get at" when he uses nebulous terms like stability and integrity. There is something important there, but Leopold does not precisely name it. However, Leopold's contribution to environmental philosophy is important, because his Land Ethic is focused on 'the biotic community', rather than individual beings. Here, 'biotic community' refers to ecosystems understood as a community of beings (Leopold 239-45). Value is located in particular states-of-affairs or qualities in an ecosystem. This is an important break with previous ethical traditions. This focus on a community of beings could only have come about with the advent of ecology, which provided the understanding that living things do not, and cannot, live in isolation.

While Leopold does not tell us why he chose his three values – integrity, stability and beauty – it is worthwhile to speculate as to why he chose these, as environmentalists often point to these systemic values when trying to locate value. It seems necessary to understand what they really are and what they really mean. Two of Leopold's values – integrity and stability – seem quite relevant to ecosystems that are interconnected and unpredictable. A dynamic, complex system of parts is always in some danger of coming apart, especially if perturbed by an outside influence such as human interference, so integrity and stability seem like wise things to value. The third of Leopold's values – beauty – is a notoriously difficult quality to define, but it is very relevant in discussions of environmentalism.

Many people speak of an appreciation for the aesthetic value of the natural world. The idea of natural beauty will be examined in Chapter Six, but firstly it will be useful to look at the work of Leopold's most famous intellectual descendant. Natural beauty is often associated with a spiritual aspect to interactions with nature. The next chapter is about the work of Arne Naess, a philosopher who emphasised the value of natural landscapes as a direct experience – a kind of "coming home" to the natural world (Naess 53-4).

Chapter 3: Deep Ecology and Intrinsic Value

The Norwegian philosopher Arne Naess was influenced by Aldo Leopold's ideas and combined them with concepts drawn from Heidegger, Spinoza and East-Asian Buddhism to argue for the necessity of a greater understanding of the close relationship between all beings, including human beings. He referred to his philosophy as 'Deep Ecology', to distinguish it from shallow ecological concerns like the conservation of particular resources.

To Naess, ecology offered a way to think about the world which did away with the distinction between human existence and nature, with the word "nature" being used here in the broadest sense possible. Human beings are an aspect of the world, according to Naess's understanding. They are not beings that live "in" or "on" the world, they are entirely integrated with it, along with the world's other inhabitants (Naess 8). Naess argued for a non-anthropocentric world-view – a world-view that expands 'the self' to include the beings that make up one being's ecological context.

In his book *Ecology, Community and Lifestyle,* Naess suggests that the adoption of his ecological ontology leads to a natural tendency to value nature. If the self is expanded to include a person's ecological context, then to harm one's ecological environment is to harm oneself (Naess 84). Naess does not attempt to construct an ethical system *per se*. In fact, he actively avoids this by focusing on the need to realise the 'ecological Self'. To quote Naess, 'Ethics follow from how we experience the world' (Naess 19). If we accept our true nature, and experience the world through that understanding, then we will value and protect ecosystems.

However, despite his focus on ontology, Naess did write about value. In Chapter Three of *Ecology, Community and Lifestyle,* entitled "Fact and Value", he suggests that environmentalists should prioritise their key values by creating a pyramidal structure with what Naess calls 'derived norms' at the bottom and 'non-derived norms' at the top (68). There is a clear assertion that some values are more fundamental than others, and that the less fundamental values support the fundamental ones. Naess suggests a 'top norm', which is Self-realisation – the realisation of the ecological Self (197). The ecological Self is a being that identifies with its ecological context to the point where the distinction between any constituent organism and its ecological context is blurred or even abandoned altogether.

In Chapter Eight, entitled "The Systematisation of the Logically Ultimate Norms and Hypotheses of Ecosophy T", Naess constructs a 'pyramid' of norms that connect the idea of Self-realisation to values that I would describe as systemic values – he points to diversity, complexity and symbiosis (200). Starting from his top norm of Self-realisation, he works through three hypotheses (which are distinct from the norms): [1] 'The higher the Self-realisation attained by anyone, the broader and deeper the identification with others', [2] 'The higher the level of Self-realisation attained by anyone, the more its further increase depends on the Self-realisation of others', [3] 'Complete Self-realisation of anyone depends on that of all'. This leads to a second norm, 'Self-realisation for all beings'. Diversity, complexity and symbiosis are seen as norms which support these first two norms. They support the first two because they increase the potential for Self-realisation (Naess 200-4).

An ecosystem that displays diversity, complexity and symbiosis will provide the potential for Self-realisation to the beings that constitute the ecosystem. A system that displays less of one of these may provide less potential (Naess 202). Diversity, complexity and symbiosis do not exist in isolation – they are interrelated aspects of an ecosystem. Symbiosis represents the way the potentials of beings, including their potential for developing their diversity and complexity, are dependent on each other (Naess 201).

The norms of diversity, complexity and symbiosis – all of which are systemic values – are, according to Naess, a kind of support structure for the norms of Self-realisation and Self-realisation for all beings. The systemic values are important because they facilitate the norms of Self-realisation – they are instrumental in the fulfilment of the higher norms. Self-realisation and Self-realisation for all beings are not 'derivable' because they cannot be purely instrumental in the fulfilment of other norms (Naess 197). Naess contends that these two norms of Self-realisation have *intrinsic* value (199). To him, this means that they have value that is non-derived.

Then Naess's reasoning seems to follow this line – if Self-realisation is complete identification with the natural world and Self-realisation has intrinsic value, then it follows that the natural world has intrinsic value (199). This is only logical if Self-realisation *is* the natural world. If one accepts Naess's blurred boundary between subject and object, and the idea that Self-realisation is the highest 'norm', then this idea might seem reasonable.

Proceeding from the idea of Self-realisation as identification with the natural world, Naess derives what is probably his most famous piece of writing, *The Platform of the Deep Ecology Movement* (co-written with George Sessions). This is basically an eight point manifesto, but I will focus here on the first point only:

> The flourishing of human and non-human life on Earth has intrinsic value. The value of non-human life forms is independent of the usefulness these may have for narrow human purposes (29).

As with Naess's reasoning regarding his norms, the distinction he is making in *The Platform* is between intrinsic and instrumental value. This accords with the basic environmentalist desire to prevent nature from being reduced to a source of raw materials with instrumental value only.

The idea that nature has intrinsic value has become the most widely known aspect of Naess's work. Despite his focus on ontology, this normative idea has spread far and wide among environmental activists and become an important part of environmental ethics. The attainment of Naess's ecological Self-realisation might seem like a high bar (or even mystical nonsense to some), but most environmentalists agree that nature has more than mere instrumental value.

