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# The Precautionary Ecosystem Health Principle

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Weak Anthropocentrism, Environmental  
Ethics, and Sustainability

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## **Acronyms and Abbreviations:**

Biological Integrity (BI)

Commission of the European Communities (CEC)

Convention on Biological Diversity (CBD)

Ecosystem Health (EH)

Millennium Ecosystem Assessment (MA)

Second-Order Principle One (SOP-1)

Second-Order Principle Two (SOP-2)

Sustainable Development (SD)

The Precautionary Ecosystem Health Principle (PEHP)

The Precautionary Principle (PP)

The World Conservation Union, United Nations Environment Program, and World Wild Fund for Nature (IUCN/UNEP/WWF)

World Commission on Environment and Development (WCED)

World Health Organisation (WHO)

World Summit on Sustainable Development (WSSD)

## **Abstract:**

This thesis will propose that an innovative synthesis between ‘ecosystem health’ (EH) and the ‘precautionary principle’ (PP) can open up new and fruitful avenues for sustainability theory. My precautionary ecosystem health principle (PEHP) will be grounded on a weak anthropocentric approach, guided by contributory value, and will be promoted as a replacement to non-anthropocentric and intrinsic value definitions. My PEHP framework will propose an adaptive, resilient, and dynamic approach instead of relying on fixed ecological benchmarks. I will argue that health is a thick descriptor, but I will argue against it being defined intrinsically. I will establish that we receive many different benefits from ecosystems, such as ecosystem goods, services, and cultural services.

I will claim that there are different ways to estimate the value we place on these ecosystem benefits without having to resort to economic pricing, such as non-excludable goods and services. Ecosystem services and cultural services must be taken into account, as they are fundamental for the functional capacity of ecosystems and can enrich our lives in non-material ways—recreational, spiritual, and psychological. I will propose that catastrophic and irreversible harm should not be used as thresholds to guide precautionary action, but a resilience approach will be more appropriate to guide the PEHP.

I will propose that a post-normal scientific approach to decision-making is a more appropriate approach to take in the PEHP because it acknowledges both the scientist and public’s opinions on risk instead of just focusing on one or the other, and allows us to evaluate the benefits of ecosystem and cultural services instead of simply overlooking them for economic benefits. Overall, my approach will contribute to the area of sustainability theory by offering a philosophical analysis of the PP and EH and by integrating them together within a holistic weak anthropocentric framework—the PEHP.

**Declaration Regarding the Thesis:**

I hereby declare that this thesis is my own work and I have not obtained a degree in this University, or elsewhere, based on this work.

Mark Ryan

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Mark Ryan

## INTRODUCTION

The main aim of this thesis is to evaluate some of the predominant issues within sustainability debates in order to find a suitable environmental framework to overcome many of these stagnating and confrontational issues. In order to find possible compromises or alternatives for many of the divergences and arguments within the environmental arena, I propose a merger between the precautionary principle and ecosystem health, in my original precautionary ecosystem health principle (PEHP). I believe it will overcome many of the issues and dichotomies within the debate and allows us new avenues within the sustainability debate. In this thesis, I will highlight many of the issues that we should consider within environmental discussions and will claim that the precautionary ecosystem health principle is a suitable framework to guide the discussion and overcome many of the problems inherent within the debate. By adopting a long-sighted weak anthropocentric framework, guided by contributory value, and implemented through a deliberative democratic approach, guided by a post-normal scientific reflectivity, my PEHP will avoid many of the philosophical pitfalls positions within the debate currently face.

To begin with, the environmental movement is an ever-growing and developing field, and has come a long way in the past four decades when it really started to gain momentum within the global theoretical and political arenas. However, despite there being an abundance of literature, discussion, and debate in this area, there are still some striking concerns and disagreements that seem to split the movement into opposing factions. The environmental movement has constantly been divided into supposedly irresolvable dichotomies – anthropocentrism/non-anthropocentrism, intrinsic value/instrumental value, economic/ethical, and theoretical/practical. These preliminary dichotomies have the potential to divide and undermine the movement goals, through stagnation and disagreement. While debate and dialogue is important for any field, these dichotomies become locked into a tussle where there is often no compromise, no middle ground, and no recourse for action. We are often left with an either/or decision, where both possibilities are still inadequate because of their inherent weaknesses and lack of cooperation.

For example, the division between anthropocentrism and non-anthropocentrism has explicitly underpinned arguments within environmental ethics since the seventies. On the one hand, anthropocentrism claims that human beings are at the top of the chain of being, we have superior characteristics than other species, which gives us the right to use the

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environment as we see fit. On the other hand, non-anthropocentrism was created to combat the detrimental outcomes that were being caused by the short-term exploitative gains of strong anthropocentrism. Non-anthropocentrism claims that non-human organisms, species, and environmental systems have a value in themselves and we should protect them from interference and destruction. There is the view that we should interfere with these entities on the one hand (anthropocentrism), and on the other hand, there is the view that they have value and merit our respect and protection (non-anthropocentrism).

The values that these two positions typically place on the non-human world are intrinsic and instrumental value, and these distinctions cause another rift in the environmental movement. Instrumental value refers to value that something brings to us, or the benefit we receive from it. Intrinsic value on the other hand refers to a value that is extrinsic to the value that thing brings to us, it is a value that thing has in itself, totally aside from any benefit it brings. Intrinsic value is a value that implies an obligation on others not to harm or maltreat the possessor, simply for the instrumental benefit they receive from it. Without intrinsic value, critics claim that instrumentalists view the environment in a reductionist manner, proposing that everything in the non-human world is merely there for our benefit and is essentially disposable. Instrumentalists on the other hand typically state that only human beings can possess intrinsic value and that non-human entities do not.

One problematic outcome of this division is that instrumental value would reduce all non-human things to what value they bring to us and that this in turn would be valued in simple economic terms. Organisms, species, ecosystems, and everything in the non-human world would be given a fixed economic cost and worth, and their 'value' would be reduced to that number. There is an economic and ethical tension between different positions and it appears to be quite problematic for the environmental movement. On the one hand, there is the economic position that states we can measure values through economic methods, and on the other hand, there is the position that states the economic method cannot depict the wide array of values within society. The economic proponents also state that it is the most practical and effective way to measure value because theoretical views of value have no ability to be styled into the policymaking arena.

The division between the practical and the theoretical has been a constant reason for arguments and clashes between different factions within the environmental debate. Policymakers claim that theoretical viewpoints may be sound in principle but because of their

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rhetorical nature, it becomes extremely difficult to fit them into practical policymaking decisions. Ideas of intrinsic value and oneness with nature may be values that can guide individuals' morality but they cannot be used to implement effective change in negotiations on a global scale. It is often said that environmental ethics is far too theoretical and does not take into account the real-life decisions that have to be made. While on the other hand, theorists often claim that policymakers do not take into account the many important issues that are discussed in environmental ethics and hence lose the richness of valuative decision-making for what is most economically or politically beneficial. My research will analyse an often-used policy guideline (the PP), but I will apply the explanative and analytical rigour used in environmental ethics.

Overall, this thesis aims to find compromises between some of these dichotomous positions and aims to do so through the merger of two conceptual approaches within the field – the precautionary principle and ecosystem health. This thesis will propose that an innovative synthesis between 'ecosystem health' (EH) and the 'precautionary principle' (PP) can open up new and fruitful avenues for sustainability theory, and will overcome the problems inherent within both positions individually. For example, the precautionary principle (PP) is rarely grounded on a strong ecological or ethical basis as it is usually confined to a political science setting, while EH has never been guided by a politically oriented approach but is instead usually confined to philosophical theory or ecological settings. The PP will provide EH with greater guidance and thresholds to work within, while EH will enable the PP with a stronger ecological and ethical basis to be guided by. My precautionary ecosystem health principle (PEHP) will be grounded on a weak anthropocentric approach, guided by contributory value, and will be promoted as a strong holistic and ecological valuative approach within the sustainability debate.

I will demonstrate that ecosystem health (EH) and biological integrity (BI) are underpinned by the functionalist and compositionalist worldviews and are guided by ecosystem and evolutionary ecology. I will propose that BI is grounded on a compositionalist worldview and is guided by evolutionary ecology, while EH is grounded on a functionalist worldview and is guided by ecosystem ecology. However, one problem with establishing an effective ecological position is that it must overcome the issues contained within adopting a wilderness approach to environmental protection, the human/nature dichotomy split, and promoting areas free from human habitation and use. The position of biological integrity, which promotes these agendas, will be evaluated and rejected as a principle I wish to

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incorporate within my thesis.<sup>1</sup> I will demonstrate that BI's promotion of wilderness and habitats free from human interference is flawed, and is one reason why ecosystem health is a far more defensible concept to use within the sustainability debate. I will establish that EH needs the assistance of the PP and that the integration of the two concepts creates a stronger approach for sustainability theory. However, these concepts need defensible ethical frameworks and strong valuative concepts to guide them in practice and the options of anthropocentrism or non-anthropocentrism are usually given.

The dichotomous split between non-anthropocentrism and anthropocentrism will be identified and resolved in Chapter Three, when I propose that strong anthropocentrism and Callicott's version of non-anthropocentrism are inadequate approaches for the PEHP. I will show that Callicott's Bio-Empathy approach<sup>2</sup> is a misleading and skewed basis to ground a concept of intrinsic value upon because Hume did not endorse a holistic approach (he was a communitarian) and Darwin described the origin of value instrumentally, not intrinsically (instrumentalist caring for others). In addition, Callicott's interpretation of Leopold as a non-anthropocentrist and pioneer for intrinsic value will be criticised because Leopold only ever referred to species and ecosystems as having value *to us*—option values for future generations, and never mentioned anything resembling non-anthropocentrism in his works. Again, this is important for establishing what theoretical framework to ground the PEHP upon and it will be shown that non-anthropocentrism is an inadequate way to underpin it.

Another problem that I will answer is the issue whether or not we need intrinsic value within the PEHP, or if there is a more suitable valuative concept to guide it. I will claim that we cannot value non-human entities intrinsically and that non-anthropocentrism cannot overcome many of the glaring problems within its definition. I will propose that a long-sighted anthropocentric position should be used instead, because it overcomes many of the problems within strong anthropocentrism, but it is also a more defensible position than non-anthropocentrism.

Weak anthropocentrism will be used to ground my PEHP because it overcomes many of the criticisms that cripple both strong anthropocentrism and non-anthropocentrism. The PEHP, grounded on a weak anthropocentric framework, will overcome the problem of ecofascism (descent into abusing individual human interests for the benefit of a greater

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<sup>1</sup> I will analyse it for its usefulness of comparison with ecosystem health, but essentially, I will claim that because of its very restrictive criteria and values, it is too difficult to support it for the flourishing of humankind.

<sup>2</sup> This axiology combines Hume, Darwin, and Leopold as the forerunners for the intrinsic value concept.

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ecological whole) and will avoid short-sighted economic approaches that cause devastating environmental destruction. It will do this by taking a long-sighted approach to our actions and values, which will be guided and directed by the requisites that are set out within the ecosystem health component of the PEHP.

However, one distinct problem for my PEHP is that definitions of ‘health’ are not clear or concise and it is uncertain what value we should attribute to it. When health is applied to ecosystems, it is typically referred to in a metaphorical manner, making the concept quite vague and weaker as an approach. My PEHP needs to have a clear definition of health in order to have clarity within the sustainability movement, and my interpretation of it being objective (empirical and analysable) will strengthen it as a defensible sustainability framework. I will demonstrate that health is holistic because it is concerned with the whole instead of its individual parts and variable because it changes in different contexts and situations, giving the PEHP greater clarity and guidance for policy-setting goals.

I will propose that a health definition should use an organism’s functioning capacity instead of definitions that only incorporate a thing’s well-being or interests. This would allow the inclusion of ecosystems into the literal definition of health for the PEHP as well, which would in turn strengthen it as a concept and greatly aid the implementation of ecosystem health practically, rather than decoding it as metaphor. I will also claim that a definition of health should include the characteristics of self-organisation and self-generation in order to overcome the problems of including inanimate human-made objects within our definition of health. However, a problem with definitions of ecosystem health is the issue of how to determine normal ecosystemic change from abnormal or unhealthy change. In order for the PEHP to work as a sustainability approach, it must establish what is understood as normal and abnormal change, in order to protect, avoid, and ensure these standards are met towards achieving healthy ecosystems.

Therefore, I will analyse normal ecosystemic functioning and types of routine historic change for the PEHP and will claim that if routine historic change were seen as both erratic sudden change and ever-present steady change, then it would allow *all* change to be deemed normal. Instead, I will propose that ecosystems are constantly changing systems and they do not have clear definable thresholds. My PEHP framework will propose an adaptive, resilient, and dynamic approach instead of relying on fixed benchmarks for what normal ecosystemic change should be, in order to identify and support the very nature of ecosystems themselves. I

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will establish the characteristics of self-renewal and self-organisation as guidelines to determine healthy functioning ecosystems. However, even if we know what is or is not healthy in order to direct the PEHP, we still need to establish a value for ecosystems, otherwise it would not imply any obligation to protect and maintain their health as a fundamental goal of the PEHP.

It will be shown that health is a good for, an instrumental good to fulfil other tasks and activities in our lives. I will argue that health is a thick descriptor—fact followed by value—but I disagree that it needs to be intrinsically valued in order to guide the PEHP. Instead, I will establish that we receive many different benefits from ecosystems, such as ecosystem goods, services, and cultural services and because of this, health is one of the greatest values but is still a defeasible good—a good that can be overridden by other goods. I will establish that an ecosystem good is the easiest ecosystem benefit to be economically priced because of the difficulty and ethically questionable ways of valuing cultural and ecosystem services in economic terms. Therefore, there needs to be a balance between both economic and political methods for sustaining these benefits within the PEHP because economic methods alone are sometimes inadequate. While ecosystem goods are more favourably controlled by economic methods, they should not automatically override the non-economic values of cultural services within our PEHP approach.

I will establish that there are ways to estimate the value we have for these ecosystem benefits without having to resort to economic pricing and sometimes they even need to be understood as non-excludable goods and services, protecting people who cannot afford to pay for them. This is important for the PEHP so that present and future human beings' welfare is protected and ensured. While ecosystem goods are more favourably regulated by socioeconomic means, this does not exempt them from being politically regulated when their consumption is beyond sustainable levels.

The services we receive from healthy ecosystems and the cultural value they bring to our lives must be taken into account, as they are fundamental for the functional capacity of ecosystems and can enrich our lives in non-material and non-monetary ways. These benefits must be included within the PEHP as their importance is what effectively defines it as a weak anthropocentrist position as opposed to a strong anthropocentric position (predominantly/only concerned with ecosystem goods). However, even when we establish that ecosystems have a benefit towards us and that they have value in non-monetary ways, we still need the

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application of the precautionary principle to guide ecosystem health within the decision-making and application process, as it gives greater clarity and guidance within the debate as ecosystem health has no explicit policy-oriented direction. The merger of ecosystem health with the PP benefits both concepts because it strengthens the former's practical implementation and application, while it benefits the latter as it gives greater ecological and ethical grounding towards it, in a field where these aspects are commonly overlooked.

However, the problem of how to define the precautionary principle component of the PEHP will be addressed, and I will establish that the PEHP must be divided into three stages: the trigger (damage and knowledge thresholds), decision, and application stages. The first issue that I will tackle is determining what damage to ecosystem health is permissible and if we can use any of the commonly used PP damage thresholds, such as irreversibility and catastrophic harm in order to guide the PEHP. I will demonstrate that using threshold benchmarks such as irreversible is too problematic to guide the PEHP, as it would imply a freezing of the environment, which is practically impossible and ethically undesirable. I will propose that the irreversibility benchmark of proximity to extinction does not account for a species contribution to their ecosystem, while establishing damage threshold benchmarks such as catastrophic are inadequate because they only formulates risks in quantitative manners and defining what is or is not catastrophic is too problematic to effectively guide the PEHP. The irreversibility and catastrophe benchmarks do not take into account the fact that ecosystems are open, non-linear systems that may be open to a wide range of different bifurcations and pathways. Instead, edges of chaos, guided by bifurcation theory, will be given as a suitable damage threshold theory for the PEHP because of its acknowledgement of the complexity of open systems such as ecosystem, while also giving predictions and estimations of possible outcomes of our actions.

There is still the problem of who decides that an action is permissible or not, once these edges of chaos and different bifurcations are established for the PEHP. How much authority should governments give to the public within the decision-making process of the PEHP will be answered. I will show that the PEHP differs from standardised risk assessment models because it incorporates valuative judgments and does not place the sole burden of responsibility in the hands of the expert. It will be shown that approaches that overlook individuals' autonomy and liberties, and place the sole responsibility of decision-making into the hands of scientists and policy-makers is ethically indefensible for the PEHP. While on the other hand, approaches that give full authority to the public may lead to irrational views

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towards risk being taken. I will propose that a deliberative democratic approach, guided by post-normal science, to be the most suitable approach to take within the decision-making process. One that acknowledges both the scientist and public's opinions on risk, but is deliberated and discussed between variant stakeholders, is the approach that I will defend in Chapter Seven.

I will review some of the problematic features within the application of the PEHP in Chapter Seven such as the possibility that our precautionary actions may lead to more serious and detrimental outcomes than the risks we are trying to avoid. I will demonstrate that the PEHP is not liable to this charge because it is theoretically and practically impossible to try to prevent all risks, especially ones we do not know about. Another problem that I will review in this section is the issue that we will be forced into a state of inaction due to our attempt at avoiding all risks. I will reject this criticism as being invalid because the PEHP does not force us into a state of inaction, as it is very action-oriented and understands that we will still have to make decisions in difficult and complex situations, such as ecosystemic protection and maintenance.

The problems of who should pay to implement precautionary actions and why will be discussed at the end of Chapter Seven. While I cannot give a fully thorough analysis of the abundance of political and economic complexities in this area, I will analyse some of the main issues within the debate in order to provide some clarity about how these problems may be resolved. Although my research on the area of the economic and political implementation stages of the PEHP is quite preliminary, it leaves it open for greater analysis and expansion upon my work to take place in the future. Some of the initial findings I will propose for the PEHP in this area are that cost-benefit analysis does not adequately determine the value of the non-human world and does not account for the consequences of adversely affecting ecosystems' healthy functioning. I will demonstrate that we need to evaluate the benefits of ecosystem and cultural services instead of simply overlooking them for economic benefits. Overall, my approach will contribute to the area of sustainability theory by offering an analysis of the PP and EH and by integrating them together within a holistic weak anthropocentric framework—the PEHP. How and why they should be merged in the first place will be discussed in the following section.

**i. Merging Ecosystem Health (EH) and the Precautionary Principle (PP):**

The precautionary principle (PP) and ecosystem health (EH) concepts can be usefully combined because of a number of conceptual and ethical features that underpin them, such as weak anthropocentrism, holism, and ethical concern for future generations. The PP and EH concepts can be merged together because of their conceptual similarities and because both positions can help strengthen one another. They both work best when they are grounded upon a weak anthropocentric approach instead of non-anthropocentrism or strong anthropocentrism.<sup>3</sup> Strong anthropocentrism is inadequate because it emphasises short-term economic gain, while the non-anthropocentric position is inadequate because of the problems within intrinsic value. The weak anthropocentrism that grounds the PEHP focuses on the long-term sustainability of the planet and the fact that we need to act in a precautionous manner in order to survive. Therefore, there is an essential requirement to protect ecosystems because of the goods and services they provide us with, and we need to take a precautionous approach in order to ensure a sustainable future. The PEHP is underpinned by a weak anthropocentric approach but it needs to be guided by a specific valuative norm also in order to be useful in practice. Therefore, what type of value concept can we use to illustrate the value of ecosystems to human beings? Can we use ‘intrinsic value’ or economic utility to guide the PEHP?

I will analyse three predominant philosophers’ work in the area of intrinsic value: Bryan Norton (against intrinsic value), J. Baird Callicott (for non-anthropocentric intrinsic value), and Eugene Hargrove (for weak anthropocentric intrinsic value). I will establish that the paramount divergence between these three philosophers is that Callicott and Hargrove claim that nonhuman entities have a *value*, while Norton proposes that value is synonymous with a *use or benefit*. I will demonstrate that the PEHP should use instrumental valuing (contributory value) to guide it in a holistic and long-sighted anthropocentric manner. It will be shown that contributory value is a more philosophically sound approach instead of solely relying on economic utility calculations (strong anthropocentrism) or intrinsic value (non-anthropocentrism).

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<sup>3</sup> Strong anthropocentrism typically underpins approaches such as neoclassical economics, environmental economics, and strands of neoliberalism, while non-anthropocentrism typically underpins approaches such as biocentrism, ecocentrism, and deep ecology. However, it must be noted here that I am not criticising all of the positions that fall under the categories of strong anthropocentrism or non-anthropocentrism. I am instead criticising the underlying ideology that links them all together. I am giving these examples to illustrate the types of positions that fall into these disparate frameworks.

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Contributory value refers to the contribution a species makes to their wider ecosystems and it does not rely solely on the economic benefit we receive from these species and ecosystems, and it does not rely on the intrinsic value concept, and thus will function as an important guiding value in the PEHP. It functions more effectively for the PEHP because it allocates a specific value towards a species based on the value that they bring to their particular ecosystem and allows for a hierarchy of importance within the decision-making process. The contributory value hierarchy towards their ecosystems is essentially underpinned by the value that these ecosystems thus in turn have for human beings. Therefore, the contributory value concept does not rely on vague, idealistic intrinsic value notions that cannot be shown or proved, but instead relies on the provable and analysable contribution levels a species has towards their particular ecosystems, in order to guide the PEHP in policy implementation and practice.

The synthesis of the PP and EH is a unique and innovative merger, and there are only very few positions in the field that are even remotely alike or bring similar concepts together. Trouwborst (2009) aligns the ‘ecosystem approach’ with the PP, but not explicitly ‘ecosystem health’, and Laura Westra (1998a) integrates the ecosystem *integrity* model with the PP, but does not apply the EH concept. Therefore, my thesis will make a very clear and apparent contribution to environmental ethics and sustainability discussions. However, to interpret precaution and its relationship to ‘health’ as a new thing would be misleading because ‘[p]recaution is at the heart of centuries of medical and public health theory and practice’ (Tickner 2002, p. 493). Therefore, its integration with *ecosystem* health should not be an impossible task because precaution is one of the foundational ideals of maintaining and protecting *human health*. One possible way to view their relationship is as follows:

[T]he ecosystem approach may be regarded as pointing out *what* harm is (*inter alia*) to be prevented, namely damage to ecosystem health; whereas from the perspective of the ecosystem approach, the precautionary principle may be regarded as indicating *when* action to prevent such damage is called for, namely when there are reasonable grounds for concern that serious or irreversible harm to ecosystem integrity may occur (Trouwborst 2009, p. 33).

The combination of the two concepts allows us to establish what harm should be prevented and when it should be prevented. In order to protect EH we need to act with precaution and in order to act in a precautionous manner we need to take into account human impact on ecosystems’ healthy functioning. We need to act in a precautionous manner towards ecosystems because we do not know what effects our actions will have. There is always a great deal of uncertainty about the levels of adaptability and resilience of ecosystems, so a

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precautionary approach to protecting ecosystems' health should be a fundamental requisite of the PEHP, and is in turn why the merger between the two concepts is so paramount, to begin with.

If the PP chooses to overlook the effects we have on ecosystems and their level of functionality, then it raises questions about its ability to protect human beings from detrimental environmental risks. This is because we are fundamentally dependent upon ecosystems' goods and services because without their protection, it would jeopardise the sustainability of the planet. We need to combine ecosystem health and the precautionary principle together in order to provide sustainability theory with an ecologically, ethically, and theoretically strong approach. The following section will give a brief overview of some of the main benchmarks and viewpoints within sustainability policy and will assess some of the main theoretical positions within the debate in order to locate where ecosystem health and the precautionary principle are situated.

### **ii. Sustainability, Ecosystem Health (EH), and the Precautionary Principle (PP):**

Sustainability has often been criticised as being too vague and obscure, so it is important to analyse the two sustainability concepts of ecosystem health and the precautionary principle, in order to see if they are suitable concepts that can be used and applied within the PEHP. Sustainability originally came from the Latin word 'sustinere', translated as to hold up, to maintain, to support, or continue. 'In itself, sustainability is simply a property of any activity, practice, process or institution that has the capacity to continue or be continued indefinitely' (Leist and Holland 2000, p. 3). There has been a long history of sustainable practices throughout the world, and if you categorise sustainability as living with minimal widespread environmental destruction and leaving enough natural resources for the future, then we have actually been living sustainably for the majority of our presence on earth.<sup>4</sup>

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<sup>4</sup> Western sustainability practices can be traced back to the preservation of forestry reserves when they were being rapidly depleted in the fourteenth century. There was a threat that agricultural expansion and timber usage would cause widespread deforestation (Bosselmann 2008, p. 13). Localities began implementing laws to enforce trees to be re-planted, and felling not to occur beyond the levels of re-growth. This was one of the first forms of sustainable planning and attempts to maintain ecological resources for future generations. This system, which distinguished between public and private ownership of land, was called *Allmende* in Germany, and the commons in England (Bosselmann 2008, p. 14). Land could be distributed as private property to individuals, but 'it could only be owned within the limits of ecological sustainability' (Bosselmann 2008, p. 15).

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However, the concept of ‘sustainable development’ (SD) originated out of resurgence in pro-environmental thinking in the 1980s and involved the promotion of living within one’s environmental limits without stressing ecological systems’ regenerative capacities. It came about as a response to the environmentally disruptive effects of global development and attempted to balance economic, social and environmental issues within one overall approach. Environmental sustainability and SD are often used interchangeably, but they are in fact quite different (Fahy and Rau 2013). Environmental sustainability is focused on the health of the environment and is guided by concepts such as EH, while SD is focused primarily on economic and social development. Another approach, ‘ecological sustainability’, claims that any form of SD ‘should be ecologically sustainable as well as economically sound. An ecologically sustainable development project does not compromise ecosystem health’ (Callicott *et al.* 1999, p. 28). In other words, protecting the healthy functioning of the world’s ecosystems should be a moral end in itself (intrinsic value).

Theoretically, *Our Common Future* was one of the first documents to promote sustainability as a way to tackle global ecological issues. Its definition of sustainability was as follows: ‘Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED 1987, p. 8). While the PEHP adopts an approach similar to this, whereby it places human concerns as the underpinning of our environmental actions, it differs because it advocates sustainability based on precautionary and responsible action, not just advancing our technical skills to adapt to environmental changes. Sustainability positions such as *Our Common Future* promote an altering of our political agendas and by becoming more technologically advanced and economically efficient, rather than promoting environmentally conscious precautionary actions. My PEHP approach will claim that this technological optimistic approach has proved detrimental in the past in relation to environmental concerns and that we should act with precaution instead of continuing in a business-as-usual fashion.

Documents such as *Caring for the Earth* veered away from definitions such as *Our Common Future* by proposing that ‘sustainability is improving the quality of human life while living within the carrying capacity of supporting eco-systems’ (IUCN/UNEP/WWF 1991, p. 10). It placed a stronger emphasis on environmental limitations imposed on us by nature and gave a greater moral respect to the natural world, claiming that it should be respected as a life-source for the whole planet, not just for humans. Technological development and economic growth were given less of an emphasis than in *Our Common*

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*Future*, with a greater emphasis on *living sustainably* through precautionous actions, in a similar respect to my PEHP, but I exclude their intrinsic value application to nonhuman entities. I will instead claim that protecting ecosystems should be based on a long-sighted anthropocentric viewpoint. My approach will demonstrate characteristics of such divergent sustainability positions as just described, but will ultimately be quite different from all of them. I will use the ethical reason for promoting sustainability as used in *Our Common Future* (present and future generations); the ecological guiding concept used in Callicott's *Ecological Sustainability* (ecosystem health) and the precautionous approach discussed in the *Caring for the Earth* (the precautionary approach).<sup>5</sup>

The EH concept and the PP have often been criticised as being relatively new concepts, emerging within international policy in the late 1980s and 1990s.<sup>6</sup> The PP is a relatively new concept in environmental theory because it has only been around since the late 1970s and early 1980s, despite the fact that precautionary approaches and action towards the environment has been around for centuries. The PP as a theoretical concept only emerged in global policymaking since the Declaration of the Second International North Sea Conference on the Protection of the North Sea in 1987 (Freestone and Hay 1996, p. 5). However, the PP has been incorporated within many political agendas and policies since then.

For example, versions appear in the UN Framework Convention on Climate Change (1992), the Third North Sea Conference (1990) and the Ozone Layer Protocol (1987). Precautionary approaches are also endorsed by major institutions, such as the UN Environment Program (1989), the EU in its environment policy (1994) and the US President's Council on Sustainable Development (1996) (Gardiner 2006, p. 35).

The PP has also been mentioned in many important documents such as the Maastricht Treaty and the Rio Declaration of Principles but is still criticised as being a purely rhetorical non-binding ideal with little cohesive political power. The PP can be found in over sixty environmental treaties and documents, whereas EH has not had quite the same attention in policy (Trouwborst 2009, p. 27). Trouwborst lists the 1978 Great Lakes Agreement, the 1982 World Charter for Nature, and the 1986 World Commission on Environment and Development (WCED) as being the first documents to incorporate ecosystem theory within policy (Trouwborst 2009, p. 29).

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<sup>5</sup> The PP already exists in numerous political frameworks and policies, both nationally and internationally and it can be seen as one of the foundational principles within sustainability theory.

<sup>6</sup> However, this is a misleading criticism because ecosystem theory has actually been around since Arthur Tansley first formulated it in the 1930s.

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However, it was not until the 1992 Rio Declaration that ecosystem health explicitly made a global appearance. It stated that we should aim ‘to conserve, protect and restore the health and integrity of the Earth’s ecosystem’ (Rio Declaration 1992). The 2002 World Summit on Sustainable Development (WSSD) aimed towards the integration of the ecosystem approach within policy by 2010. The combination of the PP and the ecosystem approach appears in some key documents such as the OSPAR/HELCOM statement (2003), the Convention on Biological Diversity’s Decision VII/11 (1992), and the ICP-7 Report (2006). However, its coverage has still been minimal, because the two concepts are usually ‘mentioned in one breath’ (Trouwborst 2009, p. 26). My thesis will analyse both of these concepts in detail and will successfully merge them within one overall theoretical approach, the PEHP. The PEHP will offer a new and innovative approach to the debate, one that may have the potential to open up new avenues within the field and discourse.

### **iii. Thesis Methodology:**

This thesis will assess the PEHP concept and will claim that it is a useful and valuable concept to have within the debate and overcomes many of the theoretical deficiencies currently faced by both concepts individually. It will be shown that EH and the PP are most effectively described when they are underpinned by weak anthropocentrism, which also makes it less difficult to merge them together within one overall approach such as the PEHP (Lemons, Westra, and Goodland 1998). My reason for taking a weak anthropocentric position is that it is the most suitable approach to link EH and the PP together within the PEHP and because it is the most defensible overall framework within the sustainability debate. I will show that the alternatives are either too concerned with frivolous present-day desires rather than our future sustainability (strong anthropocentrism), or they are too theoretically led, vague, and do not carry much weight in practical situations (non-anthropocentrism).

Sunstein’s (2003, 2005) work on the PP, Callicott’s analysis of EH and intrinsic value (Callicott 1989, 1999a, and 1999f), and Norton’s (1984, 2005) weak anthropocentrism will be important works within my thesis. These philosophers will be paramount for my analysis because of the quantity and detail of their work within the areas of investigation. While many others have discussed non-anthropocentrism and weak anthropocentrism, I believe the

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tension and similarities between Norton and Callicott to be extremely interesting and the most conducive for any type of practical implementation.

I specifically chose a number of articles which incorporate some of the strongest and most detailed positions in the debate and which combine ecological and philosophical analysis in a balanced and cohesive manner. These works were chosen from the top environmental ethicists in the areas and comprise highly referenced and discussed articles on ecosystem health and the precautionary principle. I chose Callicott's work as the main source for my discussion on EH because he is one of the most prominent philosophers in the field and has written extensively in the areas of intrinsic value, non-anthropocentrism, and EH, making him an obvious choice for a thesis on the ethics of ecosystem health. Callicott examines EH in several of his articles, often collaborating with scientists in order to balance the ecologically sound with the ethically feasible and desirable. He manages to bridge the gap between science and ethics, which lends more legitimacy to EH as a concept, and allows it to be taken more seriously within sustainability discussions.

I decided to choose Norton's weak anthropocentrism instead of Callicott's non-anthropocentrism to ground my PEHP because Callicott's work on ecosystem health is important, but Norton's overall theoretical framework is a more philosophically defensible position, despite his insufficient work on the ecosystem health concept. However, his overall environmental philosophy has the potential to help strengthen EH; but he has failed to do so himself. His work on the EH concept is extremely lacking and almost non-existent, except for a few occasional references and brief mentions of it as self-explanatory. Therefore, his actual philosophy *on* the topic of EH itself is too vague to be analysed substantially (Norton 2003e). However, Norton claims that one of the primary objectives of conservation biology is to view whole ecosystems as healthy or ill, so he *does* acknowledge the importance of EH in environmental discourse and claims that it should be something we provide to future generations (Norton 2003i, p. 108 and Norton 2003c, p. 481).

His work on the topic is minimal and he only mentions it in passing, assuming that it is already well established. One example of this is where Norton describes EH as a descriptive and normative concept, but does not fully elaborate upon *how* it is descriptive and normative (Norton 2003a, p. 115). Norton only notes that it is quite difficult to define concepts such as ecosystem health and integrity *because* they are descriptive and normative concepts (Norton 2003b, p. 305). Whereas Callicott goes on to describe them in detail and

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shows how EH is both descriptive and prescriptive. He shows that health is a thick valuative descriptor, as it describes what is or is not in something's wellbeing but it also implies action and obligation on others to do no harm to that wellbeing.

Another discrepancy with Bryan Norton's work is that he often does not differentiate between ecosystem health and integrity, referring to them as the same thing throughout many of his articles and collaborations.<sup>7</sup> This is a clear problem for sustainability theory because it confuses, bundles, and conflates these two concepts together, making it unclear about how to apply these concepts in specific situations. Despite many of these problematic issues within Norton's work on EH, his weak anthropocentric framework will be important for grounding my PEHP. His weak anthropocentric approach is not left open to the same problems as strong anthropocentrism and non-anthropocentric approaches such as Callicott's.

However, despite Callicott's theoretical failings with non-anthropocentrism and intrinsic value, I will still adopt many of his ideas and approaches to the concept of EH itself, such as its descriptive and prescriptive elements, the need to show health is a thick descriptor, and his holistic approach to environmental ethics. This is because many of his approaches to ecosystem health are sound, but in need of minor adjustments, whereas I will show his non-anthropocentrism and intrinsic value approaches are quite ethically and practically problematic. I will review and alter many of Callicott's theories and positions, and I will apply Norton's form of weak anthropocentrism and contributory value concepts instead of non-anthropocentrism and intrinsic value.

My thesis evaluates the value of the PP as a guiding principle for sustainability by assessing the ethical issues contained within its method of risk analysis, moral aspects in its decision-making process, and philosophical difficulties with its implementation. I chose the PP because of its widespread use within the sustainability debate, policy documents and environmental agendas, but also because of its ability to be merged with EH. I will show in Chapter Six that there should be a balanced cohesive relationship between the two concepts instead of any type of hierarchical imbalance. They both have a lot to offer one another and for very different reasons, but neither is stronger or more useful than the other is. Both approaches are best suited to be underpinned by weak anthropocentrism and guided by values such as contributory value. I will show that when the PP is grounded on a non-

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<sup>7</sup> In their article, Norton and Ulanowicz (2003) conflate the concepts of ecosystem health and integrity by referring to them as 'it' in the singular.

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anthropocentric framework or guided by intrinsic value, as Trouwborst proposes, it loses its practical tenability and clarity as an approach. I chose contributory value to guide both concepts because it gives clear scientifically calculable but valuatively rich guidance of what species is of more importance within their ecosystems, and thus more important for health ecosystems for humankind. Altogether, the PEHP is holistic and variable in its very nature and the careful integration together of EH and the PP will strengthen both concepts individually and will create a stronger overall ecological concept, the precautionary ecosystem health principle.

Furthermore, the reason I analysed the PP is because even though it has already received a great deal of attention, many problematic issues are overlooked and ignored. While a few policy documents mention the PP, they are typically only brief definitions and explanations, rather than defences and rigorous analysis of the concept. I chose to analyse Cass Sunstein's work on the precautionary principle because his work is critical and rigorous on the topic and he is one of the most established academics who analyses this concept and includes many of the main issues and views on the PP in his work. His work has a distinctly philosophical and analytical component, but remains practical and pragmatic, qualities that I believe my thesis also characterises and whose works I researched and incorporated into my thesis.

In addition, Ahteensuu (2007b), Manson (2002), Gardiner (2006), and the Commission of the European Communities [C.U.C.] (2000) all develop their own interpretation of the PP and I chose them because they demonstrate key divergences within the debate and they allow me to illustrate problems within the PEHP. I categorised their interpretations of the PP into three distinct sections – identification of risk, the deliberation on a risk, and action taken to avoid potential risks. The reason for this breakdown is that, despite differences of terminology, they all have these overlapping goals within their approaches that I have managed to identify. Aside from this, the three different categories are fundamental for the implementation of the PEHP in practice because we need to be able to identify the type of risk we want to prevent, have appropriate means to decide how to deal with it, and ethical methods for applying our decisions into practice.

### **iv. Thesis Content and Structure:**

This thesis is divided into eight chapters in total, six main sections and an introduction and conclusion. Chapter Two and Three will illustrate the main theoretical background of EH and the PP, the theoretical frameworks that underpin them, and the values that should guide them. Chapters Four and Five specifically focus on the ecosystem health component of the PEHP, assess its defensibility, and what ecosystem health is and why we should value it. Chapter Six describes the precautionary principle and how it relates and merges with the ecosystem health definition that I describe in Chapters Four and Five. Chapter Seven will merge these two concepts together within my overall definition of the PEHP within the trigger, decision, and application stages. Finally, I will conclude in Chapter Eight what I have managed to achieve and the PEHP's place within sustainability theory. I will now describe the contents of each of these main chapters in a little bit more detail.

Chapter Two will focus on compositionality and functionalism, and the norms these two positions adopt, i.e. biological integrity (BI) and ecosystem health (EH) (Westra 1994, 1998a, 2000, Rapport 1995, 1998a, 1998b). I will show that functionalism focuses on the functioning systems of bodies interacting within the natural world and analyses ecology from an ecosystemic approach through EH. Compositionality on the other hand takes a bottom-up approach by focusing on individual organisms and species and their interactions, and this position views the world from an evolutionary ecological framework guided by BI.

This chapter will give clear outlines of compositionality and functionalism in order to establish its differentiation from BI. I will analyse EH and compare it to 'land health' in order to give an illustrative account of where it emerged from. It is important to illustrate the differences between land health and EH because Callicott proposes that both concepts are underpinned by intrinsic value and we should value the health of the environment because it is intrinsically valuable (Trouwborst 2009, Westra 1998a). I will disagree with the assumption that ecosystems can be intrinsically valued in Chapter Three.

Chapter Three will focus on the value system within my PEHP and will be the groundwork for denying a possible intrinsic value component. I will review intrinsic value and will show why its application should not be used as a reason to protect ecosystems and how contributory value is a more adequate and applicable concept. Sections six to eight will assess some of the fundamental difficulties and inconsistencies within non-anthropocentrism. This chapter will also emphasise Callicott's understanding of Leopold is flawed and that his

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non-anthropocentric holistic grounding of EH is philosophically and practically inadequate to underpin the PEHP. Callicott claims that Leopold was a non-anthropocentrist, but I will claim that Leopold was in fact a weak anthropocentrist, which further weakens Callicott's intrinsic value and renders it an insufficient concept to guide the PEHP.

Chapter Four will analyse whether or not human health is objective, if EH can be measured, and will describe how health is both holistic and variable to ground and define the PEHP. It will be shown that ecosystems and health are both fundamentally holistic and variable and are highly compatible within one overall approach, such as the PEHP. The majority of health definitions include all organisms but exclude systems from being healthy in a literal sense. Chapter Four will claim that this is an oversight within the definition of health, as many organisms do not aim towards well-being but towards 'functionality', similar to an ecosystem's functioning. It will be shown that in order to possess health, a thing must have a functioning capacity but it also needs to have the characteristics of self-renewal and self-organisation. Otherwise, we could claim that inanimate objects made by humans such as iPods, toasters, and cars should be understood as healthy or ill in a literal sense. This would in turn make the ecosystem health component of the PEHP quite difficult to adhere to, as all human made things would be considered to have health literally, which I will show the problems of later in this thesis.

Chapter Five will question the value we place upon health and what type of good it is, so that we can use the definition within our application of the PEHP. It will show that health is a good *for*, which is essentially and fundamentally an instrumental value because we value it for the tasks it allows us to fulfil, even when we are not directly *using it*. I will also argue that health is a 'thick descriptor' because it is both descriptive and prescriptive. I will re-establish my weak anthropocentric holistic approach to PEHP in this chapter, and will outline the specific benefits we receive from healthy ecosystems. Cultural services, ecosystem goods and services will be identified as the three key categories of benefits we receive from ecosystems and I will analyse them to see whether or not we can effectively value these things in political or economic settings, or if any of them should be considered non-excludable goods and services for the application of the PEHP.

Chapter Six will evaluate the value of the PP as a guiding principle for sustainability and will assess if it can be merged with EH within the PEHP. It will analyse some of the ethical issues contained within the PP's form of risk analysis, moral aspects contained within

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the decision-making process, and philosophical difficulties with its implementation. The PP is often seen as an important concept within sustainability, being used in the Rio Declaration (1992) and other policy documents and agendas. However, my research seeks to add an ethical dimension to the PP debate by incorporating it with EH in a non-hierarchical alliance between the two of them.

I will reject Sunstein's (2003, 2005) 'catastrophic' and 'irreversible' harm damage thresholds in Chapter Seven, in favour of edges of chaos grounded in bifurcation and resilience theory to guide the PEHP. Chapter Seven will assess the damage threshold and the knowledge threshold of the PP and will conclude that both positions are inadequate to guide my PEHP. The damage threshold section will also include an analysis of actual and potential risks and will question whether or not there is a fundamental difference between the two or if it is just a variation in probability and I will question whether the concepts 'catastrophic harm' or 'irreversibility' can be used as thresholds to guide the PEHP. The knowledge threshold section will analyse the philosophical tension between the PEHP and scientific risk assessment/management and will include an evaluation of the philosophical issues with probability calculations, 'uncertainty', and 'burden of proof'. I will explain a scientist's obligations to describe their findings in a coherent and open way to the public, in order for them to make informed and educated decisions, as part of the decision-making component of PEHP.

The decision-making section of the PEHP will analyse the possibility of ignoring the public's reaction to risk because it is irrational and emotion-laden, and will evaluate if a paternalistic approach can be used instead. I will suggest that a post-normal scientific approach is a better alternative for the PEHP and I will assess a number of options within the application stage such as providing more information to the public, waiting until further study is completed about risks and uncertainties, or prohibiting the potentially harmful action altogether. This chapter will highlight some of the main problems that arise when applying the PEHP such as the absolutist criticism<sup>8</sup> (Sandin *et al.* 2002), the unforeseen risks criticism<sup>9</sup> (Manson 2002) and the criticism that the PEHP leads to inaction. There are also many economic problems such as who should pay for its implementation, what happens when

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<sup>8</sup> The absolutist criticism implies that by trying to prevent risks there is the possibility that we will be forced to try to prevent *all* risk, which is essentially impossible.

<sup>9</sup> The unforeseen risks criticism is that if we try to avoid one risk there is the chance a greater risk could occur instead, leading to a problem similar to Pascal's (2010) 'many Gods' argument.

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countries cannot afford to pay for precautionary action, or what happens when countries ignore risks to ecosystem health.

Chapter Eight will conclude that the EH and the PP are suitable concepts to merge within the precautionary ecosystem health principle (PEHP). The PP helps give the EH concept more clarity and practical guidance, while EH allows the PP to be grounded on stronger ecological grounds with a more prominent ethical basis. Both concepts work best when they are underpinned by a form of weak anthropocentrism aided by contributory value—as opposed to utility (strong anthropocentrism) or intrinsic value (non-anthropocentrism). Altogether, my thesis will demonstrate that a weak anthropocentric position is a suitable and effective framework for overcoming many of the problematic issues that arise in environmental ethics and the sustainability field, allowing the PEHP to open up new and fruitful avenues with sustainability debates.

The PEHP will be guided by contributory value and it will aim to protect ecosystem health and human health from being adversely affected. It will acknowledge that the most appropriate damage threshold to aim to prevent should be underpinned by potential edges of chaos, as shown within different bifurcation and resilience studies. Scientists will acknowledge that they are not infallible and in turn that a deliberative democratic approach to decision-making should be grounded on a post-normal scientific approach. Altogether, this thesis will offer the PEHP as an alternative framework to guide sustainability dialogue and debate, and hopefully open further avenues of research within the area.

## CHAPTER TWO

### THE ORIGIN AND DEVELOPMENT OF ECOSYSTEM HEALTH

In this chapter, I will claim that biological integrity (BI) and ecosystem health (EH) reside in the ecological schools of compositionism (guided by evolutionary ecology) and functionalism (guided by ecosystem ecology, respectively). These ecological schools are grounded in environmental science but are also often used within ethical frameworks—compositionism being adopted by biocentrists<sup>10</sup> and functionalism being adopted by ecocentrists<sup>11</sup>. Environmental science and ethics are linked together in a number of ways and I will highlight their roles in the compositionalist and functionalist worldviews, but also how they relate to their ethical positions.

To begin with, Sagoff (2010) claims that one of the main differences between environmental science and environmental ethics is that the former observes environmental patterns, while the latter determines reasons for acting on this knowledge or sometimes in spite of it. Environmental science and ecology describe the relationships between different species and ecosystems, but they do not prescribe what we *ought* to do about it. Ecologists and environmental scientists investigate ecosystem functioning while ethicists decide how we should act in light of these findings. We should aim to understand ecosystemic functioning in order to implement appropriate policies that do not hinder, destroy, or impede ecosystems' ability of self-renewal and resilience.<sup>12</sup>

Our new relationship with Nature – that of sustainability – requires entering into a cooperative relationship rather than continuing a confrontational one. In order to begin a mutualistic relationship with nature, we must understand how nature works (Jordan, 1998, p. 166).

Tensions within ecological theory can often cloud our decisions, but at the same time, it is not possible to have unifying ecological theories in all circumstances because the conceptual perspectives of ecologists vary so much. However, the variant ecological views are often allocated on a continuum or sliding scale between two specific end-points: the compositionalist's 'evolutionary ecology' and the functionalist's 'ecosystem ecology'. Compositionism adopts an evolutionary ecology approach; while functionalism adopts an

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<sup>10</sup> Biocentrism refers to the ethical position of valuing all living things in the world. It values all living individual organisms and claims that living things should be allowed to pursue their own good without interference. It values individual organisms and values ecological systems as a sum of its individual parts.

<sup>11</sup> Ecocentrism values species and systems and allows us to trump individual needs for the greater good of that species or system. It values species and ecological systems and only values individual organisms because of their value to those systems/structures.

<sup>12</sup> The importance of self-renewal and self-organisation will be discussed in great detail in chapter four.

## The Origin and Development of Ecosystem Health

ecosystem ecology approach, which will be discussed further in section one. This chapter will describe the background of these two positions in order to understand EH and BI. This thesis will predominantly cover the functionalist framework, ecosystem ecology and 'ecosystem health', and the reason I chose these positions is discussed in sections three to five.

Callicott and Mumford (1997) claim that we should use ecosystem health (EH) as the guiding norm for all areas inhabited or used by humans, while BI should be the guiding norm for areas that are uninhabited nor used by humans. The claim that areas are free from human use or habitation falls prey to the same criticisms that will be put against the wilderness datum in sections six and seven. The purpose of this chapter is to give a broad descriptive overview of biological integrity (BI) and ecosystem health (EH), the ecological approaches they are grounded upon (evolutionary ecology and ecosystem ecology), and the schools of thought that underpin them (compositionalism and functionalism). Once I establish the meaning of ecosystem health, I will describe its relationship to Leopold's land health approach in section six, and will give an overview of the valuative dimensions which underpin biological integrity, ecosystem health, and the precautionary principle (instrumental and intrinsic) in section eight, before analysing Callicott's version of intrinsic value in Chapter Three.

## The Origin and Development of Ecosystem Health

Table 1.1: Compositionalism and Functionalism Comparison

<i>Characteristics</i>	Compositionalism	Functionalism
<i>Ecological Approach</i>	Evolutionary ecology	Ecosystem ecology
<i>Main Focus</i>	Individual components within an ecosystem	The overall functioning whole of ecosystems
<i>Methodologies Used</i>	Bottom-up (population and community dynamics)	Top-down (thermodynamics)
<i>The Role of Species</i>	Size, structure and evolutionary development is paramount	Concerned with the effects they have on systems
<i>The Role of Ecosystems</i>	Concerned about species' interactions within ecosystems	Concerned with ecosystems' functioning, regardless
<i>Humans and Nature</i>	We are apart from nature because of our effects on It	We are just another part of nature
<i>Philosophical Positions</i>	Biological integrity	Ecosystem health

### **i. Compositionism and Functionalism:**

It is important to analyse the two different worldviews that the positions biological integrity and ecosystem health are derived from, namely, compositionism and functionalism. I will begin with the framework that allowed biological integrity to develop from, namely, compositionism, guided by evolutionary ecology. Compositionism ‘perceives the world through the lens of evolutionary ecology, an essentially entity-oriented, biological approach to ecology that begins with organisms aggregated into populations’ (Callicott *et al.* 1999, p. 23). Evolutionary ecology analyses and attempts to calculate patterns and activities related to individual organisms, populations, and species. Evolutionary ecology focuses on the numbers, types, and interactions of these specific components within ecosystems and attempts to comprehend population and community dynamics through the evolutionary history of species.

The historical pattern of evolutionary change is very important for this position, whereas in ecosystem ecology it only matters incidentally.<sup>13</sup> Evolutionary ecology claims that we need to understand evolution before we can attempt to implement sustainable ecological policies. Compositionists use evolutionary ecology and view humankind as essentially *apart* from nature, that we are more evolved and somehow different from other species. Our species is a destructive one that ‘employs a unique means, culture, of adapting to its environments and altering its environments to suit itself’ (Callicott *et al.* 1999, p. 24). Compositionists agree with Darwin that we are just another species but propose that our culture’s impact differentiates us from the rest of nature and because of this we are essentially *apart* from it. Our ecological impact is on a scale far surpassing any other species, and a logical conclusion one may draw from this is that any human action towards the natural world is *unnatural*.<sup>14</sup>

An example of this compositionist outlook is that if nature is impacted or degraded by some natural force such as a volcano or tsunami, then the integrity of that system would *not* be compromised as it is a ‘natural process’. However, if humankind is responsible for a similar type of effect then the integrity of that system is jeopardised. The main normative concepts used within compositionism are biological diversity, biological integrity (BI), and

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<sup>13</sup> The historical patterns of evolutionary change only matter to ecosystem ecology in relation to how it might affect the functioning of the ecosystem. The historical patterns of evolutionary change only matter incidentally to the overall functioning of the ecosystem that they are a part.

<sup>14</sup> This is an important distinction from functionalism and will be assessed in further detail in the sections on Leopold and ecosystem health indicators.

ecological restoration. BI is the one I will discuss as it is always contrasted with EH and because biological diversity is a redundant concept within ecological theory, while ecological restoration is typically only used as a subsequent application of BI. Therefore, I will focus on BI as a guiding norm and will describe how it relates to EH.

It is important to analyse functionalism in order to illustrate EH's place within this model, its worldview and humankind's relation to nature, because this will allow us to understand how it differs from compositionism and how EH differs from BI. To begin with, functionalists 'perceive the world through the lens of ecosystem ecology, an essentially process-oriented, thermodynamic approach to ecology that begins with solar energy coursing through a physical system that includes but is not limited to the biota',<sup>15</sup> where 'organisms are regarded as moments in interlocked processes of energy transfers and nutrient cycles' (Callicott *et al.* 1999, pp. 23-24). Functionalism views humankind as *a part of* nature, not apart or beyond nature. We are just another primate, merely differing in scale but not in our essential biological features (Callicott *et al.* 1999, p. 24).

