



Environment & Society



White Horse Press

Full citation:

Peterson, Markus J., and Tarla Rai Peterson, "Ecology: Scientific, Deep and Feminist." *Environmental Values* 5, no. 2, (1996): 123-146.

<http://www.environmentandsociety.org/node/5573>

Rights:

All rights reserved. © The White Horse Press 1996. Except for the quotation of short passages for the purpose of criticism or review, no part of this article may be reprinted or reproduced or utilised in any form or by any electronic, mechanical or other means, including photocopying or recording, or in any information storage or retrieval system, without permission from the publisher. For further information please see <http://www.whpress.co.uk/>

Ecology: Scientific, Deep and Feminist

MARKUS J. PETERSON* AND TARLA RAI PETERSON†

**Department of Wildlife and Fisheries Sciences
Texas A&M University, College Station
Texas, 77843-2258, USA*

*†Department of Speech Communication
Texas A&M University, College Station
Texas, 77843-4234, USA*

ABSTRACT: The application of hierarchy theory to ecological systems presents those who seek a radical change in human perspectives toward nature with a unique window of opportunity. Because hierarchy theory has enabled scientific ecologists to discover that the window through which one chooses to observe a system influences its reality, they may now be more amenable to including the perspectives of deep and feminist ecologists into their self-definition. A synergy between deep, feminist, and scientific ecology could improve environmental policy by encouraging more ecofeminists to encompass the marginalisation of nonhuman life-forms within the ethic of care, more deep ecologists to encompass the issues of overconsumption and militarisation within the anthropocentric-biocentric polarity, and more scientific ecologists to scrutinise the politics behind their investigations.

KEYWORDS: Communication, deep ecology, ecofeminism, environmental policy, scientific ecology.

Those concerned about human interactions with nature have long maintained that a radical change in human perspectives toward nature is necessary if our increasingly destructive exploitation of the biosphere is to be arrested. Recently there has been a heated exchange on the relative merits of deep ecology versus ecofeminism as appropriate radical philosophies for undergirding a sound environmental ethic (see *Environmental Ethics* since 1984). It appears from their respective rhetorics that both ecofeminists and deep ecologists are vitally concerned about human interactions with earth's biophysical processes. This also is a central concern of scientific ecology. While we have no desire to further complicate this sometimes acrimonious debate, and have no pretensions to philosophic prowess, we do wish to explore the potential of the ongoing

paradigm shift in scientific ecologists' view of ecosystems (and its historic context) as common threads for weaving a more productive dialogue among feminist, scientific, and deep ecologists. Such a dialogue is productive to the degree that it facilitates greater reflexivity on the part of those who define themselves as ecologists (whether feminist, scientific, or deep).

Not surprisingly, most scientific ecologists, when asked about the philosophies of deep ecology or ecofeminism, respond with a resounding 'what?' (although some may claim awareness of ideas these philosophies promote). Arne Naess (1986) tried to change this condition in his keynote address at the Second International Conference on Conservation Biology. He argued that most environmental experts were basically sympathetic to eight planks forming the platform of the deep ecology movement, evaluated why scientific ecologists do not become more actively involved in promoting strong conservation policies, and proposed seven suggestions for counteracting the tendency toward public silence among environmental experts. Most scientific ecologists who are aware of deep ecology by name can trace such awareness to this presentation. Such limited, yet explicit, recognition of ecological feminism by scientific ecologists has not occurred. Conversely, deep and feminist ecologists' existence at the margins of environmental policy making has rendered them acutely aware of scientific ecology.