However, intrinsic value is not the opposite of instrumental value. The opposite of intrinsic value is extrinsic value, and the opposite of instrumental value is, unsurprisingly, non-instrumental value. To avoid confusion, it is important to understand and use well-defined terms. According to G. E. Moore's widely accepted definition:

> To say a kind of value is "intrinsic" means merely that the question whether a thing possesses it, and in what degree it possesses it, depends solely on the intrinsic nature of the thing in question (260).

Following from Moore, value that a thing possesses is extrinsic value if that value is dependent on the thing's relationship to another thing or things. As discussed in the introduction to this dissertation, instrumental value is value that a thing has as a means to an end. Non-instrumental value is value that a thing has that is not related to its value as a means to an end.

If these definitions are accepted, then Naess can be accused of having conflated intrinsic and non-instrumental value. His philosophy is actually stressing nature's non-instrumental value without pointing to what it is in the nature of Nature that affords it intrinsic value. In Naess's system, systemic values are identified, but then relegated to instrumental (and extrinsic) status, as a support structure for 'higher norms'. This does not preclude them from having intrinsic value, but Naess does not assign them any. All Naess seems to do in the end is assert that nature has non-instrumental value. The 'higher norms' seem to be assigned intrinsic value, but they are assertions about the world, not things that can be readily identified in the natural world.

According to the British academic John O'Neill, the term "intrinsic value" gets used in three different senses in the work of environmental ethicists. These three senses have different meanings, and only one of them corresponds with the widely accepted definition of the term. Firstly, intrinsic value is often used as a synonym for non-instrumental value –

this is the sense that Naess employs. Secondly, the term might refer to the value an object has by virtue of its intrinsic properties – this is the sense corresponding with Moore's definition. Thirdly, it is sometimes used to mean objective value – value that does not depend on any valuer performing a valuation (O'Neill 9).

It is possible for a thing to have more than one type of value, and some might argue that nature has intrinsic value in all three of O'Neill's senses. However, O'Neill contends that most environmental ethicists tend to employ only one or two senses, although they may conflate them (O'Neill 10). The tendency to conflate non-instrumental value with intrinsic value in the Mooreian sense is quite common, according to O'Neill. Naess's non-anthropocentric philosophy might seem to allow for the idea that nature has intrinsic value in the objective sense, but his project involves blurring the distinction between subject and object. O'Neill focuses specifically on objective value in his own work.

Chapter 4: Environmental Virtue Ethics and Intrinsic Value

In his 1993 book *Ecology, Policy and Politics,* John O'Neill supports the idea that nature has intrinsic value, but his approach is very different from that taken by Naess and the deep ecologists. His project is motivated by a desire to include non-human beings and future human generations in political and economic considerations. His approach to ethics is Aristotelian, and he points to human virtue as a basis for his ethical approach. He is one of many environmental ethicists who have embraced Environmental Virtue Ethics.

Virtue ethics is an approach to ethics, usually associated with Aristotle, that emphasises virtues, or moral character, in contrast to approaches which are based on rules or duties (deontology) or those which emphasise the consequences of actions, such as utilitarianism (Van Hooft 16). Virtue is understood to promote *eudaimonia*, or flourishing. Virtues are learned as skills, developed over time, through the gaining of practical wisdom (Van Hooft 66). The application of virtue ethics to environmental ethics is an appealing idea – the learning of virtues that lead to the flourishing of beings seems like an appropriate thing for an environmentalist to believe in.

O'Neill's ideas about value are focused on his third possible sense of the term "intrinsic value" – that is, objective value. He identifies value that is not dependent on human valuers. He reasons that all living things can either flourish or suffer the opposite through harm or misfortune. In this sense, all living things have a 'good' or at least a set of conditions that is good for them. Social groups and entire ecosystems also have a 'good' – although they do not possess a life in a literal sense, they can flourish to varying degrees. This good is independent of human observers. It is an objective good. It might be thought of as objective value (O'Neill 19-22).

However the act of choosing whether or not to value an objective good is an important part of O'Neill's approach (O'Neill 22). The objective goods are just states of affairs in the world. Just because the flourishing of a particular living being or system can be promoted, doesn't mean it should be promoted. O'Neill uses the example of a virus. A virus has an objective good independent of human observers, but human beings may choose not to value this good because the virus is injurious to human flourishing (O'Neill 23). O'Neill believes that objective value exists, but that it does not compel human actions unless a person chooses to give importance to it.

O'Neill contends that human flourishing 'requires a breadth of goods' (24). A healthy relationship with a large number of flourishing non-human beings and ecosystems is an integral part of a good human life. A small number of exceptions have to be made for beings that are actually injurious to human well-being, but for the most part the relationship between human beings and nature should be like the relationship between friends. Friends are valued for their own sake, not for any benefits they may bring, although they do bring many benefits. A life filled with friends is a richer, more fulfilling life. So too is a life richer, and closer to *eudaimonia,* when it is filled with a breadth of natural goods (O'Neill 23-4). O'Neill suggests that human beings should learn the skills – the virtues – that will allow them to recognise and value natural goods.

The natural goods have objective value, which represents a kind of intrinsic value. However, this intrinsic value must be recognized and valued by a person to be important in an ethical sense, according to O'Neill. O'Neill's ethical system can cope with complex ecosystems by treating them as entities that have a good of their own – the good of the ecosystem is not reducible to the goods of the constituent beings, so the problems associated with approaches like a utilitarian calculation are avoided (O'Neill 23). As a guide to action however, O'Neill's system may be limited by its dependence on human evaluation of the objective goods in nature.

Environmental virtue ethics is dependent on the learning of virtues which promote the understanding and valuing of the natural world. O'Neill introduces the idea of a kind of intrinsic value possessed by the natural world, but this value is dependent on human choices which may be subjective. Meaningful valuations are dependent on human beings and their skill-set of environmental virtues. As the virtues are not specified, the value of O'Neill's ethical approach as a guide to action is limited.

The most useful aspects of O'Neill's approach are his clarification of the different uses of the term "intrinsic value", and his suggestion that there is value, intrinsic to identifiable aspects of nature, that does not depend on the presence of an observer. O'Neill's objective goods are based on the idea that both living things and ecosystems can either flourish or experience harm. This is true of living things, and it is also true of ecosystems because they require particular conditions in order to exist and their requirements may differ from the requirements of their constituent organisms. As was pointed out in Chapter One, the interests of organisms and the interests of ecosystems are not one and the same. O'Neill points out that, 'the goods of collective entities are not reducible to the goods of their members' (21).