Evolution is reduced to how it affects functions and processes within a species and is only assessed in relation to the function they provide to the ecosystem. Essentially, ecosystem ecology is the ecological school of thought that analyses the world from an ecosystem-level perspective. Functionalism adopts an ecosystem ecology approach and is concerned with the specific structure of trophic systems<sup>16</sup> rather than where those specific components have evolved. It is more concerned with the functioning capacity of ecosystems rather than the specific species that the system is comprised of. It must be made clear that this 'functionalism' is not the same as the functionalism used within sociological theory.<sup>17</sup> While there are similarities between the two, sociological functionalism focuses on the interdependent aspects within society, while ecological functionalism refers to the functioning of entire ecosystems, not just human society, and can be seen in the

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<sup>15</sup> Thermodynamics refers to the transferral of heat and energy, and the entropy caused in the process. There are two laws of thermodynamics; the first one states that when there is an increase in the internal energy in a closed system it is equal to the difference in heat and energy of that closed system. Energy is transformed rather than destroyed, and is transferred through heat. The second law in thermodynamics discusses the idea of entropy, that there will be a decline in energy over time, and that this entropy is the measurement of how much that system has decreased.

<sup>16</sup> Trophic system refers to a level or mapping of different organisms and their place of the food chain.

<sup>17</sup> Sociological functionalism was popularised by Emile Durkheim and Robert Merton, and signifies the interactions and workings of social order, disorder, and the functions of human behaviour. It is similar to ecological functionalism in this thesis but it only analyses the interactions between the functions of smaller groups and their effect on the whole system and vice versa.

methodological application of ecosystem ecology, which analyses the functions of multiple interacting species.

Compositionism and functionalism are two different worldviews but this does not necessarily mean that they should be seen as competing or oppositional, as they are both analysing the same thing but from *different perspectives* (DeLaplante and Odenbaugh 2010). Functionalism and compositionism are two important positions and often ‘the two extremes simply represent boundary points in a multidimensional continuum, in which a variety of measures of differing levels of detail may be applied’ (De Leo and Levin 1997). The distinction between compositionism and functionalism is conceptual rather than empirical, because most ecologists do not confine themselves to only one category (DeLaplante and Odenbaugh 2010).

Ecologists are usually situated somewhere on the compositionism-functionalism continuum (Callicott *et al.* 1999, p. 24). However, these two approaches view humankind’s place in the world in very different ways and have different scientific perspectives. Compositionism views humankind as apart from nature because of the scale of our impact on the world, while the functionalist views humankind as just another part of nature. The two positions of compositionism and functionalism have very different scientific methods, with the former applying evolutionary ecology and the latter ecosystem ecology.

Ecosystem ecology is concerned with the make-up of organisms and species within an ecosystem and is only concerned with the *effects* these species have on the overall multi-scalar ecological processes taking place within that system (Callicott and Mumford 1997, p. 37). Ecosystem ecology depicts ecosystems as functional units and bundles together ‘individual species into process-oriented modules and so do not generally specify components shaped by evolution’ (Callicott *et al.* 1999, p. 31). The concepts that fall under the functionalist rubric are ecosystem health, ecological rehabilitation,<sup>18</sup> sustainable development and ecological sustainability. While the focus of my thesis will be on the ecosystem health concept within the functionalist school, it is still important to understand how it relates to biological integrity and this can be done by analysing their different scientific approaches: evolutionary ecology (biological integrity) and ecosystem ecology (ecosystem health).

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<sup>18</sup> Ecological rehabilitation refers to the work done on damaged ecosystems, by humans, to enable them to function healthily once more. It does not try to ‘restore’ them to a previous state, it only attempts to make sure that they are functioning healthily, but not according to a specific fixed criteria.

### **ii. Evolutionary Ecology and Ecosystem Ecology:**

This section will discuss the ecological applications of functionalism and compositionism, namely, ecosystem ecology and evolutionary ecology, guided by ecosystem health (EH) and biological integrity (BI). It is important to identify the different ecological schools of thought that BI and EH reside in so that the application of these concepts within policy is effective. My focus is on EH, but it is still helpful to analyse evolutionary ecology in order to contrast it with ecosystem ecology. Ecosystem ecology is a top-down ecological methodology that attempts to analyse and uncover the function and structure of ecological systems by using mathematical formulations and abstract formal systems (Fath 2009). In contrast, bottom-up evolutionary ecology is focused on local populations and the causal workings that allow those particular meshes and structures of ecological systems to take place and develop. Bottom-up refers to organisms and their relationships within populations and species' groups; while top-down takes a thermodynamic approach, starting with solar energy and its subsequent processes such as air, water, photosynthesis, and respiration (Callicott 1999c, Orr 2009). These two ecological schools have a distinctive relationship with compositionism and functionalism, and the norms of BI and EH, but their relationship is not mandatory.

Callicott *et al.* (1999) claim that the link between compositionism and evolutionary ecology, and the link between functionalism and ecosystem ecology, is 'tenuous and contingent, not logically necessary' (Callicott *et al.* 1999, p. 24). For example, you do not have to separate humans from nature within evolutionary ecology, as there are certain strands of compositionism that propose cultural evolution is a human process embedded within nature and the scale of our impact should not automatically exclude us from it. There are also aspects of ecosystem ecology that claim artificially created things can be separated from the natural environment, so the concepts outlined earlier can potentially be used within both rubrics.<sup>19</sup> For example, adaptive management 'might be just as useful to a compositionist trying to maintain the biological integrity of the Arctic National Wildlife Refuge as to a functionalist trying to rehabilitate Lake Michigan' (Callicott *et al.* 1999, p. 30).

Therefore, ecologists might apply the norm of EH or ecological rehabilitation towards ecosystems that are too badly degraded to apply the norm of BI. While at other times, policy may follow the stricter guideline of BI rather than EH; for example, when ecosystems are

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<sup>19</sup> Biological integrity, biodiversity, ecological rehabilitation, ecological restoration, sustainable development, ecosystem health, and ecological sustainability.

already healthy and able to meet higher standards. These overlaps point to a unity between the two ecological schools, in both theory and application. Callicott *et al.* (1999) claim that a fusion between the two approaches should not be ruled out; however, there are no guidelines about how to achieve this. While there are overlaps between the two positions, some conservation concepts fit more comfortably within certain frameworks, i.e. BI is more concerned with the evolutionary history and composition of an ecosystem, while EH is focused on its functionality.

### **iii. The Norms of Ecosystem Health (EH) and Biological Integrity (BI):**

EH and BI mirror many of the core values and goals within sustainability theory and represent two important theoretical positions within the debate (de Groot *et al.* 2000, p. 192). Proponents of BI and EH concentrate on the health or integrity of ecosystems as *signals* of sustainability, rather than using utility or GDP because environmental systems typically cannot be understood or valued by economic consumer preferences.<sup>20</sup> Fundamentally, proponents of BI and EH claim that we should ‘develop policies that allow human cultures to thrive without changing the life support functions, diversity, and complexity of ecological systems’ (Haskell *et al.* 1992, p. 4).

The concepts of EH and BI are potentially suitable holistic and integrative concepts to achieve these goals. For example, Costanza (1992) makes the claim that definitions of sustainability and EH should be combined together and a sign of a healthy ecosystem is that it is sustainable, i.e. it can maintain its ‘structure and function over time’ (Haskell *et al.* 1992, p. 9). The emphasis placed on environmental sustainability has increased and EH has begun to receive more attention and ‘[i]n a sense, health is sustainable development considered in ecosystem terms. Sustainable health of people and other animals assumes a healthy context – a healthy biosphere’ (Waltner-Toews 2004, p. 89). Therefore, EH is a prerequisite for SD (White *et al.* 2010, p. 81).

BI is also related to sustainability theory because for a system to sustain its integrity we must protect ‘the systematic organization which maintains that diversity, including, especially, the system’s multiple layers of complexity through time’ (Norton 1992, p. 26).

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<sup>20</sup> This point will be clearly illustrated later when I discuss Norton’s preference values and considered preference values.

## The Origin and Development of Ecosystem Health

Westra (2000) integrates sustainability with integrity because integrity is valuable in itself as it maintains life on the planet and it provides human beings with goods and services that allow our survival: 'Ecological integrity is thus essential to the maintenance of ecological sustainability as a foundation for a sustainable society' (Westra 2000, p. 25). However, do we need both health and integrity concepts for a sustainable ecological ethic or should we concentrate on one principle over the other? How do the two concepts relate to one another and why is there a need for them within sustainability theory?

EH and BI gained prominence through the philosophy of Aldo Leopold in the mid-twentieth century through his adoption of land health and the promotion of BI in his often-cited land ethic: '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' (Leopold 1949). Leopold proposed that conservation should not solely focus on the continuous supply of a particular resource, but should concentrate on the healthy functioning of the parts and wholes of an ecosystem and we should try to protect integrity and beauty within nature. Leopold claimed that a more holistic approach to environmental management was required and could be achieved by using integrity and health as guiding concepts. However, Leopold did not refer to 'ecosystems' specifically and the concept of EH only came about much later.<sup>21</sup>

The ecosystem concept has been around since the 1930s, when it was first created by Arthur Tansley, and has since been established as one of the most important concepts used within ecological thought. For example, it 'was ranked first in importance by British ecologists in a 1987 British Ecological Society survey' (Callicott 1997, p. 134). Some ecologists claim that we should define an ecosystem by spatial-temporal boundaries within a specific area or habitat. This would give very clear and specific physical boundaries of where an ecosystem is located and it would enable ecologists to easily pinpoint and define what is or is not part of that ecosystem. However, these definitions are too narrow and simplistic because they do not take into account the different processes, functions, behaviours, and interrelationships taking place within that ecosystem.

Ecologists may propose that an ecosystem is a group of interrelating processes within a hierarchically ordered spatial-temporal system. This definition is different because it does not define an ecosystem by *only* its physical boundaries but it is the *integrated systemic*

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<sup>21</sup> The issue of holism and individualism still plagues environmental thought today, and it is often noted that individualism is an inaccurate approach towards the environment and a more holistic approach is required to replace it.

## The Origin and Development of Ecosystem Health

*interactions of multiple processes occurring within that system*, interlinked and overlapped by other systems. An ecosystem may be referred to as a community of organisms and their environment or it may be more appropriately understood as all biotic components and the physical and chemical processes that occur within the area that they inhabit (DeLaplante and Odenbaugh 2010, p. 4). Definitions of ecosystems are usually concerned with the interrelationships and processes between biotic and abiotic components<sup>22</sup> instead of merely analysing the physical components (species) of that system. Therefore, a greater emphasis is placed on the overall holistic functioning of the system rather than what species perform what functions.

The very definition of an ecosystem is quite contentious in itself and the wider debate of what is or is not an ecosystem still rages on within the field. Some advocates claim that ecosystems do not actually exist at all. They cannot be categorically shown or proven and their supposedly open and fluid movements make them impossible to pinpoint. However, it is not the purpose of my thesis to get into the debate about the actual objectivity of the concept of an ecosystem itself because it would require far too much work in the thesis as to warrant another thesis itself. I have taken a brief analysis of the two main definitions of an ecosystem and took the latter one, and will not get into the theoretical debate on the determinacy of this understanding. Subsequently, I accept that further analysis on its objectivity is a fruitful task and it may have a subsequent resulting effect on my use of contributory value, self-renewal, and self-organisation concepts. However, for the purpose of this thesis I take that when I refer to an ecosystem I mean a system or community of biota and their environment and the physical and chemical processes that occur within the area that they inhabit. It is the interrelationships and processes taking place within a particular environmental area and is more fluid and dynamic than the earlier definition of a habitat and its inhabitants.

Therefore, the ecosystem approach views the world through the lenses of ecosystem ecology and thermodynamics, as expressed in the functionalist paradigm, and will be the position that I will adopt throughout this thesis. However, how do we define ecosystem health and how does it differ from biological integrity? What characteristics indicate a healthy ecosystem and what impact do they have on an ecosystem's integrity? Fundamentally, one can define EH in two specific ways: positively (healthy functioning ecosystems) or

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<sup>22</sup> Biotic components refer to all living components of an ecosystem, such as organisms and plants. Abiotic components refer to the non-living components within an ecosystem that affect the living parts of it, such as water, air, temperature, humidity, soil, light, and radiation.

negatively (the absence of ill health or disease). Some claim that the easiest way to identify EH is to allocate its opposite—ill health or disease. Ecosystem health may be defined as ‘normal ecological processes and functions, irrespective of which species perform them’ (Callicott and Mumford 1997, p. 39). The value of species in the EH model is only measured by what they can offer the overall system, while BI allocates value to species regardless of their contribution to the overall system.

#### **iv. Ecosystem Health (EH) and Biological Integrity (BI) Division:**

Callicott and Mumford (1997) propose that EH (ecosystem ecology) should focus on areas that are humanly inhabited and economically exploited and BI (evolutionary ecology) should focus on areas that are protected from human interference. They state that EH should be applied to humanly inhabited and/or economically exploited areas, while BI should be applied to ecosystems that are free from human habitation and economic exploitation. Rapport (1998b) also highlights this difference between the two concepts and claims that EH refers to areas already humanly inhabited and/or exploited, and claims that the ‘resilience, organization, and vitality of ecosystems is maintained, despite the fact that, in most cases, some of the biotic diversity has been compromised because of human interventions’ (Rapport 1998b, p. 193). One of the main differences between BI and EH is that the former relates to the promotion of untrammelled natural habitats, while EH acknowledges that areas are already inhabited and used by humans but aims to use them in a sustainable manner (Rapport 1998b, p. 193).

Rapport (1998a) claims that an adequate approach to conservation biology should promote both BI and EH. These two concepts are often related as areas with BI are more than likely healthy because BI is a *sign* of EH (Callicott and Mumford 1997, p. 39). However, the BI of areas that are humanly inhabited and economically exploited will nearly always be compromised to some extent unless our actions and behaviours are very minimalistic and/or sparsely concentrated (Waltner-Toews 2004). EH is required for BI, but it is not an adequate characteristic on its own. BI is adequate for EH, but it is not necessarily required for a system to be ‘healthy’ (Callicott and Mumford 1997, p. 37). BI is a sign of EH, but it is not a necessary requirement of it because the integrity of an ecosystem may be jeopardised while remaining healthy (Karr 1992). Health and integrity are understood as being essentially interlinked or that health is a prominent component of integrity and vice versa.

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The example of a fish farm will help illustrate the relationship between EH and BI in practice: An ocean ecosystem may remain healthy after the introduction of a fish farm if overall fish numbers remain steady and there is little dramatic impact on the overall functioning capacity and processes within that ecosystem. The simple change of composition (species) does not necessarily determine its health. However, the BI of this ecosystem would be rapidly diminished with the introduction of non-native fish if a result of this were a drop in the numbers of native fish. The BI of that ecosystem is jeopardised while remaining healthy, showing that the BI of an ecosystem is not always necessary for a systems' healthy functioning.<sup>23</sup>

When we try to concentrate on protecting the BI of an ecosystem, it may have negative effects on the *health* of that ecosystem. For example, the integrity of a particular species of fish is evaluated without reference to the health of the ground water systems that they depend upon or the interaction of that species of fish with its predators and other fish species (Kay and Regier 2000, p. 130). While the integrity of the species may be of concern and in turn protected, the damage done to the overall health of the ecosystem may be devastating. Therefore, it would make more sense to use EH as the guiding norm for most ecosystems because it is more holistic and applicable to real ecological situations. This is not to say that the integrity concept is useless and is of no more use researching, it simply means that in accordance with both definitions, ecosystem health appears to be the more rounded, all encompassing, and useful of the two concepts when applied to humanly affected/inhabited areas, which is of our main ethical concern.

I will give a range of examples as to why integrity and the naturalness model are problematic and difficult to incorporate to areas humanly inhabited and used by humans in the following sections. It will become clear why it is too difficult to merge biological integrity with the ecosystem health concept, in a similar way that I will merge it with the precautionary principle. It will become apparent that the issues in the biological integrity definition that are problematic are also the reasons why it is so fundamentally different from ecosystem health and thus cannot be merged. Before I get into the details of how the integrity model is problematic, it is important to understand ecosystem health in more detail so that its juncture from integrity becomes clear.

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<sup>23</sup> However, this raises the questions of how we should measure the healthy functioning of ecosystems and over what particular period. These questions will be answered in the EH indicators and 'normal' ecosystem functioning sections later in this thesis.

**v. Ecological Sustainability and Ecosystem Health (EH):**

It is important to identify past ecological worldviews before discussing ecological sustainability and ecosystem health (EH) in detail, and to illustrate how similar or different they are from these other approaches. For example, *classic* preservationism is essentially anthropocentric because it bases values on aesthetic, recreational, spiritual, and cultural reasons. In classic preservationism, preservation was not a good in itself, but was only a by-product of human desires. Contemporary preservationism is different in many respects, as it values the healthy functioning of biota and biotic communities regardless of what benefit they bring to us. Contemporary preservationists claim that human beings are located within a wider ecological web of intricate systems. Callicott claims that ecological sustainability is different from conservationism, preservationism and contemporary preservationism, but it should not be seen as a replacement or substitute to them but as complementary to contemporary preservationism (Callicott and Mumford 1997, p. 36).

Callicott and Mumford (1997) establish that ecological sustainability is ‘stipulative rather than descriptive’ and admit that their definition needs further clarification after their initial proposal. They are less concerned with the diversity of interpretations and definitions of sustainability but are more concerned with how sustainability can be interpreted within a specific conservation context and applied through the norm of EH. However, ecological sustainability should be distinguished from other sustainability concepts such as SD and maximum sustainable yield because these concepts are concerned with places that are humanly inhabited and economically exploited and they take reductionist and individualistic approaches towards ecosystems.

One of the main differences between ecological sustainability and SD is the former is concerned with issues other than the sustainable use of environmental goods and services, while the latter is *solely* concerned with these issues (Callicott and Mumford 1997, p. 33). Ecological sustainability places an ethical emphasis on ecosystems and our interrelatedness to these systems (Lélé 2006) and categorises sustainability as activities that are economically sustainable while maintaining the healthy functioning of ecosystems (Dasgupta *et al.* 2000). Ecological systems are interrelated with humankind so we need to acknowledge our biophysical dependency upon them. Essentially, we are not above nature, but instead, we live as a part of and within nature (Boetzkes and Roberts 2000, p. 144).

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Ecological sustainability is informed by ecosystem ecology, which is guided by EH. However, linking health to ecosystems is a relatively new idea, so it is important to understand how this developed from Leopold's land health concept. Leopold influenced Callicott's interpretation of EH and played a strong role in Callicott's understanding of intrinsic value,<sup>24</sup> so it is very important to evaluate Leopold's land health to show how it enabled the creation of EH. The reason for analysing Leopold's land health approach is to outline the main tenets within it in order to contrast it with EH. There are many similarities between EH and Leopold's land health, but it should not be seen as synonymous with it. Leopold's land health approach will give us insights into where EH originated from and key components contained within it.

To begin with, Leopold proposed that we should maintain healthy functioning systems in order to promote 'land health' in our actions and policies, instead of the resource-driven environmental attitudes of the past.<sup>25</sup> One of the main threats to land health is when environmental management is divided and subdivided into parts and used/protected under the guidance of singular resource criterion or habitat management, instead of taking a holistic approach. Leopold criticises this reductionist perspective because it overlooks the need to manage ecosystems as wholes, instead it only focuses on maintaining the profitable parts of an ecosystem (Leopold 1944, p. 316). If we manage the environment by dividing what is and is not economically beneficial to us, it would be impossible to protect the system as a whole because so many components are not necessarily, overtly, or even at all, profitable to maintain. We must be aware that there are profitable parts as well as unprofitable parts in order to establish a holistic approach to ecological management (Leopold 1944, p. 317).

The unprofitable aspects must be seen as constituent parts and linked to the profitable parts. If the unprofitable parts are neglected it would have a negative impact on the overall system. The ecosystem's overall health must be the key aim for conservation, not just the profitable or exploitable parts of that ecosystem. Therefore, the consistent neglect of particular parts of a system will often have detrimental effects on the overall health of that system. Leopold's holistic precautionary approach to land management should be guided by the norm of land health in order to avoid the reductionist profiteering effects of resource management. His holistic approach to conservation veers away from the atomistic

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<sup>24</sup> This will be discussed in further detail in Chapter Three.

<sup>25</sup> The reason for this is largely to overcome the detrimental effects of reductionist resource management that only focus on profitable parts of the environment. This approach neglects many other important components and processes within the system and their effect on the overall system as a whole.

reductionist approach of analysing only the individual parts of an ecosystem (Leopold 1944, p. 310).

Leopold aimed to establish distinctive ecological parameters where we can inhabit and use the environment without impeding it in such a way as to compromise its healthy functioning (Callicott 1999a, p. 339). Synthetic change often causes land illness and degradation, changing pristine healthy habitats into sick degraded ones by integrating exotic species and diseases (Leopold 1944, p. 314). Leopold claimed that ‘the land should retain as much of its original membership as is compatible with human land-use. The land must of course be modified, but it should be modified as gently and as little as possible’ (Leopold 1944, p. 315). However, Leopold’s ‘land health’ does not necessarily presuppose that *all* humanly caused changes are fundamentally bad in-and-of-themselves.<sup>26</sup> Ecosystem management should aim to protect and repair ecosystem damage in order to sustain healthy functioning ecosystems and minimise present humanly-caused environmental impacts as much as possible, by using ‘wilderness’ as a base-datum for land health.

### **vi. Wilderness as a Base-Datum for Health:**

Leopold’s *The Farmer as a Conservationist* (1939b) demonstrates that the farmer should aim to keep the good health of his farm, while maintaining a ‘mixture of wild and tame attributes’ (Leopold 1939b, p. 264). This mixture is quite difficult to implement in practice because too many tame attributes could diminish the health of the wild components and vice versa.<sup>27</sup> Leopold established that health is the overall functioning capacity of ecosystems regardless of which ‘wild or tame attributes’ contribute to these processes.<sup>28</sup> In order to differentiate healthy ecosystems from unhealthy ones we need to establish a specific base-datum for land health. Leopold deduced that there are essentially two base-datum possibilities: places that are healthy despite human habitation for many centuries, or areas of complete pristine wilderness (Leopold 1941b, p. 288).

Leopold believed that areas of complete pristine wilderness are more effective norms than finding healthy ecosystems despite human habitation. Wilderness gives us clearer

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<sup>26</sup> Following from this, Callicott also claims that human-caused changes to ecosystems are not bad in their own right or are ultimately incompatible. Anthropogenic changes can often actually *improve* EH.

<sup>27</sup> In addition to this, what we know as ‘wilderness’ today is actually the result of human intervention in the past.

<sup>28</sup> We need the normative goal of land health to guide our actions in order to balance the mix of non-native species with native species in areas that are humanly inhabited or exploited.

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indications about how nature should function on its own without human interference and in turn gives us a ‘base-datum’ for healthy functioning ecosystems (Leopold 1941b, p. 287). Wilderness should be used as a form of ‘land laboratory’, a place where we can examine and understand how ecosystems function healthily.<sup>29</sup> Leopold did not state that we should leave wilderness untouched altogether but that when there is a lack of scientific knowledge about land management, we should err on the precautionous side and not affect wilderness in deleterious ways that might jeopardise future options (Callicott 1999a, p. 341).<sup>30</sup>

Wilderness is used within BI but has been more or less taken out of EH definitions, so this raises another issue when comparing Leopold’s land health approach to EH: Leopold uses ‘integrity’ synonymously with health and does not appear to separate the two concepts (Leopold 1944, p. 310). Bryan Norton (2003b, 2003d, and 2003f) has also mixed up the two terms, using them synonymously within his work, in contradistinction to modern ecological theory that makes a fundamental differentiation between them (see Table 1.2.). However, it is important to clarify what Leopold means by ‘healthy’ before we can criticise the conflation of health and integrity (see Table 1.2.). Leopold claims that an area is healthy if it is ecologically stable and contains levels of diversity and complexity (Leopold 1944, p. 312). While complexity and diversity are often *signs* of EH, they are not fundamental requirements for it, but they are usually defining characteristics of *biological integrity*.

Another notable difference is that Leopold’s land health approach refers to the health of *species within an environment and an ecosystem’s health as a whole*, while EH predominantly refers to *the health of the overall ecosystem*, with the individual components only being of contributory importance to the system, but not fundamentally necessary.<sup>31</sup> Of course, the health of organisms and species contributes to the health of the overall ecosystem so protecting their health is important for this reason but is not important to protect organisms and species’ health. Despite these differences, Leopold’s land health approach established a fundamental link between environmental management and the objective of ‘healthy’ systems (Haskell *et al.* 1992, p. 15). Leopold’s land health established that individual parts of the environment were being mismanaged and exploited because regulators and policymakers

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<sup>29</sup> Wilderness can also offer a great deal towards scientific advancements in how the ecological world functions. Therefore, its use as a recreational tool should not be the sole function or even its predominant use (Leopold 1941b, p. 289).

<sup>30</sup> This precautionary approach is a defining characteristic within EH and this will be shown in the PP chapters.

<sup>31</sup> Leopold uses ‘land’ as shorthand for the *entire environment*, while EH applies ‘ecosystem’ instead. However, it would appear that Leopold’s idea of health would be more in line with an overall conservation approach of EH and BI within one overall approach.

were not looking at the bigger picture.<sup>32</sup> EH establishes a holistic approach to ecosystems by maintaining their overall health rather than mismanaging and exploiting its individual parts. However, one issue of concern about Leopold's land health is his use of wilderness as a base-datum for EH because of its valuative goal of being 'free from human habitation and use'.

### **vii. 'Free from Human Habitation and Use':**

Callicott and Mumford make a differentiation between humanly inhabited and exploited areas and areas that are free from human habitation and use. Rapport (1998b) also claims that we should include the integration and promotion of biodiversity reserves protected from human habitation and exploitation as a goal of integrity. Callicott and Mumford (1997) propose that '[s]ustainably inhabiting and using some areas and establishing biodiversity reserves in others should be regarded as complementary, not as either competing or mutually exclusive, approaches to conservation' (Callicott and Mumford 1997, p. 33). Bratton (1992) also supports this idea: '[w]e desire either a "natural ecosystem" or one that is productive or intensively managed and have little concept of anything in between. This means we either demand a national park or a cornfield' (Bratton 1992, p. 181).

Therefore, the division between humanly inhabited and uninhabited places acknowledges that not all places should be inhabited and used by humans. Areas that are free from human use and habitation are important for humankind because they allow us to understand and analyse how these systems react and maintain themselves without human influence. This can enable us to incorporate this data into managing humanly inhabited and used ecosystems by giving us a base-datum in which to contrast it. Therefore, we need to construct adequate comparisons and case studies with other ecosystems (Rapport 1995). Having wilderness as a "benchmark" for EH is obviously not a value-free claim and there are numerous problems with it (Lackey 2003, p. 15).

For instance, if one begins with the premise that a system has more integrity when it is free from human use and habitation, then this would imply that making ecosystems free from human habitation and use is a specific aim in itself (Waltner-Toews 2004). One very distinct problem with this is that there are almost no ecosystems free from human contact in

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<sup>32</sup> Ecosystem health also takes this holistic approach to the environment, and rejects reductionist profiteering attitudes that only care about economically profitable aspects of the environment.

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one way or another. If integrity should be applied to ecosystems that are completely untouched by humankind, one would be hard-pushed to come up with examples of this in practice. Even the most remote places in the world are influenced by humankind, with some of the most desolate places such as the Antarctic being inhabited by humans. Ryszkowski (2000) makes the point that there are very few habitats not directly affected by us and our activities affect multiple and far-ranging ecosystems, even 'national parks, reserves and other protection areas are changing as a result of those external impacts. Steady-state ecosystems do not exist' (Ryszkowski 2000, p. 52).

Hannah *et al.* (1994) claim that 48% of the planet's terrestrial space is occupied or affected by humankind, and if we exclude the land covered by rocks, ice and deserts, then we occupy or affect 75% of the world's terrestrial space. Mayell (2002) also proposes that our human footprint covers 83% of earth's land, while we affect 98% of the land where it is possible to grow rice, wheat or maize. Therefore, our impact is ubiquitously spread out and there are no signs of it diminishing anytime soon. However, this does not change the fact that a great deal of philosophers have proposed that areas of wilderness are more desirable than humanly inhabited areas: 'Tacitly, the assumption is that pristine, or less altered, is good and preferred, whereas highly altered ecosystems, by contrast, are less desirable, if not degraded' (Lackey 2001, p. 439).

The naturalness model<sup>33</sup> implies that an ecosystem is healthier when there is less human habitation and activity in it (Hearnshaw *et al.* 2005, p. 2). The naturalness model claims that the health of an ecosystem is the closer a system is to its 'natural' state. However, 'there is no scientific basis for "natural" pristine systems to be considered healthier than other human modified ecosystem states and that the maintenance of structure and function of an ecosystem are indeed quite distinct projects' (Hearnshaw *et al.* 2005, p. 4). How can we attempt to restore ecosystems back to a state where they were free from our interference without firstly interfering with them? This is a logical contradiction because we need to interfere with nature in order to restore it back to when it was free from our interference.

Furthermore, sometimes our actions may actually *help* ecosystems become healthier despite the inherent premise of the wilderness model. 'Thus, it is paramount that when managing ecosystems that we acknowledge that anthropogenic changes of ecosystems are as

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<sup>33</sup> Naturalness in this context simply refers to the positions that promote all forms or states of being natural over unnatural and human-made.

“natural” as any other’ (Hearnshaw *et al.* 2005, p. 5). The assumption that an ecosystem unaltered by human beings is more desirable than an ecosystem used and inhabited by humans is unfounded. There is no scientific proof to claim that all ecological systems which are uninhabited by humans are healthier than systems that are not (Lackey 2001, p. 441). This position claims that natural and unaltered systems are more desirable than humanly inhabited systems that are deemed *unnatural* (Lackey 2003, p. 15). The EH position essentially views humankind as a part of our ecosystems, and takes into account our place within these interconnecting systems rather than separating us from them.

However, despite this we can still benefit from the use and study of wilderness areas to give us some clarity and guidance on patterns, effects, and interactions within nature in an untouched area. It can be helpful, as Leopold mentioned, as a type of land laboratory; not in the way of experimenting and exploiting these areas, but instead to see what has worked already without our interference with it. We can learn a great deal from areas free from human use and inhabitation, but my main point is that we cannot use these areas as definitions of what we should aspire towards or value because of the very make-up of the planet now and for the implications that I have outlined in this section. This point brings up the question of what types of values should be strived towards then, and the following section will outline some of the value components within the main concepts I will be discussing.

### **viii. Value in Biological Integrity (BI), Ecosystem Health (EH), and the Precautionary Principle (PP):**

Callicott and Mumford (1997) claim that BI and EH have intrinsic as well as instrumental value,<sup>34</sup> but both concepts place a different emphasis on bearers of value. BI proposes that the ‘components of biotic communities and the native biota have primary, unqualified intrinsic value’ (Callicott and Mumford 1997, p. 36). The intrinsic value of the overall whole (ecosystem) does not automatically override the collection of its individual parts. On the other hand, Callicott and Mumford’s version of EH values ecological components and processes intrinsically, but only secondarily to the fact that they are ‘functional moments in ecosystems’.

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<sup>34</sup> Instrumental value refers to the value we place on things because of the benefit or value we receive from their use. Intrinsic value refers to the value of a person or thing, regardless of the benefit we receive from their use. These concepts will be explained in more detail in Chapter Three.

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The intrinsic value of the ecosystem as a whole overrides the value of its individual parts. Callicott and Mumford (1997) claim that healthy ecosystems produce instrumental goods and services to use, but that these ecosystems are also intrinsically valuable *in themselves* (Callicott and Mumford 1997, p. 36). Ecosystems can be protected by ‘sustaining natural ecosystems and all their components for their own sake, with human uses included only when they are entirely compatible with conservation of the native biota and natural processes’ (Noss 1995).

Callicott and Mumford (1997) claim that the components should be understood as ecological *processes* rather than the ‘several sets of species that compose various biotic communities’ (Callicott and Mumford 1997, p. 36). The ecological processes of biotic communities and native biota can be valued intrinsically, but only after they are valued as functioning processes within ecosystems. Healthy functioning ecosystems take priority over the individual parts that they are comprised. Callicott and Mumford believe that the concept of EH is important in conservation biology because it has both identifiable and valuative aspects to it, which will be discussed further in Chapter Four.<sup>35</sup>

Callicott assumes that if health in humans were identifiable and valuable, then it would be applicable to extend this to ecosystems: ‘Health is a more or less objective condition of organisms; and health is, without exception, also a good thing’ (Callicott 1999f, p. 356).<sup>36</sup> Callicott understands ‘objective’ to mean identifiable and empirically analysable rather than merely something based on personal whim or emotion. However, it is very difficult to pinpoint if most people are considered healthy or unhealthy. For example, while someone in late-stage of a terminal illness is definitely unhealthy and a top sports athlete with no health issues is definitely healthy, what about the majority of people who find themselves between these two extremes? This is where the claim that health is objective becomes problematic and is why Callicott refers to it as being objective ‘more or less’. He claims that in most circumstances, whether or not someone is considered healthy or unhealthy would be a ‘judgment call’ (Callicott 1999f, p. 352).

Despite his proposal that health is objective, he never claimed that *intrinsic value* itself is something objective because it ‘is subjectively conferred—that is, that if there existed

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<sup>35</sup> Their main assumption is that health itself is identifiable because we can identify what is functioning properly and it is valuable because we value health intrinsically and instrumentally.

<sup>36</sup> Whether or not health is something more or less objective will be analysed later in the thesis. Objective refers to the empirical type of objectivity, i.e. it can be analysed and understood.

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no valuing subjects, nothing would be of value, intrinsic or otherwise' (Callicott 1999e, p. 15). He gives the example of how our bodily health is an example of intrinsic and instrumental value, a good in itself and a good to be used. He proposes that if we can value our own health and the health of other people intrinsically, then we can value the health of ecosystems both instrumentally and intrinsically. Callicott (1999a) refers to 'health' as being an 'intrinsically valuable state of being' and 'valuable for its own sake as well as for its utility' (Callicott 1999a, pp. 334-335). He extends the value we have for human health to the health of ecosystems and claims that EH is a strong conservation concept that contains instrumental and intrinsic values, which will be analysed further in the next chapter.

In this chapter, I demonstrated that biological integrity and ecosystem health fit into the worldviews of compositionism (guided by evolutionary ecology) and functionalism (guided by ecosystem ecology), respectively. The main purpose of this chapter was to give a broad descriptive overview of biological integrity and ecosystem health, and their ecological approaches of evolutionary ecology and ecosystem ecology, and the schools of thought that underpin them (compositionism and functionalism). I defined what ecosystem health is and how it emerged from Leopold's land health concept. I demonstrated that Leopold conflated the concepts of integrity and health, whereas in current practice they are seen as two separate concepts.

It was shown that biological integrity and ecosystem health are grounded in environmental science but that they also have explicit ethical positions about our relationship and behaviour towards the environment. I proposed that the compositionist worldview, with its guiding norm of biological integrity, were not as strong as the concepts of functionalism and ecosystem health. I demonstrated many of the difficulties contained within the biological integrity model, such as its aim to protect wilderness areas from human contact. It was also shown that a position of free from human habitation and interference was far too problematic to implement in practice, and that even theoretically it was inherently contradictory because we would need to interfere with the environment in order to make it free from our effects. I then gave an overview of the valuative dimensions that underpin biological integrity, ecosystem health, and the precautionary principle (instrumental and intrinsic), as a preamble before discussing instrumental and intrinsic value in Chapter Three.

The following chapter will focus on the application of intrinsic value to ecosystems but is also a criticism against the use of intrinsic value within the PP. The following chapter

## The Origin and Development of Ecosystem Health

can also be understood as a fundamental criticism of the PP and EH concepts because many proponents establish an intrinsic value component within them. They claim that we should value the health of human beings and we should care about the environment because it is intrinsically valuable (Trouwborst 2009, Westra 1998a). For example, Trouwborst (2009) and Callicott (1989) claims that we should protect the environment for the benefit it brings to us and for its own sake. I do not include intrinsic value within my definition of the PEHP and will disagree with the assumption that ‘the environment’ can be valued intrinsically. The next section will reject the concept of intrinsic value for the application in the PEHP.

## CHAPTER THREE

### WEAK ANTHROPOCENTRISM AND CONTRIBUTORY VALUE

‘Intrinsic value’ has been a prominent concept within philosophical thought since Ancient Greece and it is typically defined as the understanding that certain objects or states of affairs have a non-reducible characteristic, a specific value that is good in itself and not merely to satisfy other ends. It is in contrast from things that *only* possess instrumental value, a value that is desirable for the benefit of some other end. We have intrinsic value because we are ends-in-ourselves regardless of the value or benefit we provide to others. However, it is not my aim to argue against *human* intrinsic value but to review the application of intrinsic value to non-human species and ecosystems. Therefore, it is important to firstly identify Callicott’s version of intrinsic value and if it can be applied to the PEHP.

To begin with, Callicott places a greater emphasis on the intrinsic value of holistic entities over the intrinsic value of singular members of that community and establishes a hierarchical form of non-anthropocentric subjective intrinsic value. It is hierarchical because of the different levels of importance within intrinsic value and it is subjective because he claims that value only exists if there is a subjective valuer, namely us—humankind. However, this does not imply that only the valuer (human beings) has value, which in turn gives it its non-anthropocentric characteristic. Before we analyse Callicott’s intrinsic value in more detail, it is important to assess how intrinsic value came about in the first place. I will analyse Leopold’s contribution to Callicott’s thought and why Callicott claims Leopold was one of the first to promote intrinsically valuing non-human species.

This chapter will argue that Callicott’s view of Leopold as the godfather of non-anthropocentrism is false, and that Norton’s view of Leopold as a weak anthropocentrist is much more accurate. I will assess Callicott’s intrinsic value in order to show it was built on false pretences before I point out the problems it faces when specifically applied to the PEHP. This will discredit Callicott’s intrinsic value in relation to how it originated, but I will also show how he cannot overcome the ecofascism criticism and why intrinsic value is ultimately detrimental for the PEHP. Instrumental value and the three types of intrinsic value will be evaluated in order to show why we need a different type of valuing for the PEHP. In section five, I will analyse Callicott’s non-anthropocentric holism to see if it can overcome the ecofascism criticism in order to demonstrate how it is fundamentally flawed and why it should not be used as the framework to ground the PEHP.

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Sections six and seven will demonstrate Callicott's attempt to get out of the ecofascism problem but will show that he fails to come up with a solution and therefore his approach should not be used as the grounding framework for the PEHP. I will demonstrate that weak anthropocentrism is far less problematic than Callicott's non-anthropocentrism, and it retains a distinct holistic component, allowing it to underpin the PEHP. Hargrove's weak anthropocentric intrinsic value will be rejected as being essentially contradictory in section seven, while sections eight and nine will clarify how Norton's weak anthropocentrism and 'contributory value' takes a distinctly ecosystemic holistic approach to our environmental actions to guide the PEHP. Overall, this chapter will give clear and evaluative reasons as to why intrinsic value is essentially problematic and why we should adopt a weak anthropocentric holistic approach to the PEHP. It will demonstrate that Norton's contributory value is an effective value replacement to the dubious concept of intrinsic value and a more suitable way of valuing ecosystems and as a basis to guide the PEHP. Altogether, this chapter will demonstrate that weak anthropocentrism, guided by contributory value, is the most suitable approach to guide the PEHP.

### **i. Instrumental and Intrinsic Values:**

Instrumental values are values that are the means to further ends, whether it is an object being used for manual labour, an animal being used for its meat, a hairdresser being used for a haircut, or a national park being used as a place of recreation. There is a wide and varying range of instrumental values, but environmental ethicists often only concentrate on the *physical* instrumental values and the view that non-human organisms and communities are mere 'resources', while overlooking the aesthetic, spiritual, and psychological benefits we receive from them. In a human context, Callicott gives us the exploitative and objectifying examples of 'slaves for work, prostitutes for sex' (Callicott 1999d, p. 248). Callicott gives examples where valuing humans instrumentally is morally repulsive in order to show that valuing ecosystems or communities instrumentally is also morally repugnant. However, my qualms are not with the fact that we should value individuals intrinsically, but my problem lies with the valuing of non-human communities and ecosystems *intrinsically*.

Instrumental value does not need to be defined in such a negative and reductive manner. An instrumental value is anything that provides a benefit or use in a very broad sense and there are many different ways this can be interpreted and many different contexts, in

which it can be applied. Something can be of use or service to us in a physical sense, for example a cow for its milk, meat and skin. We can also benefit from things in a non-physical sense, for example, we may enjoy a wildlife area because it provides us with great aesthetic pleasure or we may enjoy it because we are spiritually attached to it. One similarity between all of these types of instrumental values is that they provide us with a benefit or advantage. Instrumental values discuss what is valuable, can be used, or bring direct benefit to us. Instrumental values are very apparent because they can be formulated and measured within our value systems, while intrinsic values are unclear and cannot be clearly measured.

It is obvious that we can value non-human entities that are of benefit or use to us, but whether or not we have the dispositions to value non-human entities intrinsically is far more problematic. Intrinsic value means valuing something in its own right regardless of any benefit or use we obtain from it. It means that something has a value in itself, for its own sake, exterior to any value that may be received from it. It is a good that is non-derivative for some other good; it is an end in itself, despite any instrumental value it brings to us. However, many different interpretations of intrinsic value and things can be the bearers of intrinsic value. For example, bearers of intrinsic value range from concrete objects such as organisms, species, and abstract things such as properties, states of affairs, or facts.<sup>37</sup> Therefore, it is vital that we understand what type of intrinsic value Callicott is referring to when he describes species and ecosystems as having ‘intrinsic value’.

O’Neill (2003) divides intrinsic value into three specific definitions: non-instrumentalism, subjective intrinsic value, and objective intrinsic value. ‘Non-instrumentalism’ refers to being valued regardless of any instrumental value it brings to us. The object in question is a good in itself; it is an end and not a means to fulfil other ends. Lo (2009) attributes this quality to all three types of intrinsic value, but the second and third intrinsic values have additional characteristics that separate them from the first definition (non-instrumentalism). The second intrinsic value (subjective intrinsic value) is when something possesses some type of specific intrinsic property or characteristic. Intrinsic properties relate to something’s ‘non-relational properties’ and can be classified as properties that remain regardless of the existence of other objects such as valuing agents, or properties

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<sup>37</sup> Things that can be intrinsically valued range from distinct concrete objects (i.e. human and nonhuman individuals, species, ecosystems, and so forth) to abstract notions such as states of affairs, properties, and facts. If one were to interpret properties as the holders of intrinsic value, then being healthy would be an intrinsic good. If however, the bearer of intrinsic value were states of affairs then this would imply that the states of affairs of someone or something being healthy is intrinsically valuable (Ross 1930).

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that are valuable without referencing other objects such as valuing agents (O'Neill 2003, pp. 134-5). They have non-instrumental value but they may also have 'certain intrinsic qualities' (Lo 2009, p. 268). These intrinsic qualities can be things such as possessors of health, life, or things that feel pleasure and pain.

The third type of intrinsic value can be classified as a 'value that an object possesses independently of the valuation of valuers' (O'Neill 2003, p. 132). This stance proposes that there is an objective value in the non-human world regardless of whether or not we, the valuers attach value to it. Lo's interpretation of this last type of intrinsic value is that it has the same properties as the other two types of value, namely it is non-instrumental and has intrinsic qualities, but that 'the value is in itself an intrinsic quality of X' (Lo 2009, p. 269). This position claims that certain objects have value regardless of whether or not we attach value unto them. Value is essentially *out there* in the world and is merely acknowledged by us rather than created by us. For example, giraffes would have intrinsic value even if there were no humans left on the planet to acknowledge this value. Is Callicott referring to *this* kind of objective intrinsic value or one of the other types of intrinsic value?

### **ii. Bio-Empathy:**

This section will analyse Callicott's understanding that intrinsic value originated from the Bio-Empathy approach, stemming from Hume, Darwin, and Leopold. I disagree with Callicott's combination of these three theorists within one approach and my criticisms will range from their theoretical differences to the fact that none of them even mentioned intrinsic value in their works. I will demonstrate that the Bio-Empathy origin of intrinsic value is misleading, the philosophers used are arbitrary and unconnected, and Callicott's non-anthropocentric intrinsic value is incompatible with their positions. I will show that the application of intrinsic values to non-human entities is problematic and cannot be given as a reason for underpinning the PEHP.

Callicott's (1989) 'Bio-Empathy' approach covers a number of key works from Hume, Darwin, and Leopold, and simply refers to the axiology that Callicott created, linking these three philosophers together as a result of their empathetic philosophies towards biological entities. The Bio-Empathy approach stemmed from Hume's morality, which proposed that ethics should be guided by emotions and rational calculations. While our

ethical actions should be guided by reason, essentially our emotions and passions motivate human beings towards action. Our passions incite action or prevent us from acting in a certain way, often regardless of our rational understanding and involvement in a case. Reason influences our actions when it informs us of the existence of a passion towards an object or ‘when it discovers the connexion of causes and effects, so as to afford us means of exerting any passion’ (Hume 2010). Value essentially rests on human emotions about particular objects and cases because it is internal to human beings and projected outwards onto other things. ‘Value is, as it were, projected onto natural objects or events by the subjective feelings of observers’ (Callicott 1989, p. 147). If human beings were eradicated, there would be no such thing as right, wrong, good, or bad, as there would only be impassive phenomena occurring in the world. What is good or bad depends upon the feelings of an individual or group of individuals.<sup>38</sup>

The main problem with this type of ethic is that it appears to descend back into relativism because one’s behaviour is based solely on emotion and self-interest. There is no way to establish what is or is not ethical because all of our actions would be based on emotion and self-interest alone. In order to overcome the problem of a relativistic ethic, Hume established the ‘judicious spectator’ (Hume 2010, p. 318). A judicious spectator would establish whether an act is a virtue or a vice by loosening their grip on their own personal emotions and interests. This is because ‘sympathy varies without a variation in esteem. Our esteem, therefore, proceeds not from sympathy’ (Hume 2010, p. 318).<sup>39</sup>

The judicious spectator should have a careful impartial deliberation of a situation or action, and should not allow personal interests or feelings to cloud their judgment. Their judgment is not an evaluation of how we act in particular situations or what our moral sentiments are; but instead, the judgment should be the way we *would act* if we were to follow the ideal conditions laid out by Hume. The three conditions set out by Hume (2010) and reiterated by Lo are: we should have a full awareness of the object/situation under evaluation, we should have an awareness of human nature, and the judicious spectator should act in a non-egocentric way (Lo 2006, pp. 127-130). We should try to implement these three conditions in how we view a particular object/situation and ‘try as sincerely as possible to see

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<sup>38</sup> I will show later in this section how Callicott claims that this view is not inherently anthropocentric because values may reside in a subjective human valuer and this does not imply that we are the sole locus of all value.

<sup>39</sup> This judicious spectator is an ideal however, and not just any or all individuals from the public. The spectator has to be aware of all of the different aspects and conditions in relation to the action or object under inspection. They must look at them in a non-egocentric way that is fully knowledgeable with all of the latest data and criteria available in relation to what is being assessed.

whether we feel the sentiment of approbation (or disapprobation, or neither) toward the object' (Lo 2006, p. 132). Trying to meet these high standards is extremely difficult but we should get an approximation of our approbation or disapprobation in each situation.<sup>40</sup> However, it is still unclear why Callicott thinks that Hume's position is somehow related to intrinsic value.

The reason why Callicott links Hume to the origin of intrinsic value is Hume's community-level formation of society (justice) and his claim that it is prior to sympathy towards individuals within that community. Callicott links this, extends it out to the community itself, and establishes that sympathy can be extended towards holistic things such as nations and ecosystems. However, this extension by Callicott is an inaccurate depiction of Humean thought. For Hume, sympathy could only be attached to the collection of individuals, but not in the way that Callicott suggests, i.e. holistic entities take on an importance greater than the collection of their individual parts. Hume's individualistic communitarianism values *collectives* of individuals, which is different to Callicott's valuation of holistic entities (Lo 2006, p. 126).

Despite this incongruity between Hume's philosophy and Callicott's interpretation of Hume, Callicott goes on to claim that Darwin's position was a direct result of Hume's philosophy and was the next step in the Bio-Empathy axiology. After this very fundamental mistake, the foundation of Callicott's Bio-Empathy approach is essentially undermined, making the application of intrinsic value to the PEHP shaky before we even begin. Furthermore, Hume never referred to non-human entities as possessing intrinsic value or any other type of similar non-use value. Despite these criticisms, one may defend Callicott by claiming that he only meant that Hume's position should be used as a *stepping-stone* towards intrinsically valuing non-human species and ecosystems, with the next step in the bio-empathy approach being Charles Darwin.

In order for species to survive there needs to be some form of parental care towards their offspring (Darwin 2004).<sup>41</sup> Sympathy began with parental affiliation, but parents required the protection of the community/society in order for their offspring to survive. This was the origin and development of value at the individual level because it was a direct

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<sup>40</sup> Human value is created by human beings, not discovered or found. The Humean perspective is fundamentally humanist because it does not rely on gods or any transcendental notion of morality but instead analyses morality from facts and details about human beings.

<sup>41</sup> Original edition published in 1871.

organismic response to one's offspring. It was purely *self-interested* behaviour but with subsequent positive outcomes for the species as a whole and for the systems. On first impressions, it is hard to see how Callicott views that this egoistic action can allow for the valuing of non-human entities intrinsically. Darwin proposed that justice developed and continued within society through the psychological mechanism of sympathy, which allowed us to understand when another's self-interests were being violated, thus creating a societal response to these injustices. This need for care is extended outwards to social units because a stronger social unit allows the individual a greater chance of survival. The care for one's offspring would extend to aunts, uncles, and eventually to the care for other families in order to increase the overall survival-ability of the parent and offspring.

Groups that are more cohesive would tend to out-compete other groups for resources and advantage (Callicott 1989, p. 148). Ethics originated from a clearly *egoistic* perspective that places one's own self-interests, and the interests of their offspring, first.<sup>42</sup> In order to flourish, we required the protection and cooperation of other individuals within our closely-knit communities. As time went by, it became clear that there was a need to extend this close communal sympathetic bond further out to the province, the nation, and eventually to the overall ecological community. Individual self-interest allowed for the formation of ethics and justice within society. However, it is still unclear how Darwin's work contributes to the valuation of species intrinsically. Darwin does not mention intrinsic value nor does he claim that we can value other species in a non-instrumental way. Despite these issues, we could still use Darwin's framework as a stepping-stone towards valuing non-human entities intrinsically. However, we would still need to establish some sort of link between Hume, Darwin, and Leopold in order for Callicott's Bio-Empathy approach to have any consistency.

It is highly questionable how Hume's form of anthropocentric communitarianism is related to Darwin's self-interested survivalism. Hume's position claims that the formation of society and justice was prior to sympathy towards other individuals in the community. Hume believed that there was a need for society to band together before the origin of sympathy towards others. Justice and rules were set in place to order society and regulate property, and individuals benefited from this system directly. Sympathy and moral sentiments followed afterwards, when individuals understood that acting benevolently was beneficial to them and their community. Darwin's position on the other hand states that sympathy originated from

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<sup>42</sup> There are Darwinians who prefer to describe the evolutionary origin of ethics from an altruistic group selection basis, such as Sober and Wilson in *Unto Others* (1998).

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the sympathy for our kin, family members, and members of our community and because of this society and justice were created. This difference essentially undermines Callicott's reason for linking these two theorists within one axiological approach, and further undermines that version of intrinsic value as a concept in which to underpin the PEHP. The following section will analyse if Callicott's interpretation of Leopold further weakens the Bio-Empathy approach, his understanding of intrinsic value, and the possibility of it guiding the PEHP.

Table 1.2 Callicott and Norton's view of Leopold

<i>Leopold's Thought</i>	Callicott	Norton
Species have value	Species have intrinsic value	Species are instrumentally valuable
Self-proclaimed 'conservationist'	Leopold was a holistic non-anthropocentrist	Leopold was a weak anthropocentrist
Health and integrity used synonymously	Health and integrity are two separate ideals	Health and integrity used synonymously
Reason for caring about land health	Species and ecological systems have intrinsic value	Land health provides option values for future generations

### iii. Leopold's Biotic Community Extension:

Leopold's contribution is monumental for the development of EH but it is misleading to place his work within an axiological framework with Darwin and Hume as a precursor for intrinsic value. Leopold claimed that our ethical behaviour began with closely related communities and spread outwards to include other communities so that our biotic community should be the next step in 'social-ethical expansion [of individual and collective self-interested survival]' (Callicott 1989, p. 149). The individual is a single member in an interdependent community, so an ethic is formed because we need to arrive at some form of cooperation for the benefit of the overall group and ourselves.<sup>43</sup> If we belong to a community, we are generally obliged to cooperate according to a certain type of ethic.<sup>44</sup> Ethics is a human construct aimed at social cohesion for the survival of both individuals and our wider human community.