In this essay we first summarise our understanding of deep ecology and ecofeminism. Secondly, we outline the historical development and current status of scientific ecologists' perspective on ecosystems. Thirdly, we discuss differences and potential connections among the perspectives of feminist, deep, and scientific ecologists – contextualising each group's usage of the ecological concept, the 'balance of nature', within the historical development of scientific ecology. Finally, we explore how feminist, scientific, and deep ecologists might use this abstract concept in exploring the material problems of forests, and human population growth. We conclude that the complementary strengths of these three perspectives provide a basis for improved environmental policy formation. Karen Warren and Jim Cheney (1991; 1993) have delineated important similarities between scientific and feminist ecology 'in the interest of furthering discussion on the nature and direction of future bridge-building between the two' (1991, p. 180). This essay offers one such articulation. We argue that both despite, and because of, the fundamental tensions between deep, feminist, and scientific ecology, building bridges rather than walls among the three enriches the distorted image of the natural world produced by each group's unique discursive screen. The resulting vision can lead to the formation of more broadly based environmental ethics and more effective environmental policy.

DEEP ECOLOGY AND ECOFEMINISM

Deep, as Opposed to Shallow, Ecology

The basic precepts of contemporary deep ecology were first synthesised by Arne Naess in 1973 'to describe a deeper, more spiritual approach to Nature exemplified in the writings of Aldo Leopold and Rachel Carson' (Devall and Sessions, 1985, p. 65). Naess argues that a 'deep ecology' is needed because 'ecology as a science does not ask what kind of a society would be the best for maintaining a particular ecosystem – that is considered a question for value theory, for politics, for ethics' (Devall and Sessions, 1985, p. 74), and reformist environmentalism, while important, does not address the necessary shift from the dominant social paradigm. Naess (1973) presents two ultimate norms or intuitions that are the basis of his ecosophy; *self-realisation* and *biocentric equality*. Bill Devall and George Sessions (1985) argue that this concept of 'self requires a further maturity and growth, an identification which goes beyond humanity to include the nonhuman world'. Becoming such a mature person requires 'real work':

The 'real work' can be summarised symbolically as the realisation of 'self-in-self' where 'Self' stands for organic wholeness. This process of the full unfolding of the self can also be summarised by the phrase, 'No one is saved until we are all saved', where the phrase 'one' includes not only me, an individual human, but all humans, whales, grizzly bears, whole rain forest ecosystems, mountains and rivers, the tiniest microbes in the soil, and so on. (p. 67)

To the deep ecologist, 'self' is an inclusive rather than an exclusive term. Self-realisation, then, requires that individuals broaden their self-concept from the traditional view of self as individual *Homo sapiens*, to 'self' including other individual humans, humankind, all living organisms, as well as the nonliving environment – everything is connected to every other thing and all form a single whole (self).

Deep ecologists also maintain that 'all things in the biosphere have an equal right to live and blossom and to reach their own individual forms of unfolding and self-realisation within the larger Self-realisation', referring to this concept as biocentric equality (Devall and Sessions, 1985, p. 67). This intuition is anti-anthropocentric and calls for ecocentric egalitarianism, which, Warwick Fox (1989) argues, 'allows all entities (including humans) *the freedom to unfold in their own way unhindered by the various forms of human domination*' (p. 6). This second ultimate norm naturally follows the first. If 'self' includes everything in the biosphere, as well as individual humans, then the western inclination toward the needless destruction of other species and their habitats would cease. Simply, ecological egalitarianism naturally should result because humans would be no more likely to needlessly injure or destroy their inclusive selves than their own bodies, or exclusive selves.

A number of deep ecologists have attempted to systematise the deep ecological ethic. Devall (1980, pp. 309-13) lists 15 'basic principles', Devall and Sessions (1985, pp. 70-5) list and expand upon eight 'basic principles', and Naess (1986, pp. 509-10) suggests 8 planks of the 'platform of the deep ecology movement'. Each of these formulations places emphasis on the inherent value of living things, whether organisms or biotic communities. Deep ecologists maintain that human interference with nonhuman life-forms is excessive, humans should not reduce the abundance or diversity of other life-forms except to satisfy 'vital' needs, and that anyone who ascribes to the philosophical stance of deep ecology should actively attempt to implement requisite changes in their personal lives and society. Not everyone finds deep ecology sufficient philosophically to ground an effective radical ecology. In fact, some feminist commentators fear it actually reaffirms many societal characteristics that lead to human domination of nonhuman life-forms and natural systems.