This irreducible quality of ecosystems will become important in Chapter Six. The important point that O'Neill makes is that both individual organisms and ecosystems have objective goods that can be thought of as value. These objective goods are states-of-affairs that encourage what might be called health. An organism can be healthy or unhealthy, and so can an ecosystem (O'Neill 21). In both cases this health is dependent on qualities such as the integrity and stability of the entity in question. In other words, upon analysis, the basis of O'Neill's intrinsic value is valued qualities that are common to both individual organisms and ecosystems, and these qualities are systemic values. They are systemic values because they do not just occur in individual beings, but in collectives as well. The objective goods can equate with ecosystem health, stability, integrity and other qualities that have been pointed to by ecologists as indicators of health, such as diversity.

O'Neill does not explore the essential nature of the objective goods he points to. He simply accepts that beings flourish when in particular states and uses this idea as a basis for his version of intrinsic value. I have suggested that this limits his approach in terms of it being a guide to action, but to be fair, it can be argued that O'Neill never pretended to locate value in nature in a way that can facilitate decision-making. The ideas presented here are from the early part of *Ecology, Policy and Politics,* and O'Neill seeks to facilitate decision-making through political structures that he recommends in the latter part of his book. In the early sections he seems content to have shown that a particular form of intrinsic value exists in nature before moving on to social and political concerns.

Arne Naess's philosophy seems at first to locate intrinsic value in nature in the Mooreian sense, which could provide a guide to action through judgements based on a valued characteristic of ecosystems or beings, but then his approach proves to be an extended argument for nature's non-instrumental value. O'Neill's intrinsic value does not seem very valued in its own right, being dependent on evaluators that have learned how to live skillfully in their ecological context. Some thinkers argue that there is no particular advantage in looking for intrinsic value in nature, and it is to a school of thought that de-emphasises intrinsic value that I turn next.

Chapter 5: The Pragmatist Approach

The proposals put forward by philosophers such as Hugh P. McDonald and Anthony Weston represent a reaction against foundationalist approaches to environmental ethics. Many environmental ethical theories, especially the ones I have mentioned in Chapters Two to Four, are based on the idea that there is a foundational value which is not inferred, from which other values can be inferred. Any ethical system based on the idea of intrinsic value or a strong central principle is foundationalist (Timmons 596). McDonald and Weston offer up the American pragmatism of John Dewey as the basis for an environmental ethics that does not rely on intrinsic value, or prescriptive principles like the Land Ethic.

Dewey held that all justified values are derived from other values, so there are no ultimately foundational values, and that a hard distinction between ethical 'ends' and 'means' represents a failure to take into account the interrelated nature of different values (Dewey 297). In his *Experience and Nature*, he suggests that a useful value theory:

> … will have to recognise that natural termini (ends) are as infinitely numerous and varied as are the individual systems of action they delimit … It must recognise that limits, closures, ends are experimentally or dynamically determined, presenting, like the boundaries of political individuals or states, a moving adjustment of various energy-systems in their cooperative and competitive interactions, not something belonging to them of their own right (298).

Dewey points out in the same book that in ancient Greek thought, 'we find no room for a theory of values separate from a theory of nature' (295), and he suggests that, while avoiding the ancient Greek idea that nature has ends that represent perfection, modern thinkers should avoid value theories that separate values from events and objects that exist in the physical world (295-8).

To Dewey, values are only justified if they join together to form a kind of coherent whole. Hugh McDonald has called this coherent whole a 'web of relations in moral deliberation' (McDonald 125). In this formulation, objects have no value in themselves and they gain value by being deliberated upon in the context of all relevant information about existing sets of values, physical events and changing circumstances (Dewey 295-6). Dewey's pragmatic approach to value is coherentist. Values are justified when they cohere with each other to form a useful whole that can serve as a guide to moral action. This coherence involves logical consistency at a minimum, and real-world practicality is especially important (Dewey 314). Right away it can be seen that intrinsic value has no place in this scheme, at least not in the sense of value with no need for justification. In Dewey's value theory, any value that an object has is to some extent extrinsic, being dependent on the object's relationship to other objects.

Adopting Dewey's approach, Anthony Weston suggests that environmental ethicists should avoid being wedded to the notion of intrinsic value. He points to three specific aspects of intrinsic value in order to critique the idea: [1] It is self-sufficient – a thing with intrinsic value has value that is independent of its relationship to other things (Weston 324), [2] It is abstract – a thing with intrinsic value is 'special' and abstracted from ordinary things with inferred value (Weston 324), [3] It has to be justified in 'special ways' – a thing with intrinsic value must have that kind of value for non-arbitrary reasons. That is, its special status must be 'grounded' and justified in some way (Weston 326). This could refer to ideas like Naess's pyramid of norms or O'Neill's subject-dependent objective value.

Weston casts doubt on the idea that an ethical system must include a type of value that can exist as a self-sufficient 'end' in itself with no reference to other values. He suggests:

> We can … understand the notion of instrumental value by reference to further, but non-intrinsic values. Values may refer beyond themselves without ever necessitating a value which must be self-explanatory (328).

This would mean that there is no need to justify any particular intrinsic values in 'special ways'. Here, ethical decision-making must be done through deliberation and the examination of particular values in particular contexts – that is, on a "case-by-case" basis. Context depends on the relationships between interdependent values. This reliance on a 'web of relations in moral deliberation' is characteristic of pragmatism.

Hugh McDonald points to John Dewey's 'holism' (McDonald 124-6) and his naturalism to make a case for an environmental ethical theory based on pragmatism. The holism that McDonald refers to is evident in Dewey's interrelated, relationally-determined values. McDonald compares their relational quality to the relational quality of ecosystems:

> Moral considerability … is not grounded in acts alone, but involves consideration of a number of elements. These elements form their own web of relations in deliberation just as natural elements form a web of relations in an environment (125).

Here, importance is placed on the relationships between things, and a wide net is cast for relevant values that must be considered. Dewey's approach seems relevant to problem-solving in an ecological context where many interacting factors have to be considered. McDonald extends the idea, recommending that a wide variety of environmental values be included in a web of relations that can be used to solve environmental ethical problems, with the interrelated values representing the interrelated elements of the natural systems being considered (McDonald 125).

In an ecosystem, a complex web of cause and effect means that all of the beings constituting the system are interdependent. If one chooses to infer the value of constituent beings according to their extrinsic value to other beings rather than any intrinsic value, then every constituent being, including a human being, still has value due to its "contribution" to other beings which have value due to their own contribution. Here, none of the beings have intrinsic value in the isolated, Mooreian sense, although they may possess value in the non-instrumental or 'objective' sense. All of them will have extrinsic value. Arbitrary attribution of intrinsic value is unnecessary. Intrinsic value is not necessarily a "higher" or more important form of value than extrinsic value (Orsi 27-31), so a viable set of values might be built around this relational approach. The extrinsic value afforded by relationships can be sufficient, according to the pragmatist environmental ethicists, to justify the value of nature.