Leopold (1949) proposed that if one extends the boundaries of 'community', then we could include other species, plants, and organisms, as being part of a larger 'biotic community'.<sup>45</sup> Human beings are no longer the *only* objects of moral concern (as proposed in strong anthropocentrism), but non-human entities and systems should be valued as part of our biotic community. Callicott claims that Leopold meant intrinsic value in his writings, despite Leopold never mentioning it (see Table 1.2.). Hume, Darwin, and Leopold never mentioned valuing nonhuman entities intrinsically, but Callicott still contends that they enabled the creation of intrinsically valuing non-human species and systems. Callicott claims that Leopold *implies* the attribution of intrinsic value within his work and that he was a non-anthropocentrist (see Fig 1.1.).

Bryan Norton claims that Leopold was not actually a non-anthropocentrist, but was in fact a weak anthropocentrist (see Fig 1.1.). He claims that Leopold endorsed the conservation of the non-human world for the benefit of future generations and did not discuss anything that is non-anthropocentric (Norton 2003f, pp. 14-15). Leopold developed a weak anthropocentric viewpoint because he claimed we have a responsibility to protect species because they have a

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<sup>43</sup> In this regard, we are autonomous in our own individuality to a very limited extent as we are ecologically and socially interdependent upon the wider community that we are situated.

<sup>44</sup> However, there is no ethical obligation for insects or animals to cooperate as part of their community in order to survive, but one can still say that the membership of their community is dependent upon some type of social interaction, cohesion, and organisation.

<sup>45</sup> Leopold does not deduce that nonhuman entities are moral agents or that they reciprocate in ethical actions towards us. However, we are members of a human community, as well as a larger ecological community. This idea proposes that we should implement some form of ethical conduct towards the nonhuman world, as well as our own human community.

*use for us*, because they are useful to their ecosystems and for our survival (see Table 1.2.). Leopold claimed that we should protect ecosystems because they may have a future use for us even if they have no use for us at present (see Table 1.2.). This early form of ‘option values’<sup>46</sup> implies that just because we do not necessarily *need* a specific type of species, or a species has no direct value for us now, it does not mean that they will not be valuable in the future.<sup>47</sup> Therefore, we should not let species—such as condors, otters, and grizzlies—go extinct if we have the ability to protect them (Leopold 1939a, p. 271).

He does not claim that we should protect these species because they have a value in-themselves but he is saying that even if they are not valuable to us now, they *may* be valuable to us in the future. However, this obligation is for the benefit of future human beings, not the species we are protecting (see Fig 1.1.). In addition, Leopold claims that ‘eliminating a few species’ is perfectly acceptable if it is for the greater good (Leopold 1939a, p. 255). Norton endorses this viewpoint when he states that if we have to ‘tinker’ with nature then it would be advisable to do so in order to avoid irreversible losses (Norton 2003a, p. 122). Norton claims that Leopold’s holism is a form of weak anthropocentrism because we protect ecosystems because they are valuable to us (see Table 1.2.). Leopold goes on to claim that it is perfectly acceptable to make changes to the environment if it is ‘essential for human welfare’ (Leopold 1941a, p. 194). Leopold illustrates his anthropocentrism in this quotation:

I have an ulterior motive, as everyone has. I am interested in the thing called —conservation. For this I have two reasons: (1) without it, our economy will ultimately fall apart; (2) without it many plants, animals, and places of entrancing interest to me as an explorer will cease to exist (Leopold 1947, p. 336).

He does not endorse conservation for the benefit of species and often makes explicit reference to human beings’ superiority over ‘beasts’ (non-human animals); but this does not mean we should exploit and damage nature in a callous and irresponsible manner. However, we need to prove that we are worthy of this superiority and not just another base creature that knows no better than to consume and destroy the ecosystems we depend upon (see Table 1.2.). We are superior over other species because of our *moral agency*. Our use of reason and our ability to make moral decisions differentiates us from other species. However, just because we are superior does not mean we should exploit and destroy other species and ecosystems. Leopold’s land ethic indicates our dependency on non-human species and

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<sup>46</sup> Option values have been described by economists as a reason for protecting species. Norton (1987) also uses this terminology in his work.

<sup>47</sup> There is no specific time-line given as to when in the future. The main emphasis is to protect the environment because future human beings might benefit from them.

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ecosystems and requires a long-sighted responsible approach to the environment. We must establish ‘a society decently respectful of its own and all other life, capable of inhabiting the earth without defiling it’ (Leopold 1923, p. 97). Despite this, Leopold made some mistakes early on in his career such as policies initiating the eradication of wolves and mountain lions.

He believed that, given sufficient knowledge and sensitivity in management, the living organism (the land) could be kept thriving, while some of its less desirable organs were removed. Faith in ecological technique, therefore, shielded him from the conclusion that destruction of wolves and mountain lions would cause serious illness in the organic system of nature (Norton 2003f, p. 25).

This was not a change from anthropocentrism to non-anthropocentrism, as some environmental philosophers will argue, but it instead marked a lack of available scientific knowledge within his early research. When Leopold became aware of scientific and empirical research about the negative effects of these policies, he changed his position. This was a result of developing scientific knowledge and research, rather than changing his position to non-anthropocentrism. To conclude my analysis of the Bio-Empathy approach, it has been shown that the three philosophers in Callicott’s axiology cannot be merged together under the same roof. Furthermore, while the three theorists—Hume, Darwin and Leopold—are quite different from one another, they still all mention *our* value and place *human interests* above non-human interests in order to preserve our species.

Essentially, all three philosophers proposed to widen our moral concern *because it is valuable to do so*; it is valuable as a self-serving tactic from an evolutionary and practical perspective, not because nonhuman intrinsic values should be promoted. Despite the fact that intrinsic value originated out of individual self-interest, it does not necessarily mean that we could not develop the ability to value non-human things intrinsically; it just points out that we originally developed these values from a self-serving perspective. We may have been able to develop moral tendencies to value things intrinsically in a completely selfless, non-egoistic way, despite the self-serving benefits we receive from them.

Callicott’s subjective intrinsic value lacks credibility because he misinterprets so many theorists and merges them together under one disparate and contradictory roof which, by implication, is not a solid basis for or defence of his position. Callicott’s position is so far untenable as a working basis for grounding the ecosystem health and precautionary principle concepts upon. His notion of intrinsic value is so far problematic, and I will show in the following sections that it only becomes more difficult to defend, which will in turn prove why my weak anthropocentric position, grounded on the contributory value concept, will be more

suites as guiding frameworks. The origination and construction of intrinsic value from the bio-empathy approach is fundamentally flawed, but I will show in the following sections that Callicott's own form of intrinsic value is also far too problematic to guide the PEHP.

### iv. Callicott's Version of Intrinsic Value:

In chapter eight of *In Defense of the Land Ethic*, Callicott states that from a scientific viewpoint 'the *source* of all value is human consciousness, but it by no means follows that the *locus* of all value is consciousness' (Callicott 1989, p. 133). This essentially means that human beings are the creators of all value in the world but that this does not mean that we are the only things of value, i.e. it is non-anthropocentric (see Fig 1.1.). Value as a concept is obviously anthropogenic as it is a human creation, created through human linguistics and used and implemented by humans, but this does not mean that all value judgments have to be anthropocentric.<sup>48</sup> Value is a construct of human consciousness and can only be valued if there is a subjective valuer. Callicott goes on to say that just because we are the only species that has the capacity *to value*, it does not mean that we are the only things *of value*.

Other species have value regardless of the benefit or advantage they bring to us. Value is therefore 'subjective and affective' but this does not mean that certain things will always be valuable to the valuer (Callicott 1989, p. 133). Callicott (1989) describes possessors of intrinsic value as things that we value for their own sake regardless of any use they bring to us. However, only species with a valuing consciousness, i.e. human beings, can value. Therefore, value is essentially and fundamentally subjective; it is ultimately dependent upon a valuing consciousness. 'Values—all of them—are subjective states. To believe that some are objective is to believe falsely. To objectify values is not only deceptive, it is pernicious' (Callicott 1999e, p. 359). We are the only species that can claim to have intrinsic value and be able to assign it to other things.

An intrinsically valuable thing on this reading is valuable *for its own sake, for itself*, but it is not valuable in itself, that is, completely independently of any consciousness, since no value can, in principle, from the point of view of classical normal science, be altogether independent of a valuing consciousness (Callicott 1989, p. 134).

Therefore, Callicott's intrinsic value is the second type of intrinsic value in O'Neill's analysis (see section 1 of this chapter). Callicott states that the Bio-Empathy approach gave

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<sup>48</sup> Anthropogenic refers to all things that are a result of human effects, whereas anthropocentric refers to placing humans at the centre of our value, and typically refers to humans as the only possessors of intrinsic value.

us the possibility of valuing non-human species intrinsically; however, his view of these three theorists (Hume, Darwin, and Leopold) is invalid because they are incompatible within one uniting theory or genesis of that theory. Even if we overlook this huge discrepancy within Callicott's thought, and only analyse his definition of intrinsic value, we will still see that species and ecosystems' intrinsic value is an insufficient concept for the PEHP and sustainability theory.

Callicott (1989) claimed that the notion of intrinsic value originated as a way of expressing species rights. There was a need to establish an ethical basis to protect species from harm and the notion of giving rights to species was rejected as being too legally and politically difficult to implement. Callicott (1989) links species rights and intrinsic value, claiming that species preservation is concerned with a species' right to exist—or its intrinsic value. However, intrinsic value was a less problematic way of expressing species rights. There is a difference between rights within the human realm and a species' intrinsic value. The former is concerned with the welfare of individuals while the latter is concerned with holistic species preservation: 'Those who claim that nonhuman species have a right to exist are concerned with species preservation, not necessarily with animal and/or plant welfare, an entirely separate issue' (Callicott 1989, p. 135).

Rights are given to human individuals but can also be given to holistic things, such as groups or species (Callicott 1989). Callicott (1989) proposes that a collection of individual organisms has different 'rights' to the sum of its individual parts. For example, a nation has rights that are not equivalent to the sum of its population. Callicott (1989) goes on to parallel national rights with species rights, claiming that species rights are different to the collective rights of its individual parts. Again, what Callicott means by rights is the moral attachment of intrinsic value to nonhuman species. To reiterate from earlier, one of the fundamental differences between anthropocentrism and non-anthropocentrism is the inclusion of 'intrinsic value'.<sup>49</sup>

In order for the non-anthropocentric holistic approach to be successful, it must be able to argue that nonhuman species and ecosystems have 'the characteristics constitutive of such [intrinsic] value. Until these very difficult tasks are undertaken by defenders of non-anthropocentrism, it is difficult to criticize their often casual remarks about intrinsic value of

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<sup>49</sup> There are of course some exceptions to the rule, one such example is Hargrove's form of weak anthropocentrism, which will be discussed later in this section.

nonhuman species' (Norton 1987, p. 180). However, just because human species have intrinsic value does not automatically mean that nonhuman species also have intrinsic value. The causal link between human intrinsic value and valuing nonhuman species intrinsically is tenuous at best. In order to establish that nonhuman species have intrinsic value, and that we should adopt a holistic non-anthropocentric approach to the environment, we need to be able to describe intrinsic value in a non-individualistic way and 'then state some positive characteristic standing as the mark of such value' (Norton 1987, p. 187).

If Callicott is assuming a Humean mode of value, then non-anthropocentrism must be able to show that we have the capacity to value non-human organisms and systems intrinsically as moral properties before we can incorporate them within our value system. Lo claims that we need to have the ability to value non-human entities intrinsically, which involves showing 'complex psychological capacities, habits, and dispositions of human beings, which cannot be answered by philosophers *a priori*' (Lo 2006, p. 126). Whether we can value nonhuman entities intrinsically can only be shown through empirical and scientific methods. Lo (2006) proposes that intrinsic value, through Humean criteria,<sup>50</sup> can only come about if people can 'experience moral sentiments of approbation towards them [non-human species and ecosystems]' (Lo 2006, p. 141). Whether or not we have the *ability* to value non-human entities as ends-in-themselves requires empirical evidence:

If valuable things are those towards which we are disposed to feel the pleasing sentiments of approbation, but if we are not already bestowed with some natural tendency to appreciate the natural world and/or its nonhuman inhabitants as ends-in-themselves, then it will be in vain for philosophers to argue that those things have intrinsic value and moral standing – these notions will be perfectly unintelligible and will not have any sense annexed to them (Lo 2006, p. 142).

Therefore, while we can show empirically that humans value other humans through evaluative psychological means, it is still unclear how much we value nonhuman species and systems. A non-anthropocentrist can only be 'informed and realistic about human evaluative psychology, and try to excite favourable moral sentiments from us towards the objects of environmental concern by catching our imagination and sympathetic understanding' (Lo 2006, p. 142). Instead of appealing to philosophical arguments that are not widely acknowledged, it would be better to implement these arguments in the hope that these 'sentiments will endure our reflections' (Lo 2006, p. 142). It would be more appropriate to

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<sup>50</sup> According to Hume, our moral actions are motivated by our sentiments and desires that we feel when we act morally, which implies that facts about values fundamentally depends upon our 'evaluative dispositions, [and] whether there are universal values [or not] thus turns out to be an empirical question' (Lo 2006, p. 127).

use our primary moral sentiments that we have instilled within us already and that the idea of justice is grounded upon—us, humankind.

One critic of the intrinsic value concept and proponent of an approach more directed at our primary moral sentiments of humankind is the weak anthropocentrist Bryan Norton. However, Norton claims that he is not against intrinsic value *per se*, but he is against it being used as a defence for protecting *non-human entities* (Norton 2003g, p. 469). Whether or not we believe in the intrinsic value of organisms, species, and biotic communities is speculative and requires empirical proof before it can become accepted, whereas weak anthropocentric reasons claim that losses or degradation of species and ecosystems is a ‘loss of richness from the *human experience*’ (Norton 2003g, p. 474 [emphasis added]). This loss of richness should be protected because it will be valuable to future generations. This type of weak anthropocentrism is *not dependent upon* intrinsic value to support the valuing and protection of nonhuman species (Norton 1984, p. 138). This will be discussed further in sections eight to ten of this chapter when I formulate my interpretation of Norton’s weak anthropocentrism and contributory value concept as guiding concepts for my PEHP.

The fundamental problem with attaching intrinsic value to nonhuman species is that it is firstly too problematic theoretically, as just outlined, but it is also too problematic practically. If we wait until we can prove and then implement theories of intrinsic value, it is impeding us from environmentally protective actions now. I am not completely against the intrinsic value concept being used as a *personal* reason for acting ethically towards the environment; but I am against it being used as a *political* reason for acting ethically towards the environment, with our current knowledge of it. This is because it is far too theoretically and practically problematic to form the basis of, and be initiated into any type of cohesive policy framework.

Ultimately, the non-anthropocentric intrinsic value concept is philosophically unsound and practically problematic. It cannot be shown that we have the ability to value nonhuman entities intrinsically but perhaps someday it will be empirically shown and incorporated within our value system: ‘Attributions of intrinsic value to nonhuman species might be included in those new ideals but need not be’ (Norton 1987, p. 211). I do not exclude the attribution of intrinsic value to nonhuman entities outright because it may be useful for the aims of long-sighted anthropocentrism in the future. However, this is not possible at present, so we need a different valuative concept to guide our ethical defence of

the non-human world. Despite all of these difficulties put against non-anthropocentrism's guiding concept of intrinsic value, one may claim that Callicott's non-anthropocentrism itself may be used to guide the PEHP, albeit in need of a different valuative norm. However, non-anthropocentrism faces the criticism of ecofascism before being implemented to guide the PEHP.

### **v. Ecofascism:**

Callicott places a greater emphasis on the intrinsic value of holistic systems over the intrinsic value of members of that community, thus establishing a hierarchical form on non-anthropocentric subjective intrinsic value. However, this approach runs the risk of falling into the 'ecofascism' trap that undermines many holistic environmental approaches (Regan 1983). Callicott's non-anthropocentrism attempts to overcome many of the problems and disadvantages inherent within individualistic anthropocentric frameworks—such as the focus on harm towards individual entities and species. Holism is concerned with our relationship with the environment, but does not ignore the ethical importance of individual organisms. It places a greater emphasis on ecological systems rather than its individual components. However, should we take a non-anthropocentric holistic approach or is it possible to implement an anthropocentric form of holism instead? Both approaches will be analysed in order to see if they can overcome the charge of ecofascism in order to ground the PEHP.

To begin with, environmental fascism (or ecofascism) is a criticism put against holistic approaches because they attempt to preserve ecosystems and larger wholes at the expense of individual organisms within that system.<sup>51</sup> Holistic approaches overlook individual organisms, viewing them as means for the greater whole. These approaches tend to permit the abuse and death of individual organisms for the benefit of the greater good of the ecosystem (Regan 1983). If human beings are just another species and are no more important or superior to other ones, we should therefore permit the 'culling' of humans for the benefit of the greater good. However, if we propose that human beings have superiority over other

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<sup>51</sup> The predominant aim of ecocentric approaches is to protect groups and biotic communities, and focuses upon ecosystems or the biosphere as a whole. Ecocentrism cares less about individual animals or organisms, and more about their interactions.

species then our position would fall back into strong anthropocentrism and the ethical difficulties this position faces.<sup>52</sup>

Therefore, there is a distinct tension between taking a holistic approach and being accused of ecofascism or taking a strong anthropocentric approach and being open to the criticism of human chauvinism (speciesism).<sup>53</sup> How does Callicott resolve this problem? Does he end up taking an anthropocentric approach or does his holistic non-anthropocentrism overcome the problem of environmental fascism? If his version of the land ethic cannot adequately respond to the charge of environmental fascism then it would appear to be ethically indefensible. Callicott proposes that Leopold's land ethic is meant as an *addition* to our human values, *not as a replacement to them*. 'To think that it [the land ethic] does, one must assume that Leopold proffered the land ethic as a substitute for, not an addition to, our venerable and familiar human ethics. But he did not' (Callicott 1999c, p. 71).

We have many different levels of duty: duties to our family, our job, our country, and our ecological community. These duties do not cancel each other out because 'the duties attendant upon citizenship in the biotic community (to preserve integrity, stability, and beauty) do not cancel or replace the duties attendant on membership in the human global village (to respect human rights)' (Callicott 1999c, pp. 71-72). However, what do we do when these duties conflict with one another? What happens when our duty to uphold human rights greatly influences our duty to the biotic community?

### **vi. Callicott's Second-Order Principles:**

We must analyse Callicott's two second-order principles in order to test whether or not they can overcome the ecofascism criticism. His first second-order principle (SOP-1) states that when our obligations are in conflict, our responsibility lies with those closer to us, over other communities that are more distant.<sup>54</sup> We have a greater duty to 'more venerable and intimate communities' over communities that have emerged recently or communities that are less personal to us:

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<sup>52</sup> These strongly anthropocentric positions establish that because we are the only ones able to subjectively value; we are the only ones that should be of moral concern. Humans are at the centre of moral concern and everything in the non-human world is only usable goods and services for humankind.

<sup>53</sup> My response to this dilemma is the proposal of a weak anthropocentric approach.

<sup>54</sup> If we have the choice to provide for our family or give money to a charity, and we have limited economic resources, our obligation lies with our family because it is closer tied to our personal community.

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Obligations generated by membership in communities to which one has longer periods of recognition of one's belonging and with which one is more intimate take precedence over those generated in communities to which one has shorter periods of recognition of one's belonging and with which one is less intimate (Lo 2001, p. 347).

I disagree that our ethical obligation rests with communities that we are closer to because the term 'community' itself is vague and can often refer to a wide array of different social units we are members of. We can be part of a church community, baseball team, AA group, online community, social movement, or juggling society. In addition, we are also a part of geographical communities such as our street, estate, neighbourhood, town, county, province, country, or continent. These examples exist in a complex web of interactions that do not always flow or interact smoothly and we often have to choose one community over another. For example, baseball practice is on at the same time as church, or you have to vote on a policy which is in the interest of your continent but disadvantageous to your country. The examples of when our different communities' interests' conflict are endless, so how does Callicott reconcile these issues? What should we do when communities that we are members of for a long time conflict with communities that we are more emotionally attached to? How should we apply our responsibility to communities which are 'more venerable and intimate' to us?

One implication of Callicott's first second-order principle is that it always places the human community ahead of the biotic community, by its very definition. Our ethical responsibility to kin and ourselves come first, while our obligation to other things is extended outwards. Our duties are stronger towards those we are closer to and are 'generated by membership' to the communities we are a part.<sup>55</sup> Callicott claims that this is *not* anthropocentric as our obligation resides with humans because it is a closer community, and not because human beings have special status or superiority over other species. The human community comes first and our duty to other species and non-human entities appears to be determined by how close they are to us.

However, by doing this, he puts human beings *at the centre* (anthropocentrism means *human-centred*) of our ethical concern, and our obligations extend outwards to other organisms and species because of their similarities or closeness to us. How we determine which species is of greater ethical importance is their similarity to us or 'in more venerable

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<sup>55</sup> There is a striking similarity between this position and Norton's weak anthropocentric position, which will be discussed later in this chapter.

and intimate communities' (Callicott 1999c, p. 73).<sup>56</sup> However, how is this different from anthropocentrism? One way out of this criticism is to establish a second second-order principle that would reposition him as non-anthropocentric. This second second-order principle needs to overcome the criticism of human chauvinism on the one hand and the criticism of ecofascism on the other hand, in order to be suitable to underpin the PEHP.

Callicott's second second-order principle has the ability to override the first second-order principle but only when our duties conflict in *special circumstances*. It may seem that 'special circumstances' is only rhetoric for strong anthropocentric business-as-usual because it gives no clear context of when alternative action is required. Special circumstances also indicate a strong degree of relativity because different countries and businesses have different interpretations about what counts as a special circumstance. Therefore, Callicott needs to give clearer guidelines as to when the second second-order principle becomes effective instead of just referring to some kind of circumstance that differs from the norm. He proposes that '[t]he second second-order principle (SOP-2) is that stronger interests (for lack of a better word) generate duties that take precedence over duties generated by weaker interests' (Callicott 1999c, p. 73).

Callicott claims that it would be unethical to spend exuberant amounts of money on luxurious toys for our children, if there were other children in our community lacking necessities. 'Having the bare necessities for a decent life is a stronger interest than is the enjoyment of luxuries, and our duties to help supply proximate unrelated children with the former take precedence over our duties to supply our own children with the latter' (Callicott 1999c, p. 73). However, how can his second second-order principle be applied within an environmental context?<sup>57</sup> Can it overcome the charge of environmental fascism? What happens when individualistic human concerns are in conflict with our holistic-oriented duties?

Callicott goes on to argue that both individualistic and holistic concerns can be balanced within the land ethic: 'Thus, when holistic environment-oriented duties are in conflict with individualistic human-oriented duties and the holistic environmental interests at issue are significantly stronger than the individualistic human interests at issue, the former

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<sup>56</sup> This is not only weakly anthropocentric, but strongly if viewed in this light, as it places species' ethical importance on a scale measured by how similar they are to us by their closer community relationship.

<sup>57</sup> This point has been seen within the necessities versus luxuries debate in the sustainable consumption research arena and will be further examined in this section.

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take priority' (Callicott 1999c, p. 76). The first second-order principle states that we should have a greater concern for communities that we are closely linked to (i.e. our human community) over more distant community membership (i.e. environmental community). In the first second-order principle, human individualistic needs would override our holistic environmental duties but the second second-order principle claims that when there is a conflict in a moral agent's duties, they must choose the stronger interest at stake. If the choice is the same as SOP-1 then that act is morally condonable, but if SOP-2 is different to SOP-1, then SOP-2 overrules SOP-1.

Thus, when holistic environment-oriented duties are in direct conflict with individualistic human-oriented duties, the human-oriented duties take priority [because of the first order principles SOP-1, guiding us to the more closely linked community membership]. The land ethic is, therefore not a case of ecofascism. However, the second second-order principle, SOP-2, requires an agent to give priority to the stronger interests at issue. When the indication determined by the application of SOP-1 is reinforced by the application of SOP-2, an agent's choice is clear. When the indication determined by the application of SOP-1 is contradicted by the application of SOP-2, an agent's choice is equally clear: SOP-2 countermands SOP-1 (Callicott 1999c, p. 76).

Callicott gives us no clear guidelines on how to determine weak and strong interests and it appears to be left as an arbitrary decision made by the human community. How we determine whether human concerns or concerns of the biotic community are *stronger* or *weaker* is highly problematic and undermines Callicott's non-anthropocentric holistic approach, unless he provides defensible criteria to do so. His second second-order principle gives us no guidance about what to do in sustainable consumptive practices or when human interests should be considered stronger or weaker than our duties to the environment. Stronger and weaker interests are so vague as to be fundamentally useless when we apply them in environmental practice.

However, if we try to tease out Callicott's position, it would appear it is pointing towards a form of sustainable consumption where we only meet our basic human needs. Therefore, Callicott's second-order principles would imply a certain sense of minimalism, where once our basic needs are met; we would then have a stronger obligation to the holistic system. For example, when we buy luxury goods [representing the human community] instead of giving this money to pay for necessities of other individuals and their children [representing other species], we are acting unethically. If we propose that the human community is more important than the biotic community is, except in special circumstances, then what is to prevent us from *always* placing human interests ahead of the biotic community?

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‘Weaker’ and ‘stronger’ interests tell us very little about what to do in complex ethical situations without an explicit decision-making process. An example of SOP-2 in practice is the case of logging in the Northwest forest and its potential to eradicate the endangered spotted owl. On first appearance, this example of biocide would appear to surpass the weaker economic interests of the loggers, if we take into account the spotted owl’s intrinsic value. If we extract intrinsic value from the equation, which I demonstrated is philosophically necessary in the previous sections; we are still left with the issue of why we should care about the spotted owl over the wages of the individual loggers. In addition, Callicott’s framework tells us very little about how to implement SOP-2 in even more complex situations when these distinctions are not as obvious, so it is more difficult to see the basis of a decision.

Weaker and stronger interests disintegrate into arbitrary decisions when cases are not as straightforward and clear-cut as the comparison between biocide and short-term economic interests. Therefore, there is a need to look elsewhere for a moral framework that overcomes the criticisms of ecofascism and strong anthropocentrism, and which can act as a suitable guiding framework for the PEHP. I will evaluate weak anthropocentrism as a possible alternative to ground the PEHP upon and will assess two fundamental guiding values within different versions of it, namely Hargrove’s weak anthropocentric intrinsic value and Norton’s contributory value concepts. Therefore, it may also follow from this that intrinsic value may have more plausibility if constructed within a weak anthropocentric framework.

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Table 1.3 Callicott, Hargrove and Norton

<i>Characteristics</i>	Callicott	Hargrove	Norton
<i>Claimed Position</i>	Non-anthropocentrism	Weak anthropocentrism	Weak anthropocentrism
<i>Types of Value</i>	Intrinsic value and instrumental value	Intrinsic value and instrumental value	Demand value and contributory value (both instrumental)
<i>Intrinsic Value</i>	Non-anthropocentric intrinsic value	Weak anthropocentric intrinsic value	Intrinsic value is too problematic
<i>Value and Use</i>	Non-human entities can have a value regardless of whether or not they have a use for us	Non-human entities can have a value regardless of whether or not they have a use for us	Non-human entities value is a use value because it provides us with benefits (psychological, spiritual, etc)
<i>Organisms</i>	Individual organisms are only important in relation to their effect on their species and/or ecosystems	Individual organisms are only important in relation to their effect on their species and/or ecosystems	Individual organisms are only important in relation to their effect on their species and/or ecosystems
<i>Ecosystems</i>	They have intrinsic and instrumental value	They have intrinsic and instrumental value	They have demand value and contributory value
<i>Response to Ecofascism criticism</i>	Two second-order principles	Not included	Contributory value

**vii. Hargrove's Weak Anthropocentric Intrinsic Value:**

Hargrove (2003) criticises Norton's weak anthropocentrism on the grounds that he overlooks the possibility that intrinsic value can be incorporated within it and his view that intrinsic value only provides us with a *benefit* in the same way an instrumental value does. For example, when someone makes an 'aesthetic intrinsic value judgment', it is because it triggers feelings of pleasure (Hargrove 2003, p. 183). Hargrove (2003) criticises this view because he claims that it is morally unsettling to propose that all non-instrumental value is actually another form of instrumental valuing.<sup>58</sup> This approach depicts the individual as valuing nature in an essentially *using* manner, for his or her own personal benefit and for feelings of pleasure and satisfaction.

Norton claims that when we value nature non-instrumentally, we are doing it from an instrumental point-of-view in one way or another. If we get aesthetic, spiritual, or non-instrumental value from our appreciation of nature then we are valuing it in an instrumental manner. One of the predominant differentiations between Callicott and Hargrove's intrinsic value, and Norton's considered instrumental value, is that the former two theorists claim that nonhuman entities have a *value* to us, while Norton proposes that this value is synonymous with a *use or benefit* (see Table 1.3). The value of something stems from either the fact that it has a use or benefit for us or else its value is intrinsic, i.e. the use or benefit is not required for it to have value.

For example, Hargrove claims that an ornamental knife may have intrinsic value for us but it may not necessarily have a specific *use* for us. Hargrove distinguishes between use and value and claims that the knife may be valuable regardless of its use. We can appreciate the value of a particular species' existence even though we have no particular *use* for it. He separates use and value, proposing that instrumentality only focuses on something's use and overlooks any non-use value to us—a criticism he puts against Norton's weak anthropocentric instrumental framework. We need to understand what Hargrove means by weak anthropocentric intrinsic value, before we can assess it as a replacement to non-anthropocentric intrinsic value or anthropocentric instrumental valuing.

To begin with, weak anthropocentric intrinsic value refers to when something is intrinsically valued by human beings regardless of the instrumental value it brings to us.

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<sup>58</sup> It must be noted here that he is discussing his form of weak anthropocentric intrinsic value and not any type of non-anthropocentric intrinsic value.

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Something is intrinsically valuable if we have affection, admiration, or appreciation for it regardless of its specific instrumental or economic use. This type of intrinsic value can be placed on a number of different types of things such as non-human, living and non-living non-human things. There is a moral onus not to destroy or abuse these things, but there is also a responsibility to protect them from being destroyed or abused. This is the version of intrinsic value that Hargrove (2003) defends as an example of anthropocentric intrinsic value. An intrinsic value is a value allocated or attributed by human beings to an object of non-instrumental value, and is the first type of intrinsic value in O'Neill's list at the start of this chapter.

In order to gain some clarity about Hargrove's weak anthropocentric intrinsic value, it is important to illustrate what he means by 'intrinsic value'. Hargrove examines Paul Taylor's (1986) notion of the 'intrinsically valued' and claims that it is a perfect example of what he means by weak anthropocentric intrinsic value. This type of intrinsic value depends upon what *we admire, respect, and have affection for* (Hargrove 2003, p. 179). However, this definition of intrinsic value must rely on some form of emotion and feeling from the subjective human valuer. If we admire, respect, and have affection for something (i.e. the ornamental knife), this gives some form of positive emotional and psychological benefit to the valuer. We value the knife because it has a sentimental value for us, or perhaps it has cultural, spiritual value, or aesthetic value. However, all of these values essentially imply that it provides us with a specific *benefit*.

Of course, we can have feelings and sentiments for things without receiving felt instrumental benefits from them but to claim that one can admire, respect, and have affection for something without receiving *any* psychological, emotional, spiritual, or aesthetic benefit from the object (e.g. the ornamental knife) seems far-fetched. There are obvious instrumental benefits we receive from the knife besides using it for cutting things. We can value the ornamental knife because we think it looks beautiful (aesthetic value), or that it was our grandfather's knife (emotional value), it may have religious significance (spiritual value), or maybe we should value it because it brings us comfort, contentment, or enjoyment to have it in our possession (psychological value).

Species and ecosystems also warrant ethical consideration because they provide a use and value to humankind. Not only is our survival dependent on ecosystems but we consider them as valuable for establishing who we are, where we came from, and assisting our

## Weak Anthropocentrism and Contributory Value

creation and development of values. Harm to the species or ecosystems by our present community would be doing a disvalue to future generations because it would deprive them of valuable means for survival but it would also deprive them of things that enrich their lives through spiritual, psychological, and aesthetic benefit. However, Hargrove's understanding of instrumental valuing only refers to the first example where the knife is physically *used* to do something for our benefit, i.e. cutting.

He would say that instrumental valuing only refers to the base commodity values we derive from ecosystems, and not the abundance of values I have listed and the deprivation caused to future generations by overusing them. The definition of instrumental value that I propose in this thesis refers to anything that gives us a benefit and is a much broader and inclusive definition of value than Callicott or Hargrove's. The examples of values listed have nothing to do with valuing the ornamental knife in itself or for its own sake, but instead they refer to reasons why we value it and why individuals should not damage, destroy or steal it.

Therefore, Hargrove's weak anthropocentric intrinsic value itself is a form of instrumental valuing. It is a form of instrumental valuing because even if we continue to use the 'intrinsic value' terminology, we are still benefiting from the protection of objects with intrinsic value (the ornamental knife). We are receiving emotional, aesthetic, religious or psychological benefit from their continued existence and wellbeing, and if we were not, there would be no incentive to protect them because it would just be a knife, which benefited nobody and thus would not inspire any kind of obligation toward it. However, how does this specifically apply in an environmental context? Can ecosystems be contrasted to Hargrove's valuation of the knife or are ecosystems more in tune with Norton's definition of value?

Hargrove attempts to clarify his position by giving the example of the alien species in the *Alien* film pentalogy (1979, 1986, 1992, 1997, and 2012).<sup>59</sup> In the *Alien* movie franchise there is an alien species that is hostile and extremely dangerous to human life but represents an example of unique biodiversity. According to standard non-anthropocentric views of intrinsic value, we should protect and care for this species because it has intrinsic value—a value regardless of whether or not we have affection towards it or if it provides us with a benefit. Hargrove uses this analogy to demonstrate the flaws within non-anthropocentric intrinsic value, showing that it is an essentially naïve position that attempts to protect and care for species that may be a threat to our very existence.

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<sup>59</sup> Not including the spin-offs *Alien vs. Predator* 1 and 2, of course.

Hargrove assumes that his weak anthropocentric intrinsic value overcomes the problems that non-anthropocentric intrinsic value fails to overcome, but he does not actually elaborate upon what his weak anthropocentric intrinsic value would do in the above example but only views it as a critique of Taylor's idea of inherent value. However, by analysing the outline of his intrinsic value, we could deduce that we have an obligation to protect or at the very least not harm the alien species if they are loved, admired, respected, or elicit affection from us. If the alien is a serious threat to our species, then we do not have the same obligation towards it any longer. However, what would happen if we do not have 'love, admiration, and respect' towards a species but it is not a *serious* threat to us—such as snakes, sharks, or rats?

Ethical obligation, for Hargrove, resides in the fact that we love, admire, respect or have affection for a species or ecosystem and so they should be protected. However, claiming that we have no moral obligation towards a species because they scare or disgust us is very problematic for the environmental movement. For example, sharks scare and disgust people and most people do not love, respect or have affection for snakes. However, it would be absurd to propose that we have no moral obligation towards them based on this fact alone. Most people do not value sharks for their dynamic contribution to the world's ocean ecosystems, but instead view them as ferocious man-eating creatures that should be feared—as exemplified in numerous shark movies over the past few decades.<sup>60</sup> While many hold a cautious indifference towards sharks, this should not override the fundamental role they play within ecosystems. They are an important keystone species within our planet's oceanic ecosystems and even if they are disliked and/or feared by some, this should not be a reason for not protecting them. However, can Norton's weak anthropocentrism overcome the glaring problems inherent within Hargrove's position? How does he account for the value of species such as sharks, which may not have aesthetic or cultural value for us?

### **viii. Norton's Weak Anthropocentric Holism**

In this section, I will analyse Norton's weak anthropocentric holism and his contributory value concept and will propose that contributory value is a far more tenable and philosophically sound concept than Callicott and Hargrove's notion of intrinsic value, because it overcomes the ecofascism and strong anthropocentrism criticisms. Weak

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<sup>60</sup> For example, in movies such as *Jaws* (1975), *Deep Blue Sea* (1999), *Open Water* (2003), and *The Reef* (2010).

## Weak Anthropocentrism and Contributory Value

anthropocentrism and contributory value are suitable frameworks to ground the PEHP upon, instead of relying on intrinsic value and non-anthropocentrism. Criticisms that weak anthropocentrism is a ‘rare if not nonexistent ethic’ or is a disguised form of strong anthropocentrism will be revealed as grossly inaccurate and misleading (Westra 1998a, p. 95).

To begin with, weak anthropocentrism states that human beings are at the *centre* of our moral concern but this does not necessarily mean that our present exploitative desires will always come before the protection of species and ecosystems. Human value is *prima facie* greater than any other species’ value, but this does not necessarily mean that we should *always* put *present* human interests first in all circumstances and situations. Norton’s weak anthropocentric approach attempts to promote a full range of human-centred values, and not just the base economic and commodity values usually endorsed by strong anthropocentrism (see Fig 1.1.). He asserts that ‘if our culture perceived the breadth, depth, and power of human-oriented values of species, we would do more to save them’ (Norton 2003g, p. 475).

This enlightened anthropocentrism<sup>61</sup> protects the environment based on human benefits, but not in the economically exploitative manner of strong anthropocentrism. One of the main differences between weak and strong anthropocentrism is their views on how we value non-human entities, what we value the most, and where our main concerns lie. Strong anthropocentrism favours ecosystem goods we receive from healthy ecosystems, while weak anthropocentrism acknowledges the importance of the entire ecosystemic functioning and the goods and services they provide.<sup>62</sup> The difference between weak and strong anthropocentrism can be seen in the distinction between felt and considered preferences: positions that only focus on felt preferences are strongly anthropocentric, while positions that review considered preferences, as well as felt preferences, are weakly anthropocentric. However, how does one differentiate between a felt and considered preference and is this difference important when we are debating which one should ground the PEHP?

Norton claims that a ‘merely felt preference’ is any desire or need that can be satisfied by a specific *direct* experience of an individual (Norton 1984, p. 134). They are often considered the most appropriate starting-point to understand societal values but are by no

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<sup>61</sup> ‘Enlightened’ and ‘long-sighted’ anthropocentrism are synonyms for weak anthropocentrism.

<sup>62</sup> I will show that we receive the benefits of ecosystem goods, services, and cultural services from healthy functioning ecosystems in Chapter Five. I will also further differentiate weak from strong anthropocentrism, and will show how the former values ecosystems while the latter values the environment, in Chapter Six.

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means a fully comprehensive account of them (Norton 1987, p. 9). Felt preferences are easily found through market valuations and economic measurements, in order to assess what individuals prefer without having to care about values and beliefs within society. Felt preferences establish what is valued within society, but only takes into account unexamined satisfaction rates and desire fulfilment. However, what does all of this mean in practice and can we use these preferences to make practical ethical decisions in the PEHP?

If we apply them to the spotted owl case described earlier, the logging of that area would be a demonstration of felt preferences overriding other preferences. However, sometimes we need to override felt preferences because they do not represent our worldviews and value systems, for example, protecting the spotted owl species and their habitat over the felt preference benefits of logging that area. However, one problem with this is that '[m]ost people currently have no felt preference for preserving plants and invertebrates and little concern for natural habitats and ecosystems' (Norton 1987, p. 129). In this example, the interests of the loggers, their company and the service they provide the public override the biocide committed to the spotted owl if we were to integrate only felt preferences as guiding our environmental decisions and actions.

Values are found through market methods and the economic pricing of felt preferences. While it is possible to factor in non-use values, it is commonly seen as an ethically problematic method as seen in the spotted owl case.<sup>63</sup> This is because all non-human entities are only seen as instrumental-economic entities, usable commodities for the satisfaction of human desires. Felt preferences only analyse the pure resource-driven exploitative *use* value of nonhuman entities. The spotted owl and its habitat would not factor into the felt preferences valuation, only the price and benefits of logging the area. This form of instrumental value is what most philosophers are highly sceptical about, not because it is problematic in itself, but if it were the *only* way of determining value, then it would lead to a strongly anthropocentric worldview.

A strong anthropocentric framework would only value felt preferences derived from ecosystem goods while overlooking the importance of ecosystem services and cultural

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<sup>63</sup> The utilitarian approach has the ability to integrate non-use values within its approach, under the concept of total economic value (TEV). TEV integrates both use and non-use values, tangible and intangible services and is a more incorporative and detailed than mere economic preferences. This approach includes direct use values, indirect use values, and option values. While utilitarian approaches such as TEV do not directly refer to the idea of intrinsic value, it does allow intrinsic value to be incorporated within its approach through 'existence values'. There is a problem with measuring the values of ecosystem resources because there is the possibility of undervaluing them while overestimating our ability to cope.

services, which will be discussed in Chapter Five. Weak anthropocentrism takes into account all three benefits<sup>64</sup> and is a far more holistic and far-sighted framework than strong anthropocentrism. In order for the PEHP to be grounded on an ethical and practical basis that avoids the problems of strong anthropocentrism, we must establish another way of determining values asides from felt preferences. Norton manages to overcome this problem by establishing that we should take into account: ‘considered felt preferences’ (Norton 1987, p. 9). A considered preference is

any desire or need that a human individual would express after careful deliberation, including a judgment that the desire or need is consistent with a rationally adopted world view—a world view which includes fully supported scientific theories and a metaphysical framework interpreting those theories, as well as a set of rationally supported aesthetic and moral ideals (Norton 1984, p. 134).

Considered preferences are desires and needs that an individual would have if valuative conditions were met (Norton 1987, p. 9). They are the types of preferences that remain ‘after a complex process of analysis and self-criticism’ (Norton 1987, p. 208). Considered preferences critically assess whether or not felt preferences are rational and moral, and implement other ideals if they are not. Considered preferences are hypothetical, but if we had a methodology to assess them empirically, then it would allow us to test them against our current felt preferences for consistency (Norton 1987, p. 9). Some methods attempt to understand our considered felt preferences in sociological value-action-gap research and choice modelling in economics, despite the many difficulties that remain between expressed preferences and values.<sup>65</sup>

If we apply considered preferences to the spotted owl case, we would view this situation differently and base our actions on worldviews, beliefs, and ethical systems instead of merely calculating that it is more economically beneficial to log that habitat than to protect the spotted owl, which would be the automatic response of the felt preferences approach. On the other hand, considered preferences would be retrieved from the careful deliberation and analysis of the particular situation and would be supported by our grounded ethical and aesthetic ideals, in addition to the values expressed through felt preferences. We would have

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<sup>64</sup> Ecosystem goods, ecosystem services, and cultural services.

<sup>65</sup> Often there is a divergence between values and actions within society, in particular, in relation to the environment. There are numerous factors at play within consumers’ choices of what products they buy and in turn how they affect the environment. The factors that are at play within human decision-making may be out of their hands, i.e. socio-economic factors. They may also have insufficient information about the decisions they make or other barriers in the way such as a hierarchy of responsibility, i.e. family first.

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to factor in things such as the contributory value<sup>66</sup> of the spotted owl to their ecosystem, the aesthetic and cultural benefit we receive from them and their habitat, and the ecosystem services they provide us with, in order to arrive at an appropriate answer. This would be the process of deliberation of a weak anthropocentric approach, while on the other hand, strong anthropocentrism would only care about the utility and cost of the logging outweighing the economic value of the spotted owl and its habitat.

It is important to take into account, before going into the next section, that contributory values are only one out of many types of values to guide the PEHP—such as cultural, aesthetic, and felt preference values. Contributory values can help us guide what is the most ecologically appropriate outcome in a particular situation by clarifying what is the most valuable ecological course of action to pursue. Contributory value is a more scientifically objective and clear way to implement a specific species or habitats value instead of relying on the supposed intrinsic value of them or the base and problematic valuation of them in economic or utility terms. Contributory values should be used in addition to the aesthetic, cultural, and economic values of species and ecosystems, and will be discussed further in Chapter Five of this thesis, and also concluded in the final part of Chapter Seven.

A brief overview of the relationship between these different values within the PEHP would be one of a balancing and weighing up of different criteria in particular examples and situations. They will be discussed and analysed within a post-normal scientific setting in order to evaluate the defensibility of each criteria for acting in a certain way. Because of the overriding importance placed on contributory values within the PEHP approach, they will be given the foremost attention in order to ‘set the scene’ for the discussion of the other values within the topics of discussion. The contribution and knock-on effect of particular species, habitat or ecosystem is paramount in making environmental decisions. This will be elaborated on further when we discuss contributory values in the next section and in Chapter Five in our discussion of different values and finally in Chapter Seven, on the post-normal scientific approach to deliberative decision-making.

Essentially, my weak anthropocentric PEHP will later illustrate that an approach that incorporates ecological analysis with ethical decision-making is the best approach to take in decisions such as the spotted owl case, and that guiding norms such as the contributory value concept can help direct us in practice. However, more ecological information would be

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<sup>66</sup> Contributory value refers to the value of a particular species to the ecosystem that they belong.

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required in the spotted owl case before a definitive answer could be given, such as what type of contributory value does the species bring to its ecosystems and what would be the outcomes of it becoming extinct. This would have to be evaluated in a deliberative democratic process with how much we value the spotted owl culturally, aesthetically, or ecologically (contributory value), and will be depicted in a post-normal scientific framework to the decision-making process, in Chapter Seven. One of these components, contributory value, is an important part of the weak anthropocentric position I adopt to guide the PEHP.

### **ix. Contributory Value:**

Norton's definition of weak anthropocentrism states that threats to ecosystems and species means we should protect them if they are emotionally/psychologically and practically valuable to us. If we do not value sharks emotionally and psychologically, do we still have a duty to protect them. I propose that Norton's contributory value will help us to overcome this problem. 'Contributory value' is the value a species contributes to the ecosystems it is a part of and is a distinctly holistic way of valuing that emphasises the importance of the *function* of species on their ecosystems and 'the entire fabric of life on which those species depend' (Norton 2003g, p. 474).

One of the outcomes of contributory value is the understanding that every species has a particular value to human beings even if their value is not apparent straightaway. Each species has a specific contribution to the ecosystems they are a part of and thus have a value to us because of this contribution. If our main concern is the precautionary protection of ecosystems' healthy functioning, then the contributory value concept should guide us in how we implement these goals in practice. It allows us to place a value hierarchy on species based on their level of contribution to their ecosystem.

This section will analyse whether or not contributory values have the ability to guide the PEHP within sustainability theory and in order for contributory values to be successfully applied they must overcome similar criticisms that I put against intrinsic value. Contributory value must demonstrate that it is philosophically sound and has the ability to be applied within a policy-led discussion on sustainability. It must have theoretical consistency and pragmatic policy possibilities—two aspects seriously lacking within the intrinsic value concept. To begin with, Norton proposes that it is impractical to protect *all* species and it is

also ethically undesirable.<sup>67</sup> While every species has a value because of their contribution to their ecosystems, we still cannot protect all of them, so we need to establish a hierarchy of value. Therefore, we should try to devise a criterion in order to establish which species merits more protection than others do. One way to establish this is by using an ecological criterion, i.e. which species is more ecologically valuable than another is, as a defensible basis for considered preferences. This can be implemented by determining which species contributes more to EH. 'It may, therefore, make ecological sense to give up on some species and concentrate on those that are truly important for human or ecological reasons' (Norton 2003a, p. 124).

Instead of relying on our arbitrary opinions of which species we should protect or attempting to protect all species because of their intrinsic value, we should instead use contributory value as a more scientific and ecologically respectful valuative basis to decide an effective course of action. Contributory value states that all species could potentially contribute to the diversity and richness of their ecosystems, but some contribute more than others do. Even if it is not apparent that a species adds something to an ecosystem, it may still have a contributory value to species diversity, thus implying a *prima facie* duty to protect all species before their roles and functions are analysed (Norton 1987, p. 237). However, how do we differentiate species values from each other? How can we establish a hierarchy of value if all species have a value?

One way around this problem is by placing a greater moral obligation onto species that have a significant impact upon the functioning capacity of their ecosystems. Contributory value measures the positive and negative effects a species is having on their ecosystems as indications of our ethical responsibility towards them. Species with a greater contribution to their ecosystem would indicate a stronger moral obligation to protect them than another species with less contribution to the health of their ecosystems. This is not because of the inherent value of that species but is because the species contributes to the functioning capacity of their ecosystems and this functioning capacity is beneficial to humankind. However, we cannot have total knowledge of how a species affects its ecosystem so contributory value relates to the best available knowledge at that time for calculating their value. Our knowledge is not perfect or all encompassing in relation to a species' effects on

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<sup>67</sup> I will demonstrate its undesirability later in the irreversibility section of the precautionary principle chapter.

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their ecosystem, but it acknowledges this when we make our estimations and that our knowledge will change in time with developments in science.

The level of 'contributory value' does not remain at a fixed level but it changes with our developing knowledge of species and ecosystems. For example, the contribution of sharks to their ecosystems in the past would not have been seen as a reason for caring about them but with the latest scientific and ecological knowledge, we know that the knock-on effects of their extinction would have a dramatic effect on the world's ocean ecosystems. The contributory value approach takes a less arbitrary stance than other environmental positions because it measures species interaction and contribution within their ecosystems, rather than taking an economic or aesthetic approach to value. Our moral obligation to sharks would not be neglected under the contributory value definition because sharks' contributory value to ocean ecosystems is fundamental and far-reaching. Sharks are seen as a 'keystone species' and their extinction would have a devastating effect on other species and ecosystems as a whole.

In other words, without the sharks to eat the species that prey on the algae-eaters, those algae-eaters will decline, leading to an accumulation of biological refuse that eventually chokes out almost everything else, such as colorful reefs and everyone's favorite marine animal: the sea dragon (Murray 2010).

Therefore, sharks' contributory value would override the economic instrumental value of killing them for shark-fin soup. Their contribution to the ocean ecosystems is far more valuable to us and for future generations. However, a critic may argue: 'How do you know it is apparent? Would the felt instrumental preferences not override all forms of contributory value of the shark?' It appears that this type of argument summarises one of Hargrove's main disagreements with Norton. He claims that Norton's approach would always allow felt instrumental values to trump our considered instrumental values, meaning this approach would descend back into strong anthropocentrism. Hargrove argues that

the reduction of intrinsic value to instrumental terms demeans and trivializes it, giving a counterintuitive advantage to (instrumental) resource exploitation by turning nature preservation into a peculiar, and largely indefensible, special case of resource exploitation and consumption (Hargrove 2003, p. 185).

However, this criticism is not only contradictory against Hargrove's form of intrinsic value itself, but it is also contradictory for any approach that attempts to protect nature from resource-usage and degradation. It is contradictory because Hargrove cannot say that it is impossible to preserve nature from an instrumental position but then claim that the very vague and controversial idea of nonhuman intrinsic value would be more suitable to protect

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the natural world from destruction. Hargrove cannot be this pessimistic towards Norton's view of humankind and its value system, while at the same time believing that weak anthropocentric intrinsic value would trump our economic and material concerns when they are in conflict. He is claiming that there is a better chance of protecting nonhuman entities if we attach the label of 'intrinsic value' onto them instead of protecting them because they have a use or benefit for us. However, it would be a lot easier to implement environmental policy because of their spiritual, emotional, and psychological value to human beings over implementing policy based on ideas of intrinsic value.

If Hargrove insists that Norton's type of values will always end up being overlooked for more resource-hungry exploitative uses, but thinks that his weak anthropocentric intrinsic value would be a more suitable way to protect species, he is being extremely naïve. Intrinsic values are overlooked time-and-time again, in favour of resource consumption and have little to no force in reality. Intrinsic value has been used in policy documents such as WSDD (2002), the Convention on Biological Diversity's Decision VII/11 (1992), and the Rio Declaration (1992). However, it has had little effect or clarity within these documents and is used as a rhetorical tool for continued business-as-usual attitudes. Intrinsic value rarely gets formulated and implemented, making Hargrove's interpretation that it can be used within environmental policy effectively is both impractical and misleading. While Hargrove's criticisms of Norton are unfounded and essentially contradictory, a more pertinent problem for Norton's position is the charge of ecofascism.