A Feminist Perspective Toward Ecology

To approach ecology from a feminist perspective one must 'recognise the validity of women's own interpretations of their lived experience and needs, and acknowledge the values women claim publicly as their own' (Offen, 1988, p. 152). This argument incorporates a political aspect that precludes the feminist from limiting her work to the disclosure of injustice. Indeed, it advocates active participation in attempts to eliminate injustice through efforts to destabilise coercive power relationships. This viewpoint encourages criticism of the status quo, suggesting that practising feminists must be both capable of, and willing to, critically examine a broad range of human patterns of socialisation. This perspective provides a necessary, but not sufficient, impetus to radicalise environmental study and policy formation and implementation.

Feminism holds many different meanings, and has been categorised with various taxonomies. One of the most commonly used differentiates feminist perspectives as 'radical', 'liberal', and 'socialist' (Steeves, 1988). Radical feminism focuses on fundamental change of culturally constructed values and patterns. Conversely, liberal feminism focuses on legal reforms to the existing political system, such as the Equal Rights Amendment (USA). The goal is to provide equal opportunity for achieving individual development for women. Thirdly, socialist feminism identifies changes in the economic system as fundamental to the feminist agenda. It is closely allied with Marxist and neo-Marxist arguments that capitalism is the fundamental factor in women's oppression (Gonzalez and Peterson, 1992). Each of these perspectives has contributed to contemporary ecofeminism.

Bell hooks' (1984; 1994) feminist theory, which is grounded in the experiences of domination, provides a strong, yet flexible, foundation for a feminist inquiry into ecology. She characterises the liberal focus on individual rights, the

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

socialist focus on economic control, as well as some radical feminists' focus on biological determinism as too reductionistic. She is particularly hostile toward the focus on individual rights because such a feminism can degenerate into encouraging women to join the ranks of those who dominate others. Hooks writes that feminism is:

not about dressing for success, or becoming a corporate executive, or gaining elective office; it is not being able to share a two career marriage and take skiing vacations and spend huge amounts of time with your husband and two lovely children because you have a domestic worker who makes all this possible for you, but who hasn't the time or money to do it herself; it is *not* opening a Women's Bank, or spending a weekend in an expensive workshop that guarantees to teach you how to become assertive. (1984, pp. 7-8)

Her insistence that all forms of oppression are interrelated is fundamental to ecofeminism. The Western emphasis on individual rights, competition, and consumerism, in other words, does not define feminism for hooks.

Although hooks' theory of feminism developed out of her analysis of relationships between white women and women of colour in the United States, it can be extended to a global ecological scope because she views women's oppression as an example of the broader issue of domination. In fact, she defines feminism as 'a struggle to eradicate the ideology of domination that permeates Western culture on various levels as well as a commitment to reorganising society so that the self-development of people can take precedence over imperialism, economic expansion, and material desires' (1984, p. 24). Thus, hooks' definition of feminism does not focus on 'man as enemy', nor does it privilege women over men. To emphasise this point, she adds:

sexist oppression is of primary importance not because it is the basis of all other oppression, but because it is the practice of domination most people experience, whether their role be that of discriminator or discriminated against, exploiter or exploited. It is the practice of domination most people are socialised to accept before they even know that other forms of group oppression exist. (p. 35)

From their earliest memories, instances of sexist oppression teach children that domination is a fact of life. As they grow older and move out of the family circle, they learn to participate in other forms of oppression associated with race and class. Sexist oppression, however, remains the earliest form of domination to which they were exposed. Hooks does not assume that awareness and critique of sexist oppression will eliminate patterns of domination, only that it is a necessary pre-condition for that elimination. Ecofeminism picks up where hooks stops, and extends her critique to the domination of non-human beings. The ecofeminist critic's most powerful political potential, therefore, lies in her ability to empathise with, and expose the domination of, nature based on her lived experience as an 'object' which has suffered domination.