Dewey referred to his philosophy as a form of scientific naturalism. In the general sense, scientific naturalism is the idea that 'reality is exhausted by nature, containing nothing supernatural, and that the scientific method can be used to investigate all areas of reality' (Papineau par. 1). Dewey's naturalism includes the idea that human beings are an integral part of nature, with the distinction between subject and object being one of useful convention rather than one of ontological significance (Dewey 380-82). This strong identification with nature marks Dewey's ideas as being compatible with the ideas of the environmental movement, according to environmental pragmatists (McDonald 67-8).

Critics of the pragmatist approach have claimed that it leads to an anthropocentric idea of value that is too dependent on the deliberations of human beings (Samuelsson 414). They argue that by rejecting the idea of a foundational value, pragmatists make the valuing of nature dependent on the choices of the particular people that might be involved in discussions of particular environmental issues. This groundlessness might be thought of as a natural outcome of coherentism, but the criticism may be countered by the argument that there is something that pragmatists, and particularly pragmatist environmental ethicists, are pointing to as having special importance – that is, coherence.

Dewey's value theory involves the collaborative construction of logical and coherent systems of value from diverse values, and these values are not necessarily subjective ideas, separated from events in the world – they can be valued events or things. The pragmatist environmental ethicists believe that this approach can be "mapped on" to the diverse set of beings that can be valued when considering natural environments (McDonald 125). Their approach is to accept and value diversity while attempting to reach a coherent view of the value of the various aspects of natural systems being considered. A coherent and accurate mode of thinking about an ecosystem is an understanding of how the different elements interact, and how they form a coherent whole. Systemic values are in evidence – value is identified with the diversity and coherence of ecosystems.

I suggest that the lack of foundational values in the pragmatist approach to environmental ethics does limit its usefulness as a guide to action, because it does leave ethical decisions up to particular groups of people in particular situations. However, its emphasis on sets of relationships – sets of relationships characterised by coherence and diversity – gives it an ability to include considerations of complex natural environments. Coherence and diversity are systemic values, along with complexity, stability, integrity and symbiosis. These things are valued in all of the approaches to environmental ethics that have developed since the advent of modern ecology. In the next chapter I will investigate these values further.

Chapter 6: Science and the Systems View

The systemic values are qualities displayed by both individual beings and whole ecosystems. They characterise the environmental value theories that have come into existence since the advent of the science of ecology. All of them are important in another branch of science that has become closely associated with ecology – *systems theory*. Systems theory is radically different from other branches of science, especially in its treatment of nature. This chapter is a brief exploration of the relationship between the systemic values, science and the systems-based view of life.

Some environmentalists see in modern science a tendency to objectify and compartmentalise the natural world, and to ignore its cultural and spiritual importance (Spretnak 41). Criticism of the scientific world-view, and its manifestation in scientific naturalism, is relatively common among environmentalists, even among some who make appeals to the science of ecology. Some see science as being partially or even wholly responsible for our treatment of the natural world as a source of materials and a sink for pollutants, as opposed to a home for living beings (Spretnak 38-41).

This suspicion directed at science seems to have its origins in two factors – the use of technology to “subdue” and exploit the natural world (Spretnak 128-9), and the methods of Western science which emphasise the conceptual breaking down of objects of study into their constituent parts. An emphasis on analysis has allowed science to expand human knowledge exponentially over the last few centuries, but some fear that by emphasising analysis, modern science has neglected processes which involve synthesis and wholes (Capra & Luisi 23-4).

In the early nineteenth century, the scientist Simon Pierre Laplace claimed that given sufficient knowledge of the positions and velocities of all the fundamental particles in the universe, a sufficiently intelligent being could compute the universe's entire future and past (Kauffman 14). This is a form of determinism, coupled with an idea that has been called *reductionism*. Reductionism (in a scientific context) is the idea that the phenomena in the universe can be explained by conceptually reducing objects under investigation to their parts (Capra & Luisi 24).

For many scientists up until relatively recent times, there existed a kind of hierarchy of scientific "purity" based on the practice of understanding objects of study through studying their constituent parts. "Messy" or inexact sciences like ecology were regarded as the least pure, with biology being a little purer. Biology could be reduced to biochemistry, with understandings becoming more exact and therefore purer. Biochemistry could be reduced to physical chemistry, and physical chemistry to physics (Kauffman 10-11).

Science is highly regarded as a source of knowledge in modern culture. The environmentalists who have implicated science in the destruction of nature point to scientific reductionism as having led to a cultural divide between human beings and nature. Reductionism, they argue, leads to 'nothing but-ism' (Kauffman 15) – the idea that nature is "nothing but" a collection of particles, or nothing but a collection of forces and materials. If any being, including living beings, is completely understandable in isolation or by analysing its parts, then once a being is reduced to a collection of understood objects, it is regarded as a well-understood object that contributes to human knowledge and nothing more. The objection is that this reductionist world-view leaves little room for values (Spretnak 220). There are objects and there is knowledge about those objects, but there is nothing to stop those objects from being used for any purpose. Here lies the problem that leads to the use of technology to exploit nature.

The sciences of ecology and systems theory are relative newcomers to the scientific world, having only existed since the early twentieth century, and even then having taken many years to develop into their current form. As was discussed in Chapter Two, ecology was instrumental in the development of what we now call environmentalism, engendering a way of thinking about the natural world that emphasises "communities" of beings. At roughly the same time as ecology was developing, a new science called systems theory was developing (Capra & Luisi 63). Systems theory, I will argue, offers a way toward introducing value into a naturalistic and science-based view of the natural world with the idea of a community of beings at its centre.

Systems theory started as a way of understanding phenomena that are dynamic and not easily understood by breaking the object of study down into parts. Initially, systems theory was a branch of engineering, growing out of the school of thought known as *cybernetics* (Capra & Luisi 87-9). Cyberneticists studied objects like self-governing machines – machines that introduce some of their output back into their input in a process known as *feedback* (Capra & Luisi 89-91). Feedback can allow a machine to control itself to some degree. A classic example is a water heater controlled by a thermostat. Water temperature determines the operation of the thermostat and the thermostat controls water temperature, creating a feedback loop that keeps water at a steady temperature without the need for outside governance.

The thermostat combined with the water heater is an example of a *system.* A system is a non-random set of things with co-acting components working together as parts of a mechanism or an interconnecting network (Laszlo 30). This can be contrasted with a *heap*, or an unconnected collection of things (Laszlo 30). The focus of a systems scientist is on the behaviour and characteristics of systems, not on the characteristics of their isolated components, although the nature of the components will affect the nature of the system. In the case of the temperature-controlled water heater, a systems scientist would not be primarily interested in the nature of the thermostat or the heating element. She would focus on the way the system is able to regulate its own temperature when all of the system's components are in place.