### **x. Weak Anthropocentrism and Ecofascism:**

This section will analyse Norton's weak anthropocentric holistic approach and its attempt at answering the ecofascism criticism in order to ground the PEHP. To begin with, Norton claims that a balance between felt and considered preferences is vital for effective environmental management because leaning too much towards felt preferences would lead to strong anthropocentrism but putting too much emphasis on the holistic whole may lead to ecofascism (Norton 1984, p. 146). The last section demonstrated how Norton's form of weak anthropocentrism does not fall into the category of strong anthropocentrism and this section will describe how his position can overcome the ecofascism criticism, and in turn why it should underpin the PEHP.

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The PEHP requires a distinctly holistic approach because of the very nature and make-up of health and ecosystems, and because a holistic approach is required for protecting ecological wholes rather than individual parts. However, as was demonstrated in the previous sections, we cannot use non-anthropocentrism because it does not overcome the ecofascism criticism and we cannot use strong anthropocentrism because of its distinctly exploitative and individualistic nature. Norton's weak anthropocentrism does not claim that nonhuman entities have intrinsic value, but it proposes that they possess a value because we benefit from their continued existence through their interactions in their ecosystems. Weak anthropocentrism overcomes the ecofascism criticism because it gives us a practical and ethical way to measure what we should do when the health of multiple nonhuman species are in conflict, i.e. which has the greatest contributory value to their ecosystems.

This is very different to Callicott's vague claim that stronger interests should take priority over weaker interests. Weak anthropocentrism gives us more direction about what to do by taking into account which species has a greater contributory value to the system, instead of arbitrarily establishing which species has a stronger interest, as Callicott suggests. Callicott's stronger and weaker interests gave us little indication of how to implement these values in practice. It instead resulted in arbitrary decisions about which species has higher or lower interests in each particular case. It gave us no guidance about how to implement a valuative methodology for promoting the PEHP in practice.

Norton's contributory value concept gives the PEHP more guidance because it states that the species with a greater ecological contribution to the ecosystem would override our obligation to other species that contribute less. It is something which is scientifically deducible and which can be backed up with rigorous ecological testing. Contributory values promote a more adequate valuative system for the PEHP and allows scientifically defensible ways to evaluate our value of species and ecosystems. If we ethically desire EH for the benefit of present and future generations, then the most effective valuative system to achieve this would be through contributory value. However, how does Norton's weak anthropocentrism overcome the difficulties that Callicott's position could not? How does weak anthropocentrism overcome the problems of ecofascism, while avoiding the descent into strong anthropocentrism?

Callicott places human interests first in his first second-order principle in the same manner that Norton does, but his second second-order principle lets him down because he

does not clearly distinguish between weak and strong interests. It was shown to be far too difficult, vague, and essentially arbitrary when put into practice. Norton on the other hand establishes that we can judge which species should receive more attention based on their contribution to their ecosystem. It is a more holistic, scientific, and ecological approach to guide the PEHP in sustainability theory and practice. However, Norton's weak anthropocentric approach still needs to overcome two fundamental criticisms which were put against Callicott's non-anthropocentrism in order to be a sufficient framework for the PEHP—the ecofascism criticism and the issue of descending into strong anthropocentrism.

Norton's weak anthropocentrism overcomes the ecofascism criticism because it is concerned with humans first. While we may need to sacrifice *human* felt preferences for *human* considered preferences, we do so because it benefits humankind as a species in a long-sighted anthropocentric way. It simply readjusts the focus of our ethical concern from present-focused wants to future-focused needs. What differentiates weak and strong anthropocentrism is that weak anthropocentrism projects a long-sighted moral concern towards future human beings as well as present human beings, while strong anthropocentrism<sup>68</sup> is focused on what is most advantageous for present human beings. However, what happens when the needs of present-day humans clash with the need to protect ecosystems for future generations?

Norton identifies the clash between what we should conserve for the future against present needs as a misinterpretation (Norton 2003d, p. 422). Economists use this 'trade-off' problem to establish projections of incomings, outgoings, and economic costs of doing business in a supposedly ethical manner. The trade-off problem establishes that we would have to sacrifice present people's interests for the benefit of future generations. A strong anthropocentrist would often argue that we should maximize our use of the environment for the benefit of the present generation and some economists would go so far as to say that we have no responsibility to future generations at all because it is too difficult to establish their needs, wants, and entitlements. This line of thought is formulated by Robert Solow (1993) and is known as 'the ignorance problem', which essentially relieves us of any ethical responsibility we have towards future people.

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<sup>68</sup> I associate and define strong anthropocentrism as a shortsighted form of anthropocentrism, as opposed to weak anthropocentrism's long-sighted anthropocentric approach.

Solow claims that the only obligation we have towards future generations is to increase our overall total capital.<sup>69</sup> This would mean that money, artefacts, labour, and environmental assets can be substituted and used interchangeably as we see fit. This is because we have no idea what the future will want, so it is best just to provide them with greater total capital. However, to a large degree, we *can* establish what future generations would want, and we should not be hindered by lack of unequivocal certainty. Take the example that Norton gives of a toxic time bomb, which will be safe for 150 years but will explode some time thereafter. Solow would say we have no responsibility to the people of the future because we do not know what their interests will be. Maybe they would like to be covered in toxic sludge or perhaps they could find new ways to use it such as to propel spacecrafts to distant planets or resolve the future energy crisis. There are a whole host of far-fetched ideas one could muster up as reasons to justify the storing of toxic sludge time bombs, regardless of the fact that most people would intuitively believe that this action is grossly irresponsible.

These examples do not override our present knowledge that toxic time bombs would be grossly damaging and destructive to the future, regardless of *full* certainty of the future's interests. I will demonstrate that this claim to total ignorance is completely incorrect as there are actually only degrees of certainty, and if one wants to claim total ignorance about a situation that there is ample evidence and information about then we can charge them with culpable ignorance (the application stage in Chapter Seven). Culpable ignorance holds people like Solow responsible for their actions when they claim total ignorance about future generations' needs when there is ample evidence available to indicate what they would need, i.e. healthy ecosystems. There is an abundance of information available to us that the explosion of toxic waste would certainly not be in the interests of future generations, to the best of our available current scientific knowledge. Therefore, '[o]nce we reject the extreme ignorance claim and recognize that we have a convincing basis for some expectations about what the future will want, it is possible to re-establish a closer relationship between distance questions and typology of questions' (Norton 2003d, p. 434).

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<sup>69</sup> Total capital refers to all forms of capital calculated under one economic roof rather than separating them. Natural capital, man-made capital, social capital, and economic capital are all categorised under the rubric of total capital and can be traded-off and substituted with one another as long as the total overall capital does not decline. An outcome of this is that our natural environment can be drastically impacted if it means that economic capital goes up and there is an overall non-declining rate of total capital.

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Ultimately, we should be responsible for ‘inculcating certain values and for ensuring that those values are perpetuated in future generations’ (Norton 2003d, p. 436). Values are passed on from generation to generation and change during this transferral. We should still try to promote an environmentally conscious value system for the ‘successful transmission of an attitude of love, respect, and caring for these places to the persons of subsequent generations – including a sense of moral obligation to continue protectionist policies and ideas’ (Norton 2003d, p. 437). To view the issue as a trade-off problem is reducing the discussion to an economic debate, not a moral one. It is ‘preordained by the theoretical scaffolding chosen to express the trade-off problem’ (Norton 2003d, p. 443).

The view that a trade-off between future generations and us and is calculable in economic terms alone is a bleak world-view. It is a view that completely overlooks our position as human beings as part of an ethical community, an ethical community that has a past, present, and future. After all, society is made up of a linked bond between different generations, and ‘[a]s the ends to such a partnership cannot be obtained in many generations, it becomes a partnership not only between those who are living, but between those who are living, those who are dead, and those who are to be born’ (Burke 2005, p. 54). Therefore, measuring our responsibility to future generations *solely* in economic terms and in relation to trade-off issues would ignore the fact that ‘both our past and future are entwined with the broader community of living things, the living things and ecophysical systems that form the habitat and the context of multigenerational human communities’ (Norton 2003d, p. 442).

We must view our intergenerational relationship as a responsibility to ensure that our environmental values do not disappear over time and that to ‘the extent that the community has committed itself to certain values and associated management goals, these goals are deserving of social resources and investments in the future’ (Norton 2003d, p. 446). Present generations need to initiate an active role to reduce their impact in a collective moral effort, while at the same time trying to instil these values in the generations that will follow (Norton 2003h, p. 511). Our values are a combination of inherited values from the past and also our addition and interaction with these values. Environmental values should be instilled in generations to come, because not only are they the very life-source for humankind, but also because they tell us our story about whom we are and where we come from.

The considered instrumental values of a weak anthropocentrist would often place a strong emphasis on the aesthetic, spiritual, psychological, and contributory values of species.

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However, this is being done because they bring *us* aesthetic and psychological value, or their contribution to their ecosystem provides us with ecosystem goods and services. Norton's weak anthropocentrism and his contributory value concept are effective replacements to non-anthropocentrism and intrinsic value as ways to guide the PEHP. Callicott failed to overcome the ecofascism criticism because his first second-order principle would make him a strong anthropocentrist, and if he includes his second second-order principle it makes it too vague, practically problematic and insufficient as a theoretical basis for the PEHP.

My interpretation of weak anthropocentrism does not fall into the ecofascism trap as it places humankind ahead of other nonhuman species, but at the same time this does not allow for any kind of abuse we see fit. We need to maintain EH for future generations so we need to act responsibly instead of adopting a shortsighted abusive mindset as expressed in strong anthropocentrism. Weak anthropocentrism states that we do not override present individual human needs for the benefit of ecosystems or the biological world as a whole, but is actually balancing collective human considered preferences with collective human current felt preferences, instead. This is not done against present generations' will but is instead integrated as part of a cohesive agreement between generations and also the public and policymakers, as will be expressed in Chapter Seven (deliberative democracy and post-normal science).

Our considered preferences and value systems would propose to protect EH for future generations and sometimes overrides our current felt preferences. However, this will be an acknowledgement of collective sacrifice and not an enforced fascist environmentalism. My adoption of Norton's weak anthropocentrism overcomes the ecofascism criticism because it still places *human* interests first, but it sometimes has to place the future humankind's needs (for healthy ecosystems) above present frivolous wants. It varies in its reason for application (for humans) to holistic non-anthropocentric positions that fail to overcome the ecofascism criticism (putting intrinsic value of systems above individual human interests). While the end outcome of an action may be the same as holistic non-anthropocentrism on some occasions, the reason for these actions is still grounded on human interests and values.

Take the spotted owl example, we would probably protect the spotted owl because of its contributory value to its ecosystem is quite large, therefore the impact of exterminating it would have a devastating impact on EH far beyond the economic loss to the loggers. The contributory value is beneficial for present and future generations of human beings, not

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because we want to protect the spotted owl for its own sake. We may also value it because of cultural and aesthetic reasons, for passing on to future generations of human beings. The aesthetic and cultural value they bring to future generations and us would be additional reasons for protecting the spotted owl from harm.

However, we still have to weigh up what contributory value the spotted owl has to its ecosystem and the value of the forest ecosystem, and then balance this with the aesthetic and cultural value that species has. Regardless of how much we value a species or habitat; there may be justification for controlling or culling a species if it affects its ecosystems in such a way as to warrant this action. Therefore, my weak anthropocentric approach to the PEHP, guided by contributory value, acknowledges that sometimes we must sacrifice individual organisms for the greater good of its species. However, it does not conclude that we should also sacrifice individual humans for the greater good of EH, because as illustrated earlier, we are not sacrificing our present human needs for the benefit of ecosystems as such, but we are doing so for the benefit of future generations of human beings.

The view of ‘us versus them’ is a misnomer by economists and a simplification of what it means to be human. If we view our past, present, and future and a linking together of knowledge, history, and value, and that we are part of a continual ethical community, the idea of trade-offs and sacrificing individual desires for the greater good begin to disappear. It is a readjustment in perspective of our place and an alteration in how to view the issue that is not simply based in the economic monetary realm. It is a closer bond of passing on environmental values to the inheritors of the planet rather than the black and white worldview of maximizing our wealth at the expense of others, or being seriously hindered by having a care for the future.

This chapter discussed the difference between instrumental and intrinsic values, in order to evaluate their place within ecosystem health and the precautionary principle. It was shown that Callicott and Hargrove’s definition of instrumental value is too restrictive and confined to the mere base material use of things rather than the abundance of other benefits we receive from them aside from this—I gave other examples, such as aesthetic, cultural and psychological/emotional value. The position I adopt from Norton is that instrumental value is a more inclusive and broader definition of as anything that provides us with a benefit or we have a use.

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It was shown that non-anthropocentrism, and its norm of intrinsic value, was far too problematic to be used to ground and guide both ecosystem health and the precautionary principle. Callicott's intrinsic value definition was flawed from its very origin in his Bio-Empathy axiology because of the misleading and theoretically conflicting information and he uses as its basis. His descriptions of intrinsic value fared no better because it was shown to be too vague, theoretically problematic, and contradictory in its assumptions. His second-order principles were shown to be inadequate as a thorough defence against the ecofascism criticism because SOP-1 on its own implemented an anthropocentric approach, but if SOP-2 is combined with it then it becomes completely unclear and arbitrary about who or what has stronger as opposed to weaker interests in a particular case or situation.

In response to the ecofascism claim against non-anthropocentrism, I analysed Hargrove's weak anthropocentric intrinsic value position and Norton's weak anthropocentric contributory value. Hargrove's position was shown to be contradictory and too focused on criticising non-anthropocentric intrinsic value but did not allocate enough information to establishing his own position in the debate. His form of weak anthropocentrism was shown to be just another form of instrumental valuing because we are benefiting from the things he wants to protect under the definition of intrinsic value; otherwise, it would not elicit any obligation on others to protect those things. For example, we are still receiving emotional, aesthetic, religious or psychological benefit from the ornamental knife, or else there would be no obligation to protect it because it nobody would have any benefit or attachment towards it.

Norton's position of weak anthropocentrism, guided by contributory value, was shown to be the most suitable out of the three main theorists' positions I evaluated in this chapter. His weak anthropocentrism overcomes the difficulties inherent within the ecofascism criticism and it avoids the traps that Callicott's non-anthropocentrism fell into, i.e. the vague definition and separation of weaker from stronger interests. Norton's position overcomes the ecofascism criticism because it places humans first, but also gives a great importance to the needs of future generations. The environment or ecosystems do not override individual human needs as expressed in the ecofascism criticism, but it is instead proposing that we may have to sacrifice present human needs for future human needs. However, it is a balance between human needs and has nothing to do with an inherent value of nature or interests of the environmental whole overriding individual human needs. Norton's contributory value concept gives us clear guidance in how to balance the value of individual non-human species

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in fair and appropriate ways, i.e. which species has a greater contributory value to its ecosystems.

It has become clear that non-anthropocentrism does not work as the grounding framework for ecosystem health and the precautionary principle, and ‘intrinsic value’ is inadequate as a guiding norm for both concepts. Therefore, we can begin to assess ecosystem health and the precautionary principle individually as to evaluate them as standalone concepts before we solidify their merger later on in the thesis. The next two sections will be devoted to my assessment of ecosystem health, followed by chapters on the precautionary principle’s merger with it in the PEHP. The next section will analyse the first claim that ecosystem health is something that is analysable and understandable to begin with. If it were not, then its value as an ecological concept and its use for merging with the PP would be thrown into doubt, but if it is shown to have objective merit then it allows us to identify it in order for it to be valued and subsequently implemented in practice.

Callicott's Non-Anthropocentrism and Intrinsic Value

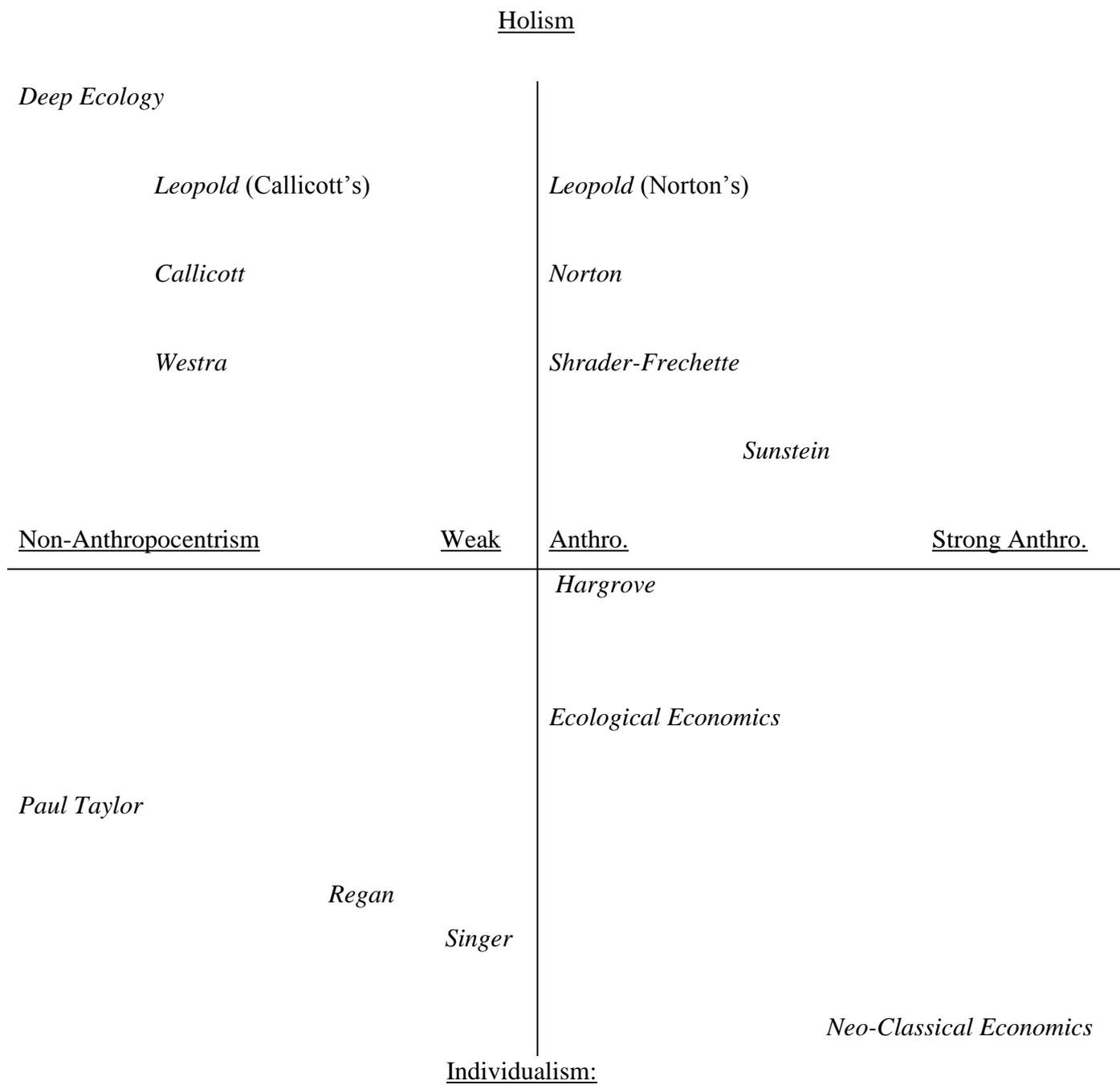


Table 1.1: Theoretical Map

## CHAPTER FOUR

### HEALTH IS OBJECTIVE (EMPIRICAL AND MEASURABLE)

The purpose of this section is to evaluate Callicott's claim that EH is objective (measurable and empirical). If we can show that health is objective then this would indicate that it may be applicable to ecosystems. While human health and EH are quite different, they do have striking similarities. Therefore, the analysis of human health will give us insights into EH; its characteristics; how it can be applied and potential philosophical problems within it. This will give us clarity about if health can be applied to ecosystems in a literal objective way.

To begin with, Callicott claims that health is both objective and valuatative: 'Health is a more or less objective condition of organisms; and health is, without exception, also a good thing' (Callicott 1999f, p. 356). The focus of this chapter is on his first claim that health is objective and Chapter Five will focus on the value of health. However, what exactly does Callicott mean by 'objective' and why is it so important for EH? Health is objective if it can be analysed and categorised as to what is and is not 'healthy' in humans and other organisms. If I refer to human health or EH as being 'objective', I mean that it can be empirically studied and measured. However, it is important to question whether health is objective in humans before assessing its applicability to other organisms and ecosystems. If health were not understandable and measurable in a human context, then it would cast doubt over the possibility of it being applied in an ecosystemic context.

Some people propose that health is too difficult to define or that it is something intuitively known and does not necessarily require a definition. Others claim that health is 'like beauty, [it] is in the eye of the beholder; and that a definition cannot capture its complexity' (Jahad and O'Grady 2008, p. 1364). However, if health were this arbitrary, it would be extremely difficult to understand it or categorise it in practice. In this chapter, I will outline a clear and concise definition of health, why health should be taken literally when it is applied to ecosystems and also to demonstrate that ecosystem health is something objective, i.e. empirical and measurable. However, we first need to establish some criteria of health in order to define it, for example, that it is holistic and variable.

Health is Objective (Empirical and Measurable)

**i. Health is Holistic and Variable:**

Health is related to one's well-being and is a holistic approach to the adequate functioning within one's body. If it were individualistic and reductionist it would only analyse the individual components in isolation from their effect on the overall functioning system. One *could* analyse and describe the individual parts of a body and their level of functioning but this would have to be done in isolation from their overall effect on the system as a whole. This approach would tell us a great deal about individual organs, bones, nerves and so forth, and would tell us a lot about the amalgamation of the separate parts, but it would not give us an indication of the interrelationships taking place between the different processes throughout the body (system), and would not describe one's 'health'. While these two approaches are not mutually exclusive, we need to apply the individual analysis of the health of individual parts of the human body to the overall system to have an accurate holistic portrayal of health.

When this is applied to ecosystems, health is shorthand for the overall functioning capacity of the *entire* holistic system and not just a collection of its individual parts. This can be distinctly contrasted with many environmental frameworks that take holistic approaches within their valuative methodologies. Environmentalists would argue that individualistic management is insufficient because the environment works in ecological wholes rather than in individualistic ways. It is only when the unhealthy individualistic parts affect the overall functioning of their ecosystems do those ecosystems become unhealthy. If certain organisms are unhealthy but they do not affect the overall functioning of their ecosystems, then the unhealthy components do not necessarily determine the environment's health.

This holistic approach underpins every aspect of this thesis and is fundamental for future progress within sustainability theory. The framework of weak anthropocentrism should be based on a holistic framework, as its fundamental concern is the *whole* of humanity because the protection of ecological wholes enables our survival as a species. The PP framework is also fundamentally holistic as it aims to protect human health and the environment, but protects them as holistic entities rather than a collection of individualistic properties.

The holistic framework can also be seen within ecosystemic theory where one takes an overall systemic approach rather than focusing on the individual parts. However, how would this holistic approach be implemented in practice? What would we do if parts of a body were affecting the overall health of that body, or in an environmental context—when

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species affect the health of the overall ecosystem? If certain components within a system began to function poorly or affected the future functioning of the entire body (or ecosystem), then it would be wise to treat or operate on that (or those) part(s). When this happens, and when the functioning of the whole body (or ecosystem) may be impaired, it would appear that a holistic approach to the whole body (or ecosystem) should be taken. For example, consider an individual whose leg becomes badly infected because of an accident and if appropriate action is not taken, it will threaten their life. The individual has the option to amputate the leg, a sacrifice of an individual body-part for the good of their overall physical health. The same parallel can be applied to ecosystems, whereby, if a species were threatening the overall health of the ecosystem, it would be sensible to control that element.<sup>70</sup>

As it stands, our definition of human health is still left open to some drastic and morally repugnant outcomes. For example, if an individual is in a car accident and becomes disabled from the waist down; are they considered ill under this definition or are they functionally limited but relatively healthy? Would they be considered ill if they were born with this disability? To reiterate, the definition of health is the adequate functioning of the entire body in a holistic manner, and if part(s) of that body threaten to impair its overall functioning, then it is veering towards the unhealthy end of the continuum. It would appear that most definitions of health would categorise disabilities as states of ill health, in addition to pathogens, infections, and viruses.

However, my primary concern is to establish how human health can help us understand EH, not necessarily the social and economic problems associated with the application of health in the human context. Applying the health concept to ecosystems avoids any social and ethical problems that categorising individuals with disabilities as 'ill' brings. One key characteristic of health that may help overcome these issues is its 'variable' component. Health is variable because it is always dependent on particular situations and can be divided into different categories and sub-categories, i.e. health of a teenage boy, or health of a teenage boy with cystic fibrosis. The types of health alter depending on the particular variables in a situation.

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<sup>70</sup> However, as discussed in the weak anthropocentric response to the ecofascism criticism, we would control the human element from destroying EH through policy and regulation. Nevertheless, it was expressed earlier that this would be done for the benefit of humankind's survival and human beings interests as a whole, rather than any kind of direct moral obligation to the non-human world itself.

## Health is Objective (Empirical and Measurable)

A variable is something that changes and does not have a fundamentally consistent pattern in all situations and circumstances. Health is a variable because it is not something that is categorically universal; it is instead something that changes with the particular factors affecting a situation. In a practical situation, it means that health cannot be universally the same for all people in all contexts. There are different levels of health depending on the particular life-stage or circumstance. Health is variable because it factors in the idea that there are ranges of different types of bodies, conditions, abilities, and ages throughout the world, so what might be considered healthy for a twenty-year old athlete would be different to what is healthy for an eighty-year old pensioner or an individual who is paralysed from the waist down. It takes into account the different stages in life and the different limitations on our health because ‘a person in their eighties cannot perform physically at the same level as they did in their twenties, health in old age is a condition that enables the full potential of a human of that age to be realized’ (Albrecht 2001, p. 246).

However, this appears to outline how an *ideal* twenty-year old, eighty-five year old or someone who is paralysed should be. It contrasts health with an ideal state, where health is established from the ideal functioning of a human body free from disease and illness, and relative to the specifics of that individual. The health of an ecosystem can also be measured in similar respects while avoiding the social and ethical controversy of defining human health in this way. There are different types of ecosystems at different stages and cycles, so it allows for a dynamic and adaptive approach to healthy functioning. ‘There is no “norm” of health that applies to all stages of human health. Similarly, there is no “norm” of health that applies to all stages of ecosystem development’ (Kimmins 1997, p. 231). There are no ‘ideal’ ecosystems, just as there are no definitively ‘ideal’ human beings, but we can still establish a defensible scientific approach by comparatively analysing similar ecosystems.

Health is not evaluated by only one type of criterion such as age or physical state, but is characterised by numerous other factors, in order to establish what is or is not healthy. For example, on first appearance, a twenty-year old marathon runner would be considered healthier than a twenty-year old in a wheelchair, under the criterion that health is the overall functioning of individual parts within the greater whole of the body. However, to make the health concept variable in another comparative way, we could identify two twenty-year old individuals in wheelchairs but one individual eats healthily and gets exercise, while the other drinks heavily, smokes, eats junk food, and suffers from many health-related illnesses.

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Therefore, there are different *degrees* of health in different contexts and when applied to ecosystems a similar approach can be adopted.

There are different types of ecosystems and their level of health depends on their context and the components and processes that they consist of. While one ecosystem could be definitively healthier than another ecosystem because its biodiversity is flourishing, the other ecosystem may be healthier in another way such as having greater accumulation of biomass. There is the possibility of systematically mapping out and evaluating similarities and differences between ecosystems in order to understand certain *parameters* of health. This is not to enforce a normalcy or exactness of what is or is not healthy, but it is in order to establish *levels* of health. Callicott claims that despite the fact that there are problems defining human health, there are still parameters we can work within in order to establish what is or is not healthy. Within these parameters, we have to make ‘judgment calls’, which are claims based on the parameters of health (Callicott 1999f, p. 352).

Overall, health is related to one’s physical well-being and is a holistic approach to the adequate functioning of all the component parts. Therefore, health is definable if one uses it as a broad overall descriptive ideal to represent the intricate workings, functions, and processes within the human body or ecosystem, and not as a specific universal methodology that analyses health from only one *modus operandi*. Health has a variable nature and cannot be defined using clear-cut singular categorisations. One of the most significant problems with health in an ecosystem context is that it can only be applied metaphorically to ecosystems, while applied literally to organisms.

### **ii. Ecosystem Health is Objective (Empirical and Measurable):**

This section will analyse if EH has the potential to be analysed in a *literal sense* and not simply in a metaphorical sense. If we analyse the health of ecosystems metaphorically, then signs of its health or illness would be understood as only representations of what its health or illness would be *if it could possess these faculties*. If we take EH as literal, then signs of health or illness would be *actual representations of its health or illness*. The main difference between taking EH as metaphorical or literal is that the signs of its health/illness would be taken as *actual indicators* of its health or else they would be taken as *representations* of its

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health. However, we must understand what is meant by ‘health’ and if EH can possess health literally.

The word health originated from the Old English word ‘hale’, which meant well-being or being whole. Definitions of health usually include a number of characteristics that are not relevant to all organisms and are often specifically created for *human* health—such as ideals about family life, sexual wellbeing and access to healthcare. We are often left with vague definitions of health when applied to nonhuman organisms, which makes it problematic because some organisms only partially fit within its definition. Furthermore, health is confined to organisms in a literal way and only metaphorically to groups or systems. MediLexicon establishes health as ‘[t]he state of the organism when it functions optimally without evidence of disease or abnormality’ (MediLexicon, 20/05/2012). This clearly shows that health can be applied to organisms in a literal way, but does not include systems.

This is because ecosystems do not fit into the Darwinian selection paradigm, as they are neither organisms nor super-organisms because they lack DNA and ‘do not reproduce themselves—at least not in the way that organisms do’ (Callicott 1999f, p. 350).<sup>71</sup> Callicott claims that health can only be applied to ecosystems in a metaphorical way but ecosystems’ functioning capacity should be compared to the functioning capacities of organisms (Callicott 1999f, p. 351). However, why do we consider health as being literally applicable to organisms but only metaphorically applicable to systems that are composed of organisms?<sup>72</sup> In order to understand the value of EH we need to clarify what exactly an ‘organism’ is and why are they viewed as the only literal possessors of health.

To begin with, the definition of an organism includes everything that is a living biological entity, including bacteria, protists, fungi, and other very basic biotic life, in addition to plants, animals, and human beings. However, to depict bacteria, protists, or fungi as being either healthy or unhealthy seems intuitively problematic. To describe single-cell organisms as healthy or unhealthy is slightly confusing and appears to diverge from our initial definition of health. Can we say that a specific course of action is in a mould’s interest or well-being? Can a parasite, an organism that fundamentally lives off another organism, be said to be healthy or ill? If we cannot apply the concept of health to *all* organisms, then the literal application of health to only some organisms would seem arbitrary. To say that health

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<sup>71</sup> Of course, there are opinions about selection at an ecosystem level, but this research is still very preliminary and requires more research.

<sup>72</sup> A human being for example could have numbers of microorganisms existing on their person.

## Health is Objective (Empirical and Measurable)

can only be applied to organisms would be misleading because it would in fact only be applicable to *certain* organisms. Sentient animals develop similar illnesses, disease, cancers and maladies to human beings but applying health to only organisms that are comparable to us would be philosophically inconsistent for the definition of health, if this definition were categorised as the functioning capacity of all organisms.

There is a striking inconsistency with the literal application of health to all organisms. If we establish that the health of some organisms should be seen in a metaphorical way, then there must be a good reason why only some organisms can have health in a literal way. However, if we propose that all organisms can be healthy in a literal way, then we would have to reassess the definition of health as being in an organism's 'well-being' or 'interest'. If we define health as an organism's ability to function and be free from threats, then this would raise some very interesting questions in relation to the application of health to ecosystems. When this definition of health includes organisms whose health would not fit into the category of well-being or interest, then this leaves us with the problem of why exclude an ecosystem from being healthy in a literal way. After all, ecosystems have the capabilities of functioning and being free from harm, so why can we not apply this literal definition of health to ecosystems also?

However, if we use the above definition of health, it leaves us open to the problem of including artificially manufactured creations as being healthy or unhealthy. It would include anything that has the capabilities of functioning and being free from things that affect their functioning capacity. This would be highly problematic for the definition of health because it would include things such as televisions, toasters, and iPods as healthy or unhealthy in a literal way. One possible way to overcome this problem is to add more criteria about what can or cannot possess health in a literal sense. For example, an extension of the definition of health could include the ability to self-renew and self-organise (autopoiesis).

Capra describes self-renewal as 'the ability of living systems continuously to renew and recycle their components while maintaining the integrity of their overall structure and self-transcendence' (Capra 1982, p. 289). A very simplistic example of this is the way in which every cell (except the brain) in the human body is replaced with new ones over the space of a few years, but still retains some of the overall structure of the body that identifies that body as you. The self-organisation of an organism or living system states that there is essentially an 'internal plasticity and flexibility of living systems, whose functioning is

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controlled by dynamic relations rather than rigid mechanical structures, gives rise to a number of characteristic properties that can be seen as different aspects of the same dynamic principle' (Capra 1982, p. 289). He claims that a living system or organism's

order in structure and function is not imposed by the environment but is established by the system itself. Self-organising systems exhibit a certain degree of autonomy; for example, they tend to establish their size according to internal principles of organisation, independent of environmental influences. This does not mean that living systems are isolated from their environment; on the contrary, they interact with it continually, but this interaction does not determine their organisation (Capra 1982, p. 289).

Leopold proposed that if organisms and ecosystems should have the ability to self-organise and self-generate, then they possess health. 'Land-health is the capacity for self-renewal in the soils, waters, plants, and animals that collectively comprise the land' (Leopold 1944, p. 318). The health of something is its ability to maintain its self-renewing and self-organising capacity (autopoiesis). Callicott links the idea of autopoiesis (self-organising and renewing) with EH, as it helps to strengthen and clarify the concept, and allows ecosystems to be included within the definition of health. Callicott claims that organisms, characterised by their autopoiesis, possess health in a literal way. Ecosystems can also be characterised by their autopoiesis, but he proposes in a separate article that they can only possess health in a metaphorical way.

A logical step would be to propose that because ecosystems are characterised by their autopoiesis, and if autopoietic organisms possess health literally, then ecosystems should possess health literally also. He overlooks this apparent link, instead claiming that they are both different and that ecosystems are not some kind of super-organism (Callicott 1999a). In another article, he resigns himself to the fact that ecosystems can only ever be understood as being healthy in a metaphorical way (Callicott 1999f). It is an overly cautious approach by Callicott to avoid the obvious connection that all autopoietic things should possess the characteristic of health literally.

The advantage of using autopoiesis is that it allows us to include ecosystems within the definition of health, while excluding things that do not have self-renewing and self-organising capacities, such as televisions, toasters, iPods, and so forth. The reason for this is that these human-made artifacts do not possess self-organising or self-renewing traits, and no matter how complex these technologies become, there is no visible sign that they will ever be able to obtain them. Capra (1982) highlights that the most obvious and striking difference between organisms and machines are that machines are created or constructed by us, whereas

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organisms develop and grow themselves. Both organisms and living systems grow and develop on their own, whereas machines on the other hand are constructed in a specific and rigid way, and function within a certain cyclic loop of processes.

Whereas a machine is constructed to produce a specific product or to carry out a specific task intended by its designer, an organism is primarily engaged in renewing itself; cells are breaking down and building up structures, tissues and organs are replacing their cells in continual cycles (Capra 1982, p. 293).

Capra goes on to state that a machine ‘will fail if its parts do not work in the rigorously predetermined manner, but an organism will maintain its functioning in a changing environment, keeping itself in running condition and repairing itself through healing and regeneration’ (Capra 1982, p. 293). This is why the inclusion of the autopoietic traits of self-organisation and self-renewal are so important to define health by. Therefore, the main signifier of health is the level of self-organisation and self-renewal taking place within ecosystems. The more self-organisation and self-renewal taking place within an ecosystem the healthier it is, while the less self-organisation and self-renewal, the sicker it is. Self-organisation is focused around an ‘attractor’ where the system is attracted towards this domain, regardless of changes in its ‘external environment’ (Hearnshaw *et al.* 2005, p. 13). This is down to the fact that the system is able to maintain its present state despite changes taking place to its environment.

It is the capacity to organise and maintain itself about an attractor that is the fundamental hallmark of a self-organising system. As such, a self-organising system implies a goal-like function [...] whereby internal causal mechanisms direct the ecosystem towards the state attractor’ (Hearnshaw *et al.* 2005, p. 13).

The ability to self-renew and self-organise is also an effective way to establish moral considerability for things. For example, Salthe and Salthe (1989) believe that the self-organisation is an appropriate way to assign moral considerability to things.<sup>73</sup> Our level of responsibility towards self-organising and self-renewing systems is described by Albrecht:

Health is a condition that enables individual life and living systems to maximize potential. While the universe as a whole might be heading toward heat death and maximum entropy, life in living systems is busy self-organizing toward increasing complexity and diversity. It is this directionality that provides humans with a normative principle that is of great relevance to the way the human economy can connect with and live within nature’s economy (Albrecht 2001, p. 251).

Norton also claims that we should link health to self-organising and self-renewing systems because a ‘system is healthy if it maintains its complexity and capacity for self-organization’ (Norton 1992, p. 26). Forget and Lebel claim that EH should be able to sustain

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<sup>73</sup> Rather than such examples as Cahen’s attachment of ‘goal directedness’ (Cahen 1988).

## Health is Objective (Empirical and Measurable)

itself over time and that essentially 'it remains active and can maintain its organization and its autonomy over time, and rebound from stress' (Forget and Lebel 2001, p. 13). This definition would automatically exclude human made objects while permitting ecosystems. One thing that must be made clear is that ecosystems are not super-organisms despite their self-generating and self-organising capacities (Callicott 1999a, p. 343). However, they do not have to be understood as super-organisms in order to be considered healthy in a literal sense. Ecosystems change and evolve over time, but healthy ones maintain some level of continuity and order. They do not need to be considered super-organisms in order for them to possess the characteristics of self-renewal and self-organisation (autopoiesis).

Kay and Regier (2000) establish that uncertainty and partial unpredictability are inherent aspects of self-organising dynamic systems, such as ecosystems. Despite being considered as self-renewing and self-organising, finding out what exactly is and is not healthy for these systems is a difficult task. Self-organising holarchic open systems (ecosystems) are hierarchical systems 'with reciprocal power relationships between levels rather than a preponderance of power exerted from the top downwards' (Kay and Regier 2000, p. 127). This interplay makes our understanding of ecosystems quite difficult because there is no 'ecological doctor' to test for ecosystem ill health and disease, humankind is dependent upon the ecologist and environmental scientist to establish when ecological functioning is under threat or disrepair. This is done by comprising lists of ecological stressors and indicators of EH in order to give us goals.

Therefore, systems that have the characteristics of self-organisation and self-renewal should be included within the definition of health, or things that can possess health. Instead of it simply being confined to only organisms within definitions of health, they should also include systems that are composed of organisms, such as ecosystems, within the definition. If ecosystems fit within the parameters of the description of health than the diversity of complex organisms described, then there is no reason why they should not also be permitted within the inclusion of this definition. As it stands, ecosystems have just as much reason to be included within a literal definition of health as protists, bacteria, mould, and the range of microorganisms that it would be descriptively difficult to stand by a defence of them possessing a well-being or deducing what is in their interests.

Health is Objective (Empirical and Measurable)

### iii. Ecosystem Health Indicators:

Ecosystem health (EH) indicators are the characteristics something must possess to be considered healthy, but defining an indicator of health is not straightforward. How do we determine universal health indicators? Is EH merely a simplified description of detailed scientific indicators, which adds nothing new to the debate (Shrader-Frchette 1997)? On the other hand, can it give some fresh insight into an already well-established area of ecological research? Callicott (1997) concedes that EH only analyses the indicators of functioning ecosystems and nothing more, but that this does not somehow relegate it as being unimportant for environmental science and sustainability theory. Instead, it can be used as an important concept to unite many disparate fields within sustainability theory. However, it must be understood for what it is, a concept that grounds these complicated scientific explanations into an understandable area for public and policymakers alike. ‘Pronouncing you “healthy” provides no additional scientific explanation of your condition not already provided by assessing your temperature, your blood pressure, your cholesterol count, and other such indicators’ (Callicott 1997, p. 135).

However, we still need to establish that things like blood pressure and cholesterol counts are indicators of health, and we need to establish indicators within an ecosystem context. ‘Before health can be measured, we need to identify the relevant indicators, endpoints, and parameters (with acceptable ranges) that we are going to use in assessing the health of a particular ecosystem’ (Haskell *et al.* 1992, p. 7). However, because each ecosystem is so complex and often very different to other ecosystems, we need to establish a range of different processes and functions that occur within all ecosystems in order to find out if individual ones are healthy or sick. We essentially need to find *indicators* of the health or illness of ecosystems. These indicators are integrated as measurements of ecological functioning and resilience, but are not *universal* indicators for *all* ecosystems in all circumstances ‘because all ecosystems are different, even ecosystems of the same type, there are always some very case-specific indicators that are selected on the basis of sound theoretical considerations’ (Jørgensen 2010, p. 5).

The diversity of indicators gives us a lot of room for application, as it does not confine assessments to strict universal formula. However, there are a number of specific indicators and signs to establish levels of health. Despite the fact that our knowledge of ecological functioning is quite limited, we can still establish some fundamental parameters

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that are similar to all ecosystems (Castle 2000, p. 155). The characteristics of resilience, self-organisation, self-renewal and function are commonly understood to be aspects of *all* ecosystems. The benefits of these characteristics are that they give us indicators and norms for functioning ecosystems, which in turn gives us guidance for policy recommendations (Castle 2000, p. 155). The concept of EH is fundamentally grounded in the knowledge provided by these characteristics and will be explained in more detail in the following sections, but will also be applied later in the damage threshold section of the PP.

There is a fundamental difference between human and ecosystem health—we can establish both signs and symptoms in the former, but only *signs* in the latter. Walner-Toews (2004) states that signs can be analysed because they are things that show whether someone or something is unhealthy through birth and death ratios, x-rays, or taking someone's temperature. While symptoms on the other hand are what a person *feels*, such as headaches, pains, dizziness and so forth. An ecosystem's health is measured by *signs* of health within that ecosystem because symptoms are only manifest through the people and animals within that system and are often too difficult to measure with any kind of consistency. However, the signs that we analyse and uncover can be taken as warnings that these ecosystems are under strain and pressure. Analysing EH is less complicated than analysing human health because it does not have to include any subjective emotional dispositions inherent within a human diagnosis.<sup>74</sup> It does not have to rely on very subjective and personalised interpretations of illness from a patient, which can so often be very misleading and harmful for an accurate diagnosis. EH measures *only* definitive signs of health and does not have to take into account the often misguided and inaccurate symptoms of illness.

Signs of EH are often described in ecological thought already, with examples such as the eradication of species beyond normal levels and the impairment of ecological processes beyond their functioning capacities (Leopold 1941, p. 287). These signs are a lot more definitive and empirical than relying on personal subjective accounts of how one is feeling. However, these are signs of what EH is not, they are examples of ecosystem illness rather than health. Examples of health indicators include numbers of large organisms, species diversity, preservation of biotic community structure, accumulation of biomass, soil stability and nutrient recruitment, normal hydrologic and nutrient cycles, flourishing microorganisms, and natural decomposition of animal and plant waste (Callicott and Mumford 1997, p. 38).

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<sup>74</sup> Often these symptoms do not actually indicate ill health at all but are due to psychosomatic effects, a common problem that doctors have to deal with regularly.

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These components and processes occur within an ecosystem and a healthy ecosystem requires their optimal functioning. A system's functioning includes the processes occurring within it, while structural aspects refer to the singular parts and their interrelationships within that system (White *et al.* 2010, p. 65).

Ecological processes and functions are hierarchically linked from solar energy down to photosynthesis, passing through the trophic levels (Callicott 1999f, p. 350). Processes and functions can include, but are not limited to, mineral nutrients being extracted from lithosphere, the production of biomass, the decomposition of detritus, the manufacturing of soil, the modulated flow of water, and the exchange of carbon, oxygen and nitrogen within the atmosphere (Callicott 1999f, p. 350). 'When such linked processes and functions occur normally (that is, as they have occurred historically) or change normally (that is, at rates that they have changed historically) then ecosystems may be said to be healthy' (Callicott 1999f, p. 350). However, what is 'normal' ecosystem functioning? If we claim that health is what occurs or changes normally, how can we pinpoint what 'normal' should be.

### **iv. 'Normal' Ecosystem Functioning:**

One of the main problems with EH is that its advocates do not usually agree on a specific endpoint for 'normal' ecosystem functioning. Therefore, we need to devise some kind of norm to strive towards in order to differentiate healthy from unhealthy ecosystems. We must essentially establish 'performance criteria' in order to differentiate successful from unsuccessful ecosystem management (Hearnshaw *et al.* 2005, p. 2). Therefore, establishing what is or is not normal healthy ecosystem functioning is a problematic and challenging task. It can be problematic in a scientific way because of our limited technological means to study past ecosystem changes and it is problematic in a valuative sense because one could question why we should promote a certain 'normal' ecosystemic state to begin with.

To find out if change is 'normal', we need to apply temporal and spatial analysis to establish whether or not it fits into the category of 'routine historic change' (Callicott 1999c, p. 350). Callicott proposes that routine historic change can take two forms: It can be sudden, erratic and local; or it can be ever-present and steady changing. Ill health is where changes in the processes and functions are beyond normal evolutionary changes (Leopold 1941, p. 287). However, if routine historic change were seen as both erratic sudden change and ever-present

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steady change, would this not suggest that *all* change is normal and therefore healthy? Regardless of human involvement, ecological communities and systems are constantly changing. In order to function ‘healthily’, it implies that there is in fact a ‘normal’ or ‘stable’ state of functioning from some prior knowledge of what it means to be healthy and that this past state is in fact desirable.

Either we can decide upon a fixed point in history where an ecosystem is healthy, or we can view the health of an ecosystem on a gradual relative basis through short-term examinations of change in its life cycle. If we base health on a relative gradual basis by analysing it against recent changes, then this would allow consistent gradual changes to occur. This would allow for the gradual disintegration and degradation of an ecosystem because an ecosystem’s health is only being assessed on a short-term basis. If an ecosystem’s health deteriorates gradually then it would be ‘normal’ because the point-of-reference we are analysing it against would not be a great deal different over these courses of time, so changes would appear minimal and therefore healthy.

If an ecosystem has not changed *dramatically*, then this would fit into the criteria of normal evolutionary change. This would allow an ecosystem to decline gradually over time so long as it is not doing it ‘abnormally’. ‘One interesting question is whether abrupt changes inspire overreaction while chronic changes lead to complacency’ (IDR Team Summary 3 2012, p. 27). Associating ill health with changes that are abrupt and dramatic would leave EH tied to a benchmark of complacency and gradual degradation because it would only associate illness with sudden dramatic shifts. Therefore, an effective approach to establish normal ecological functioning would be to implement strategies to measure and compare short-term gradual changes with long-term thresholds—if these were crossed then it would become a threat to an ecosystem’s healthy functioning.

An ecosystem’s health would be measured in relation to a very broad and detailed analysis of its *overall* historical change. However, how far back do we trace these changes? It seems that if we arbitrarily choose *one* specific point within an ecosystem’s life span and claim that this past state was the healthiest stage of the ecosystem’s cycle then it would imply that it was healthier in the past and thus more desirable than its present ecosystem states. This approach would have a stagnating effect on our actions because we would aim to obtain a particular past state or freeze an ecosystem from degrading further.

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Attempts to maintain this idealistic state goes against basic evolutionary principles because it would not allow any change to occur.<sup>75</sup> It would go against evolutionary principles because systems are constantly changing and are not in stable equilibrium. There is no clear idealistic state when it comes to non-linear systems. Often, stages that would appear catastrophic on the outset may in fact be moments of ‘creative destruction’ where the disturbance suddenly flips the system back to a state of increased self-organisation from a state of catastrophe, as will be examined further in the damage threshold section in Chapter Seven (Hearnshaw *et al* 2005, p. 18).

In order to understand normal ecosystemic change, we must be aware that ecosystems are not completely calculable and definable, but they are also not completely uncertain, chaotic, and abstract. They are usually somewhere in between these two extremes. While we are able to calculate and formulate scientific hypotheses on ecosystem functioning, there is so much change occurring within the biosphere that management must be adaptive, innovative, and constantly developing. One important scientific theory that would help guide normal ecosystemic functioning is the process of thermodynamics.

Thermodynamics underpins the fact that ecosystems are self-organising open systems that do not have specific catastrophic outcomes at certain points like closed systems—this will be discussed further in Chapter Seven (damage threshold). If ecosystems were considered as ‘closed systems’, then they would follow the second law of thermodynamics, whereby energy dissipates in a closed system. Ecosystems are not closed systems however, they are open systems that ‘exchange energy with surrounding systems and their environment’ (Hearnshaw *et al*. 2005, p. 14).

Ecosystems are open systems that overlap with other open systems and allow interaction between their internal components, their environment, and have the potential to change shape and composition. As one can imagine, most things within the ecological world would fall into the category of an open system because most organisms, species, and systems interact with their environment and exchange energy with other immediate systems. Within open systems, energy and resources are continuously exchanged with other systems, while closed systems are confined to a limited amount of energy and resources within its system

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<sup>75</sup> This also strikes me as a strongly anthropocentric position because it attempts to implement domineering stability control policies that are both impractical and undesirable.

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because their components are isolated from interaction with their environment (Walonick 1993). An ecosystem

is an open system, which exchanges energy (incoming solar radiation and outgoing heat irradiation) and matter (water, carbon dioxide, nutrients, organic matter, etc.) with the environment. The biosphere is [arguably] a typical closed system, since it exchanges only energy with space (matter exchange can be neglected with a good approximation) (Jørgensen and Svirezhev 2004, p. 14).

The reason I included ‘arguably’ into the above quotation is that the biosphere emulates both closed and open systems. It is open because it exchanges huge energy transfers with the rest of the solar system but it is closed because it does not exchange matter with it. Energy and matter can be exchanged within an open system, but only energy can be exchanged within a closed system—closed systems cannot exchange matter (Hearnshaw *et al.* 2005). One of the most obvious differences between open and closed systems is in relation to their boundaries. A closed system has very clear and definitive ‘hard’ boundaries, while open systems tend to have more porous and changing boundaries. Closed systems are not regularly found in the natural world because in ecological systems there are constant movements and exchanges between ecological components and their environment. Closed ecological systems would often refer to ecosystems that do not depend on exchanges of matter with anything outside of that system. For example, a fungus in a glass bottle is completely dependent upon its environment as it has no access to or exchange of outside matter and is closed off from other systems. Other such examples of closed life-supporting systems are space stations or space habitats where all matter is utilized and reused.

If we follow a thermodynamic approach, we can understand closed and open systems in specific ways. For example, if entropy increases in a closed system it would lead to disorder and distinct problematic ecological consequences, where limitations such as ‘catastrophic’ could be applied, which will be discussed further in Chapter Seven.<sup>76</sup> In a

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<sup>76</sup> Thermodynamics is the process of energy exchange in a system. It is the transfer of energy from one form or state to another. It usually involves the exchange of heat to supply work, with the Greek meaning of the word translating as heat (thermo) and movement (dynamics). Thermodynamics takes place in a top-down process, originating with solar energy moving downwards, warming the earth, air, and oceans. The energy within this process merely changes form but cannot essentially be created or destroyed. Energy within thermodynamics typically has an orderable and patterned form of movement, for example, if we are discussing heat in a system we can observe that it tends to move from hot to cold, i.e. if we place a hot object on top of a cold object, heat will be transferred from the hot object onto the cold object. The hot object will lose energy in this transferral of energy, but it does not cool down because the cold object transfers cold energy to it. The first law of thermodynamics proposes that energy changes form and cannot fundamentally be created or destroyed, while the second law of thermodynamics states that in isolated systems there are limits on the use of energy understood through the concept of entropy. Once you understand the quality of energy being used in a process you can then establish whether entropy increases or decreases. When the quality of energy decreases, entropy

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closed system, we have definitive barriers and guidelines that would lead to dramatic consequences easier than they would in open systems.<sup>77</sup> In a *closed* system, entropy can increase or decrease locally, depending on the energy use processes and flows, which can result in disorder, chaos, and catastrophic consequences.