The systems-based approach proved to be very useful in fields outside engineering. The biologist Ludwig von Bertalanffy adapted it to problems encountered by scientists trying to understand the behaviour and anatomy of living things (Capra & Luisi 85-7). A living being exhibits behaviours that cannot be understood by examining its anatomy, or by breaking it down into its component parts. If a scientist wishes to understand these behaviours, she must study the whole organism. Even if she does this, it is difficult to understand the behaviour of a living being outside of its natural habitat.

Von Bertalanffy developed a General Systems Theory that described characteristics that could be observed across many different types of natural systems, from single cells to the bodies of animals to the ecosystems formed when multiple organisms interact. These phenomena are formed from sets of things working together. The body of an animal is a system of cells working together. An ecosystem is a system of organisms and non-living things that are interdependent. The behaviours of these systems are only evident when the components are assembled together. These behaviours are described as *emergent* (Capra & Luisi 133).

General Systems Theory explains emergent behaviour as being the result of feedback loops (Capra & Luisi 95-6). A living thing is a vastly more complex system than the cyberneticists' self-governing machines, but it can still be understood as a system that is governed by feedback. In the case of living things, the feedback loops are numerous, and they interact, creating complex behaviours (Capra & Luisi 95). A simple example of feedback in a living thing is the ability of warm-blooded animals to maintain their internal temperature by sensing their own skin temperature and then increasing or decreasing their heat-generating metabolism to compensate.

An example of feedback in ecosystems is the predator-prey relationship. The population of a prey species is a function of food availability, fertility and predation rates, while the population of a predator species, and therefore predation rates, is dependent on fertility and prey populations. This circular relationship serves to balance populations at levels consistent with the food supply. Complex matrices of feedback processes like this are the stuff that ecosystems are made of, and they also characterise the processes that allow living beings to maintain their internal organs and metabolism (Capra & Luisi 91). The ability of natural systems to self-organise and display "useful" emergent behaviours, such as population regulation or metabolic stability, is referred to as *autopoiesis* (Capra & Luisi 134-5).

At the core of the systems-based approach is an abandonment of reductionism. Stuart Kauffman, a widely-cited systems scientist working in the field of biology, has declared that:

> Biology is really not just physics. Nor are organisms nothing but physics … Life is emergent with respect to physics (43).

The importance of this simple statement cannot be overstated. It represents a break with a tradition that has existed in the sciences since the time of Isaac Newton – the idea that everything can be understood in terms of fundamental physical principles. The concept of emergence allows for a world-view that does not disregard the laws of physics – emergence and systems theory violate no physical laws (Kauffman 41) – but this world-view places a limit on the ability of the laws of physics to explain some phenomena.

Evolution can be understood as a feedback-driven process – living things adapt to changing environments, causing them to change those environments by changing the things they do and the things they consume and excrete. This forces them to adapt to a changed environment once again. Ecologists have embraced systems science as one of the best tools for understanding ecosystems and how they evolve over time (Capra & Luisi 345-6). As a tool in ecology, systems theory presents an entirely different approach to that of the so-called hard sciences. By focusing on emergent rather than constituent phenomena, it can deal with ecosystems that are difficult to analyse.

Systems ecology can provide a simple set of concepts that describe how highly complex systems develop. Living systems are *open systems* – they have a boundary, such as a skin or a membrane or a natural barrier, but they also exchange matter and energy with their surrounds, including other systems (Capra & Luisi 133-4). One system's output can be another system's input, which allows for complex arrangements of systems within systems. Feedback loops can form between systems, creating meta-systems, and so on.

Living systems are regarded as *complex adaptive systems* (Laszlo 106) – they are made of a complex arrangement of sub-systems, and they adapt to their environment by means of feedback loops that extend beyond their boundaries. Not all complex adaptive systems are living systems but all living systems are complex adaptive systems – they adapt to their environments and they self-organise and self-maintain.

As an important component of ecology, systems theory often plays a role in contemporary environmental debates, but this is usually in discussions of epistemology and ontology rather than ethics. This is understandable given that systems theory is a science, and given that science is generally regarded as value-free. However, a few environmental philosophers working in the Deep Ecology tradition have seized upon the concept of complex adaptive systems as a way to combat reductionism while updating Arne Naess's concept of the ecological Self.

Deep Ecologists like Warwick Fox and Freya Mathews have suggested that systems ecology's nested systems can be understood as an expression of the intimate relationship between all beings on Earth. This collective can be described as a community that is, quite literally, greater than the sum of its parts, having the ability to self-organise and exhibit its own identity. Mathews attributes value to this entity. She describes 'self-maintaining systems' as having value due to their 'self-hood' as beings that create their own identity (Mathews 107-16). Fox suggests that it might be possible to formulate an 'autopoietic ethics' that attributes value to systems that strive to create and maintain themselves. He argues that their self-organising capacity designates them as 'ends in themselves' (Fox 172-3). I do not see self-organisation as being valuable in the intrinsic sense that is put forward here – it seems more like another expression of coherence or integrity.

Coherence, diversity, complexity, stability, integrity and symbiosis are the qualities exhibited by complex adaptive systems that describe how they self-create and self-maintain. When Aldo Leopold writes about integrity and stability, one might ask to what kind of integrity and stability he refers. He is referring to the integrity and stability of complex adaptive systems, although he would have been unlikely to have heard the term in 1949. When he refers to beauty, one might think that scientific concepts would fail to supply any insight, but complex adaptive systems have an interesting relationship to aesthetics.

Natural processes can produce intricate patterns and structures through the repetition of simple events over time. This repetition is the result of feedback in natural systems. If the feedback is *nonlinear* – if energy or materials travelling from the output of a system to its input are changed in some way – then the system in question may become unstable (Capra & Luisi 105-6). The system may collapse, it may become chaotic, or it may exhibit a kind of order at the “edge “of chaos. Systems at the edge of chaos can produce patterns called *fractals* that are often regarded as beautiful (Capra & Luisi 116-25). Examples of fractal patterns include the branching of trees, the intricate patterns of veins in a leaf, the multi-coloured tentacles of a sea anemone, or the arrangement of petals in a flower.

Complex adaptive systems have evolved to exist at the edge of chaos. This may seem like a precarious existence, but it allows these systems to achieve a kind of stability and integrity that is not available to systems with rigid, overly stable characteristics (Laszlo 106-7). Living systems must be flexible in order to maintain themselves in changing environments. An existence at the edge of chaos produces diversity in a system’s structure and behaviour, which becomes important when adaptation requires a novel structure or behaviour (Laszlo 107).

Complex adaptive systems are coherent, diverse, complex, stable, integral, often symbiotic and they self-create and self-maintain. They are also often beautiful. They are not physical objects, although they can only exist as sets of relationships between physical beings. The systemic values all point to complex adaptive systems as being a locus of value. I contend that all of the approaches to environmental ethics that involve an ecological understanding of nature are attributing value to the special qualities of complex adaptive systems.

The idea that complex adaptive systems have valuable qualities does not in itself provide a strong basis for ethical decision-making – the idea does not provide for degrees of value – but if value is located in the qualities of complex adaptive systems, then it may be useful to narrow the list of systemic values down, or find what they have in common, to see if there is a particular quality to these systems that can justify the idea of value in nature and provide a guide to action in natural environments. Chapter Seven is concerned with this task.

Chapter 7: Systems, Entropy, Negentropy and Exergy

Concepts like integrity, stability, complexity, diversity and symbiosis are important when describing the ways in which a complex adaptive system (CAS) displays order and directionality. The elements of a CAS may initially be disorganised and unconnected, but once relationships form between elements, allowing feedback processes to occur, the system can develop an identity that distinguishes it from its environment. The CAS will be integral and stable to a degree, but it will also take advantage of being at the edge of chaos – it will be internally diverse and complex, always branching in new directions. It may also develop diverse and complex relationships with neighboring systems, based on still more feedback processes. These relationships can range from predator-prey relationships through to close-knit symbiotic partnerships.

Apart from diversity and complexity, these systems display a kind of order. They are "messy" and often unpredictable, but their elements work together and they form structures. These structures are the most intricate and sophisticated objects known to science. They include the human brain, and the vast macro-system of ecosystems that we know as the Earth's biosphere (Capra & Luisi 95). The order that they manifest also seems to have a quality of directionality, or even purpose. A CAS will behave in ways that promote the conditions that it needs, tend toward remaining intact rather than allowing itself to be dissipated (Laszlo 270) and form mutually-beneficial relationships with neighboring systems where possible. This is can be understood as a function of Darwin's natural selection – a system that did not do these things would not remain intact and persist long enough to be perceivable as a distinct system . It is important to note that directionality occurs in all kinds of CASs, not just those that represent individual organisms.

The systemic values are the qualities of a CAS that allow it to manifest order and directionality. Natural beauty may be a special case, being not so much an enabling quality as an expression of order in its own right. The order spoken of here is not a rigid order like that displayed by a machine. This is the order that can be perceived when diving on a coral reef. There is a sense that the organisms on the reef are all part of a whole – a whole that is ordered and possessed of directionality. The reef system has a tendency toward growing, developing and holding together. Something about it – some emergent quality – opposes its disintegration or decay.

Stuart Kauffman and the ecological political philosopher Murray Bookchin have described the directional quality of natural systems as a form of *telos* (Bookchin 455-6) or intrinsic purpose. The idea of *telos* implies a universal aim or the idea that all things have their own purpose, whereas the directionality spoken of here applies only to CASs, so it could be argued that Kauffman and Bookchin are misapplying the idea. However, some scientists have proposed that life may be a "built in" and inevitable component of the universe (Bookchin 456). If that were proven to be the case, then a biological teleology might be feasible. Regardless of this, directionality is certainly a universal feature of living systems.

Ervin Laszlo, who has applied many ideas from systems theory to philosophical problems, has pointed to the fact that the activity of CASs seems universally directed toward adaptation and survival, which might suggest that these objectives constitute an ultimate locus of value (Laszlo 269-70). The problem with this idea is that living systems do much more than simply survive. They branch out, they grow, they develop and they explore. They form relationships and they display emergent behaviours that are reliant on those relationships. The very fact of their survival entails and requires all of the systemic qualities that have been identified in this dissertation as values. "Surviving" is a richly complex affair.

In a series of lectures published as a book in 1944, entitled *What is Life?,* the famed quantum physicist Erwin Schrödinger attempted to deal with the vexed question of just what it is about living things that makes them different from non-living things. His central question was, 'How can the events in space and time which take place within the spatial boundary of a living organism be accounted for by physics and chemistry?' (Schrödinger 3). Rather than focusing on the components of living things, he applied the science of *thermodynamics* to whole organisms.

Like systems theory, thermodynamics has origins in engineering. Thermodynamics includes the concept of systems in its own framework. Under one of the tenets of thermodynamics, now accepted as a law of physics (the Second Law of Thermodynamics), it is stated that for an isolated system (one where nothing passes its boundary) there will be an inevitable tendency toward disassociation of the elements of the system (Jørgensen 20). It will "wind down" so to speak, toward a less cohesive state. This process is known as *entropy*. Theoretically, in a totally isolated system, there will eventually be nothing left but an undifferentiated "bath" of heat energy.

This state rarely occurs in real-world systems, because very few are entirely isolated. It may be that the universe itself is the only truly isolated system, although even that may be questioned by adherents of the multiverse theory. Most systems are to some degree either closed – with energy passing through their boundaries – or open, meaning that both matter and energy pass through (Jørgensen 20). These systems are subject to entropy too, and if their elements become completely disassociated, they become indistinguishable from their environment. When in this state, a system is said to be at thermodynamic *equilibrium* (Jørgensen 20). CASs are open systems. The biosphere of the Earth is a closed system for all intents and purposes, although some matter does enter in the form of meteorites, and the odd spacecraft or two does makes it out of the atmosphere. The biosphere is dependent on radiant energy from the sun, captured by photosynthetic green plants, to prevent it from winding down toward equilibrium (Jørgensen 20-1).

All of the living things and ecosystems on Earth, considered as CASs, depend on this captured energy to maintain themselves. They ingest it in the form of chemical energy, stored by green plants (Capra & Luisi 354). We think of energy-carrying chemicals as foods. In *What is Life?,* Schrödinger investigates the ways in which living things seem to be able to minimise their internal entropy, using energy to organise themselves in ways that prevent their constituent elements from disassociating (Schrödinger 70-1). In other words, he was interested in the way they maintain their integrity and stability. He coined a term to refer to the ability of living things to maintain their own order – *negentropy* or negative entropy (Schrödinger 70).

It is important to understand that negentropy does not refer to the negation of entropy. Negentropy cannot occur in one location without an increase in entropy at another. For example, a predatory animal cannot maintain its bodily integrity without impinging on the integrity of other animals' bodies. Any organism takes in food because the food matter is highly organised (low-entropy) in a way that benefits the organism when ingested. Once maximum benefit is extracted, what remains of the food is discharged as high-entropy, less organised waste. That is not to say that this waste cannot still be organised enough to constitute food to another organism, but the overarching ecosystem would tend toward equlibrium if it were not for the constant input of fresh energy from the sun (Schrödinger 73-4).