However, in an *open* system, where entropy can be exchanged from system to system, it is a lot more difficult to pinpoint what is beyond a system's level of resilience or manageability, and thresholds such as 'catastrophic' and 'irreversibility' would be inadequate to help guide us (Chapter Seven). Entropy is exchanged between different systems because they have different levels of resilience and may have the ability to reorganise, adapt, and even benefit from these effects (Kaufmann 1995). Threats would more appropriately fall into different bifurcations and edges of chaos (Chapter Seven), where there are different degrees away from thermodynamic equilibrium:

Once a dissipative process emerges the open system has a high propensity to move away from thermodynamic equilibrium, and when the system does move it will reach a critical distance from equilibrium, whereby the open system responds with the spontaneous emergence of new organised behaviour that uses the throughflow of high quality energy to manifest and organise itself as a complex ecological structure. These structures provide a new context, nested within which new processes can emerge, which in turn beget new structures (Hearnshaw *et al.* 2005, p. 14).

Therefore, any attempt to 'freeze' ecosystems is essentially contradictory to evolutionary theory and has the potential to push ecosystems further away from their thermodynamic equilibrium. This is where resilience theory differs from the idea of homeostasis or attempting to establish a 'stable' ecosystemic state. Resilience is different to stability because the former is concerned with non-linear dynamic systems and does not promote specific 'steady state' equilibrium. It instead establishes different points where a system can be impacted while remaining healthy, it categorises resilience as its ability to respond to these changes and how adaptive it is to changes.

Resilience refers to a specific state that an ecosystem is capable of adapting to while remaining at that particular state and thus allows a system to veer away from its current state without facing disorder and chaos necessarily. Therefore, resilience is concerned with 'the magnitude of disturbance a particular state can absorb without transitioning to an alternative system state' (Hearnshaw *et al.* 2005, p. 10). It does not freeze ecosystems at one particular

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grows. Entropy is essentially the measurement of order or disorder. A system has low entropy when it is in order or high entropy when it is in disorder.

<sup>77</sup> The application of 'irreversible' consequences will be analysed later in Chapter Seven.

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state, but it understands that systems may shift and transition into different system states while not affecting the overall ecosystem. Costanza very succinctly summarises the importance of resilience in defining an ecosystem's health as being 'resilient to perturbations and stresses over a time and space frame relevant to the system' (Costanza 1992, p. 7).

#### **v. Ecosystems and Resilience Theory:**

Resilience theory underpins ecosystem frameworks because it creates barriers and thresholds to establish points that, when crossed, could prove detrimental to an ecosystem's health. While EH takes the health of an ecosystem from recent changes, the threshold criteria establishes states or conditions of unacceptable levels of abnormal change, which will be described as 'edges of chaos' in Chapter Seven (damage threshold section). 'When changes to an ecosystem cross a threshold, recovery is generally slow and costly, even impossible. Thresholds may become lower as anthropogenic impacts simplify these natural systems and reduce their intrinsic resilience to change' (MA 2005a, p. 7). EH can allow for slow variables of change over long periods of time but

often managers are only aware of the significance of the slow variable after a threshold has been crossed and large-scale ecological and social changes have occurred. Managing ecosystems to avoid such thresholds will therefore be challenging (Rafaelli and Frid 2010, p. 12).

Therefore, when 'resilience' is used within an ecological context it refers to an ecosystem's ability to respond to changes, alterations, and disturbances taking place within it. It is essentially an ecosystem's capacity to adapt to and recover from damage. Damage to an ecosystem can be classified as either human-caused or non-human-caused (i.e. natural). Humanly caused destruction can include deforestation, pollution, climate change, introduction of non-native species, and so forth. Non-human-caused damage refers to things such as flooding, forest fires (not caused by humans), overgrazing of certain species, volcanoes and so forth.

When resilience is used within environmental policy, it may either be referring to an ecosystem's ability to adapt to changes and pressure upon it or it may refer to resilience within a human or societal context. In the latter case, resilience means our ability to adapt to changes within the natural world and is our capacity to react and establish preventative measures that will affect the way we live. For example, John Barry (2012) claims that *human* resilience should become a value within society and we should view the transition process to

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resilience as one aimed towards reducing our current unsustainable practices. Human resilience is always underpinned and dictated by ecological resilience because without it any effort by us at protecting ourselves is an effort in vain. If we do not inhabit a world with healthy ecosystems, it will jeopardise our efforts at maintaining a sustainable future for humankind, as we are fundamentally dependent upon them.

Human resilience typically acknowledges and takes into account ecological resilience and the degrees and thresholds we have to work within in order to ensure systems are not damaged beyond their regenerative capacities. This resilience is in order to prepare us for a future with less energy and the need for an ethic of cooperation through community integration and adaptive environmental management. Transition initiatives will provide people with the skills that they need to cope with the strain of the energy crisis and the ‘post-oil society’ of the future. Barry (2012) mentions numerous examples of how this can be achieved in practice—such as Ghent’s ‘meat-free’ day once a week. Barry hopes to promote a closer community bond in society instead of the strong anthropocentric ‘hyper-individualism’, which currently underpins modern society (Barry 2012, p. 113). This hyper-individualism is in contradistinction to my holistic weak anthropocentrism, as described in detail in Chapter Three.

An effective resilience approach guided by contributory values is a very philosophically defensible position to take. The term resilience has both ecological and social meanings within environmental policy. Ultimately, EH proposes that a sign of health is that a system can rebound from disturbances and maintain its *relative* state, i.e. maintain its resilience from human impacts (Rapport and Maffi 2011, p. 1041). It will be shown that irreversibility and catastrophic harm should be rejected as damage thresholds to guide the PEHP (Chapter Seven). Instead, my resilience approach, with the aid of bifurcation theory and the edges of chaos thresholds, should be applied instead. However, a problem with EH still remains that we need to tackle, and that is the fact that EH still does not have a definitive valuative basis.

Claiming that we have a moral obligation to protect and/or maintain an ecosystem’s health implies valuative claims for protecting an ecosystem and its healthy functioning, but what form this takes is not yet fully apparent. We have established criteria for when an ecosystem is healthy but we have not yet clarified the precise weak anthropocentric parameters of valuing it and the way in which the contributory value concept applies to it. While we have so far implicitly acknowledged the value of ecosystem health, the following

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chapter will focus specifically on the explicit value we place on health in order to emphasise our obligation to protect it for the benefit of present and future generations.

Altogether, this chapter's focus was on evaluating typical definitions of health in order to see if ecosystems fit into this categorisation and if not, how the idea of ecosystem health should be applied. It was shown that health has the characteristics of variability and holism, and humans, other organisms, and ecosystems all share these similarities. However, despite these similarities, living systems such as ecosystems are typically excluded from the literal definition of health, instead being excluded as simply comparable in a metaphorical way. I rejected this preconception and proposed that ecosystems should actually be included within definitions of health as one of the literal possessors of health.

It was shown that definitions of health usually point towards an organism's health as a synonym for well-being or that it is in an organism's interests is misleading as a definition. This is because it is intuitively and descriptively inaccurate to portray microorganisms, protists, and so forth as having interests or a well-being. A more accurate redefinition would instead describe health as a certain state of functioning or resilience to perturbations, and in turn would allow ecosystems to fit within the definition of health in a literal way. While living systems such as ecosystems fit within these parameters, we had to identify how ecosystems can, while a definition of health would still exclude human-made artefacts.

Organisms and ecosystems share like characteristics that define them as possessing health in a literal way, but that would also exclude devices from our definition. Organisms and ecosystems share the ability to self-renew and self-organise, or as it is often called, 'autopoiêsis'. The advantage of using autopoiêsis is that it allows us to include ecosystems within the definition of health, while excluding things that do not have self-renewing and self-organising capacities, such as televisions, toasters, iPods, and so forth. Our definition of health is defined as all living things that possess autopoiêtic traits, and have a functioning capacity or resilience towards perturbations.

I went on to analyse what normal ecosystem functioning is in order to identify its resilience to abnormal perturbations. The two typical definitions of normal ecosystem change are that it can be sudden, erratic and local; or it can be ever-present and steady changing. It was shown that if we base health on a relative gradual basis by analysing it against recent changes, it would then allow consistent gradual disintegration and degradation of an ecosystem to occur because an ecosystem's health is only being assessed on a short-term

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basis. While on the other hand, it was demonstrated that if an ecosystem has not changed *dramatically*, then this would fit into the criteria of normal evolutionary change and would allow an ecosystem to decline gradually over time so long as it is not doing it ‘abnormally’. Instead, I proposed ecosystems are not completely calculable and definable, but at the same time, they are also not completely uncertain, chaotic, and abstract. They are usually somewhere in between these two polar extremes. In response to this knowledge, I proposed that a resilience approach to ecosystem management would be the most appropriate form of action to take to maintain ecosystem health.

I demonstrated that resilience is different to stability because the former is concerned with non-linear dynamic systems and it does not promote specific ‘steady state’ equilibrium. It was shown that resilience establishes different points where a system can be impacted while remaining healthy, and is an ability to respond to these changes adequately. Resilience refers to a specific state that an ecosystem is capable of adapting to while remaining at that particular state and allows a system to veer away from its current state without facing disorder and chaos necessarily. I will elaborate on the resilience approach later in Chapter Seven, but before we come to that, it is important to fully comprehend the value we place on ecosystem health and why in turn it should be protected and maintained.

## CHAPTER FIVE

### THE VALUE OF HEALTH

The previous chapter demonstrated that health can be measured empirically, but this fact alone is not a good enough reason for protecting EH. We need to understand *why* it is valuable and why we should care about it to begin with. There is a need to establish a value criterion as to *why* we should protect ecosystems' health after we understand how it can be achieved. We need to answer how much we value our health and the health of others, how can we balance it with other competing goods and values, and how can the value of health be tested empirically.<sup>78</sup> To begin with, health is considered one of the most valuable standards, if not *the* most valuable standard, in the world today. Health is something we wish for our children, our neighbours and ourselves.

One of the apparent advantages of applying 'health' to the environment is that most people know what health means in a human context and its intuitive appeal can unite the public, scientists, and policymakers in order to discuss ecological issues (Lackey 2001, p. 437). Despite the fact that its meaning appears to be clear, it is important to find an operational definition in order to understand the value we place upon it. The range of definitions of what constitutes health varies immensely; therefore, it is important to understand health as a value concept. It needs to be shown that health is something we value in order to make the claim that we have a moral obligation to protect an *ecosystem's* health.

In order to do this, we must be able to establish the value of health and if it can contribute anything to the environmental agenda. However, if health cannot be shown to have value, then its place within policy and environmental management is questionable. If health has no value then it leaves us with the problem that human beings will just manipulate and abuse ecosystems in whatever way they want. Therefore, there is the distinct need to establish a value criterion for the concept of health. The idea that health is a thick descriptor will be highlighted in section two of this chapter as a possible way to get around trading-off health for other instrumental goods.

I will analyse the Millennium Assessment's report on the value of ecosystem services and how it categorises the benefits we receive from ecosystems into four categories:

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<sup>78</sup> The focus of this thesis is to question the philosophical tenability of such claims and values prior to their application.

regulating, provisional, supporting, and cultural. I will show that this breakdown is quite misleading and theoretically and practically problematic, opting instead for the following breakdown: ecosystem goods, ecosystem services, and cultural services. It will be shown that the MA's 'provisional services' should actually be classified as ecosystem goods, while 'ecosystem services' should include the MA Report's regulating and supporting services (Byers 2008, p. 5). Despite our understanding and appreciation of the three types of ecosystem benefits, we still need to determine practical ways of valuing them, which will be discussed later in this chapter.

### **i. Health as a Good:**

There are a number of different types of 'good', so what type of good is health? For example, is it a moral good (i.e. one is good if they are considerate to others), or a good of a specific kind (i.e. a good thief or a good soldier), or a good that benefits someone/something ('it was good that I won that holiday') (McShane 2004, p. 233). Health is not the first type of good because a healthy person does not automatically qualify as a morally superior person. It is not a good of its kind either because a good tree, calf, or patient can be a good of its particular kind, but does not automatically qualify them as being healthy (McShane 2004, p. 234). Instead, health is a good for something/somebody because it is a *prima facie* good all-things-considered. For example, one's health may affect another aspect of one's life, such as destroying relationships with one's family or interfere with one's work-life but it still does not mean that health is not a good *for* that person.<sup>79</sup> 'What marks those that make up a thing's health is that their retention contributes to the thing's well-being' (McShane 2004, p. 235).<sup>80</sup> Therefore, health is something that is a distinct *good for* that person, organism, or ecosystem. However, how can an ecosystem have a good for it?

One major criticism against EH is that ecosystems do not mind being sick because they have no interests in relation to health or illness (Russow 1995, p. 364). However, the notion of health is applied to many different organisms that do not mind being healthy or sick, such as trees and plants. Even when the health of these organisms is taken into account,

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<sup>79</sup> Health has the ability to affect many aspects of our lives such as strains being put on our family due to high medical/medicine bills, it may affect our work-life because we are constantly thinking about health-related issues, and we may even lose our jobs because of inability to perform our tasks and roles.

<sup>80</sup> The last chapter discussed the health of an ecosystem and it was shown that an ecosystem could be understood as healthy or ill in a literal sense, if one maintains the definition of health as the holistic maintenance and ability of a thing to sustain its functioning physical capacities relative to the variables of that thing.

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it is also done in a somewhat arbitrary way. We must ultimately determine a plant's health by different assumptions such as the particular lifespan of a plant or the type or quantity of fruit/flowers they have. In relation to specific organisms such as plants 'we must refer to norms and values that are not determined solely by an objective investigation of the entity which is judged healthy or unhealthy' (Russow 1995, p. 365). When we discuss a good for an ecosystem, we are not talking about it in the same way as we would a good for a human being. We can establish the processes taking place within ecosystems that correlate with how they have changed in the past.

We can establish normal ecological functioning in relation to that system's resilience but this does not imply that an ecosystem has specific interests or goals. Take the example of a glacier ecosystem and its resilience to climate change: We can identify that an ecosystem's resilience was strong when there was little globally dramatic climate change, but since significant changes in climate, that ecosystem's resilience is threatened. This point does not imply that we know what the planet is thinking, nor does it say that we should just keep exacerbating the situation because it is beneficial to do so. It is instead proposing that we should base our actions on the knowledge of an ecosystem's functioning and resilience and our ability to respond to these changes. The reason for grounding our actions on this basis is that we value ecosystem health because it allows individuals to flourish and fulfil tasks in their lives because of the ecosystem goods and services it provides us. We need ecosystem health in order to maintain our physical health and well-being.

Albrecht (2001) claims that human beings need to have physical health in order to fulfil their 'full potential' and health is a good because it allows us to meet our potential capabilities. However, Albrecht is not naive about health, as he realises that health is not a fixed state and is constantly changing and adjusting. Some of the reasons we value health is because of the effects it will have on our overall body and our ability to fulfil our life's *potential*. Health is something that we tend to take for granted and we rarely acknowledge its importance in our lives. 'When we are in good health, that state of affairs becomes the hidden condition for our paying heed to other events around us' (Stefanovic 2000, p. 259).

Health is largely understood as freedom from illness and disease, but it is also understood as 'promoting well-being and productivity' (Nielson 1999, p. 65). Health is the ability to maintain oneself at a level where one can fulfil one's goals and tasks (Nielson 1999, p. 65). 'Put more formally, if health is not a sufficient condition for [present and future]

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happiness, it is a *necessary* condition. At that very fundamental level, then, any sharp distinction between the good of bodies and the good of persons dissolves' (Callahan 1973, p. 87 [*Emphasis added*]). However, is health *always* necessary for our happiness? For example, people can be happy in all types of circumstances, situations, and levels of health. One can proclaim to be at the happiest point in their life after being severely injured as it enabled them to view life from a different perspective, or one might rejoice and find solace in family, friends, or religion through the course of a terminal illness.

There are many examples of where health is not a fundamental requisite for happiness but these are not too common in our day-to-day experiences. One could also argue that these examples of ill health are not the *source* of happiness themselves but merely allow individuals to view life in a different light. It is not the injuries, suffering, and dying that underpins one's happiness but rather the fact that they are able to embrace life and the little remaining health they have left. They are not happy *because* they are ill, injured or dying, but they are happy because they appreciate the level of health they have left in order to fulfil their life's desires and goals (Daniels 1981, p. 154). Health directly and indirectly underpins every goal, desire, and objective we have, so health is a definitively instrumental value because it allows us to carry out tasks in our lives. It could be argued that it is not only a means, but it is in fact *the* means to achieve other ends. The instrumental value we place on health is one of the strongest types of instrumental values we cherish and the next section will show that it is an *instrumental* thick descriptor and not intrinsically valuable, as Callicott (1999f) and Nelson (1995) have claimed.

### **ii. Health as a Thick Descriptor:**

A problem with valuing health instrumentally is that it can be substituted by other instrumental values. One way to get out of this problem is to show that health is a type of thick descriptor, which 'is functionally equivalent to an objective value' (Callicott 1999f, p. 357). However, I will demonstrate that we do not need to attach intrinsic value to thick descriptors as proposed by Nelson (1995) and Callicott (1999f). The following section will emphasise that health is a thick instrumental descriptor and overcomes many of the problematic issues that arise with giving it an intrinsic value status. To begin with, Callicott claims that health is a thick descriptor—a value description that implies prescriptive connotations or fact followed by value. Nelson (1995) claims that when somebody is

described as healthy or ill, it 'evokes in turn coherent attitudes, dispositions, and actions such as concern and care, responses whose increased prevalence in environmental contexts would be all to the good' (Nelson 1995, pp. 311-312). Thick descriptors such as 'betrayal, treachery, and brutality' automatically imply prescriptive value, i.e. they are understood as negative values. Thick evaluative concepts refer to concepts that have both descriptive and prescriptive elements. However, does health fall into this category?

Nelson claims that illness 'does not merely describe a state of affairs, but also prescribes a certain range of responses; there is an evaluative load built into it that is strong enough to require an excuse or justification if we remain altogether unmoved by hearing that someone is ill' (Nelson 1995, p. 313). Callicott claims that health is a value-laden concept that 'designates a good condition of organisms and by metaphorical extension of ecosystems, but a good condition that is defeasible, that may be eclipsed by some greater good' (Callicott 1999f, p. 356). Health is considered a valuable thing, while ill health and disease are things to be avoided and prevented. However, this does not mean that health is an *absolute* good, as it can be overridden or forfeited for goods that are of greater value.

Therefore, health may not *always* be a thing to value; but it would seem odd for illness to replace health as a valued norm within society. There are many instances where the ill health of individuals, organisms, habitats, or species may be valued in particular circumstances, but valuing illness as a *good in itself* would seem depraved and sadistic. Health is a *prima facie* good but it is still a good that can be outweighed by other goods (McShane 2004, p. 233). It follows that health is a *defeasible* good, not an absolute good.<sup>81</sup> It can be overridden in certain circumstances for goods we deem to be of greater value, but this does not contradict the fact that health is still a good *per se*.

For example, when rabbits were proving to be a problem for Australian ecosystems, it was necessary to make many of them deliberately sick in order to control the situation (Callicott 1999f, p. 356). However, this does not mean that infecting rabbits with myxomatosis<sup>82</sup> is a good thing in itself in all circumstances, but merely that the good of health had to be overridden by another greater good, such as the health of that ecosystem and

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<sup>81</sup> Callicott uses the terminology 'defeasible good', while McShane and others use the more standard philosophical notion of *prima facie* goods. Throughout my thesis, I use the two terms interchangeably to mean the same thing.

<sup>82</sup> Myxomatosis is a disease that affects rabbits and once they are infected, it usually leads to their deaths within two weeks after contracting the virus.

its effects on the health of the human population.<sup>83</sup> Essentially, health is a thick descriptor and a defeasible good ‘in order to achieve ends that we value more highly’ (Callicott 1999f, p. 358). In essence, health has a positive value for us because it allows human flourishing to take place (Hammond and Holland 1995, p. 285). Nelson’s description that EH is a valuatively thick concept states that ecosystems *must* be intrinsically valued in order for EH to have any moral force. They must essentially be valued in a way that ‘is not reducible to human preferences’ (Nelson 1995, p. 312).

The reason for this is that things such as carburettors may be metaphorically understood as healthy or ill but are different to the obligation we would have for protecting human health.<sup>84</sup> Nelson claims that we only value the carburettor as instrumentally valuable, whereas in order for us to have any moral obligation towards the carburettor, a thing must ‘show that what they [or it] are employed of has the right kind of value [intrinsic value] for the assessments to count as moral assessments’ (Nelson 1995, p. 316). However, I do not believe that by merely establishing something to have intrinsic value, it somehow forces a moral obligation upon us. Just because something has intrinsic value, does not presuppose that we have a specific moral obligation towards it. Intrinsic value does not indicate what obligation we have, it merely states that a thing has a value. Intrinsic value begs the question rather than give us any clear indication of moral responsibility. Even if there should be some kind of moral obligation, intrinsic value would not tell us *what kind of moral obligation*. Nor would it give us any clear indication as to what we should do in practice towards objects of moral concern. However, Nelson and Callicott insist that something must have intrinsic value in order for us to have a moral obligation towards it.

Nelson believes that if we are to use health non-metaphorically then the value we attribute to the possessors of health and illness cannot be seen as *only* instrumentally valuable (Nelson 1995, p. 318). We have a moral obligation to protect health because its possessors are intrinsically valuable. Therefore, in order for us to have a moral obligation to protect non-human entities’ health it appears that they need to have intrinsic value also. Nelson argues

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<sup>83</sup> This point was expressed in Chapter Three when I defended my version of weak anthropocentrism against the ecofascism charge, and that sometimes the health of individual organisms needs to be overridden for the greater good of the ecosystem.

<sup>84</sup> Automobiles have been given human characteristics and metaphorically linked to human health since their origin. This can be seen in several examples such as giving a human name to one’s car – “My little Betsy gets me safely from A to B” etc; the use of masculine or feminine pronouns in reference to their automobile – “She’s a beauty” etc; and also anthropomorphising statements such as ‘diagnosing engine trouble’, ‘it’s choking’, and ‘it needs a check-up’.

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that health should be seen as a thick concept, but does not discuss why intrinsic value needs to be part of this definition. He proposes that thick descriptors can only be attributed to intrinsically valuable things but perhaps he ‘pushes a useful analogy too far, by treating ecosystems as analogous to human patients’ (Norton 1995, p. 324).

It is unclear why Nelson attributes a moral obligation to ecosystems similar to human patients, instead of simply leaving the concepts as they are without proposing that ecosystems are intrinsically valuable. Nelson does not evaluate ‘the possibility that healthy ecosystems can be of instrumental value to currently existing or future human individuals’ (Norton 1995, p. 326). There is no fundamental reason why we should insist that ecosystems have non-instrumental value. Ecosystemic ill health implies a disvalue across the board, whether or not it directly matters to us or we are fully aware of the disadvantage it brings to us. This is because of the deeply intricate interrelations and knock-on effects occurring within ecosystems and the need for their overall health and functioning.

Norton analyses Nelson’s example of the carburettor and claims that it only has instrumental value for us, but this fact does not somehow undermine our obligation to protect it in certain circumstances for the benefit of humans. For example, if ‘the carburettor in question is installed in a Red Cross ambulance filled with wounded children and I have accepted responsibility to transport the children out of a war zone and to a safe hospital’ (Norton 1995, p. 326). Even though the carburettor (or ecosystem) does not have intrinsic value, it does not mean that the value they provide to us should be overlooked because protecting their health is closely related to protecting human health. Therefore, when we protect EH, we are in turn protecting human health because of the ecosystem goods and services they provide us with (Karr 2002, p. 104). EH is a guiding environmental framework and also a guiding framework for the promotion of human health (Castle 2000 and Rapport 2000).

### **iii. The Value of Ecosystems:**

We have an obligation towards maintaining and rehabilitating ecosystems because our actions affect human well-being both directly and indirectly (Haskell *et al.* 1992). However, this simplification needs to be expanded upon and clarified in order to reveal the degree, scale, and types of ‘impacts’ that are permissible. Since we are dependent upon these

ecological systems, we need to develop an ethical approach in order to sustain them. To begin with, the interaction between humans and ecological systems is one of dependence; we are fundamentally dependent upon them for our existence: ‘Ecosystem illness threatens the human socioeconomic systems that are embedded in them and dependent upon them’ (Callicott 1999f, p. 359). Philosophers such as Paul Taylor also claim that we are dependent upon healthy ecosystems (see Fig 1.1.): ‘humans are absolutely dependent upon the soundness and good health of the earth’s biosphere’ (Taylor 1986, p. 114).

Rapport and Maffi (2011) state that a sustainable world is not possible without healthy ecosystems, therefore damage to the health of ecosystems should be identified and ameliorated.<sup>85</sup> Kay and Regier (2000) propose that societal systems can affect ecological systems in two very fundamental ways: Through the actual structure of ecological systems and by change through the context of ecological systems. The first type of change refers to the physical structure of an ecosystem itself, i.e. chopping down trees, polluting rivers, and so forth. The second type of change refers to indirect effects from human behaviour such as ‘the runoff into a wetland or stream may be altered by human activities on adjacent properties’ (Kay and Regier 2000, p. 141). We alter the context of an ecosystem when it affects the processes and ecological structures of that system and the way it functions.

We are fundamentally dependent upon healthy ecosystems in order to provide necessities such as clean air, water, and foodstuffs to our expanding global population. Therefore, if ‘ecosystem dysfunction becomes epidemic, human economic systems will therefore be imperilled’ (Callicott 1999f, p. 354). We are fundamentally dependent upon ecosystems and their healthy functioning in order to survive. Therefore, in order to sustain human livelihood we must understand the relationship between human economic systems and the wider ecological systems that sustain them. ‘Sustainability is a relationship between dynamic human economic systems and larger, dynamic, but normally slower-changing ecological systems’ (Norton 2003a, p. 177).

Protecting ecosystems is so closely intertwined with protecting human well-being because we are fundamentally embedded within these ecosystems. Our actions affect the ability of ecosystems to function, which affects the provision of ecosystem goods and services to human well-being (Blanco and Razzaque 2009, p. 696). We need to factor in the

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<sup>85</sup> The reason for this is that the degradation of ecosystem health causes a rise in human and animal diseases, as well as a distinct shortage and deterioration of the goods and services healthy ecosystems provide us.

impact that unhealthy ecosystems are having on human health, which economic methods alone cannot achieve. The range and abundance of these impacts fall into three distinct categories: ‘Direct’ health impacts include floods, heatwaves, water shortage, landslides, increased exposure to ultraviolet radiation, and exposure to pollutants. Secondly, ‘ecosystem-mediated’ health impacts include infectious disease risk, reduced food yields (causing malnutrition etc), depletion of natural medicines, mental health (personal, community), and impacts of aesthetic/cultural impoverishment. Thirdly, the ‘indirect’ health impacts include diverse health consequences such as starvation, conflict, political breakdowns, security issues, impositions on freedom, and impacts on livelihoods. While we do not have any direct moral duty to ecosystems and species, we do have a duty towards human beings to protect the healthy functioning of ecosystems.

#### **iv. Weak Anthropocentric Valuing of Ecosystems:**

The following section will analyse what value we place on healthy ecosystems from a weak anthropocentric perspective, highlighting how it can underpin my valuation of ecosystems. Forget and Lebel (2001) claim that EH is ultimately anthropocentric because we only aim to maintain it if it is beneficial to us. If it were severely damaging or destructive to humankind, EH may *not* be supported within environmental policy. Norton (1992) claims that the only obligation we have to protect EH is for the use and benefit of present and future human beings because ‘[n]o generation has a right to destabilize the self-organising systems that provide the context for all human activity’ (Norton 1992, p. 24). There is a need for ecosystems to function healthily in order to provide a base for our economic, cultural, and aesthetic activities. If we adopt a long-sighted anthropocentric approach to our relationship with the environment then ecosystems will be sufficiently protected because we will want to protect their long-term healthy functioning for humankind.

Humankind relies upon ecosystem goods and services but often the demand we place upon them is more than they can handle (Benett *et al.* 2005, p. 125). There has been a consistent increase in human well-being over the centuries because of the instrumental benefits we receive from ecosystem goods but at the same time, there has also been an ever-growing degradation of these ecosystems (MA 2005b, p. 5). The levels of ecosystem abuse are at fundamentally unsustainable levels, with some ecosystems experiencing levels ‘well beyond levels that can be sustained even at current demands, much less future ones’ (MA

2005b, p. 6).<sup>86</sup> In order to ensure the long-term sustainability of the planet we need to maintain and protect ecosystems' healthy functioning.

This thesis adopts a weak anthropocentric position rather than strong anthropocentrism that jeopardises EH through short-term economic gains, or non-anthropocentrism that promotes the intrinsic value of ecosystems. However, in order for weak anthropocentrism to be successful it must give clear reasons why we should care about ecosystems to begin with. We must receive some kind of instrumental benefit from their healthy functioning in order to promote valuative ethical behaviour towards them and to defend them against strong anthropocentric exploitative actions. Strong anthropocentrism promotes the continued overexploitation of ecosystems because it is beneficial for us to do so. It does this solely from a position that assigns prices to ecosystems' component parts. Everything within an ecosystem is an essential good or resource for the strong anthropocentrist.

Weak anthropocentrism promotes a more holistic approach and incorporates other ways of valuing ecosystems besides from direct unconsidered preference satisfaction.<sup>87</sup> Boetzkes and Roberts (2000) claim that any approach that proposes EH and human health are separate things is contrary to fact, and is dangerous for human health. One reason for this is because there is considerable confusion about the categorisation and definition of ecosystem goods and services, with many believing we can just take ecosystem goods because they are out there and external to us and do not affect our levels of health. Therefore, it is of the utmost importance to categorise the different benefits we receive from ecosystems and to re-establish their connectedness to human health.

One example is the Millennium Assessment Report's (2005) breakdown of the different types of services we receive from ecosystems. However, I will demonstrate that this breakdown is misleading and problematic, while my weak anthropocentric approach's breakdown into three core benefits will be shown to be more philosophically accurate and pragmatic. The categorisation of cultural services, ecosystem services, and ecosystem goods is quite different to the MA's categorisation of supportive, regulating, provisional and cultural services. To begin with, the Millennium Assessment Report (2005) claims that ecosystem services consist of: Regulating services, provisional services, supporting services,

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<sup>86</sup> The examples the MA gives are the capture fisheries and our fresh water use. These two ecosystem services need to be dramatically identified and attempts to alleviate their abuse prioritised.

<sup>87</sup> The weak anthropocentric position was discussed in chapter two of this thesis.

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and cultural services. Regulatory services include the control of weather, climate, erosion, and flooding; the purification of air, water, soil, and wastes; and the general regulation of life and death necessary for the overall continuation of our species (Orr 2009, p. 24).

Regulating ecosystem services include climate regulation, flood regulation, disease regulation, and water purification (MA 2005a, p. 15). Provisional services refer to the provision of resources we need to survive, ranging from food, shelter, fuel, and drinkable water. Supporting services include the ‘formation and preservation of soils, protection from ultraviolet rays, pollination of natural vegetation and agricultural crops, cycling of nutrients, seed dispersal, maintenance of biodiversity, primary production’ (Orr 2009, p. 24). Supporting ecosystem services are services that support regulatory services, ecosystem goods, and cultural services. Supporting services control nutrient cycling, soil formation, and primary production (MA 2005a, p. 15). Lastly, cultural services are those spiritual, aesthetic, recreational, and psychological services that ecosystems provide.

Ecosystem services would have traditionally been understood as what is physically beneficial to us and fits within the MA’s (2005) descriptions of regulatory, provisional, and supporting services. These three services are understood as ‘ecosystem services’ while cultural services are analysed separately. Cultural services are quite different from ‘ecosystem services’, but the MA (2005) bundles the two together within their definition of ecosystem services. Byers (2008) also disagrees with the MA’s lumping of cultural services and ecosystem goods together, claiming that it may be confusing for people and is misleading. ‘It has, in some cases, led to a lack of attention to the unique ecological, economic, and governance characteristics of each of the three types of benefits from nature, and this, in turn, could be impeding the search for practical approaches and mechanisms for conserving the different types of benefits’ (Byers 2008, p. 6). By putting the different types of values we receive from ecosystems into an ‘ecosystem services’ category, it devalues their complexity and uniqueness and gives the false impression that they actually can be categorised in this way.

### **v. Ecosystem Goods, Ecosystem Services, and Cultural Services:**

The MA’s analysis of ecosystems does not include ecosystem goods but instead puts them under the heading of ‘provisional services’. The MA (2005) appears to overlook this issue in

the same way as it overlooks the fact that cultural services are not actually 'ecosystem services'. Provisioning services include food, fresh water, wood and fibre, and fuel, which are all direct *physical goods*, not actually ecosystem services. The MA (2005a and 2005b) and Costanza *et al.* (1997) articles both lump ecosystem services and ecosystem goods together as 'ecosystem services', which I find to be far too generalising and problematic. Ecosystem goods refer to the tangible physical goods we need to survive; while ecosystem services are the functional services that we receive from ecosystems. For example, 'water and wood in their natural state are ecosystem goods, while the water purification function of a natural wetland and the carbon sequestration function of a forest are ecosystem services' (Blanco and Razzaque 2009, p. 694).

Provisioning services are quite different to the MA's categorisation of them into the section of 'ecosystem services', because they are in fact ecosystem *goods*. However, this is not to say that ecosystem services and ecosystem goods are two completely unrelated things. Often when there are impacts upon ecosystem goods there will be an impact on ecosystem services and vice versa. Ecosystem services are fundamental for ecosystem goods as they maintain their quality and quantity (Brown *et al.* 2007, p. 329). Ecosystem services are services provided by ecosystems that consist of processes that enable the sustaining of life on the planet. Ecosystem goods on the other hand are tangible material things that are a result of the ecosystem processes taking place within an ecosystem, while ecosystem services are more to do with actual processes, activities and cycles (Brown *et al.* 2007, p. 331).

Ecosystem services are valuable to human beings as they sustain human life and well-being. Ecosystem services are the services provided by an ecosystem and maintain human life when ecosystems are functioning healthily. We benefit from both ecosystem goods and services, which are a by-product of healthy ecosystems. Ecosystem services include gas regulation, climate regulation, disturbance regulation, water regulation, erosion control and sediment retention, soil formation, nutrient cycling, waste treatment, pollination, biological control, and refugia (Costanza *et al.* 1997, p. 254). Ecosystem services are not tangible ecosystem components but are rather specific functional services that healthy ecosystems provide. There is a distinct difference between what an ecosystem is composed of (its component parts or goods) and how it functions (and in turn, the services it provides us with):

Ecosystem services are provided as a byproduct of the functioning of the ecosystem. They thus depend partly on the identity of the flora, fauna, and microbes composing the ecosystem. We therefore distinguish the resource base of an ecosystem (i.e., its structure or composition) [ecosystem goods] from its functioning [ecosystem services] (Dasgupta *et al.* 2000, p. 342).

However, it is also important to clarify that ecosystem services are not synonymous with ecosystem processes. The main difference between ecosystem processes and ecosystem services is that the former is the complex dynamic interactions and functions within an ecosystem, while ecosystem services are the benefits we receive from their healthy functioning (Brown *et al.* 2007, p. 332). ‘For example, the forces of wind and water, made possible by solar energy and gravity, produce the service we call “translocation of nutrients.”’ (Brown *et al.* 2007, p. 332). Essentially, healthy functioning ecosystem processes provides us with ecosystem goods and services, and without protecting EH, these benefits are jeopardised. However, only tangible ecosystem *goods* are effectively priced and fixed with an economic value, while ecosystem services are overlooked or seen as free services. ‘As a result, there are no direct price mechanisms to signal the scarcity or degradation of these public goods before they fail’ (Brauman and Daily 2009, p. 31).

Ecosystem services are rarely included in cost-benefit analysis and when they are, they tend to be priced far lower than their actual worth. One of the reasons for the depletion and overuse of ecosystem services is the fact that they are not accounted for in the economic wealth or poverty of a nation, but instead are just seen as *free services*. The long-term sustainability of these services is not adequately taken into account within short-term economic frameworks. Countries can have great increases in economic growth and savings in a year but may also have dramatic overall losses *if* their EH is taken into account.<sup>88</sup> However, is it possible to incorporate ecosystem services within the economic valuation of nations? Can the non-linear structure of ecosystems be understood in a way to determine a fixed economic value of their services and can we even price cultural services?

Cultural services are spiritual, aesthetic, recreational, and psychological services that we receive from ecosystems and are non-material in their nature (MA 2005a, p. 13). They are less tangible and physically evident as other ecosystem services, but they are no less valuable to human well-being (MA 2005a, p. 4). Ecosystems provide us with more than just a collection of usable resources, such as beauty, cultural and spiritual bonds. Cultural services include aesthetic, spiritual, educational, and recreational values that we find within

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<sup>88</sup> The Millennium Assessment Report (MA) gives the examples of Venezuela, Trinidad and Tobago, Ecuador, and Ethiopia, as countries that experienced net savings in 2001 but would have experienced an overall loss when their natural resources and carbon emissions were taken into account (MA 2005b, p. 9).

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ecosystems (MA 2005a, p. 15). Cultural services can be compared with Callicott's 'environmental wellness' approach:<sup>89</sup>

Wellness medicine regards health as an optimum condition of the whole human organism and its maintenance as a way of life, expressly involving the social, cultural, and natural environments that constitute a person's life in the widest sense. *Wellness is, in short, an ecological understanding of human health* (Callicott 1999b, p. 290).

There is a distinct need to understand that environmental wellness [ecosystem health] is closely related to human wellness [human health] because our personal and societal well-being depends upon the environment we live in (Callicott 1999b). We are part of our surroundings and our surroundings are a part of us. If we live in a highly congested and polluted city, our bodies and minds will be damaged through the air we breathe, the water we drink, and the psychological impact it has on us. Ecosystems 'provide the means to criticize and limit demand values that threaten to destroy those species and ecosystems while at the same time introducing an important value that humans should place upon them' (Norton 1987, p. 189).

Untrammelled ecosystems have the ability to provide us with a deep sense-of-place and an enriched understanding of the world around us, which can help alter our mindsets and values. Cultural values indicate a non-economic way of valuing ecosystems and can act as a useful way for people to demonstrate an ecosystem's value. Cultural values enable people to express how much a particular environmental area or ecosystem means to them and enables them to change their value systems in a world dominated by economic growth. If we turn our focus from economic use values to cultural values, we can see that cultural services are values that enable human communities to incorporate nature into our 'cultural consciousness' (Norton 2012). Our experiences with nature allow us to alter our value systems, so cultural services should not be understood as only economically valuable, but should be seen as altering and adding to our very value base itself. If we overlook the importance of cultural services, then there is the possibility we will only concentrate on economic calculations of the non-human world. However, how can ecosystem benefits be valued and what happens when they compete with economic preferences? Can cultural values and ecosystem services be

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<sup>89</sup> Callicott proposes that the wellness approach can be seen as a precautionary preventative approach to health, rather than the curative response seen in the past, where one would only consult a doctor in order to 'fix' their ailments (Callicott 1999b, p. 289). The wellness approach aims to help the ailing and sick, but it concentrates on implementing an approach that gives more autonomy to the patient through their precautionary action, rather than always relying on the 'expert'.

valued economically, and can they be measured against the economic benefit we receive from ecosystem goods?

### **vi. Valuing the Benefits of Ecosystems:**

The cost of protecting ecosystems can be estimated but this does not equate to their *value* and the benefits we receive from healthy ecosystems are something we cannot attach a precise economic cost to because we are uncertain about the interrelationships taking place and the subsequent effects of damaging an ecosystem. We can establish estimates and formulate links, but we cannot predict *all* of the effects of our actions. When we overuse resources or pollute, it affects the health of ecosystems, which is reflected in the quantity and quality of ecosystem goods and services available to us. How we price ecosystem goods and services has a direct correlation to how we value the health of ecosystems. Overexploitation of ecosystem goods negatively affects the ecological processes and functions taking place within an ecosystem. That is why there is a fundamental need to establish sustainable consumption standards for ecosystem goods and services in order to maintain the healthy functioning of ecosystems. This can generally be done in either political or economic ways.

These two methods interact and work together and are rarely mutually exclusive. Sometimes more governmental regulation is required because of inadequate economic valuation methods and other times economic methods are more desirable instead of relying on arbitrary decisions of policymakers. It is important to evaluate the three benefits we receive from ecosystems and assess if they can be economically valued or are more suited to be politically protected. There is a distinct problem with the three types of benefits because one of them refers to specific tangible *goods*, while the other two refer to *services*. EH is concerned with the healthy functioning of an ecosystem because it provides us with ecosystem goods, ecosystem services, and cultural services. It is not concerned with the individual parts of an ecosystem as long as they do not interfere with the overall healthy functioning of the ecosystem. Ecosystem components can be replaced with human-constructed components as long as they do not negatively affect EH.<sup>90</sup> There must be sufficient replacements within an ecosystem or else the use of a specific ecosystem good would be unsustainable.

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<sup>90</sup> This will be exemplified in the Catskills project in the next section.

EH does not focus on the specific composition of an ecosystem, i.e. the ecosystem goods that make up an ecosystem, but it is more concerned with how that ecosystem functions. Ecosystem goods, because of their tangible nature, can be counted and verified in the market place. We can assign approximate values to them, whereas cultural and ecosystem services are a lot more difficult to value. The MA report (2005a) determined that ecosystem goods (provisioning services) are most favourably controlled and regulated by socioeconomic means, while regulating services have a medium potential for being mediated by economic means, while cultural ecosystem services have a low potentiality for being mediated by them (MA 2005a, p. 15).

Ecosystem goods can be valued through the market and while there are obvious issues with the extraction, use, and distribution of ecosystem goods using economic methods, they are still the most suitable of the three types of ecosystem benefits to be economically valued. Ecosystem goods are more likely to be included within market methodologies than ecosystem services because they can be distinctively measured, prohibited, and are competitive. There is the possibility that ecosystem goods can be exchanged within the market with less governmental interference than the protection of ecosystem services or cultural services (Brown *et al.* 2007, p. 373). Problems with this approach include the fact that the use of ecosystem goods has an effect on ecosystem functioning and affects ecosystem services and cultural services, such as oil use and its impacts on climate change, scenic beauty being damaged by oil drilling plants, and the pollution of downstream water (Brown *et al.* 2007, p. 373). These negative externalities are often inadequately priced because it is difficult to establish a specific value for ecosystem services and other ‘positive externalities’—external to the groups involved in the market decision about their price.<sup>91</sup>

In the book *Ecosystems and Human Well-being: A framework for Assessment*, Callicott and associates claim that other types of values often override the preference satisfaction values implicit within utilitarian and economic calculus (MA 2005a and 2005b). They propose that there is a need for non-utilitarian valuation method because utilitarian methods cannot determine the values we place on emotional and psychological bonds with ecosystems. People’s relationship to ecosystems cannot be easily categorised and valued

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<sup>91</sup> A positive externality refers to a situation in economics where an action or event produces a positive effect on an external party. In this context, ecosystem services are seen as positive externalities because their value is not taken into account within market pricing, they are seen as external side effects or benefits from ecosystem goods. For example, a forest (ecosystem good) provides the ecosystem service of carbon sequestration for us, but this is seen as a positive externality, a benefit outside of the price of those ecosystem goods.

because they represent historical, national, religious, and spiritual values. One of the key aspects of the MA's findings was that spiritual and cultural values were important for many local communities regardless of the fact that they are not specifically physically identifiable or economically advantageous (MA 2005b, p. 9).

Even 'if all ecosystem services are only economically valued, economic uses may be more valuable than their ecological value, for example, fishing and navigation' (Blanco and Razzaque 2009, p. 718). There is a lot of overlap between the benefits received from the different types of ecosystem goods and cultural services. Take the example of fishing: We receive ecosystem goods from fishing but we also benefit from the cultural services of fishing because 'inspiration and identity benefits are commonly associated with fishing' (Chan *et al.* 2012, p. 14). People fish for their leisure; as a hobby; they may gain a spiritual oneness with the river and environment around them; or view it as a communal activity with others. Therefore, it would be reductionist to confine the act of fishing to simply receiving ecosystem goods (the fish) from the activity.<sup>92</sup> Ecosystem services and cultural services are often in competition with ecosystem goods, but the value derived from ecosystem goods often overrides our acknowledgment of these benefits. If ecosystem services and cultural services cannot be effectively understood and discussed in a similar language (economic) as ecosystem goods, then how can we determine which one we should value more when they are in competition? Can economic prices truly reflect how much we value ecosystems for the services and cultural benefits we receive from them?

### **vii. Valuing Ecosystem Services:**

It is important to understand the very nature of 'pricing' before we see how it relates to ecosystems services. Heal (2000) proposes that economic methods do not measure value; they only measure *prices*—prices are derived by a process of supply and demand. The market value of an object is determined by how much demand and supply there is for it. Market prices provide us with a *starting point* for valuing ecosystem services but do not provide a sufficient way to value on their own (Heal 2000, p. 25). Heal uses the example of New

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<sup>92</sup> However, Dana Phillips (1996) claims that Bass fishing is being dominated by the commercialisation of this sport. It is becoming more about buying expensive fishing equipment and catching the biggest fish (which they often do not keep), rather than the cultural values associated with fishing. It is becoming nothing more than another product, another artefact, rather than being seen as a oneness and interlinking with nature.

York's preservation of the Catskills project<sup>93</sup> and asks if the \$9 billion cost is representative of the value of it? It is only a partial valuation of the watershed because it only analyses *some* of the value it provides to us. It only values the filtration process of the watershed but does not factor in its ability to support biodiversity, its use for recreational activities, and other benefits (Heal 2000, p. 27). There are five possible methods to establish the cost of ecosystem services in examples such as the Catskills project: Market prices, hedonic prices, travel costs, replacement costs, and contingent values.<sup>94</sup> Heal (2000) highlights problems in all of these approaches and concludes that

the market-based valuations resulting need not reflect the social importance of the services or the extent of the losses that we would suffer if these services were removed. The market-based prices tell us the value to society of a small amount more or less of a service and do not indicate the overall contribution of the service (Heal 2000, p. 28).

Therefore, if we evaluate a particular ecosystem service in an atomistic manner, we will only understand the individual contributions of that service to human well-being. Analysing ecosystems in this manner is misleading and problematic. Therefore, we must evaluate ecosystem services in a broader context with the overall ecosystem and its functioning parts. One of the paramount problems that underpin the atomistic way of economically pricing ecosystem services is that ecosystems are complex things and cannot be aggregated as the collection of their component biotic parts and thus cannot be assigned a fixed economic cost. Ecosystem services are complex and detailed things and the public has a limited understanding of them—mostly only valuing the benefits of particularly apparent ecosystem services (Costanza 2010, p. 190). Ecologists have a limited understanding of ecosystem functioning, which makes it increasingly difficult to attach a measurable economic value to them (Norton 1987, p. 120). This is because ecosystems are nonlinear and

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<sup>93</sup> The New York City watershed spans across the Catskill Mountains and the Hudson River Valley. The Catskill Water Supply System was completed in 1927 and the drinking water it supplies to the New York City population is vital for people's well-being. Approximately 40% of New York City's water supply comes from the Catskill Aqueduct. In contrast to other public water supply systems, it is economical and practical because the majority of the water supply is delivered to the population by natural means—gravity. Only 5% needs to be pumped, therefore it is quite cheap to maintain. New York City officials proposed to replace the Catskills watershed with a manufactured watershed instead of restoring it would cost \$6-\$8 billion.

<sup>94</sup> Market prices are the prices given to a particular ecosystem through market means, such as the traditional relationship in supply and demand methodologies. Hedonic prices reflect the price of a particular ecosystem service by measuring the costs of a particular area that provides that service and the quality of it compared to other similar areas and their quality of ecosystem services. The travel cost method determines values of a particular ecosystem service through the costs that people are willing to pay to travel to see it. Replacement costs refer to the cost it would take to replace that particular ecosystem service. Contingent valuation methods are conducted through survey-type hypothetical examples where a number of the population estimate how much they value a particular ecosystem service and how much they are willing to pay to protect it.

unpredictable so attaching a fixed economic cost onto certain ecosystem services is problematic because they are constantly changing and are difficult to understand.

Furthermore, many of the methods we use for valuing ecosystem services do not take into account the wide-range of uncertainties and complexities contained within them (Pritchard *et al.* 2000, p. 36). Costanza claims that ‘we need to understand the trade-offs involved, and these may be best expressed in units of time, energy, land, or other units, not necessarily money’ (Costanza 2010, p. 190). Costanza is contradicting himself or has since changed his view because only a few years beforehand in the collaborative work ‘The value of the world’s ecosystem services and natural capital’ (Costanza *et al.* 1997), Costanza and his colleagues outlined seventeen ecosystem services that span 16 biomes and attempted to attach a price onto them. They estimated that the entire biosphere is valued at between US\$16-54 trillion per year, averaging the total value of ecosystem services at the estimated price of US\$33 trillion (Constanza *et al.* 1997, p. 253).

The focus of Costanza *et al.* (1997) was to show that ‘ecosystem services provide an important portion of the total contribution to human welfare on this planet’ (Costanza *et al.* 1997, p. 259). They wanted to show that the overall cost of ecosystem services is so high that trying to replace them with technology or other substitutes would be far too costly. The free services we receive from ecosystems should be respected and valued because if they function poorly, it would have devastating repercussions on humankind. Ecosystem services would cost at least US\$33 trillion on top of current global GNP, deeming them ‘literally irreplaceable’ (Costanza *et al.* 1997, p. 259). However, because of our lack of sufficient knowledge about ecosystems and the knock-on effects of our actions, the replacement of these services by technology is often inadequate. It is more economically and practically beneficial to protect ecosystems rather than find their technological replacements, evidenced by the example of the Catskills project (Bennett *et al.* 2005, p. 129).

In other cases, different forms of capital (natural, human, man-made) are inherently separate and cannot be seen as mutually substitutable with one another. Natural capital should be separated and not seen as a mere commodity and replaceable with increases in technology and development. Development and economic growth are ultimately dependent upon nature, so we should give a greater respect to ecosystems within political and economic discussions. The income received from natural capital should be reinvested in the renewal of ecosystems (if they are renewable), or put into implementing renewable technologies to replace depleting

non-renewable resources. There are clear entropic limitations on ecosystems' throughput—resources (inputs) and sinks (outputs). The economy is a subsystem of the environment and we should use economic and ethical reasoning to support the maintenance of a non-declining natural capital rate for future generations. Furthermore, it is very difficult to calculate the specific economic worth of ecosystem services that would accurately reflect the benefit they bring to us. They are irreplaceable benefits and cannot be given a price or cost to represent their value.

### **viii. Non-Excludable Goods and Services:**

The pricing of ecosystem goods and services faces a number of distinct difficulties such as the fact they do not take into account 'negative externalities'.<sup>95</sup> In addition, ecosystem services do not easily fit within market exchanges:

They typically are non-excludable and non-rival and thus require some government involvement if markets are to be established and sustained. Further, the task faced by the government agencies would be formidable and expensive due to the difficulty of defining and measuring the services and monitoring compliance with any scheme established for protection and marketing (Brown *et al.* 2007, p. 373).

Non-exclusive goods and services cannot be controlled in such a way as to exclude individuals from using and benefiting from them, even if they do not pay.

A good or service may be non-exclusive because of its physical characteristics and distribution. For example, natural water storage in soils, lakes, and wetlands benefit all downstream riparian land owners and water users in the form of flood control and paced release of water (Brown *et al.* 2007, p. 357).

Institutional methods need to be implemented in order to protect ecosystem services from being adversely affected by anthropogenic affects and should be established as 'non-exclusive' goods and services. Specifically, when ecosystem goods or services are not easily determined by market exchanges, governmental involvement and control needs to increase in order to establish ways to protect them. Therefore, it is not important to include ecosystem goods, services, and cultural services within an economic valuation process because they can be valued through political means instead. It is very important to realise that: '*Valuation is neither necessary nor sufficient for conservation. We conserve much that we do not value, and do not conserve much that we value*' (Heal 2000, p. 29). Therefore, it is not necessary to

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<sup>95</sup> A negative externality refers to an action or event that produces a negative effect on an external party. For example, when something is not taken into account within market pricing but they negatively affect a party, they are seen as external side effects.

## The Value of Health

include all ecosystem goods and services in the economic valuation process because we cannot effectively value these things to begin with. In addition, just because they may not be included in economic methods of valuation, it does not mean that they have no role in environmental protection.

Out of the three types of values we receive from ecosystems, ecosystem goods are the most suited to being valued economically, while ecosystem services and cultural services are more difficult to price. Because of the closely interconnected relationship between these three ecosystem benefits, it would be inadequate to base their value on economic means alone. However, ecosystem goods are more favourably regulated by socioeconomic means, but this does not exempt them from being politically regulated when their consumption is beyond sustainable levels. Ecosystem services and cultural services overlap with ecosystem goods, and must be taken into account as they are fundamental for both the functional capacity of ecosystems and they enrich our lives in non-material ways—recreational, spiritual, and psychological.