Living systems maintain their own order in the context of an environment that might not always be hospitable, and they do this by "exporting" entropy (Schrödinger 71). Negentropy is the process of maintaining order by shifting entropy "away" from the living system. Living systems also interact with surrounding systems to form ecosystems that allow multiple organisms to increase their negentropy in a way that would not be possible for individuals. This behaviour can be thought of as a kind of cooperation, although it must be remembered that predator-prey relationships are an example of this process – in their case the cooporation occurs at a species level rather than an individual level. According to Schrödinger , negentropy is a defining feature of life (71).

This idea is given more weight by the work of the physical chemist Ilya Prigogine. Prigogine was concerned with the meeting point of systems theory, thermodynamics and biology. He concerned himself with systems that exist 'far from equilibrium' (Prigogine & Stengers 140-5), primarily living cells. He examined the way in which the internal chemistry of a cell, considered as a CAS, organises itself at the edge of chaos in a way that allows it to adapt to a constantly changing chemical and physical environment (Prigogine & Stengers 189-91). Prigogine showed how living systems are constantly distancing themselves from equilibrium at the cellular level. The edge of chaos is actually a very highly ordered state (Prigogine & Stengers 167-70). Describing something as being far from equilibrium is another way of expressing that it is in a state of low entropy, or high negentropy.

Negentropy is a very useful concept for describing the order and directionality of CASs. It is fundamental to all life and all living systems, from the level of cellular chemistry up to the entire biosphere. It is definitional that a CAS is a system that tends to maximise its negentropy. All of the systemic values point to states-of-affairs in CASs where negentropy increases. It seems reasonable to use negentropy as a catch-all value that can express the systemic values. Negentropy also has the advantage of being measurable to some degree. It can be measured because it is related to an energy metric called *exergy*.

Negentropy is closely associated with increases in the amount of 'available free energy' (Jørgensen 27-9) in a system, which is sometimes called exergy. Exergy is something that can be measured by scientists if they are able to isolate a system and calculate how much work (entropy minus free energy) that system could perform while coming into equilibrium with its environment (Jørgensen 27). Different systems possess different levels of exergy. Exergy can be thought of as a measure of the amount of energy it would take to break a system down into its constituent parts. It is therefore a measure of a system's integrity or sustainability (Jørgensen 48) and a measure of a system's distance from equilibrium (Jørgensen 47).

One advantage of exergy as a measure of negentropy is that exergy is not just a measure of energy – it is also a measure of the information contained in a system (Jørgensen 33-4). A complex system far from equilibrium contains more information than a less complex one. Living things organise themselves and build up huge amounts of information. A system containing a large amount of information can exhibit more complex behaviours and adapt to more situations than a system containing less information. Think of the amount of information contained in the human genome – the product of millions of years of evolution (self-organisation).

The use of the concept of negentropy as a locus of value, and a value in itself, will be explored in the next chapter, along with the utility of exergy as a measurable aid to decision-making.

Chapter 8: Nature, Value and Naturalism

The existence of entropy is a natural fact. The existence of systems that maintain their internal negentropy is also a natural fact. To claim that negentropy is valuable is one thing, but to claim that it is a value might be controversial. Values are often regarded as being distinct from facts (Albrecht 96-8). I will claim here that negentropy is both a state-of-affairs in the world that is valuable, and a value in itself. I will not claim that negentropy represents the only way to justify the idea of value in nature, but I do claim that it represents a compelling locus of value for environmental ethics and a distillation of the systemic values advocated by most of the environmental ethicists mentioned in this dissertation.

The concept of emergence allows for the richness in living systems that cannot be explained by physics and chemistry alone. Negentropy in CASs is largely an emergent phenomenon. The majority of the exergy (or information) in a CAS is present in the system, but not in its constituent elements. A CAS has a great deal more exergy than other types of system, and living systems are particularly exergy-rich (Jørgensen 41). Exergy is not an exact analogue for negentropy, because its measurement requires the isolation and analysis of systems, but it is useful as a guide and a way to compare systems.

Whenever a natural system is damaged – when its systemic values are compromised – there is a drop in measurable exergy (Jørgensen 49-52). For example, a damaged ecosystem is less able to adapt to changes in conditions. It can do less work because there is less available energy, or exergy. An ecologist can measure the damage by measuring changes in quantitative data, such as the biomass of key species that are known to contain a large portion of the system's available energy (Jørgensen 67). Conversely, simply planting a tree creates an increase in local exergy, especially if the tree is colonised by other living things. Exergy increases geometrically when the systemic values are maximised.

An increase in the exergy present in a living system represents an increase in negentropy and an increase for the systemic values advocated in the approaches to environmental ethics mentioned in Chapters Two to Five. If a CAS becomes more integral, stable, diverse or complex, that means it has experienced an increase in exergy. Because exergy is measurable, it facilitates environmental decision-making by differentiating the value of different natural systems. It is also a useful metric when monitoring increases and decreases in the overall health of ecosystems.

In addition to representing qualities in nature that are valued, negentropy is a value. It equates with the creative tendency in all living things – the tendency to grow, develop and form relationships. It is present in our human bodies at the cellular level, and it is a core aspect of being a living being. The majority of us, if asked whether we consider "creation" to be a positive or negative concept, would answer that it is positive. If asked whether "destruction" was positive or negative, we would tend to think of it as negative, even though we know that it is necessary to destroy things sometimes in order to create new things. We regard destruction as being acceptable in certain circumstances, but only if it leads to creation that outweighs the destruction. This is analogous with what happens in living systems – destructive (entropic) behaviour such as predation is necessary, but the destruction is limited and the overall outcome is the maintenance or promotion of systemic negentropy. Destruction that outweighed creation would lead to system collapse. Far from being separate from value, the facts about negentropy in living systems provide a basis for a naturalistic form of value.

The "fact-value distinction" has a long history, but many philosophers have argued against it, especially ethicists who advocate for the value of the natural world (Albrecht 96-8). John Dewey argued that the fact-value distinction is a mistake based on what he saw as a false object-subject distinction (Dewey 295-8). Systems theory blurs the boundary between subject and object by describing human beings as systems that are intimately interwoven with the other living systems of the Earth. When understood as living systems, human beings can be seen as highly complex beings with negentropic (and emergent) properties. Human beings are also elements within other vastly complex systems that possess the very same tendency to negentropy. We are creatures of the biosphere, and negentropy is a value common to all living things. It is a value because it is something to be strived for – something that provides direction (Albrecht 101-6).