The use of ecosystem goods and services should be directed by the goal of EH in order to ensure long-term sustainability. The weak anthropocentric view would promote this application and would ensure the long-term healthy functioning of ecosystems because they are fundamentally valuable to human well-being. However, a problem with the application of EH is that there is little guidance in the decision-making process because it usually confined to rhetorical statements and vague applications. The very definition of ecosystem health is usually taken as a given or is so minimal as to not answer any of the many problems and issues constrained within it. Therefore, the application of the PP with ecosystem health in the following chapters will help strengthen the valuative and scientific aspects within the PEHP approach.

In this chapter, I assessed the explicit valuative dimensions within ecosystem health and established how and why we should value it. This chapter illustrated that health is a good for something/somebody and is a *prima facie* good all-things-considered. It was shown that we value ecosystem health because it allows individuals to flourish and fulfil tasks in their lives because we need ecosystem health in order to maintain our physical health and well-being. I demonstrated that while health is a *prima facie* good, it could still be outweighed by other goods. It is therefore a *defeasible* good, not an absolute good. This chapter also questioned the validity of saying health is an intrinsic thick descriptor, and proposed that while it fits the

requirements to be termed a thick descriptor (descriptive and prescriptive), it does not have to be understood as being intrinsically valuable. An instrumentalist weak anthropocentric approach was applied to health in order to demonstrate that we should protect it for the long-term healthy functioning for humankind.

I analysed the Millennium Assessment's report on the value of ecosystem services and how it categorises the benefits we receive from ecosystems into four categories: regulating, provisional, supporting, and cultural. I instead opted for the following categorisations: ecosystem goods, ecosystem services, and cultural services. It was shown that the MA's 'provisional services' should actually be classified as ecosystem goods, while 'ecosystem services' should include the MA Report's regulating and supporting services. It became clear that ecosystem goods, because of their tangible nature, can be assigned approximate values to them, whereas cultural and ecosystem services are a lot more difficult to value.

However, it is very difficult to calculate the specific economic worth of ecosystem services that would accurately reflect the benefit they bring to us because of their irreplaceable nature, and often cannot be given a price or cost to represent their value. I demonstrated that while ecosystem goods are more favourably regulated by socioeconomic means, this does not exempt them from being politically regulated when their consumption is beyond sustainable levels. Ecosystem services and cultural services overlap with ecosystem goods, and must be taken into account as they are fundamental for both the functional capacity of ecosystems and they enrich our lives in non-material ways—recreational, spiritual, and psychological. This chapter also established that there are certain non-exclusive goods and services that cannot be controlled in such a way as to exclude individuals from using and benefiting from them, even if they do not pay. The following chapters will help strengthen the valuative dimensions of the ecosystem health concept and will illustrate why the PP and EH concepts make such a good merger.

## CHAPTER SIX

### THE PRECAUTIONARY PRINCIPLE

The previous chapters gave us a clear analysis of ecosystem health (EH), how it is objective, and the value dimensions within it. I will propose that when combined with the precautionary principle (PP) it gains practical strengths, but that the PP also benefits from EH because it gains stronger scientific and valuative dimensions. I demonstrated in chapter three that EH and the PP should be grounded on a weak anthropocentric holistic framework and guided by contributory value. Some propose that we should protect EH because of its intrinsic value, but I have shown in the previous chapters that this position is far too problematic to be implemented in practice. However, the use of intrinsic value also occurs within definitions and defences of the PP. For example, Trouwborst claims that the PP aims to protect the environment for the good of humankind but also for its own sake (Trouwborst 2009). My criticisms against intrinsic value from Chapter Three still stand in terms of it being applied to the PP component of the PEHP, but I will re-establish my weak anthropocentric position later in this chapter.

We should use the ‘precautionary principle’ to aid in the decision-making process, but from an instrumentalist position instead of applying intrinsic value. The precautionary principle (PP) originated in Germany in the late 70s under the title of ‘Vorsorgeprinzip’, translated as the foresight principle—a principle that aims for anticipatory proactive policy in the face of uncertainty (Tickner 2002, p. 493). This term stems from the German Vorsorge, which ‘could be translated as taking care of the future’ (Douma 2001, p. 111). The PP proposed that when there is a lack of scientific certainty about environmental outcomes we should act cautiously.

In order to protect the environment, the precautionary approach shall be widely applied by States, according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental damage (Brown 1995, p. 67).

The early understanding of the PP supported precaution when activities threaten human health and the environment, and placed the onus of responsibility on those taking the course of action to prove there was no threat of harm. When there is a lack of scientific certainty about a potential harm to human and the environment then there is a responsibility to err on the precautionous side until it can be established that there are no risks or they are minimal/acceptable. The PP proposed that when there is a possibility of harm the

## The Precautionary Principle

responsibility to show that there is no risk, or that the risk is acceptable, is on those proposing the action(s). Alternatively, more succinctly put by Wingspread:

When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action (Wingspread 1998).

However, this is just one understanding of the PP, while other definitions imply that the threat of harm should be ‘serious’ or ‘irreversible’. The Rio Declaration claims that *serious or irreversible* actions that threaten human health or the environment should not be permitted, while the Wingspread statement claims that *any* activity that poses a threat to human health and the environment should be avoided. Despite these variations, the principle essentially attempts to protect human health and the environment from potentially harmful activities where the perpetrator would otherwise ignore caution. The principle helps us to decide whether an action should be permitted, despite uncertainties about its outcomes. The PP states that just because there is uncertainty, this should not work as an excuse to overlook or ignore potentially threatening outcomes.

Those who invoke the principle undoubtedly are motivated, much of the time, by the goal of protecting the most vulnerable people against risks to their safety and health. On this view, the precautionary principle has strong moral goals, and they are distributive in character (Sunstein 2003, p. 1035).

Therefore, the PP guides our actions through a preventive approach, rather than the curative reactionary approach that has so often been used in the past. The PP claims that precautionary actions *now* are better than tackling costly and harmful effects in the *future*. The onus of proof shifted from those trying to protect human and environmental health onto those that were damaging it. In the past, we were too focused on reactionary policy, instead of the proactive precautionary approach that is badly needed for environmental protection (Karr 1990, p. 244). MacGarvan (1994) compares the PP with the approach that went before it—the ‘permissive principle’. The permissive principle established that the onus of proof was on environmentalists, while the PP puts the burden of proof onto groups proposing the potentially harmful action. The lack of scientific certainty should not prevent action in the way the permissive principle did.

It must be made clear at this stage that when I refer to the PP, I am referring to it within an environmental context. While it has been applied to other disciplines such as bioethics, medical ethics, and even economics, it was first formulated within an environmental context

## The Precautionary Principle

as a defence of public health. However, when one describes a threat of harm to public health, what exactly does that mean and should the PP be concerned about *all* threats to public health? Do we need to incorporate things such as the effects of asbestos, trial medical drugs, and cigarette smoking within the PP on the same level as polluted drinking water, contaminated food, and the damage of ultra-violet rays? This would force the PP to become a broader approach to *all* threats. For example, ‘breast implants are not direct environmental threats, [but] they are a hazardous product that has a direct impact on human health’ (Westra 1998a, p. 192).

If the PP is applied to *all* human health contexts, it diverts away from its original context and is far too general to have any real effect within policy. I will refer to the PP as being concerned with threats to human health that originate from environmental causes and not the inclusion of all threats to human health. This does not mean that non-environmental threats are not important but it means they are not the *main concern* of this articulation of the PP. They can be protected within regular governmental policy but it does not mean that the PP should automatically include all of these concerns within its definition. When I refer to ‘human health’, I mean a threat to human health from ecological sources.

Human health must not be seen as separate from EH because the two are so intimately linked, as shown in previous chapters on the value of ecosystems goods and services. I would propose that within our definition of the PP we include human health and EH as united rather than two separate goals. Therefore, our definition should use the conjunction ‘and’ instead of ‘or’ in relation to ecosystem health and human health. This is to unite these two elements of the PP and to view them as fundamentally interconnected and not mutually exclusive. All human health is fundamentally grounded upon the goods and services the natural world provides us with, so to view human health and EH as fundamentally separate is incorrect and misleading.

We are fundamentally dependent upon EH for our healthy functioning because we cannot yet survive without healthy ecosystem goods and services. We should care about ecosystems when their destruction threatens human health, but we should also take a precautionary approach to our interactions with ecosystems because of the uncertainty of our impact on the future. My weak anthropocentric approach to the PP establishes an ethics that claims that scientific and economic dominance in environmental decision-making should be questioned and re-evaluated. For example, von Moltke (1996) claims that the PP can give

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guidance in policymaking decisions because it establishes a commonality between science, ethics, law and politics.

The precautionary principle, then, is meant to ensure that the public good is represented in all decisions made under scientific uncertainty. When there is substantial scientific uncertainty about the risks and benefits of a proposed activity, policy decisions should be made in a way that errs on the side of caution with respect to the environment and the health of the public (Kriebel *et al.* 2001, p. 875).

The following section will concentrate on the issue that the PP is too vague to be useful as a guiding sustainability concept. I will establish commonalities between different definitions of the PP and will categorise two of the most divergent interpretations of it—the weak and strong PP. This chapter will give a preliminary overview of the PP and will demonstrate how it is linked to EH and why their integration will help strengthen environmental ethics and sustainability theory. It is important to validate why I chose to integrate the EH concept with the PP, and the need for a philosophically sound ecological concept such as EH to guide the PP.

### **i. The Precautionary Principle (PP) is Vague:**

The perception of precaution varies from country to country, with some countries viewing environmentally precautionous actions as a threat to their market, while other countries regard precaution as necessary for EH and the long-term sustainability of the planet. Kriebel *et al.* (2001) claim that U.S. environmental policy is reactionary rather than precautionary, as it requires a great deal of certainty that a threat exists before action is taken. This position reacts to ecosystem ill health once it has occurred, rather than implementing preventative measures to avoid it from happening in the first place. Whether or not one supports the PP often depends upon their definition of ‘precautious’. Typically speaking,

[a]n action a is precautionary with respect to something undesirable x, if and only if (1) a is performed with the intention of preventing x, (2) the agent does not believe it to be very probable that x will occur if a is not performed, and (3) the agent has externally good reasons (a) for believing that x might occur, (b) for believing that a will in fact at least contribute to the prevention of x, and (c) for not believing it to be certain or highly probable that x will occur if a is not performed (Sandin 2004, p. 467).

However, the application of what a country deems to be precautionous can be quite different. For example, following the events of 9/11, the U.S. took, what it considers to be, precautionous steps to protect its population and the world from threat. At the time, they would have claimed that the wars in Afghanistan and Iraq would save many American lives from

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being lost to terrorist activities (Sunstein 2007, p. 8). They were taking, what they believed to be, precautionary actions to prevent future uncertain threats from occurring.<sup>96</sup> The idea that one country acts in a more precautionary manner than another country is misleading because countries only react to different *types* of risk. Take the example of climate change: Europe is more fearful of the risk of the effects of climate change itself and the danger of *inaction*, while the U.S. takes a precautionary approach to the risks of implementing *action* such as unemployment, increased oil prices, and problems associated with fossil fuel substitution (Sunstein 2005, p. 14).

The PP has the potential to be adapted to suit one's own goals and agendas as it can be used to freeze our actions through neoliberal agendas or it can be used to fit a particular situation in the name of 'precaution', due to its vagueness. The PP's critics have proposed that its ambiguity opens it up to misinterpretation and makes it ineffective as a guiding principle for sustainability. Turner and Hartzell (2004) criticise the Wingspread definition of the PP as being too vague because it fails to clarify who is responsible for the costs of taking precautionary actions. 'That version fails to indicate who must bear the cost of precaution; what constitutes a threat of harm; how much precaution is too much; and what should be done when environmental concerns and concern for human health pull in different directions' (Turner and Hartzell 2004, p. 449). Majone (2002) concludes that the PP is an idea rather than a distinctive 'principle', as it gives no clear guidelines for policy.

Sunstein claims that cautious actions are a good idea in our everyday lives, but their tenability and merit within policymaking is questionable (Sunstein 2003, p. 1004). He claims that the PP's vagueness does not give policymakers any direction and is essentially unusable within regulatory situations. The PP gives us a false allure that policymaking is simple and ignores many of the broader issues at stake within political decision-making. Many critics claim that the definition of the PP is a contradiction because precautionary actions are very different to principles. However, is there a clash between the use and meaning of 'precautionary' and 'principle'?

The word 'precautionary' refers to acts of prudence and foresight but does not give guidance for action or establish rules that one must obey. Precautionary actions are actions of foresight in the face of uncertainty, where the action would prevent the undesirable event

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<sup>96</sup> This is just a very brief and generalising example and does not mean to take any political affiliation or condemnation of actions. It is used as an illustrative example and not a valuative one.

## The Precautionary Principle

from occurring, based on the best available scientific knowledge. A ‘principle’ is a rule and must be abided by under certain criteria (Adams 2002, p. 308). In the past, the precautionary approach would have simply been an unspoken rule for environmental decision-making, but ever since it became a ‘principle’, it has become seriously problematic. The PP has often been used in the past to condone protectionist measures against specific risks that regulators deemed undesirable, but at the same time, they tended to overlook other things that would also fall under the rubric of risk (Marchant 2002, p. 41).

The PP can be implemented within our everyday decisions as a guideline but it cannot be used as a definitive ‘principle’ for action, some critics claim (Sandin 2007, p. 106). Its original use as an underlying goal of environmental action was a lot less problematic before its development into a specific principle. When it became a principle, it was unclear how and when it should be put into practice and was often assumed as self-evident and intuitively understood (Adams 2002, p. 305). When it was a measure and an approach, it could be used within agendas as an unspoken understanding of erring on the precautionous side, but when it became a principle, it took on a completely new political and ethical meaning. It changed from *a* precautionary approach to *the* precautionary principle, shifting from something that was flexible and adaptable, to something rigid and precise.

Despite this, many of its critics propose that it still lacks clarity and should incorporate a greater degree of clarity. A ‘principle’ has several different meanings, whether one understands it in a philosophical, legal, or scientific sense. However, principles are commonly understood in ethical terms as moral codes or sets of values, such as autonomy, justice, beneficence, and nonmaleficence. Ethical principles are not ‘ultimate principles’, in the sense of discovered truths, but are creations that are supposed to direct human behaviour and interactions (Coughlin 2008, p. 23). Moral principles can be seen as either ‘absolutist’ or ‘contributory’. They are absolutist when they give fundamental universal guidelines and state what actions are permissible or forbidden—for example, ‘thou shall not kill’. One of the most famous proponents of absolutist ethical principles was Immanuel Kant. Kant (1788, 1797) focused on trying to establish specific moral rules, which should guide human behaviour and action. He proposed that we should live by a specific set of principles regardless of their consequences. Kant’s criteria for universalisability stated that if these moral maxims could be made into universal law then they have ethical credibility.

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However, Kant's absolute ethical principles have been criticised as being counterintuitive to our understanding of right and wrong because we can always imagine cases where they are contradictory or where there are valid counterarguments for ignoring or overriding these principles, for example, it is argued that the ethical principle of truth telling is not always ethically correct. For example, what would you do if you were hiding Jews in your attic in WWII Germany and Nazis came to your house looking for them? You could lie and say that there were no Jews in your house or you could abide by the principle of truth telling and give up the Jews with the knowledge that this would very probably lead to their deaths. Most people would find it extremely difficult to endorse this ethical principle in examples such as this. Therefore, without a significant ethical context, absolutist principles are problematic because we can always find circumstances where they fail to meet intuitively permissible ethical standards.

However, principles can be seen as contributory when they apply more than one approach and take the different factors of each case into account, instead of just relying on one overarching ethical principle to be applied in all circumstances (Coughlin 2008, p. 24-25). Therefore, the criticism that the PP is vague can actually be applied to *all* contributory principles if one judges them by the criteria of not giving universal guidance on policymaking decisions. Principles are not always absolutist and can be considered alongside other principles and values within society. The PP is a contributory principle,<sup>97</sup> as the PP is just *one* principle within sustainability ethics.

However, the PP is not even a definitive 'principle' to begin with, but is 'rather a cluster of virtues (for example, prudence and wisdom), maxims, and moral rules that can be specified using principles of nonmaleficence, beneficence, and autonomy as starting places' (Coughlin 2008, p. 50). The PP is not an ethical 'principle' because it is composed of a number of virtues, maxims and moral guidelines. The understanding that it developed from an approach to a principle is problematic because 'the duty to take precautionary actions may be seen as one of a cluster of norms related to general procedural duties similar to the duty to warn or notify other states, the duty to mitigate, and the duty to assist in case of emergencies' (Tinker 1996, p. 70).

This wide range of different duties contained within the PP would alleviate it from the criticism that it is absolutist and puts precaution above everything else. However, another

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<sup>97</sup> This has no relevance to the contributory value discussed in chapter three; the name is merely a coincidence.

## The Precautionary Principle

criticism against the PP is that a large number of official documents have cited it but none have sufficiently elaborated and clarified it. This criticism of vagueness is not a sufficient reason criticism because there is no reason why the PP cannot be defined more precisely through descriptions and analysis of its goals in order to overcome any problematic outcomes of the framework in practice. Therefore, the argument to discredit the PP because it is unclear or has not been defined adequately enough is essentially problematic and can be overcome. The main criticism here is that it has not been adequately explained and clarified *so far* but this issue can easily be rectified with a descriptive analysis. One starting point to this descriptive analysis is by establishing specific contradictions and commonalities between different versions of the principle.

Table 1.4 Different Precautionary Principle Contents

<i>Person or Agency</i>	<i>Identification of Risk</i>	<i>Deliberation</i>	<i>Action</i>
Ahteensuu (2007b)	Risks should be identified	Decisions should be taken	Apply precautionary methods
Manson (2002)	Establishing a threat	Causal relation between cause- consequence	Find solutions to these problems
Gardiner (2006)	Threat of harm	Uncertainty of impact	Precautionary response
C.U.C. (2000) – Only listed, not explained	Damage and knowledge threshold	Decision stage	Application stage
Mark Ryan (2014)	Knowledge threshold and scale should be decided in terms of resilience	Decision stage – post-normal science through a deliberative process	Application stage

### **ii. Commonalities of the Precautionary Principle (PP):**

There are many different definitions of the PP, so it is vital that we find some commonalities between them in order to assess the principle's place within the sustainability debate. Ahteensuu (2007) proposes that there are three key elements contained within the PP: risks to the environment and public health, decisions to prevent these threats, and their application. Manson (2002) claims that there are three components in the PP: an analysis that something is a threat; knowledge to establish a causal connection between event and consequence; and a remedial stage through regulation, research, or avoidance. Gardiner (2006) proposes that there are three characteristics of the PP: threat of harm, uncertainty of impact, and precautionary response. However, the 'threat of harm' characteristic and finding out how much proof is enough are both unclear in the PP. Turner and Hartzell (2004) refer to this as the 'threshold problem,' while the Commission of the European Communities (2000) acknowledge it as one part of the trigger condition—namely, the 'knowledge threshold'. The Commission – similar to Manson (2002), Gardiner (2006) and Ahteensuu (2007) – establishes that there are three distinct stages within the PP: the trigger, decision, and application stage.

The trigger stage focuses on scientific assessments of risk, while Ahteensuu (2007) proposes that the trigger condition has two distinct 'threshold' stages—a damage threshold and a knowledge threshold. Also, 'risk is a function of at least two variables – the likelihood of an impact [knowledge threshold] and its magnitude [damage threshold]' (Stirling 2001, p. 88). The damage threshold defines what impact criterion the principle should follow, i.e. a threat to human and ecosystem health that is 'irreversible' or 'catastrophic'. The second part of the trigger stage, the 'knowledge threshold', categorises what level of knowledge, or lack thereof, is required for the principle to become effective, i.e. when there is a lack of scientific proof or when the outcomes are not clearly understood. The level of knowledge required is what separates different versions of the PP, and the decision stage evaluates whether or not we should implement the PP and is an important ethical component of the principle because it balances public perception with risk assessments.

There needs to be some kind of societal acceptability of the actions towards risk with a fully transparent form of risk analysis, which will be analysed in Chapter Seven. The application stage is where the PP is applied and involves deciding what levels of precautionary action should be taken, and will be the focus of section three in Chapter Seven.

## The Precautionary Principle

Precautionary responses can be understood in many ways, i.e. the agent should refrain from carrying out an action; further research should be taken; or precautionary actions should be implemented. This stage applies processes such as cost-benefit analysis in order to assess what level of burden sharing should be incurred, by whom, how it can be initiated in practice, and who should pay for preventing the risk.

What unites the different definitions of the PP is that they all contain a few underlying conditions, such as the identification of a threat to the environment and human beings, precautionary decision-making and the application of these decisions. However, this simplification of the PP is far from straightforward because of the difficulties contained within it. For example, what level of certainty is acceptable and what kind of limitations should be put in place? What is considered ‘precautionary’ and how can policymakers balance scientific proof with public opinion? I will modify my definition of the PP throughout the rest of my thesis, breaking it up into five specific components categorised from A to E. These will be filled in after each of the five main sections, and the initial definition can be summarised as follows:

### **Definition of the PEHP (1):**

The PP proposes that when an activity poses a threat (A), then precautionary measures should be taken to prevent it from occurring. The risks to human and ecosystem health should be on a certain scale (B) in order to be deemed worthy of intervention. There needs to be a certain level of knowledge (C) in order to identify threats to human and ecosystem health. This scientific knowledge is used, in conjunction with public opinion, in order to decide what the best course of action is to take (D). There should be an appropriate precautionary response made in the application of these decisions to human and ecosystem health (E).

**iii. Weak and Strong Versions of the Precautionary Principle (PP):**

Bodansky claims that because there are multiple definitions of the PP, it makes it extremely challenging to talk about *the* PP (Bodansky 1991, p. 5). There are so many different versions of the PP, so it is extremely difficult to establish one exact definition of it as it is typically divided into different categories on a sliding scale between weak and strong precautionary principles. It must be noted here that these are merely two extreme ends of a sliding scale of versions of the precautionary principle, with most versions falling somewhere in between the two rather than being confined to their strict definitions. One clear way to differentiate these two polar extremes is their application and use of the knowledge threshold and the ‘burden of proof’ in their approaches. The weak and strong version of the PP use ‘burden of proof’ and ‘knowledge thresholds’, but they vary in the level of proof or knowledge required before the PP is implemented. The strong PP states that

regulation is required whenever there is a possible risk to health, safety, or the environment, even if the supporting evidence remains speculative and even if the economic costs of regulation are high. To avoid absurdity, the idea of “possible risk” will be understood to require a certain threshold of scientific plausibility (Sunstein 2005, p. 24).

The main difference between the two is that ‘the Strong PP, which says basically, take no action unless you are certain that it will not do harm; and second, the Weak PP, which says that lack of full certainty is not a justification for preventing an action that might be harmful’ (Morris 2000, p. 1). The strong PP places an abundance of power into the hands of organisations monitoring pollution, while the weak PP claims that this approach seriously impedes and over-penalises industry and business. The weak PP keeps the burden of proof on the regulator’s side by judging risk in terms of how cost-effective it is. One of the main things that differentiate the two types of PP is their ‘trigger condition’.

The weaker principle calls for action using a more demanding trigger, while the strong PP requires a less demanding trigger condition (Hughes 2006, p. 451). Therefore, the strong PP calls for action with less proof, requiring it to be implemented more often and in a greater range of circumstances. One criticism against this is that it still does not tell us anything about the *quality* of proof. What standards need to be met for the burden of proof to be acceptable? When proof is not enough, it undermines the effectiveness of the PP. Critics claim that the strong PP is too stringent, while many environmentalists say that the weak PP’s level of proof is too lenient. The level of proof that is required is a political issue and applies

## The Precautionary Principle

economic, scientific, and philosophical thinking within risk analysis, but where both versions of the PP differ is in their assessment of the level of proof that is enough.

For example, the weak PP does not give any direction for policymakers because it only acts as a type of pragmatic tool, enabling regulators to view the range of risks on a case-by-case basis. A *very* weak PP is nothing more than governmental rhetoric with little force as a principle in its own right. It is used to support a particular course of action that would have been taken anyway. It permits 'a permissive approach to use of resources and human activities and a balancing of interests which may favour development or quality of life choices over conservation of biodiversity or other preventative action' (Tinker 1996, p. 57). Its purpose is dependent on the environmental decision-making process and simply works as a subsequent justification for decisions towards risk that have already been made.

The strong PP has been criticised as being too shortsighted because it only considers specific individual risks and not the subsequent knock-on effects that our precautionary actions will cause (Gardiner 2006, p. 45). Its focus is too narrow and critics claim that the application of precaution is too strict. In its strongest form, one could say that it would prohibit *all* forms of environmental pollution, resource use, and actions that would potentially cause damage to human and ecosystem health. Hughes (2006) argues that critics of the PP usually focus on the strong version of it, but ignore the weak version of it. They attack a 'straw man' in the easily refutable version of the strong PP (Hughes 2006, p. 448). A problem with the strong PP is that it tends to overemphasise risks, while not taking into account the benefits that could be received from taking these risks, which will be analysed in Chapter Seven.

Weaker versions of the principle can be criticised as holding too little regulatory authority and can be easily overlooked or ignored due to their overly accommodating nature, while the strong version is seen as too rigid, unfeasible, impractical, and too heavily focused on risk. The weaker version of the PP requires an almost certain prediction that harm will occur unless precaution is taken, while the strong version of the PP states that we should act in a precautionary manner when there is even the slightest uncertainty involved. We are left in a state of inaction because our actions may cause harm on the one hand or we are left with the option of permitting all actions unless there is definitive proof they will cause harm on the other hand. We are stuck between an overly paranoid, stagnating and unfeasible position on the one hand and a careless business-as-usual position on the other hand.

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Throughout the rest of this thesis, I will highlight some of the problems contained within both extremes of the PP in order to demonstrate criticisms put against the precautionary principle as a whole and how my version overcomes them. It must be made clear that not all, if even many, versions of the precautionary principle fall into the specific categorisations of strong and weak PP. They are being used in order to exemplify some of the common theoretical problems faced within definitions of the PP in order to show how my version overcomes them. I will not confine myself to either one of these categorisations of the PP, but will instead formulate my own specific version that falls somewhere in between these two extremes.

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Table 1.5 The Precautionary Principle and Ecosystem Health Comparison

<i>Characteristics</i>	<i>The Precautionary Principle</i>	<i>Ecosystem Health</i>
<i>Origination</i>	Germany in the late 70s under the title 'Vorsorgeprinzip'	Originated from Leopold's 'land health' in the early 1940s
<i>Reason for Creation</i>	Integrate a more environmentally proactive approach instead of reactive management	Integrate a more ecological approach to environmental management
<i>In International Policy</i>	Second and Third International North Sea Conference on the Protection of the North Sea, UN Framework Convention on Climate Change (1992), the Ozone Layer Protocol (1987), UN Environment Program (1989) and the Rio Declaration of Principles (1992).	1978 Great Lakes Agreement, the 1982 World Charter for Nature, the 1986 World Commission on Environment and Development (WCED), 1992 Rio Declaration, and The 2002 World Summit on Sustainable Development (WSSD).
<i>Main Disciplines</i>	Political science and environmental sociology	Ecology and philosophy
<i>Structure</i>	Threat, uncertainty, action	holistic approach to management, best available knowledge, satisfy human needs while not harming ecosystem health
<i>Science</i>	Needs science to show there is a potential threat that is uncertain	Needs science to establish what is and is not healthy for ecosystems
<i>Uncertainty</i>	It attempts to implement precautionary action in the face of uncertain threats	Ecosystems are non-linear and there is a great deal of uncertainty contained within our study of them
<i>Approach</i>	Holistic	Holistic
<i>Main Concern</i>	Human health and the environment	Human activities must not overly damage the health of ecosystems
<i>Reliance</i>	Needs ecosystem theory to adequately understand our effects on the world	Needs the PP to work as a guiding framework in order to apply ecosystem health in policy

**iv. The Precautionary Principle (PP) and Ecosystem Health (EH) Relationship:**

EH and the PP have a great deal of similarities, so the room for integration and cohesion between them is striking. For example, one of the main criticisms posed against the PP is that it is so inherently vague. By applying EH instead of the very vague idea of protecting the ‘environment’, it gives the PP more guidance and clarity within environmental protection. EH is often criticised as giving no specific guidance of how to implement it but if applied to the PP, it would be given a greater practical force and guidance. Trouwborst (2009) thinks that because the PP has been used within international policy earlier than the ecosystem approach, it is a stronger concept in the sustainability debate. However, EH has far greater ecological and scientific credibility for effective ecosystem management and when they are integrated together they overcome many of the discrepancies contained within them separately.

Trouwborst (2009) is one of the few academics that have worked on the combination of ecosystem theory and the PP in his article ‘The precautionary principle and the ecosystem approach’. Westra (1998a) also makes a connection between the ecosystemic approach and the PP, claiming that the PP is required to give guidance and direction for the ‘ethics of integrity’, as opposed to the EH concept. Ecosystem integrity needs the PP to ensure effective policy recommendations, but both approaches are not sufficient on their own, a similarity to the relationship between EH and the PP. The principle of integrity (or ecosystem health, as with my definition) is used in order to strengthen the PP because it is based on sound scientific and ethical grounding, whereas the PP benefits ecosystem integrity (also applicable to my version of ecosystem health) because it gives it direction within practice (Westra 1998a, p. 13).

I agree with Westra’s understanding that the PP needs to be grounded on sound ecological theory and a valuative basis, and I agree that an ecosystemic approach requires a concept such as the PP to guide it more effectively. However, I disagree with her supposition that the ecosystemic concept we should use is ‘integrity’. I will apply EH with the PP instead, in order to avail of the advantages that Westra describes but without all of the faults that I found to be evident with the integrity concept in Chapter Two. I will show how the PP and EH are interlinked and how they can benefit one another. While Trouwborst (2009) attempts to integrate these concepts together, I must disagree with many of his observations on the matter, such as the need to attach a notion of intrinsic value to non-human entities in order to be effective—a point I expressed in Chapter Three and Chapter Five. His claim that the PP is

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a stronger approach than the ecosystem approach because it has been around longer and has been in more documents is short-sighted and places duration over quality and effectiveness.<sup>98</sup> This is just one out of three possible ways to view the relationship between the PP and EH.

The three main ways to interpret the relationship and hierarchy of these two concepts are as follows: the ecosystem approach is an element or component of the PP; the PP should be used as an application of the ecosystem approach because of the uncertainty contained within non-linear systems; or both concepts should be given equal merit and exist independently. The view that the PP is dependent upon the ecosystem approach is quite scarce because the PP is a well-established concept and has been given greater recognition within international policy than EH. However, a framework's life span does not make it a stronger and more effective approach. Despite the PP's *supposed* superiority, Trouwborst ends up proposing that 'the one informs the application of the other, and *vice versa*' (Trouwborst 2009, p. 34).

More explicitly, Trouwborst proposes that '(1) the precautionary principle is an *integral component* of the application of the ecosystem approach; and (2) the ecosystem approach should be taken into account in the application of the precautionary principle' (Trouwborst 2009, p. 34). In order to protect EH we need to act with precaution, and in order to act in a precautionous manner we need to take into account our effects on ecosystems. This is the essence of the PEHP and its merger of these two concepts. Their integration is not a hierarchical one, but instead, both concepts are important and strengthen one another due to their similarities and ability to be merged within one overall holistic framework.

EH and the PP both establish very holistic approaches to the natural world by taking whole ecosystems into account rather than just individual species or habitats. The holistic approach to ecosystem management aims to protect EH for future generations and the PP attempts to do the same with the environment. They place a greater emphasis on the needs of humanity in the long-term rather than the strongly anthropocentric viewpoint of economic maximisation for the present generation. Both approaches work best when they are grounded on a weak anthropocentric approach that is dynamic and adaptive because of the uncertain structure and behaviour within environmental systems. Both approaches take a very similar stance towards our interactions with the non-human world and propose that we should take a

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<sup>98</sup> Furthermore, I strongly disagree with Trouwborst that the term 'environment' is much more effective than 'ecosystem', which will be discussed in section seven of this chapter.

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more proactive approach, instead of past reactive approaches. They ‘both embody responses to the failure of reactive and ad hoc approaches to environmental protection and management, and are products of the little contested view that these approaches ought to be turned into, or replaced by, proactive and holistic ones’ (Trouwborst 2009, p. 26).

EH implies diagnostic and curative methods for alleviating ecosystem illnesses but it also proposes preventative action before ecosystems are degraded (Rapport 1995, p. 292). We should try to rehabilitate damaged and compromised ecosystems, but we should be guided towards preventative approaches to ecosystem management—a similar defining characteristic of the PP. One distinct similarity between EH and the PP is their understanding and application of science: the PP uses science to allocate early threats in order to prevent them from occurring and is dependent upon ecosystem theory in order to protect EH. Their relationship is mutual because the PP benefits from ecosystem theory’s scientific analysis, while the PP aids the ecosystem approach through guidance for protection from adverse uncertain risks. If we were to take an ecosystem approach, it would entail that we must act with caution even when there is a lack of knowledge and certainty about risks. ‘The ecosystem approach involves a recognition that the accomplishment of complete scientific understanding of ecosystems is unrealistic due to their complexity and variability’ (Trouwborst 2009, p. 35).

Therefore, EH and the PP acknowledge the unrealistic goal of certainty and accept that it is unrealistic when analysing ecosystem behaviour. Instead, we should ground our management of ecosystems on our best available scientific knowledge. Both approaches call for cautious and intelligent management decisions for the long-term sustainability of the planet. Fundamentally, ‘the application of both concepts is considered essential for the achievement of sustainable development. [...] Generally speaking, both call for a reduction of anthropogenic pressures on ecosystems’, but ‘the ecosystem approach should be taken into account in the application of the precautionary principle, whereas the latter is regarded an integral component of applying the ecosystem approach’ (Trouwborst 2009, p. 36).

While I agree with Trouwborst on this point and many other claims he makes, my disagreements and differences from his approach make both of our positions very different but also the very concepts we are analysing. For example, I agree with Trouwborst’s summarisation of the linking between the two approaches but disagree with him on his understanding of the two concepts being underpinned by intrinsic value, his placement of the

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precautionary principle as more important than the ecosystem approach, and his understanding that ‘the environment’ is a better concept to use than ‘ecosystem’. In addition, my thesis advocates the merger of the precautionary principle and ecosystem *health*, not simply the ecosystem *approach*, as Trouwborst maintains.

The ecosystem approach is much more general and vague than the more clarified and precise ecosystem health concept. The ecosystem health concept takes an ecosystem approach within its framework, it is underpinned by general sympathies of what can be described as an ecosystem approach, but the major difference is that ecosystem health is a more concrete application of the ideals and goals underpinning an ecosystem approach. It is in a similar vein of taking a precautionary approach as opposed to implementing the goals of the precautionary *principle*; the principle is much more defined and applicable than simply taking a precautionary approach in our actions. Therefore, while our positions are similar in many respects, I still hold that nobody has assessed the ecosystem health concept and the precautionary principle in the same light, let alone made substantive efforts at merging the two within one overall theoretical approach.

### **v. Ecosystem Health (EH) Needs the Application of the Precautionary Principle (PP):**

A society can never be fundamentally free from all types of risk and any attempt to avoid one risk for another potential risk appears to undermine the PP’s underlying aim: a risk-reduced society. In other words, the PP attempts to avoid risk and aims towards a risk-reduced society, which in turn places a positive valuation on risk prevention. However, by attempting to avoid certain risks it leaves us open to the criticism of ‘risk aversion’.<sup>99</sup> Risk aversion often focuses on one risk, while giving less attention to other risks. The philosopher Shrader-Frechette (1997) claims that EH should not be used within environmental policy because it is too vague; but instead, the traditional individualistic ecological risk assessment paradigm should be applied. EH is too difficult to define because of the difficulty of diagnosing healthy or ill ecosystems.<sup>100</sup> She claims that risk assessments are more scientific and less prone to the

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<sup>99</sup> The topic of risk aversion will be discussed further in Chapter Seven.

<sup>100</sup> Despite this, she later proposes that we should unite the two concepts of traditional ecological risk assessment and the ecosystem health approach, regardless of the problems she lists in her article for its inapplicability as a guiding framework. She endorses a kind of theoretical pluralism between the two approaches but makes no effort to elaborate what she means by this or how it will come about in theory or practice.

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problems EH faces. I fully reject approaches to ecology, which claim that everything can be easily summarised and categorised within reductionist scientific analysis.

Bryan Norton (1997) also claims that if one analyses ecological risk narrowly, from the traditional ecological risk assessment method, then one is not analysing it effectively because ecological risk is a system-level risk, not an individualised specific one (Norton 1997, p. 129). Norton claims that health is ‘a useful communicative and persuasive term, allowing the physician to refer to a variety of issues without predicting precisely whether the patient will end up with a heart attack, a stroke, or some other illness’ (Norton 1997, p. 130). Shrader-Frchette’s individualistic Newtonian ecological assessment would analyse one specific organ in isolation from its effects on other organs if applied in a health context. However, most ecological thought acknowledges that atomistic Newtonian scientific investigation is an oversimplification of very complex patterns within ecological systems. Atomistic Newtonian thinking refers to the individualistic analysis of things within nature separate from their effects on the complex systems they are a part. However, in opposition to this, I will propose that the complexity of ecosystems must be analysed as part of a collective whole. In essence,

health is a measure of the overall performance of a complex system that is built up from the behavior of its parts. Such measures of system health imply a *weighted* summation or a more complex operation over the component parts, where the weighting factors incorporate an assessment of the relative importance of each component to the functioning of the whole (Costanza 1992, p. 241).

If we integrate individualistic analysis with holistic ecosystem theory, we would have to account for the web of interrelationships taking place within an ecosystem: ‘There are often many levels of a system (individual, families, communities, nations), and hazards often exert effects at multiple levels. Current methods in many disciplines are not well suited to such investigations’ (Kriebel *et al.* 2001, p. 874). Despite this, regulators often avoid using ecological analysis within their decisions, preferring to establish policies based on hard sciences, such as physics, instead. They prefer to use concrete scientific ‘laws’, rather than biological ‘methods’, and try to assign environmental risks into the category of empirically testable scientific universalities, while overlooking the need to apply ecology. Environmental risks are often assigned probabilities obtained from scientific physical laws instead of ecological research. Ecosystems are often overlooked for a physical analysis of a specific resource, species, or habitat. This creates further risks and degradation to ecosystems because policymakers attempt to reduce everything in biology to physics.

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Even if biology is *in principle* reducible to physics, this does not mean that the best way to advance our present understanding of biological problems is to think about quarks and space-time. Perhaps a completed science would be able to unite both physics and biology (Sober 2000, p. 26).

Therefore, using physics without the aid of ecosystem theory would overlook the complexity of ecosystems for the desire to reduce them to physical systems. However, the application of ecosystem theory is difficult because analysing every risk and the web of interrelationships within ecological systems is exceptionally complex. While there have been substantial advancements in our understanding of ecosystem processes and functioning, we still have to be aware that scientific information will always be limited when we analyse things as complex as life cycles of dynamic systems. We need to take into account that ecosystems are quite unpredictable in order to implement adequate environmental policies that take a long-term approach to sustainability (Kay and Regier 2000, p. 121). However, one of the main problems with the ecosystem approach is that it becomes problematic when we try to implement it into practice (Trouwborst 2009, p. 28). The PP can aid EH by giving it better direction within policy, while EH can strengthen the PP with its ethical and scientific grounding.

### **vi. Apply Ecosystem Health (EH) to Guide the Precautionary Principle (PP):**

Calver (2000) claims that the PP should work as a preventive measure in order to protect EH and is similar to the way preventive medicine works by ensuring that illness does not occur in the first place—by taking precautionary measures instead of merely responding to damage once it has occurred. This precautionary response to our health is a preventative measure in order to curb future illness and disease. It is taking precautionary measures now to avoid further disastrous outcomes from occurring in the future, but it requires a greater acknowledgment and incorporation of environmental science to predict these disastrous outcomes in advance:

Implementing the precautionary principle in order to protect health and ecosystems from risks demands a broad reorganization of both environmental science and policy to make them more effective at anticipating those risks and at promoting cost-effective alternatives to risky products and processes (Tickner 2002, p. 494).

One way to do this is to strengthen the PP by giving it clear goals to aim towards rather than the very general and broad aim of protecting the ‘environment’. I believe that EH would be far more compatible with the PP because it does not automatically separate ‘us’ from ‘it’ in the same way the PP’s goal of protecting human health and *the environment* does.

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Protecting EH is so closely intertwined with protecting human health because ecosystems affect the goods and services we receive from them, as explained in Chapter Five. Our actions affect the ability of ecosystems to function, which in turn affects present and future human well-being (Blanco and Razzaque 2009, p. 696). Therefore, we should

cease thinking about environmental risk assessment and management solely in terms of human health issues and instead broadens its scope to cover human health in relation to the environment. As such, ecosystem health appears to provide the best paradigm for integrating larger, more holistic environmental issues into existing work on risk management (Light 1998, p. 147).

The Millennium Ecosystem Assessment (2005a) claims that ecosystem services are fundamental for the survival and health of human beings because without them, any kind of well-being would not be possible. However, there is still a large degree of uncertainty around the future effects of ecosystem changes on human health (MA 2005a, p. 30). This uncertainty about our effects on ecosystems is why we should adopt a precautionary approach. We need to ask if the ‘health’ ideal is a suitable one for this task and if we should change the PP’s goal from protecting the ‘environment’ to protecting ‘ecosystem health’. Essentially, the ecosystem approach attempts to protect human health and EH within one approach and can be compared to the PP’s main goal of protecting human health and ‘the environment’. They are different because the ecosystem approach attempts to protect ‘ecosystems’, while the PP attempts to protect ‘the environment’.

Trouwborst (2009) proposes that the environment is much more all encompassing, is clearer in meaning than an ‘ecosystem’, and is far more effective for implementing environmental protection. It is a term that ‘may not only allude to ecosystems and their component parts, but also to more subjective issues like landscape and natural heritage’ (Trouwborst 2009, p. 32). He goes on to claim that the PP’s aim goes beyond ecosystem management and extends towards other aspects of environmental protection too. ‘The purpose of the precautionary principle is thus more comprehensive than, and encompasses, the purpose of the ecosystem approach’ (Trouwborst 2009, p. 33). However, I would argue that the term ‘environment’ by its very definition refers to that which surrounds us, and concentrates predominantly on the ecosystem goods and services required for our material development. We are separate and different from the environment, it is ‘out there’ and we are not necessarily a part of it. The environment concept does not necessarily include the complex interrelationship between organisms and ecosystems. Essentially,

in its connotations, *enviro-* is anthropocentric and dualistic, implying that we humans are at the center, surrounded by everything that is not us, the environment. *Eco-*, in contrast, implies

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interdependent communities, integrated systems, and strong connections among constituent parts (Glotfelty 1996, p. xx).

Sustainable development (SD) views environmental sustainability as a requisite for human needs and wants, while ecosystem health (EH) views sustainability as recognition of the ecological self-organising and self-generating potential of ecosystems, identifying the interrelated nature of our species with other organisms and their constituent environments. Essentially, ecosystem theory refers to the maintainability and interdependency of all living organisms and their surrounding environments. This is because ‘thinking of risk in human health terms prepares us for thinking of ecological risk in health terms as well’ (Light 1998, p. 149).

SD appears to withdraw this notion of interdependency by only referring to the maintainability of the nonhuman world that is of use to us. While there are similarities between the two positions, EH cares about the maintainability of ‘ecosystem functioning’ rather than maximum sustainable yields, GDP, and cost-benefit-analysis. The strong anthropocentric approach can be reflected within the ‘maximum sustainable yield’ or a ‘socio-economic sustainability’ framework, while my PEHP can be expressed in a weak anthropocentric light, as expressed in Chapter Three section eight of this thesis, and aims towards ‘systematic sustainability’.

SD’s environmental sustainability relates to the maximum level of a resource that can be extracted without damaging the overall levels of that resource, or its ‘maximum sustainable yield’. This can be seen in such examples as the Brundtland Report’s definition of SD, which claims that we should meet present *human* generations’ needs without damaging the ability of future *human* generations to meet their needs (WCED 1987, p. 43). It must be made fundamentally clear that the main differentiation between this approach and my weak anthropocentric approach is that the former concentrates on ecosystem goods, resources, and social and technological means to adapt, while my PEHP acknowledges the importance of passing on ecosystem services and cultural services to future generations but is more concerned with overall ‘systematic sustainability’. For example, the extraction level of certain species of fish can be analysed to note the knock-on effects that will cause to its ecosystem. If these yields cause undue pressure to that ecosystem – because other species do not have a food source or a species overabundance because of declines in predators – then that action may be seen as ‘unsustainable’. The maximum sustainable yield may be an

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adequate measure for the sustainability of a single resource (strong anthropocentrism); but it could prove catastrophic if applied within an ecosystem context (weak anthropocentrism).

The ecological sustainability position analysed the overall ecological interactions of a particular ecosystem before implementing environmental policies, which was discussed in Chapter Two. It was based on an approach that is more in-tune with the actual workings of non-linear systems and opposed to yield maximization and other forms of outdated strong anthropocentric environmental management. ‘The knowledge that ecosystems are subject to natural changes and uncertainty lends to a focus on long-term sustainability rather than traditional management to maximize short-term yield’ (Malone 1998, p. 205). Therefore, it is beneficial for the PP to apply EH within its definition instead of using the outdated ‘environment’ concept, commonly used by strong anthropocentrism.

I reviewed the origin of the precautionary principle (PP) from the late 70s under the title of ‘Vorsorgeprinzip’, and documented the developments and range of definitions that has been given to it since. I demonstrated how the PP is a contributory principle because it is just *one* principle within sustainability ethics, and how it is not an absolute principle. It was demonstrated that the strong PP places an abundance of power into the hands of organisations monitoring pollution, while the weak PP claims that this approach seriously impedes and over-penalises industry and business. This thesis does not confine itself to either oppositional position, but will instead formulate a distinct version of the PP. I also illustrated many different versions of the PP from Turner and Hartzell (2004), the Commission of the European Communities (2000), Manson (2002), Gardiner (2006) and Ahteensuu (2007), while developing my own distinctive definition of the PP, which included a trigger, decision, and application stage.

It was shown that the PP enables EH with greater direction and practical applicability, while EH provides the PP with a sound ecological basis with strong ethical defensibility. I rejected the insinuation that there needs to be a hierarchy between the two concepts, instead opting to include them within one overall merging approach, the PEHP. The following chapter will implement the EH concept within the three stages of the PP and along the way I will continue to define the PEHP within the definition synopsis as can be seen here:

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### **Definition of the PEHP (2):**

The PP proposes that when an activity poses a threat to human health and ecosystem health, then precautionary measures should be taken to prevent these threats from occurring. Ecosystem health is defined as the healthy functioning of an ecosystem in relation to its resilience, and its ability to self-renew and self-organise. It is objective and an ecosystem's health should be understood literally, as holistic and variable. Ecosystem health is valuable because ecosystems benefit present and future generations through ecosystem goods, ecosystem services, and cultural services (A).

The risks to human and ecosystem health should be on a certain scale (B) in order to be deemed worthy of intervention. There needs to be a certain level of knowledge (C) in order to identify threats to human and ecosystem health. This scientific knowledge is used, in conjunction with public opinion, in order to decide what the best course of action is to take (D). There should be an appropriate precautionary response made in the application of these decisions to human and ecosystem health (E).

## CHAPTER SEVEN

### THE TRIGGER, DECISION, AND APPLICATION STAGE

This chapter will analyse three specific components of the PP and will assess their philosophical and practical credibility with the application of EH. It was shown that when the PP is integrated with EH it provides us with clear valuative and scientific groundings, while the PP gives EH clear political and practical guidelines for the decision-making process. In essence, EH tells us what we should protect, while the PP tells us when we should protect it. I will demonstrate the link between the two concepts within the PEHP and will divide this chapter in the following sections: Section 1 – trigger stages (damage and knowledge thresholds), Section 2 – decision stage, and Section 3 – the application stage.

The first section focuses on risk and what type of damage should be caused before action is taken. It will concentrate on whether or not risks can be divided into ‘actual’ and ‘potential’ and will ask whether or not we can use a damage threshold criterion such as ‘catastrophic’ or ‘irreversible’ harm to guide us. The second part reviews the ‘knowledge threshold’ used within my PEHP, focusing on scientific risk assessments, probability, and issues of uncertainty. It concentrates on the relationship between risk assessments and my PEHP, and analyses what burden of proof we are willing to accept before taking actions.

The second section covers the main ethical issues within policymaking such as the need to balance the expert and non-expert’s views on risk, and will analyse the reasons against using the public’s opinions on risk within the decision-making process. The third section assesses some of the key challenges against the PP and its applicability: the dilemma of inaction, the possibility of greater unforeseen risks, economic difficulties, and the absolutist criticism. These issues will be analysed in order to evaluate the PP’s tenability within the decision-making process. However, they cannot be effectively analysed unless we have a specific damage threshold criterion to ground the PEHP to begin with.

### 1 (A) The Damage Threshold

The division of what type of risk we should and should not respond to is important for the precautionary principle's defensibility as a framework, so this section will look at the range of trigger conditions throughout different definitions of the PP in order to establish what one is applicable within the PEHP. We must establish what is meant by 'risk' and identify the various trigger definitions within the PP. The PP states that we should take preventative action when there is a threat of harm, even when the likelihood of it occurring is uncertain. However, this must be in circumstances where the threat falls under a certain rubric such as 'serious harm', 'irreversible damage' or 'catastrophic harm'. There has been a wide range of different trigger responses (such as 'irreversibility' and 'catastrophic harm') used within council reports, international agreements and policy recommendations (Sunstein, 2005-2006). The definitions given in leading documents all throw up their own uncertainties and difficulties:

Is the precautionary threshold as high as "serious or irreparable damage" as articulated in the Climate Change Convention and Rio Declaration, a "significant" threat as in the Convention on Biological Diversity, or the lower "reasonable grounds for concern" threshold in the 1992 OSPAR Convention? (Cameron and Abouchar 1996, p. 44)

However, these trigger conditions have not been critically evaluated and are repeatedly seen as self-explanatory. Furthermore, it is fundamentally unclear what is meant by 'risk' to begin with. John (2010) claims there are three types of risk: those that lead to 'reversible' environmental damage; those that lead to 'serious and irreversible environmental damage'; and thirdly, those that *pose* a potential 'risk of serious or irreversible damage'. All three risks would benefit some individuals in society, while potentially harming others. John (2010) separates risks that are reversible or irreversible from those that *pose* a risk of irreversible damage.

Before we come to the problems of the reversible/irreversible distinction later in this section, there are inherent difficulties with his other proposal that some risks only posing a risk while others are definitely going to happen, unless action is taken. However, this is misleading because the division between potential risks and actual risks implies that some risks are definitely going to happen while other risks have the *potential* of happening. While there are different degrees of probability, there is never any fundamental certainty that a risk will *definitely* occur. Dividing risks that *will* occur from those that *may* occur is disingenuous as they only vary in their *levels* of probability.

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The different levels of probability relates to whether or not an action should be considered precautionary or not. For example, if the event is definitely going to happen, or is extremely likely to happen, then taking actions to avoid it is not precautionary, but instead 'reactionary'. For an action to be deemed precautionary, it needs to contain a degree of uncertainty. 'An action *a* is precautionary with respect to something undesirable *x*, only if (2) the agent does not believe it to be certain or highly probable that *x* will occur if *a* is not performed' (Sandin 2004, p. 466). That is even before we come to the issues inherent within John's irreversible risks claim. However, irreversible risks are only one typical categorisation of risks within precautionary principle definitions. Therefore, it is important to clarify what types of damage thresholds should be used to guide the PEHP, for example, Sunstein divides risk into three distinct categories: catastrophic risks, irreversible harms, and risks that are a threat but are not catastrophic (Sunstein 2005, p. 109).

### **i. Irreversible Harm:**

The irreversible harm PP proposes that actions are irreversible if they cannot be reversed or repaired and are, in turn, final. For example, once the polar ice caps melt, it is final and cannot be reversed by any of our actions. It leaves us with one less future option because of our actions now. The irreversible harm PP states that when policymakers do not possess sufficient knowledge in relation to a particular risk, it would be wise to allocate more resources towards obtaining '*an "option" to protect against irreversible harm until future knowledge emerges*' (Sunstein 2005-2006, p. 845). However, the irreversible harm PP must be clear in its goals about how it can be implemented in practice or else one may assume that protecting all irreversible environmental actions is desirable, such as the protection of *all species*.

The preservation of *all* species is a redundant goal of environmentalism because of its utopian view of avoiding the irreversible harm of species extinction and because it is fiscally and politically impossible. This is because we do not have enough time or resources to preserve *all* species from extinction, and if we attempted to do so, it would be an effort in vain and would distract us from effectively protecting *some* species. Of course not all species' extinction is necessarily harmful because some species are better off being extinct than having an extremely poor quality of life. Regardless of this, the irreversible harm PP gives us an indication about which species to protect based on the criteria of the principle

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itself, i.e. which species is closer to the point of irreversibility—the irreversible outcome of extinction being the endpoint.

When we attempt to protect certain species, we need to construct a hierarchy of value to indicate which species we should protect when they compete for resources. The irreversible harm PP proposes a hierarchy of value based on the level of irreversibility, i.e. the species that would get priority would be the one that is closer to ‘irreversibility’. One problem with this can be demonstrated in the following example: a specific species of ladybird is very close to extinction, but its extinction would not have a dramatic effect on the health of its ecosystem or any substantial loss to humankind. Its irreversible extinction is going to happen far sooner than the extinction of another species, for example the southern white rhinoceros. If we apply the irreversible harm PP, it would give priority to the ladybird’s protection because it is closer to the irreversible harm criteria of extinction. While the species of ladybird is closer to the irreversibility mark, it does not take into account that the white rhino has a far greater impact on EH.

The irreversible harm PP does not apply a scale impact criterion, which is counter-intuitive to environmental protection and is contradictory to the different valuing of different species. Placing an emphasis solely on which species is closer to extinction should not automatically qualify a species as having more value. However, if the irreversible harm PP applies an impact scale of harm, it would become a mere tool of the catastrophic harm PP. Sunstein points out that the irreversible harm PP is attached to the magnitude of harm, so it is an essential part of the catastrophic harm PP (Sunstein 2005-2006, p. 862). The irreversibility harm principle is nothing more than a preliminary step of the catastrophic harm principle, because it analyses the individual parts of the whole prior to applying it to the overall catastrophic outcome.

The irreversible harm PP on its own is problematic but when it is combined with catastrophic harm, it is too vague and incoherent to become usable. It would just be a preliminary tool in the catastrophic harm principle’s arsenal, which is also an inadequate version of the PP. However, one may argue that the irreversible harm PP tries to prevent catastrophic harms from occurring, but this does not imply that *all* irreversible harms would be catastrophic. Catastrophic harm implies a quantitative measurement of harm, while irreversibility *can* imply both qualitative *and* quantitative harms, depending on its context. Irreversible harm does not always descend into the catastrophic harm PP but I agree that there

may be overlap between the two. Therefore, this criticism does not exclude the irreversible harm principle itself as a possible damage threshold for the PP. Regardless of this, there is an inherent temporal difficulty with ‘irreversibility’ because every action and event is essentially irreversible and falls into ‘*the fallacy of ubiquitous irreversibility*’ (Mason 2007, p. 12).

Any action, behaviour, or event is irreversible—but not necessarily harmful—because they cannot be reversed. If we take our frame of reference from the second law of thermodynamics, which understands entropy as always increasing within an isolated system then it would be logically impossible to reverse an action. Therefore, the outcome is impossible to take seriously as it would involve freezing everything as it is now, which is inconsistent with the second law of thermodynamics.<sup>101</sup> Nature is constantly changing, adapting, and evolving, so it would be incorrect to claim we can prevent irreversible things from occurring. More importantly, even if it were possible, it would be undesirable because this type of control would imply an anthropocentric form of dominance and mastery over the environment. It would mean that ecosystems were essentially controllable and could be manipulated in order to prevent irreversible events from occurring.

Norton criticises ‘irreversibility’ because its practicality is questionable and this ‘deep-freezing’ of nature is in opposition to ecosystemic dynamics (Norton 2003a, p. 120-1). ‘Humans cannot protect every process just as it is without freezing nature, which would be the ultimate, and self-defeating, outcome of overdoing ‘preservation’’ (Norton 2003c, p. 482). The irreversibility harm PP imposes a fixed state on a non-linear system and does not take into account the need for ‘flexibility and adaptive management in the face of uncertainty, a no-surprise clause would be a big step in exactly the wrong direction – a step toward inflexible management that is unable to respond and adjust in the face of new information’ (Norton 2003a, p. 123). Therefore, we need a different approach than ‘irreversibility’ in order to guide the PEHP, such as ‘catastrophic harm’ or ‘edges of chaos’.

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<sup>101</sup> There is a difference between irreversibility in theory and in practice, with classical mechanical laws stating that irreversibility is possible because time is symmetrical. Within classical mechanical systems, there is the theoretical issue that things are reversible because they are time invariant. Time itself is not reversible, but time has no direction, it is just a coordinated system, theoretically. Within classical thermodynamic systems, there are irreversible systems, but if taken within classical mechanical systems theory they are reversible, for example waves. The reversibility-irreversibility of something also depends upon our theoretical frame of reference; for example, melting icecaps. We could theoretically reverse their melting, if we had some huge ice-making device, but it is impractical.

## ii. Catastrophic Harm:

Sunstein's 'catastrophic harm precautionary principle' states that if risks are likely to cause catastrophic harm then we should take greater precautions to ensure that they do not occur, even if there is a likelihood they will not occur (Sunstein 2005-2006, p. 846). However, how can one differentiate a catastrophic harm from a non-catastrophic harm? Sunstein claims that there is a distinct difference between catastrophic and non-catastrophic harm, which can be shown by the varying scales of harm. Sunstein claims that the catastrophic harm PP may consist of a greater number of human fatalities, measuring in the hundreds of thousands or millions, rather than *just* the thousands. Deciphering 99,999 deaths as 'non-catastrophic', but when it edges over to 100,000 lives it is 'catastrophic' appears to be questionable and arbitrary. This observation may be somewhat pedantic but if Sunstein did not mean this as an outcome of his definition, he makes no effort to elaborate upon what he *does* mean or provide us with an adequate way of distinguishing the two.

Differentiating catastrophic from non-catastrophic events based on lives lost is problematic. It does not give any acknowledgment of the damage and destruction to individuals' businesses, homes, and infrastructural destruction that many would see as 'catastrophic'. Sunstein's arbitrary distinction between catastrophic and non-catastrophic harm is far too simplistic, narrow, and essentially detrimental to guide the PP. It does not give us any clear guidelines about what to do in practice. For example, does he mean that we should only care about catastrophic harms and ignore non-catastrophic harms? If this were so, it would ignore a great deal of very serious harms to health that do not fall under the rubric of 'catastrophic':

Non-catastrophic extreme events can also significantly affect health. For example, although severe floods drown and injure thousands, minor floods are more frequent and can increase the risk of infectious disease via the spread of faecal contamination (McMichael and Kovats 2000, p. 223).

While minor floods do not fit into the catastrophic rubric, their effects require some serious attention, attention that would be overlooked in favour of improbable catastrophic outcomes. The ecological and social resilience of a particular ecosystem, as described in Chapter Four, such as the ones affected by minor flooding may not be resilient to the effects of this flooding. Therefore, the self-renewing and self-organising capabilities of these ecosystems should be taken into account instead of simply assessing whether or not they can be deemed a catastrophic harm.

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When applied to species, a catastrophic harm would ensue ‘[i]f too many species are lost, by increments, from an ecosystem, an area, or the worldwide biotic community’ (Norton 1987, p. 67). This is because ‘[e]ach species that is lost carries with it the risk of a catastrophic ecosystem breakdown and increases the risk that the next loss will result in such a breakdown’ (Norton 1987, p. 72). Therefore, there is a serious possibility that the eradication of a species will contribute to catastrophic ecosystemic breakdown. However, Sunstein does not give us any clear indication of how one would apply the catastrophic harm principle to protect ecosystems and it is unclear how we may go about categorising species eradication solely by numbers. This is because ‘it is by no means a given that the *seriousness* of risks is a simple function of their *magnitudes*’ (Munthe 2011, p. 35).

By analysing species numbers or loss to revenue as magnitudes of catastrophe, the catastrophic harm PP views EH in a very restrictive way. Even if we were to implement catastrophic harm as an indicator of the PEHP, it becomes problematic when it is applied to non-linear dynamic open systems (ecosystems) because of their complexity. To implement a specific critical damage point by using catastrophic theory is questionable because of ecosystems unstable and complex nature. They are open systems and do not have specific catastrophic thresholds according to thermodynamic theory—as discussed in Chapter Four. A closed system is different because it can result in specific identifiable catastrophic outcomes where entropy decreases locally.

However, open systems exchange entropy between systems so they do not have clear-cut catastrophic thresholds. Instead, open systems have different levels of resilience and adaptability to changes in their entropy and have the ability to reorganise and adapt as a result. As described in Chapter Four (section four), ecosystems are non-linear systems and ‘normal’ evolutionary change is so difficult to identify and problematic to value. Instead, it is more appropriate to use terminology like an ecosystem’s resilience, and ability to self-organise and self-renew when affected by anthropogenic changes, rather than categorising an event as catastrophic or un-catastrophic.

Edges of chaos are different from the catastrophic definition because they establish thresholds where if they are crossed there is an uncertainty about the ecosystems’ level of resilience and ability to bounce back. Because of the uncertainty of ecosystems and their levels of change and adaptability to high levels of stress and impact, it is more effective to establish possible critical thresholds and edges of chaos, instead of categorising things as

catastrophic. As described in Chapter Four, there are open and closed systems, and while catastrophic theory is useful and helpful when it is applied to specific closed systems or even some open systems that have more definitive and clear barriers, numbers, and organisation (such as specific species), the catastrophic principle is ineffective for applying at the ecosystem level.

### **iii. Edges of Chaos and Bifurcation Theory:**

The edges of chaos and complexity theory represent alternatives to catastrophic and irreversibility thresholds. They establish specific threshold points where the consequences are largely unknown. There are specific thresholds where once crossed, we do not know what the outcome will be. These ‘edges of chaos’ (Kaufmann 1993) help us categorise and understand what actions would cause ecosystems to become highly unstable and move away from self-organisation and self-renewal. These ‘shifts are not a gradual, smooth and continuous passage between system states, but rather rapid, catastrophic and step-wise’ (Hearnshaw *et al.* 2005, p. 20). These edges of chaos thresholds are when a system makes a sudden and rapid shift away from its trajectory that is unsmooth, abrupt and diverts away from self-organisation and self-renewal towards chaos. However, how to map the different movements and possible ecosystemic outcomes is quite difficult and detailed. I have already shown the limitations of the catastrophic and irreversible harm criteria, so now I will propose that the edges of chaos is a more suitable damage threshold, once it is grounded and direction by bifurcations in the ecosystem.

Bifurcation theory is an alternative to catastrophic and irreversible harm thresholds, takes ecosystem complexities into account, and states that we should establish ‘bifurcations’ in order to understand different possible trajectories and outcomes of our actions (see above diagram). Bifurcations are ‘critical points whereby the trajectory of a system is divided into new possible pathways, so as to explain the state dynamics of a system’ (Hearnshaw *et al.* 2005, p. 21). Bifurcations can be used in a number of disciplines to categorise different points in the parameter space where a system’s stability changes in a qualitative fashion. In the case of the environment, these changes are on an ecosystem-level rather than changing patterns in organisms’ attributes. Bifurcation theory may be applied to analyse the evolutionary patterns of certain, or groups of, ecosystems. They are used to describe how small differences in an ecosystem can cause massive changes in the overall patterns and structure of that system.

Bifurcation theory analyses alterations in ecosystems on a broad holistic level, while the organism's traits are given as stable. Bifurcations are more typically used to analyse complex dynamical systems, rather than individual entities. However, an organism's traits change in reality but over a much longer period. These changes are typically caused by 'mutants invading a residential population' (Troost et al. 2007, p. 253). Bifurcation analysis is particularly valuable for the ecosystem health concept because it is able to review changes to an ecosystem from a system-level approach, analysing things such as nutrient content, ambient temperature, and so forth (Troost et al. 2007, p. 253).

Bifurcation theory views the changes occurring on an evolutionary scale as slow moving, while changes on an ecological scale as fast moving. Species level alterations happen over a much greater time-scale than changes within an ecosystem. Evolutionary issues such as growth, birth and death rates, are all measured on a longer evolutionary time-scale than system-level changes (Troost et al. 2007, p. 254). As it was similarly described earlier with the ecosystem health and biological integrity distinction (fish farm example), bifurcation theory only analyses species and organisms' behaviour in relation to its effect on the overall system. If the species affects a system's level of resilience, then that species is a threat to the resilience of the system.

Interestingly, the invasibility of a resident by a mutant can also be expressed in terms of the system's stability: as the resident is assumed to be in equilibrium with its environment, the system without the mutant is stable. If the stability does not change when a mutant is added to the system, this mutant will just die out. A change in the stability, however, means that the mutant may be able to invade (Troost et al. 2007, p. 254).

However, in the bifurcation model, no theory of fitness or evolutionary pattern is required. Our analysis is simply on a system-level basis of their affect on the stability and resilience of that ecosystem. The reason that the bifurcation model is required in the first place is the complexity of the ecosystem model. Ecosystems are immensely difficult to analyse and to map their developments, so the bifurcation model provides a possibility for 'analysing models that have multiple ecological equilibria or non-equilibrium attractors, such as limit cycles' (Troost et al. 2007, p. 266). While bifurcation theory can map certain patterns and possible outcomes of ecosystem-level activity, there is still a fundamental level of uncertainty contained within it because of ecosystemic complexity.

There is however, an element of irreducible uncertainty about what new trajectory (or state) after the bifurcation will be selected prior to the actual selection occurring. This uncertainty intrinsically limits the capacity to predict categorically how a situation will unfold, say after changes in the management of an ecosystem (Hearnshaw *et al.* 2005, p. 21).

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Actions may lead to very unstable consequences because open systems react and reorganise to change and there are specific thresholds we cannot predict, as discussed in Chapter Four. There is uncertainty about their adaptability and levels of resilience, so associating the PP with the irreversible or catastrophic ‘damage threshold’ is quite misleading. One of the main reasons for rejecting these damage thresholds is because policies ‘are designed to be proportionate to the risk of damage involved. Nowhere is there any consideration of provisional measures, of the prior making of a risk assessment or of the possibility to act only in cases where there is a threat of irreversible or serious damage’ (Krämer 2001, p. 50). To design risk assessments and environmental protection around the categories of irreversible or catastrophic harm would be misleading for risk analysis. There should be no specific absolute damage thresholds like catastrophe or irreversibility in ecosystems, but our actions should instead be guided by potential edges of chaos and the bifurcations that guide and direct our actions away from these thresholds.

The PP aims to protect human health and EH in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and establishment of approximate edges of ecosystemic chaos. My PEHP proposes that we should take precautionary steps in our actions and the burden of proof should be put on those that will cause potentially harmful actions to human or ecosystem health and this should be directed by the edges of chaos established within the damage threshold section of the principle. I acknowledge that there will be a great deal of uncertainty contained within our judgments but this uncertainty should not force us into inaction but should encourage us towards a preventative course of action, as shown within the edges of chaos threshold and underpinned by bifurcation theory. Therefore, instead of using either irreversible or catastrophic harm as damage threshold benchmarks for the PEHP, we should instead establish appropriate action from the edges of chaos and the analysis of different bifurcations from certain actions.

Because there is such a large degree of uncertainty contained within ecosystems, edges of chaos guided by bifurcation predictions would appear to be far more suitable ways to protect EH than the vague and problematic ‘irreversible’ or ‘catastrophic’ definitions. A more complete risk analysis should take into account different edges of chaos outlined from our study of bifurcations and also be combined with the levels of probability and effects on a system’s resilience (defined by self-organising and self-renewing capacity), and not simply its irreversible nature or magnitude of harm of an action. Resilience theory was discussed in

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detail in Chapter Five and probability analysis will be analysed in the next section, in order to combine them within one overall risk analysis approach with the edges of chaos threshold, grounded by the bifurcations being assessed.

The following section will outline the knowledge threshold stage of the PEHP in order to demonstrate what responsibility scientists have in information distribution and sharing on risks, and what level of probability should be sufficient in order to categorise risks as fitting into the edges of chaos threshold distinction established in this chapter. Bifurcation theory will allow us to judge different courses of action once these edges of chaos are established, but we need to come up with sound parameters of probability in order to establish what these edges of chaos are and where the possible bifurcations may lead.

**Definition of the PEHP (3):**

The PP proposes that when an activity poses a threat to human health and ecosystem health, then precautionary measures should be taken to prevent these threats from occurring. Ecosystem health is defined as the healthy functioning of an ecosystem in relation to its resilience, and its ability to self-renew and self-organise. It is objective and an ecosystem's health should be understood literally, as holistic and variable. Ecosystem health is valuable because ecosystems benefit present and future generations through ecosystem goods, ecosystem services, and cultural services (A).

Edges of chaos thresholds give us boundaries as to what may cause ecosystems to become unhealthy. The edges of chaos should be guided by bifurcation analysis, which establishes critical points where the trajectories of ecosystems split into different pathways. The PEHP aims to protect ecosystem health in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and the establishment of edges of chaos. The PEHP damage threshold should take into account edges of chaos and possible pathways outlined by bifurcation analysis, in order to protect an ecosystem's resilience (defined by self-organising and self-renewing capacity) (B).

There needs to be a level of scientific knowledge (C) in order to identify threats to human and ecosystem health. This scientific knowledge is used, in conjunction with public opinion, in order to decide what the best course of action is to take (D). There should be an appropriate precautionary response made in the application of these decisions to human and ecosystem health (E).

### 1 (B) Knowledge Threshold:

There are a number of different viewpoints of where the PP is situated within risk assessment/risk management, sometimes making it difficult to pinpoint its role within the debate. Some state that it should only be applied in worst-case scenarios and where risk assessments are very limited, while others claim that it should work as a replacement to risk assessment/risk management frameworks altogether. Others propose that it should be confined to risk *management* and should have no place within the risk *assessment* paradigm<sup>102</sup> (Marchant 2002, p. 37). Therefore, it is important to investigate where it is situated and if risk assessment and risk management are separate or if there is room for cohesion.

To begin with, one way to divide the two is their implicit understanding of science and value within their approaches. For instance, van den Belt (2003) claims that there are two positions within risk analysis: those that appeal to science (risk assessments), and those that appeal to ethics (the PP). However, this division between science and ethics is too simplistic and misleading because ethics is essentially engrained within scientific analysis and application, even though the value judgment is often not explicit. However, scientific risk assessments determine whether a particular action is safe or unsafe, and if the degree of risk involved is very high, i.e. if an action is likely to kill us. In order for risk assessments to be fully effective and rigorous, they need to take into account a large range of values, viewpoints, and probabilities.

The most common definition of ‘risk’ is the combined analysis of probability and consequences. Probability is the statistical likelihood that an event will occur, while consequences are the effects of these actions. Hansson (2003) divides the ethical decision-making process into two sections: situations where there is a probability that events *will* occur and situations where there is an *uncertainty* that they will occur. The former would give the probability of an event occurring and is often associated with risk assessment and risk management. The latter approach involves giving an estimate that a risk will materialise by including levels of uncertainty and is usually associated with the PP. The main difference

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<sup>102</sup> The difference between risk assessment and risk management is that the former is a scientific process of identifying specific risks and degrees of risk, while the latter is the management of these risks, which is not a scientific process but rather a political and ethical one. Therefore, this criticism proposes that the PP should only be used within the management of risks and should have no say in the identification and categorisation of risks.

between the two is the inclusion of ‘uncertainty’. Therefore, we need to identify uncertainty within risk assessments and if any outcome is ever truly certain.

To begin with, one could argue that *all* of our actions are essentially uncertain or that there is *always* some level of probability of other outcomes. For example, Sunstein (2005-2006) claims that total uncertainty is very infrequent, and that the idea of ‘bounded uncertainty’ appears to be much more realistic. Bounded uncertainty acknowledges that there will be levels of uncertainty within our actions but these vary depending on the level of scientific knowledge we have and the probability levels we have identified. Essentially, while the PP is concerned with uncertainty, it also needs to find some degree of probability before it can be applied. The prerequisites for the PP are completed risk assessments and a demonstration that the risk involved is uncertain (Ahlers 2001, p. 81). However, scientific risk assessments will not always be able to provide concrete answers in the decision-making process, and because of this, it makes its application in risk management quite challenging.

Therefore, ‘we must devise ways of proceeding in the absence of scientific certainty about such consequences – science will never have *all* the answers – and in so doing we must acknowledge the scientific elusiveness of risk’ (Adams 2000, p. 244). This is because ‘science does not always provide the insights needed to protect the environment effectively and that undesirable effects may be caused if measures are taken only when science does provide such insights’ (Freestone and Hey 1996, p. 258). Risk management, through acknowledging edges of chaos and different possible bifurcations, attempts to manage risks, even when probability calculations are seriously flawed or uncertain. Ironically, many risk assessment proponents apply this criticism against the PP, stating that instead of basing its analysis on scientific rigour it makes decisions grounded on a type of pseudo-science, based solely around an ethical understanding of risk.

### **i. The PP is Unscientific:**

There has been widespread scepticism that the PP is unscientific, an impediment to progress, and a scaremongering concept that slows down economic development. For example, McKinney and Hammer Hill (2000) claim that it *forces us* into action when scientific proof is unavailable and is therefore a poor form of science and policy. Carr responds to this by stating that ‘[t]he precautionary principle needs to be viewed as a complement to science, to

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be invoked when a lack of scientific evidence means outcomes are uncertain' (Carr 2002, p. 37). The PP is not an alternative, or in opposition, to scientific thought, but it can work alongside it and assist it when there is a substantial degree of uncertainty involved.

When there is a lack of scientific certainty about a particular action, scientific analysis must *still* show a link between that particular action and the consequences it is proposed to cause. Otherwise, *anything* could be seen as a potential threat from *any* type of action. When the PP states that we should avoid 'possible risks', it is doing so from a logical point-of-view where there is scientific believability that this risk could in fact occur. The action that the PP endorses must realistically have the capacity to prevent these harmful events from occurring and not just an action *presumed* to be precautionary. There must be intentionality in our actions to prevent a risk from occurring. 'An action *a* is precautionary with respect to something undesirable U only if *a* is performed with the intention of preventing U' (Sandin 2007, p. 106).

However, we cannot analyse every risk out there or the process would be absurdly time-consuming and would drastically eat away resources that could be better spent on targeting risks that are more probable. Therefore, while it is philosophically problematic to rule out improbable risks, it is practically unfeasible to dedicate time and resources to every unlikely risk. Therefore, the PP takes it as a given that the risks it analyses must fit into the scientific possibility of occurring, and outlined by different bifurcations of possibility, as discussed in the previous section.

However, there is a need to analyse scientific risk assessments and establish how much proof we are willing to accept before action is taken. If we ask for too much proof, this could delay action and worsen damage to ecosystems. 'It is too often the case that no actions are taken until there is evident loss of ecosystem functions, at which point interventions are often costly and have low probability of success' (Rapport 1995, p. 290). However, there are gaps within our scientific knowledge that make it difficult to pinpoint how much burden of proof *is* possible. Non-linear ecosystems are quite complex and finding levels of proof within our current scientific knowledge is difficult, as described in Chapter Five and also the damage threshold section in this chapter. Essentially, there 'may not be a unique, ecologically "correct" ecosystem to be preserved or maintained' (Manuel-Navarrete *et al.* 2004, p. 219).

The PP places a strong emphasis on valuative judgments and does not *solely* place the responsibility in the hands of scientists. This is because there is a degree of uncertainty and

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the risk of blind spots within scientific investigation. Policymakers need to be very careful about ‘blind spots’ or gaps in scientific knowledge that may come about as a result of assumptive analysis (Harremoës *et al.* 2002, p. 192). An effective PP will detect the fact that there may be blind spots within scientific research, and must acknowledge this fact within its application. The PP emerged because progressions in science were developing faster than our ability to know the effects they would cause. ‘Society’s growing commitment to the precautionary principle is essentially a response to a growing tension between two aspects of science: its growing innovative powers were increasingly outrunning its capacity to anticipate the consequences’ (Harremoës *et al.* 2002, p. 209). The PP attempts to implement precautionary actions when there is a lack of scientific evidence, but at the same time, it needs to use scientific evidence to show that these actions *may* actually be unsafe. Therefore, ‘the PP *assumes* that although science may not be able to give us answers today, at least in principle (hence, at some future date) such answers are both possible and, in fact, almost assured’ (Westra 1998a, p. 14). If they never materialise, the cost of implementing prevention in the face of uncertainty is still better than doing nothing:

Relevant socio-economic considerations include the awareness that in the long term a healthy ecology is a precondition for a healthy economy; that sustainable development cannot be attained without applying precaution; and that the avoidance of serious environmental harm is generally cheaper than repairing it (Trouwborst 2009, p. 32).

We are preventing harms from occurring because we cannot empirically show that these risks will not cause damage. However, we are under the assumption that evidence may one day reveal that these risks are real, and hence, our trust is placed back into science once more. Precautionary actions do not require that we believe these predictions will definitely come true because the uncertainty contained within them is enough for action. We do not have to believe a specific model of risk analysis will definitely materialise in order for prevention to be justified. ‘We must choose to act one way or the other in reaction to claims about the need for precautionary action based on models of global systems, but that does not mean we are forced to believe or not believe in these models’ (Haller 2000, p. 188).

One of the underlying reasons for this is the fact that most individuals within society are willing to pay to have future ‘options’ available (option values). Option values refer to a premium that we are willing to pay in order to preserve a specific environmental amenity from being overused, degraded, or eradicated. The reason for this is so that we have the option of using it in the future, or that it may become useful in the future. ‘This premium reflects individual risk-aversion: in the absence of risk-aversion, people’s willingness to pay

would equal the mean use value (its expected value), and option value would be zero' (Goulder and Kennedy 1997, p. 35). The quantity of payment fundamentally depends upon what society deems to be important and what losses it wants to protect from occurring.<sup>103</sup> It is important to identify specific levels of probability and uncertainty so that the public are able to make informed decisions about these cases, so the following section will evaluate probability analysis and assess how it can help in the decision-making process.

### **ii. Probability is a Component of Risk:**

The PP can be seen as the attempt to avoid risk to humans and EH through precautionary actions and preventative steps and should be understood in a way that directly relates to the problems inherent within risk instead of being depicted as completely separate from risk analysis (Feintuck 2005, p. 377). Therefore, the assessment of risk is likely to be incorrect some of the time because it is attempting to predict risks and implement precautionary steps to avoid these potential harms. This is not to say that the PP is based on unscientific grounds but that there will be uncertainty about the outcomes and consequences of particular actions.

Probability analysis is fundamental for the PP because when there is little probability of negative impacts there will be less likelihood we will take precautionary actions. Whereas, when there is a high probability of detrimental outcomes to humans and EH, individuals will err on the cautious side. Of course, there are those who will still want to take risks even when there is a high probability of danger and disaster, and those who err on the cautious side even when there is a low probability of risk. However, when applying the PP, policymakers will have to incorporate scientific data and public opinion together, the same as any other type of decision.

A rational decision-maker who applies the precautionary principle will use the same type of scientific evidence (hopefully, the best evidence available), and assign the same relative weights to different kinds of evidence, as a decision-maker who requires full scientific evidence before actions are taken. The difference lies in the amount of such evidence that they require for a decision to act against a possible hazard (Sandin *et al.* 2002, p. 296).

There should be a strong emphasis on scientific findings in order to distribute the most informed and up-to-date information to policymakers and the public. This would allow politicians, scientists, and the public to deal with specific dilemmas with a fuller understanding of uncertainties, bifurcations, and probability (Buhl-Mortensen and Welin

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<sup>103</sup> This will be discussed in further detail in the application stage of this chapter.

1998, p. 403). Policymakers must receive levels of uncertainty and different possible bifurcations from scientists in order to inform the public and should make ethically informed decisions. One such demonstrable example of how science can aid policymaking is to be clear and concise about the accuracy, limitations and uncertainty within research (Kriebel *et al.* 2001, p. 873).

This has been exemplified in the earlier section where I discussed edges of chaos as opposed to specific endpoint thresholds such as catastrophic or irreversible harm. Edges of chaos outlines an approximate boundary of dangerous risks, where once ecosystems go beyond, there is an uncertainty about what bifurcation will take place, as opposed to stating that once ecosystems go beyond x levels disaster will occur. Therefore, scientists should communicate and inform the public and policymakers about uncertainties within their results, which would help clarify the levels of precaution towards ecosystem health. There is a moral imperative among scientists to provide information about their findings to the best of their ability. ‘But acknowledging the inevitable limits of knowledge leads to greater humility about the status of the available science, requiring greater care and deliberation in making the ensuing decisions’ (Harremoës *et al.* 2002, p. 187). Also,

it would be unethical to report only certainties—because of the need of early warnings—and it would in the same way be unethical to hide the uncertainties when results based on lesser certainties are reported. We believe that environmental science could make a better contribution to environmental decision making if the available knowledge is communicated in a manner which allows for insights on how strong the evidence is (Buhl-Mortensen and Welin 1998, p. 410).

This quotation misinterprets the scientist’s use of language and the contribution they make to the decision-making process. Buhl-Mortensen and Welin (1998) make a commonly misinformed assumption – that science has ‘certainties’. Scientists mostly speak in terms of probabilities, while ‘certainties’ are far less common due to the constantly adapting and evolving nature of scientific investigations (Bodansky 1991). If one were to replace the word ‘certainties’ with ‘probabilities’, it would make more sense but would still leave us with the problem that scientific risk assessments focus on the probability of an event, while overlooking any uncertainty within their findings. Scientists should report their analysis and give clear and concise descriptions of probabilities and uncertainties within their findings.

Scientists have a responsibility to report faults and uncertainties within their findings that will enable regulators and the public to make informed decisions based on fully transparent analyses. However, by establishing uncertainties contained within these findings, it may allow some risks to be overlooked because of scepticism about the science. If there are

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levels of uncertainty, then the importance of that research might be disregarded because of those uncertainties. The public tends to view science as a factual and infallible discipline and if there are uncertainties within scientific analysis then that research may be discounted. Therefore, it is important to analyse the scientist's obligations in the analysis of risk and in turn how to integrate it within the PEHP.

### **iii. Scientists' Responsibility:**

Policymakers and the public may not understand risk assessments and the technicalities contained within scientific findings, so when risk details are disseminated, there is a need to make information accessible, while at the same time attaching specific and relevant meaning to these findings. These types of warnings, with the inclusion of uncertainties, must be done in an effective and cautious manner to provide relevant information in an ethical and transparent way. Therefore, the scientist has an ethical obligation to provide information about and warnings against potential harms. How people respond to warnings is often largely down to what type of warning system is in place, and how much notice is given. Early communications help establish preventative measures, so scientists should inform the public with descriptions of what may occur and how it is a threat to their safety (Mileti and Peek, p. 184). People can effectively protect themselves from these potential hazards instead of responding to them from misguided interpretations (Mileti and Peek, p. 185).

Location is also important because the public should be informed about what areas will be affected, to what scale, and what areas are free from danger. The public should be informed about how long they have to respond to potential harms and provided with a reliable reference point from an established and credible source. This is because there is little point in following a warning message if it comes from unreliable and inaccurate data (Mileti and Peek, p. 186). One example is the MMR vaccine scare, promulgated by Andrew Wakefield. Wakefield claimed that the MMR vaccine was linked to causing colitis and autism in a 1998 article published in *The Lancet* journal. Not only were his claims untrue and had no scientific or empirical basis, but Mr. Wakefield had manipulated his findings, had conflicts of interests, and also broke several ethical codes of conduct.

The hysteria and widespread panic caused by the information in Mr. Wakefield's article had a dramatic effect on the medical profession and the international community. In

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order to prevent panic such as this, we need to establish a number of characteristics to include in warning messages. Mileti and Peek (2000) outline a number of things that are required for effective warning messages: they must be specific and consistent in their findings, have a strong degree of probability, provide sufficient information, and be distributed through appropriate channels. However, one must try to factor in and uncover possibly misleading publications, and third parties, organisations, or policymakers who benefit from releasing this information, which I will discuss in the next section (Sol and Turan 2004, p. 657).

Altogether, scientists have a clear responsibility to provide sufficient information and to map out approximate edges of chaos as part of the damage threshold, and must outline possible bifurcations within our actions towards ecosystems so that we can understand and plan how we will protect and maintain ecosystem health sustainably. Scientists are given a great responsibility to provide accurate, transparent, and clear information to policymakers and the public so that effective precautionary action can be taken towards our actions and so that we have sufficient and precise information to discuss within the deliberative democratic process that I will advocate in the next section on the decision-making stage in the PEHP. Finally, scientists' acknowledgement that their research and analysis is fallible and that the difficulties of mapping and correlating different bifurcations within ecosystem behaviours are the basis of the post-normal scientific process that I will discuss in the next section.

**Definition of the PEHP (4):**

The PP proposes that when an activity poses a threat to human health and ecosystem health, then precautionary measures should be taken to prevent these threats from occurring. Ecosystem health is defined as the healthy functioning of an ecosystem in relation to its resilience, and its ability to self-renew and self-organise. It is objective and an ecosystem's health should be understood literally, as holistic and variable. Ecosystem health is valuable because ecosystems benefit present and future generations through ecosystem goods, ecosystem services, and cultural services (A).

Edges of chaos thresholds give us boundaries as to what may cause ecosystems to become unhealthy. The edges of chaos should be guided by bifurcation analysis, which establishes critical points where the trajectories of ecosystems split into different pathways. The PEHP aims to protect ecosystem health in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and the establishment of edges of chaos. The PEHP damage threshold should take into account edges of chaos and possible pathways outlined by bifurcation analysis, in order to protect an ecosystem's resilience (defined by self-organising and self-renewing capacity) (B).

The PEHP attempts to implement precautionary actions when there is a lack of scientific evidence, but at the same time, it needs to use scientific evidence to show that these actions *may* actually be unsafe to ecosystem health. There needs to be a strong emphasis on the probability of scientific findings in order to distribute the most informed and up-to-date information to policymakers and the public. This would allow politicians, scientists, and the public to deal with specific dilemmas with a fuller understanding of uncertainties, bifurcations, and appropriate actions. Scientists should provide us with accurate, transparent, and clear edges of chaos and bifurcations so that we can effectively discuss policies within a deliberative democratic process in the decision-making stage of the PEHP (C).

This scientific knowledge is used, in conjunction with public opinion, in order to decide what the best course of action is to take (D). There should be an appropriate precautionary response made in the application of these decisions to human and ecosystem health (E).

## 2. The Decision Stage of the Precautionary Principle (PP):

Policymakers need to balance public perspectives with the latest scientific and economic findings available on risks so they have to receive information from scientists about the probability and uncertainty around particular risks, while also relying on the non-expert to assess the value placed on the scientist's findings (Lewens 2007, p. 13). Policymakers must establish a balance between the expert and non-expert's views within the decision-making process.<sup>104</sup> The public's viewpoints are often based on different assumptions and values about risk than the expert's are. However, the division between the public's 'perceived' risks and the expert's 'actual' risk is quite condescending because 'if everyone has risk perceptions, then it is misleading and unnecessary to claim that only the public knows *perceived* risks, whereas the experts know *real* risk' (Shrader-Frechette 1997, p. 76).

This was discussed earlier when I demonstrated that John's (2010) differentiation between actual and potential risks is incorrect because risks only vary in probability rather than actual and potential (damage threshold section). The public and scientist's view of risks is only really differentiated by levels of probability, levels derived by scientists to indicate that their perceptions of risks are more real. While levels of probability are important for the ecological debate, they should not always fundamentally overrule public opinion because the public's viewpoints are not only valuable, but may also be used as a form of probability analysis.

On a widespread view, an understanding of people's choices can be taken as evidence of subjective probabilities. People's decisions about whether to fly or instead to drive, whether to walk in certain neighborhoods at night, and whether to take risky jobs can be understood as an implicit assignment of probabilities to events (Sunstein 2005-2006, p. 883).

Therefore, when probability is grossly uncertain, policymakers can use the public to form probability analysis. Very often, the non-expert will

see problems, issues, and solutions that experts miss; lay judgments reflect a sensitivity to social and political values and commonsense that experts' models do not acknowledge; and the lay public may have a better capacity than experts alone for accommodating uncertainty and correcting errors (Tickner 2002, p. 494).

However, considering public values can be a difficult task because of the large variation and diversity of beliefs within society. People may arrive at conclusions that are

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<sup>104</sup> I understand and accept that the area of balancing public opinion within the policymaking arena is a complex and very detailed area of research and discussion and that it would be impossible to cover, fully and accurately, the wide school of debate on this area. My research acknowledges this but will attempt to add a contribution to the area, most specifically in relation to the topic of risk and ecosystem health.

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based on false information, ignorance, or simply because they do not care about EH. Therefore, even if the public is informed about risks, they may not follow the same line of thought as the expert. If our choices always mirrored the expert's, then what would be the point of including public opinion at all? Within risk theory, the 'rational actor' paradigm claims that if one is provided with all of the relevant available scientific information about a particular risk, then a rational decision-maker would and ethically *should* opt for a certain course of action (Adams 2000, p. 231). Another problem is that the public are too easily swayed by emotions and misguided information instead of basing their decisions on the best available scientific data. If these points are true, should policymakers leave decisions to the experts or should they embrace both the expert and the non-expert's views?

The assessment of risk is vitally important in any analysis of the PP because it incorporates societal morals and opinions, which underpins its success or failure. If policymakers try to balance the expert and the layperson's views, they need to acknowledge irrational fear or irrational passivity towards risk. However, fears or passivity towards risk needs to be balanced with scientific evaluations. When there is public concern over a risk, it would seem democratic to initiate legislation and policy representing these concerns. However, sometimes it may be necessary to override public opinion about risks when they are irrationally fearful or passive towards a risk.

Even when public opinion is misled, unsubstantiated, or blown way out of proportion, policy is still *supposed to* represent the voice of its people. Citizens should be given adequate information about a particular risk in order to make informed decisions. However, should we provide unrestricted information on risks to the public and let them decide for themselves, or should the experts implement policies based on what *they* deem to be the best choice to take? This question raises many difficulties and exemplifies two predominant positions in the debate: paternalism and libertarianism.

The libertarian view claims that all findings should be disclosed without censorship to the public. The paternalist view states that the decision-making process should be left to policymakers and scientists, rather than the public because a lot of the information received by the public would cause unnecessary panic. Libertarianism proposes that policymakers and scientists should provide the public with all of the relevant information that they have and let them decide for themselves. This would respect an individual's autonomy and liberty, but they may not understand or appreciate this information. Alternatively, there is the option of

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deciding the best option for the public and implementing policies accordingly, while only providing certain pieces of information to the public. This may lead to the implementation of policies that are not the public's wishes, and would disrespect individuals' autonomy and the democratic process.

One of the problems with the libertarian position is that if scientists gave unrestricted access to their findings; this could lead to an increase in the fear of risk because there would be no barriers to filter out speculative data. Any scientist could make a claim that appears within their findings, despite its lack of scientific merit or credibility. For example, if scientific research made a connection between the use of computers and skin cancer, this would not necessarily mean computer-use causes skin cancer. It would have to be empirically shown that there is a *causal* link between the two; the findings would have to be reviewed from another authority; and there would have to be several other conducted experiments before it could be conclusively proven.

However, one possible outcome of the libertarian position is that these initial preliminary findings should be distributed to the public, despite their credibility or peer-review status. An outcome of this is that it would value citizens' capabilities to make their own decisions with the information provided. However, if we were to filter information or restrict certain findings from being published then we could be accused of being a 'nanny-state', which dilutes, restricts, and censors information. Governments would censor certain information because they establish what pieces of data can or cannot be distributed to the public and thus descends back into a form of paternalism.

However, a result of this libertarian approach is that it would cause irrational fear and scare people into abandoning computers. People would quit their jobs if they involved many hours of computer work, some would revert to using typewriters and subsequently there would be a negative effect on the computer and information industry. This is just one example of how this method of releasing information prematurely could cause widespread chaos, despite the lack of credibility of information. It would respect individuals by not filtering their findings and allowing them to make up their own minds about the validity of the information despite their lack of knowledge and ignorance towards environmental risks. The issue of how to balance public and professional opinion within policy and whether or not a certain level of paternalism is acceptable will be discussed further in subsequent sections, after I firstly discuss the importance of the information received about risks.

**i. Information Received on Risk:**

Information received about a risk is vital in how it is perceived. There is the potential for alarmist-type reactions if media coverage of an issue is dramatic and does not accurately reflect the reality of risk probability. This control can blind individuals' capacity to understand accurate levels of probability and can cause governments to act on their population's misguided views of risk. Media coverage can grossly undermine the seriousness of threats and has the potential to distort public perception. If individuals see tragic accidents on the news, the fear that it will happen to them is amplified. However, the alternatives to these risks tend to be far more dangerous and risk-prone than the ones being avoided. For example, '[i]n the aftermath of a rail accident people consequently refuse to travel on trains, and use their cars instead, which are far more dangerous' (Lewens 2007, p. 15).

Media coverage controls the public's knowledge of risks and it often overlooks environmental damage unless it is on an unprecedented scale or causes a great deal of public outcry or governmental concern. It has to be 'newsworthy' and attract consumers' attention to make the news and everyday destructive environmental habits, pollution, overconsumption and destruction of rainforests is usually not newsworthy enough. These environmental events are lowered in importance, creating less demand for their prevention. The public, the government, and the media have a symbiotic relationship when it comes to risk and this strongly influences what is shown, discussed, and implemented in policy. Government officials and media sources can create great fears about risks; the public can demand what risks receive greater attention, while the media dictates which risks are publicised. Each agent has a powerful effect on the overall perception and action towards risk. However, reasons behind the promotion or playing down of a risk are usually motivated by certain benefits. This creates ethical difficulties because some interest groups benefit from putting other groups at risk and some benefit from creating fear around unlikely or minimal risks.

There are a number of different interest groups interlinked in the taking or avoidance of risks within policy. There is the person who decides if the risk is going to be taken (the policymaker), the beneficiary of the risk (the company/organisation), and those who will be exposed to that risk (public health and EH) (Hansson 2007, p. 28). 'It is also important to know if one of these groups is in some way dependent on one of the others, for instance if the risk-exposed are economically dependent on the decision-makers' (Hansson 2007, p. 28). If we are exposed to risk voluntarily, are these risks acceptable? What happens when there is a

conflict of interests, i.e. when an agent benefits from taking a risk while another is left with the burden? How does one even differentiate between a voluntary risk and involuntary risk?

### **ii. Voluntariness of Risk-Taking:**

There is a distinct difference between being put at risk involuntarily by an outside party and by taking a risk to your health of your own free volition. Essentially, it 'is a prima facie moral right not to be exposed to risk of negative impact, such as damage to one's health or one's property, through the actions of others' (Hansson 2003, p. 303). In many situations, those that are put at risk are the economically disadvantaged because of their circumstances. They are involuntarily exposed to extremely high levels of risk and often they cannot escape the situation they are put into. Therefore, the voluntariness of being exposed to risk is of great importance.

Hansson (2007) gives the examples of a smoker and someone who lives nearby an emission-polluting factory. While the former would be categorised as a voluntary risk-taker, the latter would be an involuntary risk-taker or victim. However, if one assesses this situation from a different perspective, it may be far easier for someone to move away from the factory than it would be for a smoker to quit smoking (Hansson 2007, p. 29). However, this misses the point of voluntary and involuntary risk-taking. This is because the individual living beside the factory is being impacted by an *outside agent* while the smoker is causing the harm to himself or herself. Simply because it is easier to remove oneself from the consequences of an action, does not change the fact it is being imposed upon us against our will.

Risk-taking and risk imposition involves problems of agency and interpersonal relationships that cannot be adequately expressed in a framework that operates exclusively with the probabilities and severities of outcomes. In order to appraise an action of risk-taking or risk imposition from a moral point of view, we also need to know who performs the action and with what intentions. For instance, it makes a moral difference if someone risks her own life or that of somebody else in order to earn a fortune for herself (Hansson 2007, p. 27).

Cranor (2007) claims that risk should be separated from its acceptability for a number of reasons, such as the differentiation between private risk-taking and public policy. He establishes that the term 'risk exposure' is a more suitable term instead of 'risks imposed' or 'risks taken'.

From a moral point of view when one party creates a risk and another bears the costs of it, this raises issues about the distribution of benefits and risks of an activity, as well as issues of externalities (as the economists would put the issue) [...] In order to voluntarily incur a risk, one

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must properly understand and be aware of the risks one is incurring, be competent to make decisions about the risks, and in some robust sense have consented or agreed (explicitly or implicitly) to them (all important features of medication informed consent) (Cranor 2007, pp. 39-40).

An important issue about the voluntariness of a risk is how much information we receive about it. If we take a paternalistic approach, we will be taking risks unknowingly because policymakers and scientists will often respond to these issues without our knowledge or consent. Understanding a risk gives one the ability to avoid or prevent that risk and is more ethically acceptable because it acknowledges the autonomy of individuals. Therefore, greater protection and regulation is required in order to give individuals relevant information to protect themselves from particular risks (Cranor 2007, p. 40). Despite all of this, what if we do not know what is best for us? What if we view risks irrationally even when we are provided with all of the relevant information and are free to make our own decisions?

### **iii. Irrational Views of Risk:**

Sunstein claims that people's decisions and aversions toward risk are inherently emotion-laden and often irrational and inaccurate. *Perceptions* of threat tend to create greater concerns around risks that may have a low probability of occurring. Public perception may be concerned with risks that do not have a high probability of occurring or else they may show no concern or be oblivious to it altogether (Sunstein 2003, p. 1046). The issue of 'probability neglect' overlooks high probability risks because the outcomes scare people into ignoring them, or they are already desensitised to them, or choose to take this risk (Sunstein 2005, p. 68). This type of attitude is often based on irrational judgments about the risk itself or by overemphasising other terrible outcomes that have less possibility of occurring. Even with all of the relevant information freely available, what constitutes a 'risk' and what levels of probability or uncertainty should be accepted is debatable. 'One man's "unacceptable consequence" is another's "regrettable necessity". What level of cost can be justified to avoid a risk which may, in the event, turn out to have been exaggerated?' (Fleming 1996, p. 147).

Public perception of risk is deeply embedded in the psychological make-up of a population and is heavily controlled by both information and the overall emotional attitude towards risk. Emotions play a massive part in the public's view of risk, with the more vivid, detailed, and descriptive accounts leading to higher levels of public concern. There is also the process of 'cascading' taking place during social interactions. Cascading refers to when one

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person's fears are communicated to another, which can have a knock-on effect on the number of people afraid/desensitised to a risk (Sunstein 2005, p. 94). Individuals can very often overemphasise these risks, taking fears as truisms, while amplifying and exaggerating them in their interactions with others.

Sunstein claims that opinions on risk are often influenced by a number of factors, such as population consensus—i.e. individuals are more easily persuaded about a risk when believed by a majority, and can be influenced by the acceptance and endorsement of risk by certain key figures and influential people. For example, if the president publicly expressed his/her opinions on the future of the recession, many would believe these views, regardless of their merit and factuality.<sup>105</sup> Sunstein claims that the majority of people make judgments based on intuition and emotions, instead of being grounded on scientific rationality. In contradistinction to this, the expert assesses risks based on scientific evidence, and would claim to be *more informed* and better equipped at making decisions than the ordinary person.

Sunstein's framework does not consider the possibility that the expert may also fall prey to the very same accusations used against the lay person—opinions guided by personal biases. They have an *expert* knowledge of risk analysis, so it somehow frees them from subjective biased opinions. Sunstein deems the expert's superior scientific knowledge as above the intuitive understandings of the average citizen. However, the expert may also mislead and be misguided through the manipulation of data, affiliation to specific organisations/companies and even arbitrarily concentrating on one risk over another. Sunstein (2005) still deduces that public opinion is something different and easily swayed and he proposes a governance of semi-coercion where the expert attempts to persuade the public towards the *correct* conclusion.

Sunstein endorses a clearly paternalistic style of governance, one that is guided by institutional bodies forcing the public into believing that these threats are real, rather than allowing them to decide for themselves. Sunstein's view of the public is patronising, as he claims that they are led by intuition and are devoid of reflective and deliberative judgments. His idea of deliberative democracy is inherently 'vote-centric', as the public votes for their elected representatives, who then rule through their power in government. 'For Sunstein deliberative democracy means the creation of institutions designed to guarantee that the best

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<sup>105</sup> Obviously, this is taking into account that that particular president is well respected and trusted within the country. This point may not apply when presidents are untrustworthy.

scientific opinions win the day – even if this involves state agencies in paternalist manipulation of an ignorant and fearful public’ (Kusch 2007, p. 140).

However, public opinion needs to be free from coercion and a paternalistic approach to risk because it is not a suitable or respectful one and relinquishes autonomy and control from citizens’ lives. The best way to understand a collective group’s values is through deliberative approaches instead of individualistic preference valuations: ‘An individual’s values can be assessed using individual preference methods, but group/holistic methods are better assessed using group or deliberative approaches’ (Chan, Satterfield, and Goldstein 2012, p. 15). These holistic methods are very suitable for a deliberative democratic approach, facilitated through a post-normal scientific dialogue, between the public and experts.

#### **iv. Deliberative Democracy and Post-Normal Science:**

As was shown in the previous sections, neither libertarianism nor paternalism are sufficient political positions to guide decisions on risk and are thus ineffective frameworks to implement in the decision stage of the PEHP. Therefore, I propose to implement a deliberative democratic framework, grounded and guided by a post-normal scientific approach. In my analysis, I will take a somewhat programmatic account of how the PEHP is best implemented, i.e. through a schematic account of deliberative democracy and post-normal science. In this section, I will give a preliminary outline of how deliberative democracy is a more defensible approach than the two positions criticised earlier in this section, but I will claim that deliberative democracy has to have a post-normal scientific component within it in order to provide clear and precise information to be deliberated upon in the first place.

Deliberative democracy is the increased incorporation of a wide array of stakeholders within the creation and establishment of policy; it is a discursive, inclusive, and deliberative form of governance instead of simply relying on votes to illustrate opinions. Post-normal science should be a crucial component of deliberative democracy and should underpin the knowledge and value basis of it. Post-normal science refers to the reversal of reductionist hierarchical approaches to ones based on the importance of value and acceptance that science is not hard ‘facts’, but an approximation of what will happen in certain situations and circumstances. Without post-normal science, policy and action will always revert to what the

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scientists say and will be led by policymakers rather than including public participation. However, we must firstly clarify what is meant by both positions in more detail in order to identify where the two positions meet. The following section will illustrate the importance of grounding deliberative democratic decisions on a post-normal scientific grounding.

To begin with, deliberative democracy refers to a type of democracy that allows and encourages deliberation and discussion within the decision-making process. It veers away from conventional vote-centric democracy and promotes deliberation amongst different groupings within society, and is not simply confined to vote counting. Deliberative democracy places more of an emphasis of power in the hands of the public instead of simply giving politicians the predominance of power in the decision-making process. Decisions and policies do not simply boil down to a counting of votes or determining what a particular grouping of politicians say as law, but it is a power-sharing form of democracy that gives more say to the people. This is in order to get the voice of the people and not simply confine politics to a select group of politicians.

Eckersley (2000) claims that the public-sphere deliberative democracy approach allows us to become aware of our dependence on ecosystem health and allows us to understand our dependence on the environment and political deliberation ‘is the activity through which citizens consciously create a common life and a common future together’ (Eckersley 2000, p. 120). Three distinct characteristics of deliberative democracy are unconstrained dialogue, inclusiveness, and social learning (Eckersley 2000, p. 121). Unconstrained dialogue goes against the typical paternalistic form of governance, whereby rational arguments and opinions are forced upon the public and dialogue is distorted and directed by those in power. Either misinformation or lack of information is provided to the public, which constrains people that are most affected and are then ‘denied an opportunity to participate or be represented in the dialogue’ (Eckersley 2000, p. 121).

Inclusiveness is at the heart of moral respect for others and their views and autonomy in their lives. It allows the steering of deliberation ‘away from merely selfish arguments towards generalizable ones’ (Eckersley 2000, p. 121). The social learning dimension to deliberative democracy allows for ‘openness and flexibility on the part of deliberators makes it possible for them to make decisions that are adaptable and self-correcting in the face of new circumstances, new information, and new or revised arguments’ (Eckersley 2000, p. 122). Because of these three distinct characteristics of deliberative democracy, it is clear that

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it is well suited to the area of risk assessments and management. It would take a long-sighted inclusive and risk-cautious approach [weak anthropocentrism], instead of the short-term risk-taking approaches [strong anthropocentrism] present within most conventional democratic positions.