The dynamic and directional quality of living systems gives facts about those systems certain special properties. Ervin Laszlo writes:

> … a damaged organism is not satisfied just to be what it is, namely damaged, but strives, presses and pushes – it fights and struggles with itself in order to make itself into a unity again. It governs itself, makes itself, re-creates itself. Likewise with the cognitive aspects of perception. Perceived "facts" are not static; they are not scalar but vectorial (having not only magnitude but also direction) (260).

The facts about the internal and external states-of-affairs that affect a living system are not separated from value. They affect and are affected by the nature of living systems, which strive toward what Laszlo calls 'a unity'. This striving toward unity equates with negentropy. Living systems have a built-in value.

When increasing its negentropy, a living system must increase the entropy in its environment, but the ecosystems of Earth have evolved (self-organised) relationships between living systems – not necessarily individual organisms – that maximise the overall negentropy of the biosphere. Entropy is shunted out of ecosystems until it escapes the Earth as a kind of waste heat. The sun maintains a constant supply of radiation that compensates for lost energy. If one accepts that negentropy is an appropriate measure of value in nature, one might ask where the negentropy that should be valued is located. It is part of all living systems, but ultimately it is the negentropy of the whole biosphere that matters. Living systems are open systems, but the biosphere is a closed system. The buck stops there. The biosphere is our contemporary understanding of Leopold's 'biotic community'.

Industrialised societies employ large amounts of energy, largely derived from fossil fuels, to modify natural landscapes and convert natural materials into useful products. Useful products represent an increase in exergy – the ability to do work – and negentropy. As with any negentropic process, entropy must increase at another location in order for the useful product to exist. More often than not, the other location is some part of the natural environment. Unlike natural systems, the industrial process does not "pay back" the biosphere, so the entropy of the natural world is increasing, imperiling all living beings. The products made by human beings represent much lower levels of exergy than the exergy inherent in natural systems (Jørgensen 41). If human societies were to adopt negentropy as an important value, perhaps instituting environmental exergy targets or entropy budgets, the advance of biospheric entropy might be slowed.

Conclusion

The concept of negentropy supplies a sound basis for a theory of value in nature. Seen as a value in itself, it is a function of the relational qualities of ecosystems along with the qualities of living things that have been traditionally valued by environmentalists and environmental ethicists. As a scientific concept, negentropy can be seen as an objective fact about the world that can be measured using metrics like exergy, making it an aid in decision-making. It is also a fundamental aspect of our existence as living beings.

In order to put forward a theory of value with negentropy as its core value, it will be useful to clarify the idea of negentropy by showing how it relates to other notions of value in nature that have been proposed. Certain terms and concepts have been developed in environmental ethics that are used to compare and contrast different approaches to the idea of value. I will describe a negentropic theory of value using these terms and concepts. One of the most important terms is "anthropocentrism", which is used in environmental ethics to describe approaches that are based on human preferences or the importance of human existence and welfare. It is usually contrasted with *eco-centrism*, a term coined by environmental ethicists to describe ecologically-focused approaches (Naess 15-6).

The negentropic theory of value is eco-centric in the sense that it is focused on the value of ecological systems and all of their constituents rather than the value of a particular species. It shares this orientation with Deep Ecology and the Land Ethic. In contrast to these approaches however, the negentropic theory of value does have a special place for people. People and the economies and societies that they build are complex adaptive systems – living systems that self-organise, grow, change and develop in similar ways to other living systems (Laszlo 98-118). They represent large accumulations of exergy, and they are valued highly according to the negentropic theory of value. The products that people make are not nearly as exergy-rich as living things, so they are less valued, but living human systems – from individuals to societies – possess great value that must be considered.

Another important concept in environmental ethics is the non-instrumental value of nature. Negentropic value is instrumental in the sense that negentropy in ecosystems serves the ends of living beings that want to survive and flourish (including people), but negentropy is also a concept that equates with that same survival and flourishing, as well as the survival and flourishing of ecosystems. Here, negentropy represents both a means and an end for all beings considered. In terms of locating value that is entirely non-instrumental, the negentropic theory of value does not point to any, although it does allow for value that is not necessarily instrumental to human beings. Negentropy existed before the evolution of human beings.

The fact that the negentropic theory of value affords value to something that existed prior to human beings indicates that negentropic value is a type of what John O'Neill would call objective value (O'Neill's approach does not include the idea of a non-human subject). If one regards objective value as a form of intrinsic value, then the negentropic theory of value affords nature intrinsic value in this sense. The intrinsic value of nature is a very important concept in environmental ethics. The next question that comes to mind is, Does the negentropic theory of value afford nature intrinsic value in the Mooreian sense?

Mooreian intrinsic value is value that 'depends solely on the intrinsic nature of the thing in question' (Moore 260). Negentropy is an intrinsic part of the natural world's nature, and negentropic value can be understood as value placed on something intrinsic to nature, but it does not follow that this affords nature intrinsic value. One might ask if negentropy is supposed to be valuable because it serves nature or if nature is valuable because it serves negentropy. Is it negentropy that is intrinsically valuable? I contend that the problem identified here is only a problem if one fails to recognise the special status of negentropy as being both a fact about nature and the locus of value in nature. As discussed in Chapter Eight, negentropy is the living world's order and direction. The definition of Mooreian intrinsic value cannot be met, either for value in nature or for negentropic value, because neither has value that can be separated from the other's value. I do not consider this to be a problem.

An environmental ethics built on the negentropic theory of value would be naturalistic, requiring no appeal to supernatural concepts, and it would be foundationalist, in that it would be based on a central value. It would prescribe no particular duties or virtues other than those actions which promote negentropy in the biosphere. It would be a guide to action through focusing attention on a useful ecological metric – exergy – that is directly related to what would be the central value of the ethical system, negentropy.

Ecologically-minded economists have suggested that parts of the natural world can be saved from destruction by allocating them economic value through eco-taxes and the like (Jørgensen 188). This is an important and useful idea – indeed some of the thermodynamic concepts used in this dissertation were taken from ecological economics – but the preservation of the biosphere's integrity will require more than the economic valuing of "natural capital". It will require a societal shift in values. At the moment, at least in the Western world and parts of East Asia, consumption is treated as though it were a value.

What is being consumed is the natural world, which is being converted into products faster than the biosphere can regenerate and re-organise. This consumption is entropy writ large. We need a value system based on nature's self-creating and regenerative property, and we need to acknowledge that human beings are kin to all living things. We can point to real, natural states-of-affairs in our world that are preferable to others due to our nature as living beings. It is time to start making better choices.

End.

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