Deliberative democracy must be able to implement policies that would ensure that ‘all those potentially affected by proposed risk-generating practices, rich and poor, citizens and ‘aliens’, now and in the future, [would] consent to such risks if they were fully informed of the potential consequences’ (Eckersley 2000, p. 122). An important part of deliberative democracy is providing sufficient and accurate information to the public so that an informed deliberation and choices can be made. If this grounding basis is not fulfilled then it undermines all of the other aspects within deliberative democracy. One way of initiating these deliberative procedures would be to provide information to the public, which would respect their right to choose whether to take a particular risk or not.

This approach also develops a participatory interaction between citizens and policymakers and provides an integrative method of risk analysis and decision-making. Lambert *et al.* (2003) propose a position that respects and fosters the autonomy of the individual by giving them information about potential risks in order to allow them to take precautionary actions. The scientist’s responsibility to provide information was outlined in the knowledge threshold section earlier, and if these guidelines are followed, the public will be provided with adequate information to make informed decisions in an ethically respectful manner.

The negative consequence of the myth of panic is that warning officials are reluctant to tell the truth or may withhold warning information because they are afraid of causing panic. [...] people typically respond to warnings by doing everything in their power to obtain more information. Thus, withholding information from the public – whether that information is good or bad – is quite detrimental to the overall warning process (Mileti and Peek 2000, p. 190).

We also need to be aware of the fallibility and uncertainty within scientific analysis and encourage public participation in order to respect the values of society within policy-making decisions. One way around the problem of insufficient knowledge about ecosystems is to educate stakeholders and encourage public debate and an ethical form of collaborative management. ‘Its main objective is to find ways to incorporate the values present in society into a decision-making process based on the discussion of alternatives and their associated trade-offs’ (Manuel-Navarrete *et al.* 2004, p. 224). We should include citizens in the practice

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of ecosystem management by allowing them to be heard by forming collaborative management systems instead of confining it only to politicians.

Westra claims that decisions should not be based on the opinions of politicians or multinational corporations, but should be a dialogue between ethicists and scientists, an approach demonstrated and instilled in post-normal science and the PP (Westra 2000, p. 32). The reason for this is to understand harm and to integrate both scientific and moral insights into policymaking decisions. Post-normal science refers to an approach by scientists that does not imply they know what *will* happen in the future, but instead it establishes different possibilities of how the future *may* unfold (Kay and Regier 2000, p. 147). It accepts that there will be uncertainty within non-linear self-organising complex systems and attempts to incorporate this uncertainty with transparency and openness.

Post-normal science reverses the previous understandings of value and science, whereby science would have previously been seen as facts and while values were seen as soft. Post-normal science reverses this and claims that science is actually soft, while values are given a far greater emphasis in our decisions because ‘moral values must have primacy because they are an *integral* part of science itself’ (Westra 1997, p. 240). Scientists and experts can only give educated approximations about future environmental effects of certain risky actions and not an outline of what will exactly occur. Westra (1998b) proposes that this post-normal scientific approach establishes that there is a need for the input of stakeholders within the decision-making process, instead of only taking the opinion of the expert into account.

The PP calls for action in the face of scientific uncertainty, and post-normal science recognises our limited knowledge but aims to tackle potentially harmful activities regardless. ‘Hence, mainstream science’s requirements for ecological precision must be modified, in line with what is possible and appropriate, without fostering expectations of an unavailable standard’ (Westra 1998a, p. 220). The post-normal scientific paradigm accepts that there will be uncertainty within our actions but it acknowledges this uncertainty within discourse. ‘The thoughtful, concerned, and open dialogue envisioned by post-normal science is tempered by a healthy recognition of our own limits and ignorance, so that extreme caution must be our guiding rule’ (Westra 1998a, p. 27). We should not be afraid of the unknown and should accept that there will be things we cannot predict in the ecological world.

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Hence, decisions must be made in the context of surprises and uncertainties, as these are not problems to be ironed out through “better” (more precise or more rigorous) methodology; the indeterminacy that gives rise to these uncertainties must be viewed as the appropriate reflection of what happens and what will happen in actuality (Westra 1998a, p. 215).

Post-normal science is based on complex systems theory that connects the scientific with the moral. It aims to abolish the dividing line between the ethical and the scientific in order to give greater control to the public within policy discourse. However, even if information is provided to the public, their perception of risks may be distorted by third parties and interest groups. In order to establish an ethically feasible method of governance one needs to establish a way of providing information to the public that would not jeopardise their safety by giving them potentially false information, while not hiding information from them in the paternalistic belief that policymakers and scientists know best.

Probably the best that can be done is to take a pragmatic, but cautious, approach that is based on what we understand at present, which will not close down options for the future and which can be monitored so that changes in trends or approaches to limits can be identified and responded to (Frid and Raffaelli 2010, p. 155).

This is what underlies the post-normal scientific approach because it accepts fallibility but aims to take the best possible approach, overall. The libertarian and paternalistic responses are two extreme approaches and were shown to be inadequate for an ethical decision-making framework. Instead, the post-normal scientific approach is a more appropriate framework to guide the PP because it accepts the uncertainty contained within scientific risk analysis and incorporates public participation in the decision-making process in a deliberative and transparent way.

Therefore, it does not ignore public participation or disrespect citizens’ autonomy, but it also overcomes the issue of being blindly guided by irrationality and emotion-led concerns because of its open communication between scientists and the public. It is respectful of citizens’ decisions and discusses the options in an open and deliberative manner. ‘Concerned citizens have shown that they can handle uncertainty and disagreement among scientific experts quite well. What causes resentment is a sense of being patronised or of problems being concealed from them’ (De Marchi and Ravetz 1999, p. 756).

Post-normal science proposes that perspectives and assumptions should not be reduced to singular standardisations such as debating within the confines of economic terms. When the richness of discourse is minimised and reduced to singular values, we need to question why and how this has been done, and if there is a possible alternative (Funtowicz and Ravetz 2003, p. 3). This was discussed earlier in Chapter Three, when Norton’s weak

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anthropocentrism was assessed and the issue of trade-offs between generations was fundamentally criticised as being too reductive and misleading. Despite this, there is still the difficult question of who is going to pay for the precautionous protection and maintenance of ecosystem health, and this issue will be one of the focuses of the next section on the application stage of the PEHP.

**Definition of the PEHP (5):**

The PP proposes that when an activity poses a threat to human health and ecosystem health, then precautionary measures should be taken to prevent these threats from occurring. Ecosystem health is defined as the healthy functioning of an ecosystem in relation to its resilience, and its ability to self-renew and self-organise. It is objective and an ecosystem's health should be understood literally, as holistic and variable. Ecosystem health is valuable because ecosystems benefit present and future generations through ecosystem goods, ecosystem services, and cultural services (A).

Edges of chaos thresholds give us boundaries as to what may cause ecosystems to become unhealthy. The edges of chaos should be guided by bifurcation analysis, which establishes critical points where the trajectories of ecosystems split into different pathways. The PEHP aims to protect ecosystem health in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and the establishment of edges of chaos. The PEHP damage threshold should take into account edges of chaos and possible pathways outlined by bifurcation analysis, in order to protect an ecosystem's resilience (defined by self-organising and self-renewing capacity) (B).

The PEHP attempts to implement precautionary actions when there is a lack of scientific evidence, but at the same time, it needs to use scientific evidence to show that these actions *may* actually be unsafe to ecosystem health. There needs to be a strong emphasis on the probability of scientific findings in order to distribute the most informed and up-to-date information to policymakers and the public. This would allow politicians, scientists, and the public to deal with specific dilemmas with a fuller understanding of uncertainties, bifurcations, and appropriate actions. Scientists should provide us with accurate, transparent, and clear edges of chaos and bifurcations so that we can effectively discuss policies within a deliberative democratic process in the decision-making stage of the PEHP (C).

A deliberative democratic framework, guided by post-normal science, is the most defensible framework for the decision stage of the PEHP. Deliberative democracy incorporates a wide array of stakeholders within the creation and implementation of policy; and is a discursive, inclusive, and deliberative form of governance. Post-normal science accepts the uncertainty contained within scientific risk analysis and incorporates public participation in the decision-making process in a deliberative and transparent way. Therefore,

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the decision stage of the PEHP does not ignore public participation or disrespect citizens' autonomy, but it overcomes the problem of being guided by irrationality and emotion-led concerns because of its open and informed communication between scientists and the public (D).

There should be an appropriate precautionary response made in the application of these decisions to human and ecosystem health (E).

### **3. The Application Stage of the PP:**

The application stage of the PP is after we have established that a holistic resilience approach is best suited to guide the damage threshold stage after all of the relevant stakeholders have discussed the issues thoroughly, in a post-normal scientific manner. The application stage of PEHP is the integration of the PP and EH and is how the knowledge and discussion of a risk is put into practice. It involves establishing agendas that apply the PP in a fair and ethical manner. Some applications range from increasing regulation; avoiding or banning the product/action; initiating further research before the risk is allowed; or asking those responsible to pay for risk prevention. 'Precautionary actions can range from informing the public about risks and uncertainties while further study is undertaken to characterize them, to phasing out activities that have been found to be particularly harmful' (Tickner 2002, p. 494).

However, trying to establish a consensus about what to do and establishing agreements countries will abide by may lead to the 'prisoner's dilemma'. The prisoner's dilemma states that unless we collectively do something, then doing it individually is often unfair and weaker because some will benefit by not performing the action, while others are left with the clean-up job and costs of taking action. Haller (2000) gives the example of greenhouse gas emissions: if only some countries reduce their emissions, even though it is in everyone's interests to reduce overall emissions, it would be unfair on those cooperating and less effective as a policy. All countries need to agree on rates of emission, but in order to do this they need to establish specific indicators to guide risk prevention.

Some possible methods of implementing regulatory policy and identifying indicators for success or failure are the integration of mortality rates and a cost-benefit analysis (Stirling 2001, p. 89). The climate change example demonstrates that countries cannot claim ignorance about the effects of their actions since the IPCC agreed that climate change was occurring and we are responsible. One method for overcoming the excuse of ignorance and the attempt to avoid responsibility is what The World Commission on the Ethics of Scientific Knowledge and Technology (2005) calls 'culpable ignorance'. This was briefly discussed earlier when I criticised Solow's (1993) 'ignorance problem' in Chapter Three (section ten). I applied the culpable ignorance argument, to an example given by Norton (2003d), to depict problems with Solow's ignorance argument. The toxic bomb example demonstrated that agents should be held responsible for their actions regardless of unequivocal proof that something will occur, if there is sufficient scientific knowledge indicating these actions should be altered.

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To reiterate, culpable ignorance is implemented in order to place obligation onto those causing damage, despite a lack of knowledge that this damage would occur. It does not claim that we should be held responsible for all outcomes of our actions but it does attach blame if we do not alter our actions despite an abundance of information available about the consequences, such as in the toxic bomb example. The aim of culpable ignorance is to force agents to change ignorance into more manageable uncertainty. For example, disposal of the toxic waste somewhere so that it will not be harmful to human and ecosystem health or finding alternative sources altogether. ‘By providing for the identification of a wider range of possibilities, this effectively helps to convert some part of the domain of ignorance into the more tractable condition of uncertainty’ (Stirling 2001, p. 94).

Secondly, culpable ignorance is used to force agents to incorporate more research into their actions and to delay one’s actions until greater knowledge is obtained, such as abstaining from using/disposing of this toxic waste until further information can be found about its effects when it explodes. ‘The goal of alternative assessment is to identify and examine opportunities to prevent environmental health impacts from an activity’ (Tickner 2001, p. 122). The third use of culpable ignorance is so that it can be applied as a motive for abstaining from a particular course of action. This is so that we can identify substitution alternatives that are less harmful or stop certain activities altogether, such as applying renewable and non-toxic methods instead of storing toxic sludge in the first place (Tickner 2001, p. 122).

One is culpable if they do not attempt to discover and apply knowledge that is relevant and readily available to them, and this overrides Solow’s ignorance argument. Culpable ignorance shows that many of the past humanly caused environmental risks were preventable, or they could have been minimised with appropriate actions. Our reactions to these events were slow due to delays in acknowledgement and policy implementation, lack of commitment, and over-discounting the future by regulators. ‘The basic notion of moral culpability is that if a harm occurs, a harm that should have been foreseen and could have been avoided, then a basic moral obligation has been violated’ (Haller 2000, p. 183). Therefore,

acting in a state of ignorance is morally culpable if harm is likely to result and the agent could have found out about the likely consequences of the action. An agent is not morally culpable if any reasonable person could not be expected to know these consequences (Haller 2000, p. 184).

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The PP attaches a moral responsibility onto those blatantly ignoring or disregarding precaution when information is available and they make no reasonable effort to find it. It prevents polluters and ecological exploiters from causing ecosystem ill health as opposed to letting them away with it because they claimed ignorance. Culpable ignorance helps to protect EH from being negatively impacted, but what happens when there is an argument about costs or when we cannot prevent all risks so it freezes us into inaction? For example, the absolutist criticism states that the PP may lead us to examine every risk despite the unlikelihood that they will occur. It is absolutist because it has the potential to overlook probabilities inherent within risks for the fact that they are risks to begin with and should therefore be prevented:

Under such a strict, absolutist interpretation of the precautionary principle, it would prohibit in principle *every* action. Since any action, in a sense, might have unforeseen catastrophic consequences (perhaps, due to the chaotic nature of causation, you will cause a new world war by taking a day off tomorrow, etc.), the action of carrying it out will be prohibited, and so will the action of *not* carrying it out (Sandin *et al.* 2002, p. 291).

This quotation touches upon two connected challenges to the PP: It cannot predict unforeseeable risks and it may cause harm unknowingly. It is contradictory because it attempts to avoid risks but may cause other harms as a result. It cannot foresee harms caused by its precautionary actions. Therefore, due to the unforeseeable risks inherent within any precautionary action and because the PP may potentially cause harm, it would appear that the PP has the potential to lead us into a state of inaction. This is because any course of action would contradict its core aim of trying to prevent potential harms and thus disallows us to take action because it may cause harm to humans and EH.

### **i. Unforeseen Risks and Inaction:**

The level of concern about a particular risk greatly depends upon society's exposure to that risk (Sunstein 2005, p. 93). This may permit risks that are presently being taken, rather than approach 'new' unfamiliar risks. This in turn impedes us from implementing new technologies or approaches because they *may* contain risks. Even if the new risks are far less harmful than the risks we are currently taking, they will not be implemented because of the uncertainty contained within them. The PP will not take *new* risks because they are seen as riskier than actions we are already taking, have studied extensively, and have knowledge about. Therefore, new unfamiliar risks are heavily regulated, while present risks are

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overlooked or deemed acceptable. One example of this is the differentiation between GM foods and organic foods. Marchant (2003) claims that GM foods have not been scientifically proven to cause injury or harm while organic foods have a long history of harming human health such as contaminated organic products (lettuce and apple juice), increased mycotoxins from insect-damaged organic vegetables, toxic levels from 'natural' pesticides, and *Escherichia coli* 0157 infections from manure use (Marchant 2003, p. 1801).

The PP implies that banning GM products, until there is enough evidence to prove they are safe, is in our best interests. However, one would also need to take into account that GM companies try to conceal information about their products to continue benefiting from their distribution and use. Therefore, there is a responsibility on policymakers to ensure that there is adequate testing and research done and scientists need to provide adequate information about risks, as expressed already in the culpable ignorance section and the section on the expert's responsibility to the public. Despite this, critics of the PP claim that no decision is ever going to be risk-free, so the PP is incoherent in its attempts to avoid risks, such as those caused by GM crop consumption.

The outcomes of our precautionary actions may cause greater harm than the risks we are attempting to avoid. For example, one commonly used reason against banning GM products is that it would cause widespread famine, disease, and poverty in developing nations due to the lack of available crops. These outcomes would be far more detrimental than erring on the precautionous side until further evidence is obtained about their safety levels. However, one would have to take into account the efficacy and legitimacy of this argument, firstly. We would have to question if the banning of GM products would actually cause these disastrous outcomes or if they are simply illegitimate arguments used by GM companies and politicians who wish to benefit from their continued use.

A critic of the PP may argue that one cannot foresee every type of risk, so the PP may allow disastrous outcomes to occur in the name of risk prevention. The PP does not take into account the potentially destructive implications of unforeseen risks when it implements precautionary action, such as widespread famine caused by banning GM crops. Manson (2002) claims that if a certain course of action (i.e. banning GM crops) attempts to avoid harm but can potentially cause harm, it undermines the validity and ability of the principle to be in any way preventative. Manson (2002) parallels this to Pascal's wager, and how the 'many gods' argument can be contrasted with unforeseen risks in the PP.

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Pascal's wager implies that it is in one's best interests to believe in the Judeo-Christian God, rather than not believing in it. The benefit of eternal salvation is far more beneficial than any earthly benefits of not believing in God, so it is in our better interests to believe in God (Pascal 2010). It is a precautionary approach to future uncertainty and can be paralleled with the PP in the 'many gods argument'. This argument proposes that if there were gods such as Odin, who is vengeful if you worship other gods such as the Judeo-Christian God, then it would be unwise to worship other gods, in the event that the vengeful Odin punishes you. His wager leads to contradictory conclusions because if we believe in God in order to ensure eternal salvation, it may lead to equal or worse outcomes, if Odin exists.

If we apply this example to the PP, it would be unwise to prevent a potentially threatening outcome from occurring unless we are sure that it will not cause disastrous outcomes itself (Manson 2002, p. 273). It is important to analyse all risk-preventing actions in case they create disastrous outcomes. Manson's criticism can be applied to the PP's outlook on risk prevention because it cannot predict unforeseeable risks. By reducing or avoiding one risk, we could create another worse risk in its place. To avoid this, one would have to possess a categorical foresight and predictive capacity that is logically impossible to achieve in real life. However, the PP does not claim that it can stop or prevent all risks, especially ones that are completely unknown or immeasurable.

The PP is more concerned with what we actually *can* prevent through our precautionary actions and attempts to avoid harms that are within our capacity to prevent. For example, the effects of GM crops are identifiable and can be understood through probability calculations, risk assessments, and political and economic examination. However, one cannot factor in unforeseeable consequences of GM crops that are beyond our current scientific, economic and political capabilities. On the one hand, the PP could be used to promote the banning of GM crops but it may also identify the possible risks of doing so, such as job loss, food price increases, and political upheaval. However, it cannot predict unforeseen risks that are out of the scope of our present scientific knowledge, such as the discovery in fifty years time that GM crops contribute to a rare intestinal disease that does not yet exist. We can analyse GM crops to see if links can be made between its consumption and other intestinal diseases, and if there is a causal link, then it would justify further action. Belsey (1978) claims that we cannot ask a scientist to correctly predict the outcomes of his investigations, but can only demand

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that they estimate probable results of their research. If we were to analyse *every* unlikely risk, it would be extremely counter-productive.

This is to ask the scientist no more than of the normal human being: that he estimates likely outcomes of various alternative courses of action before initiating them. ... There is always a *risk* that something will be lost by not taking one course of action and by doing something instead. But there is no way of eliminating this risk (Belsey 1978, p. 115).

The PP claims that risk is inherent within any policymaking decision and that our actions are never risk-free. It instead implements action in order to prevent risks that we are *aware of* and can foresee. However, does the PP contradict itself by attempting to implement risk prevention when it has the potential to cause another unforeseen risk in its place? This may be simplified in the following hypothesis: If one opts for a certain risk prevention strategy and it leads to a risk, but not implementing it may also lead to a risk. If the PP is implemented it makes a choice (continuing the same course of action or choosing a different one), which may cause unforeseeable harm and thus undermines its effectiveness. How do we know that an action will not cause greater harm than the risk it is trying to avoid? If a decision ends up causing unforeseeable harm, is it ethically worse than simply doing nothing at all? This leaves the PP in a difficult predicament, as it cannot opt for the first initial action, nor can it condone alternatives that may also cause harm. The PP appears to trap itself within a paralysis of inaction.

There are no upper limits placed on precaution, which could lead to *too much* precaution. Over-the-top precaution slows development, progress, ingenuity, and paralyses people into inaction and over-cautiousness. McKinney and Hammer Hill (2000) claim that the logical difficulty with the PP is the fact that it gives two choices—action or inaction—and is not devoid of risk, and is thus questionably precautionary. Therefore, ‘the precautionary principle appears to commit us to taking the branch of inaction, but there is absolutely no reason to believe that that branch will be any less destructive than the branch of action’ (McKinney and Hammer Hill 2000, p. 79).

The problem with the PP is that we are essentially choosing a course of action if we take the risk and we are choosing a course of action if we avoid the risk. We can either avoid the action or accept the consequences of inaction, or take the action and be burdened by its unforeseen consequences. However, the PP never states that it is *not* taking a course of action by taking precaution. Even within the Wingspread definition, it states that the PP: ‘must also

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involve an examination of the full range of alternatives, *including no action*' (Wingspread 1998, [emphasis added]).

Thomas Russ (2003) claims that the PP does not propose choosing between action and inaction, but gives the choice between two potential decisions, separated by the level and degree of perceived risk. The principle is not contradictory because it attempts to take the *most precautionous action*, and is aware that we can never be fully certain of the outcomes. Therefore, we *always* take a risk, no matter what choice or decision we make, especially when it comes to complex things like ecosystems. Therefore, the action paralysis criticism 'presupposes a version of the precautionary principle that is strong in respect of both trigger conditions and precautionary action. Weaker versions are possible and a version that was significantly weaker in either respect could avoid the paralysis that they describe' (Hughes 2006, p. 460).

As I mentioned earlier in the thesis, my version of the PP is neither weak nor strong, but rest somewhere in between the sliding scale of these two polar extremes.<sup>106</sup> My approach is certainly not a version of the weak PP because it acknowledges the risk of inaction also. Life is never 'risk-free' because every action contains risks, even inaction. The criticism that the PP implies inaction is completely inaccurate because even when 'there is *some* possibility of making things worse by acting obviously [this] should not foreclose reasonable avenues of harm prevention' (Powell 2010, p. 190).

Harremoës *et al.* (2002) proposed that in the past when governmental officials followed a course of inaction (business-as-usual) instead of applying the PP, it often led to disastrous outcomes, such as national and global trends in fish stock decreases, effects from radiation which could have been prevented earlier, the use of asbestos, benzene, PCBs, halocarbons, and sulphur dioxide. There were also early warning signs of the chemical contamination of the Great Lakes and the problem of mad cow disease, and we could have avoided these problems if we acted with precaution and foresight.

These cases illustrate that risk prevention strategies led to inaction by *not* adopting the PP, instead of the other way around. There were universal time-lags before policymakers acted in these case studies; causing more problems than if the PP was adopted earlier

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<sup>106</sup> As was discussed earlier, the weak and strong categorisations of the PP are opposite ends of a sliding scale for the different versions of the PP. Most versions fall somewhere in between these two extremes, and the two extremes are usually used as straw men for arguing against because of this.

(Harremoës *et al.* 2002, p. 185). The effects of *inaction* resulted in widespread disaster and could have been prevented or minimised if adequate precautionary actions were taken. If risks were analysed correctly, and the PP was applied, there would have been a greater chance of curbing disaster before it was too late. However, the cost of implementing precautionary action is often one of the main reasons why the PP is not applied within regulatory action.

### **ii. Economic Problems of Risk:**

Principle 15 of the Rio Declaration states that when there is a lack of scientific certainty about a threat, it should not be used as a reason for delaying preventative action, *within reasonable costs* (UN 1992, Principle 15). However, the integration of a ‘cost-effective’ guideline within the PP is problematic. If we do not distinguish between cost-effectiveness and cost-ineffectiveness, it becomes vague as to how we can implement the PEHP in practice. The issue of how much money we should spend on risk prevention is probably one of the most challenging tasks that face the PEHP. Striking a balance between adequate regulation against risk and the economic costs of preventing these risks needs to be carefully analysed if the PEHP is to have any chance of being successfully applied. ‘Without consideration of economic boundary conditions, the precautionary principle is in fact a meaningless declaration of good intentions’ (von Moltke 1996, p. 107).

A problem with having a rhetorical principle with no practical possibility for implementation is that it skews the usefulness of these theories for real-life. Another problem is that policymakers often tend to fix prices to specific risks inadequately, often over or under-regulating in their actions. Policymakers often over-regulate (false positives) or under-regulate (false negatives) which makes it very difficult to assign accurate costs to risk prevention (Marchant 2003, p. 1799). False negatives generally have worse consequences than false positives, while the main difficulty with false positives is the economic burden on society. There are limited financial resources available for environmental risk prevention; therefore, risk management is constrained from the very beginning. The issue of who is going to pay for assessing and managing these risks is at the centre of the debate in both EH and the PP.

The PP is based on the logic that a small economic loss is far more desirable than a potentially massive environmental loss. It implies that expenditure *now* to prevent widespread

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EH destruction in the *future* is more desirable than the economic savings of not doing so. Society pays an economic cost if it adopts the PP through the resources used to prevent these risks, but critics claim that this money could be better spent elsewhere (Majone 2002, p. 101). However, one problem with this criticism is that it is ‘also wrong to consider applications of the precautionary principle as an overall cost to society, because the cost of environmental damage if an appropriate activity proceeds may well outweigh any benefits that accrue’ (Calver 2000, p. 103).

If we allocate money to every potential risk, then vast amounts of resources will be wasted on preventing harms that may not occur at all. If we predict harm to the health of ecosystems, then economic expenditure would seem rational, but if the possible harm were minimal, then spending large amounts of money on it would be impractical. However, this can only be done if it is economically feasible. In many parts of the world, it is not economically feasible and in wealthier countries, ‘economically feasible’ is stretched so far as to become meaningless.

These issues are further exacerbated when implemented within international agreements because of disputes over what ‘acceptable’ degrees of precaution and expenditure levels are. There is also a need to understand the distributional differences where many countries simply cannot afford to implement adequate levels of precaution. The implementation of the PP often means focusing expenditure and resources on preventative measures that may or may not pay off in the future. There will always be a tension between the costs of precautionary actions and the most economically beneficial course of action to take.

However, the very purpose of the PP is in fact often counter to the cost-benefit approach because it states that we cannot simply measure things in the realms of economic gain and loss, especially when it comes to human life. One major reason for criticising the cost-benefit approach is that it does not give adequate value to non-human life and does not account for the consequences of adversely affecting ecosystems’ healthy functioning. Some problems with this type of economic approach are its valuation of risk and risk prevention. For example, risk analysis is the study of the consequences of a risk and the probability of that risk occurring. Human lives, destruction of property, and loss of natural resources, are all categorised under the same numerical calculation of whether or not an action is permissible.

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This is evaluated within a common currency, which is predominantly done through monetary calculations. Human life, species, and EH are bundled under the cost-benefit analysis rubric. This is in stark contrast with why the PP was developed in the first place and demonstrates why it is so important for policy, that is, it breaks away from the economic approaches of the past. The PP helps to overcome these difficulties because it does not relegate risks and consequences solely to economic calculations. Therefore, ‘economically feasible’ should not be used as an excuse for limited ecosystem protection, when countries can clearly afford to pay for the relevant protection.

As I discussed earlier, ecosystem goods are the most easily priced benefit we receive from ecosystems because establishing an economic price for ecosystem services and cultural services is highly problematic. It was shown that when we price ecosystem goods it often results in overlooking or devaluing ecosystem services and cultural services. However, the post-normal scientific approach allows us to evaluate the benefits of ecosystem services and cultural services instead of simply overlooking them for the economic benefit we receive from ecosystem goods. The post-normal scientific approach does not automatically place the economic values above cultural and ecosystem services. Values and science are placed on an equal footing and it does not allow economic worth to take priority over other values automatically. However, establishing who should pay for EH protection is an issue that must be teased out by ethicists, scientists, and policymakers in a deliberative democratic setting within the post-normal scientific approach to the PEHP. This leaves the PEHP open for greater elaboration and discussion, particularly in relation to how it will be implemented within a deliberative democratic position and how post-normal science will play a key role in this.

Despite this, the deliberative democratic approach, guided by post-normal science, still highlights the specific function and processes taking place within ecosystems and estimates the effects of damaging ecosystems and their subsequent effects on human health. In order to be able to effectively manage ecosystems, we need to find what the public values, while also taking into account the contributory value of species that are not economically valuable to us, so that their protection and management is not left to market pricing or individual preferences. As I explained earlier, the cultural value that ecosystems and their component parts bring to us can often far outweigh the economic worth of their ecosystem goods. The PP can help give clarity about safeguarding EH, so we can begin to implement precautionary and conscientious actions.

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Earlier, I demonstrated Norton's differentiation between felt and considered preferences, and how the former only take into account our economic desires about EH, while the latter takes a variety of values into account such as our aesthetic and cultural values of nonhuman things, as well as their contributory value to their ecosystems and the overall biosphere as a whole. I explained that we should not solely focus on ecosystem goods as the strong anthropocentrist would, nor should we attempt to attach an idealised vague notion of intrinsic values to these nonhuman things, as was rejected in Chapter Three. We should instead factor in the non-economic values we receive from ecosystems as reasons for protecting EH, with the guidance of the PP, for the benefit of present and future generations.

Our values go beyond mere felt preferences, utility, or economic valuations and they should not be automatically overridden within the debate. In addition, we need to incorporate the contributory values of species and ecosystems within our framework in order to develop a truly effective PEHP. Altogether, the protection of human health and EH should not be seen as an economic trade-off between generations, but should be discussed alongside economic preference valuations as these too simply define the value we attach to ecosystems. Aesthetic, cultural, and contributory values are some of the many examples of values we receive from healthy ecosystems that cannot be adequately priced for one reason or the other, and these values should not be seen as inferior to other values simply because they can be categorised within the market place.

This chapter analysed the three stages within the PEHP: trigger (damage and knowledge threshold), decision, and application stages. I demonstrated that risk assessments and the PP are not completely divergent, and that the PP actually needs risk assessments in order to show that there *are* risks to begin with. It was shown that a causal relationship between risks it attempts to prevent and uncertain consequences must be clear. I illustrated that probability calculations are of great benefit to the PP's successful application and that the knowledge threshold should guide risk analysis through an ecosystem's level of resilience, self-renewal and self-organisation.

It was shown that the decision-making stages of the PP should balance the views of the expert and public, because if the public are overlooked, it undermines the PEHP as a representative framework for sustainability. I criticised Sunstein's claim that the public's views on risk are irrational and emotion-laden, and that the expert is not free from these flaws. Sunstein's semi-coercion method was shown to be insulting to the public and

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democracy, and essentially an unviable position for the PEHP. It was shown that the paternalistic and libertarian responses were both flawed, and that a deliberative democratic framework, with the implementation of a post-normal scientific approach, is far more suitable to help guide the PEHP.

The final part of this chapter showed that the PEHP does not lead to inaction because it makes an ethical judgment to prevent harm, with the acknowledgement that actions are never risk-free. This section gave a brief overview of the main difficulties faced when applying the PEHP within political and economic frameworks. Overall, this chapter demonstrated that the main philosophical problems with the PEHP are often due to oversights by its critics or they focus too much on only limited definitions of the principle. The following chapter will conclude with my final observations and overviews of this thesis, and the below definition will hope to clarify my overall PEHP, as developed throughout the thesis but most particularly in this final chapter.

**Definition of the PEHP (6):**

The PP proposes that when an activity poses a threat to human health and ecosystem health, then precautionary measures should be taken to prevent these threats from occurring. Ecosystem health is defined as the healthy functioning of an ecosystem in relation to its resilience, and its ability to self-renew and self-organise. It is objective and an ecosystem's health should be understood literally, as holistic and variable. Ecosystem health is valuable because ecosystems benefit present and future generations through ecosystem goods, ecosystem services, and cultural services (A).

Edges of chaos thresholds give us boundaries as to what may cause ecosystems to become unhealthy. The edges of chaos should be guided by bifurcation analysis, which establishes critical points where the trajectories of ecosystems split into different pathways. The PEHP aims to protect ecosystem health in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and the establishment of edges of chaos. The PEHP damage threshold should take into account edges of chaos and possible pathways outlined by bifurcation analysis, in order to protect an ecosystem's resilience (defined by self-organising and self-renewing capacity) (B).

The PEHP attempts to implement precautionary actions when there is a lack of scientific evidence, but at the same time, it needs to use scientific evidence to show that these actions *may* actually be unsafe to ecosystem health. There needs to be a strong emphasis on the probability of scientific findings in order to distribute the most informed and up-to-date information to policymakers and the public. This would allow politicians, scientists, and the public to deal with specific dilemmas with a fuller understanding of uncertainties, bifurcations, and appropriate actions. Scientists should provide us with accurate, transparent, and clear edges of chaos and bifurcations so that we can effectively discuss policies within a deliberative democratic process in the decision-making stage of the PEHP (C).

A deliberative democratic framework, guided by post-normal science, is the most defensible framework for the decision stage of the PEHP. Deliberative democracy incorporates a wide array of stakeholders within the creation and implementation of policy; and is a discursive, inclusive, and deliberative form of governance. Post-normal science accepts the uncertainty contained within scientific risk analysis and incorporates public participation in the decision-making process in a deliberative and transparent way. Therefore,

## The Trigger, Decision, and Application Stage

the decision stage of the PEHP does not ignore public participation or disrespect citizens' autonomy, but it overcomes the problem of being guided by irrationality and emotion-led concerns because of its open and informed communication between scientists and the public (D).

The PEHP must take into account that we cannot foresee all possible risks to human and ecosystem health, but that this should not force us into inaction. Action must be implemented with the best available scientific knowledge about EH and can range from no action, banning of particular products/activities, waiting until more information is available, or taking the risk because the benefits outweigh them. The costs of implementing action to protect human health and ecosystem health should not be used as an excuse to avoid action. The weak anthropocentric PEHP should take into account the aesthetic, cultural, and contributory values we have for EH, as well as the goods and services they provide us (E).

## CONCLUSION

This thesis made many important observations about the EH and PP concepts and demonstrated how they can be combined within one overall theoretical approach, the PEHP. It was shown that while there were discrepancies and issues within EH and the PP, an innovative synthesis between them can open up new and fruitful avenues for sustainability theory. My precautionary ecosystem health principle (PEHP) was grounded on a weak anthropocentric approach, guided by contributory value, instead of the often-used non-anthropocentrism and intrinsic value. My PEHP framework proposed that an adaptive, resilient, and dynamic approach would be more appropriate instead of relying on fixed ecological benchmarks. I proposed that catastrophic and irreversible harm should not be used as thresholds to guide precautionary action, but a post-normal scientific approach to decision-making guided by resilience theory is an ethical and pragmatic approach to take in the PEHP. Overall, my approach will contribute to the area of sustainability theory by offering a philosophical analysis of the PP and EH and by integrating them together within a holistic weak anthropocentric framework—the PEHP.

Throughout my thesis, I applied diverse material, ranging from analytic continental philosophy (Kant, Hume, and Pascal), to current environmental ethicists (Callicott, Westra, and Norton), and numerous ecological studies (Karr, Rapport, Holling, and Jørgensen), as well as including an array of different political documents and agendas (W.H.O., Rio Declaration, and ICP). My thesis established that a weak anthropocentric holistic approach to environmental ethics is a possible approach to ground the PEHP, aided by the guidance of valuative concepts such as contributory value. The PEHP is both variable and holistic and I demonstrated that the health of ecosystems should be taken literally also.

I illustrated that we should adopt a resilience approach to ecosystem protection, instead of damage thresholds such as irreversibility or catastrophe. My thesis also established that the decision-making stage of the PEHP should establish a post-normal scientific approach in order to incorporate both scientific and normative values within one overall deliberative approach. However, my thesis is not the final word on the matter and I believe that there is greater room for developing and detailing the practicalities and implementation issues in further research and work in the area. Despite this, my thesis has given a fundamental and grounding analysis of the topics in these debates and has allowed further

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avenues to be explored around the PEHP concept, for example its application of deliberative democracy and post-normal science, in the future.

Chapter Two discussed the two worldviews of compositionism and functionalism, how BI and EH are concepts within them, and how they apply the ecological worldviews of evolutionary and ecosystem ecology, respectively. This chapter outlined EH and the worldview that it originated from, functionalism, and the ecological application of it in practice, the ecosystem ecology approach. I analysed the contrasting position of BI, the worldview it stemmed from, compositionism, and its ecological application of evolutionary ecology, in order to gain insights into my EH approach. I also drew upon similarities between ecosystem health and Leopold's land health, such as the role of integrity and health within both approaches.

This chapter illustrated the historical development of EH and its divergence from the integrity concept, in contradistinction to Leopold's synonymous grouping together of the two concepts. I also pointed out that the definition of health is open to criticism and interpretation, and very often, it is said that one cannot even be certain that ecosystems exist in the first place. I acknowledge that a great deal of work can still be done on analysing the objective nature of the ecosystem concept, but that this thesis was not the place to do so as it was not within the specific scope of my research and because it would have merited a large body of work unto itself, if done effectively. This can also be said about the concept of integrity. I mentioned earlier that it is not altogether useless or should not be developed upon in further work, but that it does not fit within the parameters of my research because of the wilderness and free from human habitation conclusions.

Leopold's wilderness as a base datum for health approach was criticised and the idea of having places that are free from human habitation and use was shown to be an invalid approach to take. However, this is not to say that the wilderness does not still help us understand nature better and that work should somehow stop in this area. I am instead claiming that it simply should not be used a goal in sustainability theory because of the valuative conclusions that it draws, as described in my thesis. Because of this, it was shown that integrity is a problematic concept to adopt, which in turn, is the reason I analysed EH in this thesis instead. While analysing integrity for comparative reasons in the study of EH, its use as an ecological concept was shown to be vague and problematic because of humankind's overarching effect on the planet, and the ethical implications of valuing ecosystems that are

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free from our interaction. However, this is not to disregard the work done by others such as Laura Westra, and perhaps our work may even have the possibility to merge or offer one another some useful insights in the future.

In addition, I disagreed with the assumption that ecosystems or ‘the environment’ can be valued intrinsically and demonstrated how the intrinsic valuing of non-human systems is inherently problematic and thus why the PEHP should not use it. Chapter Three involved outlining O’Neill’s categorisation of the three types of intrinsic value and establishing that Callicott’s version of intrinsic value fits into the second type, subjective intrinsic value. I went on to describe the origin of Callicott’s intrinsic value concept out of the Bio-Empathy axiology of Hume, Darwin, and Leopold. I discredited Callicott’s linking of these three theorists into the same axiology as being essentially problematic philosophically, practically misleading, and theoretically unfounded. The three had very little to unite them together, none of them mentioned intrinsic value being applied to non-human entities, and their three approaches that Callicott states should unite them actually work to separate and differentiate them from one another.

However, this is not to say that not all three philosophers may be of use to sustainability theory, or to the PEHP for that matter, but it instead simply means that their combination as underpinnings for the formation of the intrinsic value concept is highly problematic and contentious. In fact, I described and detailed how Leopold’s position gave rise to the health concept being used within ecological circles. I endorse the view that a Darwinian understanding of the environment is fundamental for any analysis and study within sustainability theory. In addition, I also indicated that philosophers such as Hume underpin my understanding that altruistic care for non-human things is simply another self-serving instrumental benefit from those proclaiming it. Teasing out and doing further work on these particular areas of philosophy may prove conducive and beneficial in the future as separate pieces of work to support the PEHP.

The third chapter analysed Callicott’s (1989) understanding of intrinsic and instrumental value. The application of intrinsic value to non-human organisms, species, and ecosystems was rejected because its application was shown to be inherently problematic, at both a theoretical and practical level. If we want to apply intrinsic value to non-human species and systems, we need to be able to show that we have the *capacity* to value these things intrinsically, which we currently cannot show. However, as I mentioned in my thesis,

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this is not to rule it out indefinitely as it one day may be shown, with philosophers such as Y.S. Lo conducting research in this area. However, as it stands, intrinsic value was shown to be problematic because it was impractical and gave us little clarity on how to go about protecting ecosystems once their intrinsic value was established.

The non-anthropocentrism that Callicott defends was also criticised in this section, where I demonstrated that his second-order principles could not effectively overcome the ecofascism criticism because Callicott could not clearly describe how they can be implemented into practice, instead resigning himself to the vague notion of stronger and weaker interests to guide us. I demonstrated that my interpretation and defence of Norton's weak anthropocentrism is a far more suitable and philosophically sound approach to guide the PEHP, instead of Callicott's version of non-anthropocentrism and his intrinsic value concept. Norton's contributory value adds a distinctly holistic and non-materialistic component to anthropocentrism, which makes it 'enlightened' or 'long-sighted'.

Chapter Four gave a detailed analysis of the meaning of health and it was shown to be both holistic and variable. It is holistic because it is concerned with the overall functioning capacity of a thing and not merely the functioning capacity of singular parts of that thing. Only if a damaged, infected, or deficient part causes or can potentially cause pain, discomfort or malfunctioning, is it deemed unhealthy. Health is variable because the standards, norms, and requirements for health vary so there will be different guiding principles based on size, age, and many other variable factors. Health has traditionally included all 'organisms' within its definition; however, section three showed that if we apply health to *all* non-human organisms, it is problematic. Non-human organisms cannot be healthy or unhealthy in a literal way because health implies a state's well-being or flourishing, which would not be applicable to protists, bacteria, and fungi.

The definition of health in these cases was shown to refer to their functioning capacities rather than well-being or flourishing. This understanding of health is strikingly similar to the health of ecosystems and it was shown that there is no fundamental reason why the health of ecosystems should not be interpreted literally also. I demonstrated that things that have health or illness in a literal sense could be described as functioning at a certain level rather than applying the idea of 'well-being'. I included the traits of self-renewal and self-organisation to show a health definition can include ecosystems but without including non-living human-made objects. These autopoietic characteristics (self-renewal and self-

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organisation) were shown to differentiate living systems from non-living beings and systems, and allow ecosystems to be defined as possessing health literally.

This section also highlighted how we can implement specific ecological thresholds in order to establish norms for EH. It was shown that an effective approach would implement strategies to contrast short-term gradual ecological changes with specific long-term changes. We need to establish a resilience approach to guide these thresholds rather than establishing specific cut-off points, succession-to-climax stages or base-datums such as wilderness. However, as I noted in my thesis, while the wilderness definition is unsuitable for the PEHP because of its valuative directions, it may still be useful for further research in the area in relation to understanding the workings of particular ecosystems. I also noted that the definition of resilience underpins a system's self-renewal and self-organising capacity, two norms that should be used as EH indicators. As I expressed earlier, I did not analyse the objectivity of the ecosystem concept itself, but there is the possibility that the self-renewal and self-organisation characteristics have the possibility of changing or altering meaning with a further examination of the ecosystem definition. This leaves this particular area open to more investigation and analysis for either altered or renewed meanings for the PEHP.

Chapter Five examined how health is valued within society, what specific type of value it is, and why we should protect it. This section demonstrated that health is a distinct good for someone or something and is therefore an instrumental value that allows us to complete tasks in our lives. However, health is also a defeasible good, a good that can be overridden by other competing goods. In addition to this, I analysed Nelson's idea that health is an evaluatively thick concept, one that implies description and prescription, or fact followed by value. However, ecosystems do not need to be intrinsically valued in order for EH to work as a thick descriptor. Health can still be seen as a thick descriptor and retain its ethical force if we value systems in a purely instrumental way. This chapter demonstrated that there is a link between human health and EH and I showed that we have a fundamental moral obligation to protect EH because it directly and indirectly affects present and future human health.

The Millennium Assessment Report on ecosystem services was also assessed and it was shown that its definition of ecosystem services was misleading as it conflates key ecological concepts. It was proposed that instead of categorising all ecological benefits under the heading of 'ecosystem services' (with the sub-categories of regulating, provisional,

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supporting, and cultural services), we should instead divide them into the three specific categories: Ecosystem goods (the MA's 'provisional services'), ecosystem services (regulating and supporting services), and cultural services. It was shown that this is a much more feasible, practical, and honest way of categorising the benefits we receive from ecosystems and it avoids many of the problems inherent with the MA's definition. However, my thesis left this area open to the possibility of more analysis and research in the possibility that these categories may be further refined for a greater strengthening of the PEHP or other sustainability approaches.

Chapter Five also proposed that ecosystem goods were the most suitable to price economically out of the three benefits we receive from ecosystems. However, more work needs to be done on the exact methodological mechanisms of how ecosystem goods should be priced and how it can be practically implemented in practice. Ecosystem goods are physically tangible and are more favourably regulated by socioeconomic means and market methodologies, but how they are to be priced is still of concern and research is still heavily focused in this area. While on the other hand, I demonstrated that ecosystem services and cultural services are a lot more complicated and difficult to price economically. They are less favourably controlled by economic means because they are often underpriced and undervalued within a market-driven society, and are usually seen as free assets to do as we please. Even if we had clear and accurate ways of pricing ecosystem services, it would still be ethically questionable, and further work needs to take place in this area within environmental ethics. The five possible methods we have currently available to price things were shown to be inadequate because of the deeply holistic and interrelated nature of ecosystems. I also demonstrated that some of the benefits we receive from ecosystems should be classified as non-exclusive goods and services in order to protect them from being inadequately priced, and to avoid preventing individuals that need them but cannot afford them.

Chapter Six demonstrated that the PP is controversial but that it can contribute a great deal to sustainability theory and practice. The first section of this chapter gave a descriptive overview of the PP in order to identify the different applications of it within policy frameworks and to try to find the basic tenets that tie all of these definitions together. This section analysed the widespread usage of the PP within political agendas in order to show how it has been used within environmental policies and how it is already well recognised within the sustainability debate. I hope that my definition of the PP and its merger in the

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PEHP will allow the field to prosper and to overcome some of the issues within the debate, while at the same time possibly leading others to build upon my work.

Chapter Six gave a detailed assessment of the PP as a sustainability goal and showed that while it has not been clearly articulated, it does not follow that the principle itself is too vague. This criticism demonstrated that there is a need to analyse the predominant interpretations of the principle, and to find some commonalities between them. This chapter depicted that it was possible to establish a working definition for the PP as I discovered that there are three predominant features within definitions of the PP (the trigger, decision, and application stages), and that these features within the incorporation of EH and can be used as the guidelines for defining the PEHP.

Chapter Seven focused on establishing risk damage thresholds and the circumstances where the PEHP should be implemented. It showed that the division between actual and potential risks is disingenuous because they only vary in degrees of probability, rather than the ‘actual’ and ‘potential’ distinctions. This section also analysed Sunstein’s two categories of risk thresholds (‘catastrophic’ and ‘irreversible’ harm) as indicators for precautionary action. They have been used in several policy documents, so their assessment was practically important for our analysis of the PEHP. Both proved to be inadequate thresholds for precautionary action on their own and we should use an overall ecological resilience approach to risk instead.

Our ecological resilience approach should instead be based on edges of chaos approximations, underpinned by the different possible bifurcations of our actions towards ecosystems. Edges of chaos thresholds give us boundaries as to what may cause ecosystems to become unhealthy, or affect an ecosystem’s resilience. The PEHP aims to protect ecosystem health in the face of uncertain knowledge about risk(s), but it must still make predictions based on sound ecological analysis through bifurcation analysis and the establishment of edges of chaos. However, my research on edges of chaos theory and the application of bifurcations to the PEHP is not the last word on the topic, but will hopefully provide a springboard for further discussions and refinements of it within sustainability theory.

Section one of this chapter was also concerned with the other PP trigger stage—the ‘knowledge threshold’. It illustrated that the distinction between science and ethics is misleading because they are closely related. This section demonstrated that risk assessments

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and the PP are not completely divergent, and that the PP actually needs risk assessments in order to show that there *are* risks to begin with. It requires science and risk assessments to show that there is a causal relationship between risks it attempts to prevent and uncertain consequences. It was shown that probability calculations are of great benefit to the PP's successful application, because without them there is little chance individuals will want to take action against risks not viewed as threats. Although, my summary of probability calculations leave the area open for greater evaluation to strengthen both the PEHP and the sustainability field as a whole. It was also shown that the knowledge threshold should be used to guide risk analysis and should be closely related to an ecosystem's level of resilience (self-renewal and self-organisation), but that scientists should be aware that there will be errors within their research and should report these within their findings.

The second section in Chapter Seven was concerned with the decision-making stages of the PP and it described why regulators need to balance the expert and general public's views within the debate. The importance of incorporating public values was well established and if we ignore these values, it undermines the PP as a representative framework for sustainability. This section rejected Sunstein's claim that the public's views on risk are irrational, emotion-laden, and inaccurate. It was shown that the expert was not free from these criticisms and that Sunstein's semi-coercion method was insulting to the public and democracy. Regulators and risk assessors need to provide the public with all of the relevant information and uncertainties so they can make informed decisions about these risks. The paternalistic and libertarian responses were both shown to be insufficient approaches and it was argued that deliberative democracy underpinned and guided by post-normal science is a far more suitable framework to help guide the PEHP in practice.

The final part of this chapter showed that the PEHP does not lead to inaction because it makes an ethical judgment to prevent harm, with the acknowledgement that actions are never risk-free. This section gave a brief overview of the main difficulties faced when applying the PP within political and economic frameworks. Altogether, there are no clear reasons why the PP cannot be implemented within environmental regulation and sustainability policy. The difficulties outlined were shown to be either inaccurate or were overcome with further description and analysis. However, there still requires a great deal of further research and analysis into the practical implementation of these positions within policy and will require further work in this area. Overall, this chapter demonstrated that the

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main philosophical problems with the PP are often due to oversights by its critics or they focus too much on only limited definitions of the principle.

Overall, this thesis offered an original and critical examination of concepts within sustainability such as biological integrity, ecosystem health, the compositionism-functionalism division, intrinsic value, weak anthropocentrism, and the precautionary principle. This thesis proposed that the PEHP should not be grounded on a non-anthropocentric framework or guided by intrinsic value but it should instead endorse a weak anthropocentric holistic framework, guided by contributory value. It was shown that ecosystems provide us with cultural services, ecosystem goods and services, and that fact should underpin their protection for present and future generations. Health is an effective, uniting, and intuitively powerful ideal that can help guide sustainability policy and promote widespread public endorsement.

The PEHP is also inherently holistic and variable and the overlap between it and EH was expressed thoroughly throughout this thesis. Their theoretical compatibility is apparent, when merged as the PEHP, because their structure and make-up is quite similar and their approaches to science, uncertainty, value, and ethics quite clearly overlap. It was shown that the PP, ecosystems, the health concept, and my version of weak anthropocentrism were all distinctly holistic and variable in their nature, which is why these concepts merged so well within this approach. EH and the PP are both variable in their nature and have the ability to adapt to different situations and circumstances. While this is an important and effective characteristic to have, further research on the PEHP's incorporation into specific situations, circumstances, and ecosystems is required within the field. Empirical research and application in the field would greatly benefit the theoretical grounding of the PEHP and will further strengthen it as a concept for the sustainability field.

I also established my own version of the PP to include three distinct stages (trigger, decision, and application), different from other versions of the PP (see Fig. 1.5). The PP's damage threshold should be guided by EH's goals of self-organisation, self-renewal, and resilience, in addition to bifurcation theory in uncertain circumstances and edges of chaos to map possible thresholds to avoid. As I mentioned earlier, more work needs to be done in this area to expand upon the preliminary findings of my thesis. I took a specifically programmatic evaluation of the PEHP in the application of deliberative democracy, guided by post-normal science, but my schematic account of this position can further be developed within the field.

## Conclusion

Laura Westra has already given ample analysis of post-normal science and deliberative democracy has been proposed and developed in the political science field. However, their link to ecosystem health and the precautionary principle have not been explored, especially their ties and relationships to self-renewal and self-organisation aspects. With the interrelationship and marriage between ecology, political science and philosophy, we can further develop upon these areas.

However, despite requiring some further detail and elaboration, the PEHP should be grounded on a weak anthropocentric holistic framework and it should apply a post-normal scientific deliberative approach. The PEHP should be ecologically directed by contributory values and should take into account the ecosystem goods, services, and cultural services we receive from healthy ecosystems. Given the value of these goods and services, we need to act in a precautionary way towards their protection. Fundamentally, we need to act with precaution if we want to protect EH and in order to act in a precautionary manner we need to have an ecological understanding about the health of ecosystems. Acting in a precautionary manner should not necessarily lead us to inaction (as lack of action was included in our choices of action), and it should not be overridden by the economic cost of implementing action. The combination of the PP with EH within the PEHP is a new step forward in the environmental debate and I believe that this thesis will lay the groundwork for the elaboration and expansion of this topic in sustainability theory, it also allows for further investigation and debate within the field.

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