While there are many expressions of ecofeminism, all acknowledge themselves as catalysts for change. Amidst their diversity is the common claim that 'ecofeminist theory includes a systemic analysis of domination that specifically includes the oppression of women and environmental exploitation, and it advocates a synthesis of ecological and feminist principles as guiding lights for political organising and the creation of ecological, socially equitable life-styles' (Lahar, 1991, p. 29).

Ecofeminism, then, is both theoretical and practical. It is concerned with creating awareness of the connection between the domination of women and the domination of nature. In addition it is concerned with changing this social pattern. It hopes to do this primarily by an exploration of alternative symbol systems, thus suggesting a critique of traditional conceptual boundaries. Ecofeminism tries to reconnect that which has been sundered, or repair the nature-culture dualism, by examining the 'holistic' life experiences of women. Warren (1991, p. 1) states that ecofeminism incorporates 'historical, empirical, conceptual, theoretical, symbolic and experiential' connections into its definition of the world. In general, ecofeminist philosophy seeks to respond to the immense failure of human society to contextualise its own existence as one of many forms of being. It then argues that people cannot move away from an anthropocentric world-view, as deep ecologists advocate, without first rejecting androcentrism.

Deep Ecologist and Ecofeminist Critiques of Each Other

Ecofeminists have clarified their environmental philosophies, at least in part, by examining the shortcomings of other radical environmental movements, particularly deep ecology. Ariel Salleh (1984) argues that deep ecologists' persistent use of the generic term *man* illustrates ecosophy's inability to facilitate the development of self as an organic whole, as deemed necessary by Naess, because men still ignore half of humankind. Men's inability to understand women's bond with nature (which is based upon biological, cultural, social, and economic factors), further demonstrates the current limitations on male perceptions of the empirical world. Salleh maintains that deep ecologists' call for biological egalitarianism rings hollow without a concomitant realisation that the twin patriarchal domination of nature and woman are not only related, but reinforce each other.

Val Plumwood (1991) argues that deep ecology provides an inappropriate perspective from which to understand nature because it does not offer 'an adequate historical analysis, and [it relies] implicitly upon rationalist-inspired accounts of the self that have been a large part of the problem' (p. 3). Because it relies on Kantian rationality, ecosophy devalues emotion, affect, and anything related to pathetic appeals. Women and nonhuman life-forms are assumed to be less capable of making 'moral' decisions because they have been sensitised by instinct, training, or both to relational aspects of existence. Similarly, Salleh

(1984) describes Naess' platform of deep ecology as 'a highly academic and positivised one, dressed up in the jargon of current science-dominated standards of acceptability', thus conforming with a hierarchical world view based upon patriarchy (p. 343). Since patriarchal structures both create and sustain patterns of domination, deep ecology attenuates its radical potential by grounding itself in patriarchy.

A related ecofeminist critique of deep ecology focuses on its tendency toward abstraction. Whereas deep ecology focuses on unifying the self with all of nature, an ecology informed by feminism would emphasise the ties individual humans have developed with each other, with specific trees, rivers, regions, etc. Plumwood (1991) argues that 'special relationship with, care for, or empathy with particular aspects of nature as experiences rather than with nature as abstraction are essential' (p. 7). Rather than the generalisation of self suggested by ecosophy, an ecofeminist approach develops out of the feminist concept of self-in-representation articulated by Gilligan (1982).¹ Maria Mies and Vandana Shiva (1993) argue that a new ecological vision cannot be created from abstract theorising, but 'can be found only in the survival struggles of grassroots movements' (p. 297).

When deep ecologists respond to ecofeminist criticisms they sometimes imply that if humans would only abandon their anthropomorphic view of nature the domination of women would spontaneously evaporate. Others simply include ecofeminist insights into a basically patriarchal world view. For example, Davis (1986) argues that Devall and Sessions simply append a short ecofeminist perspective to their basically patriarchal book on deep ecology – with no real integration of ecofeminist thought. Similarly, Cheney maintains that there is 'a widespread tendency on the part of ecologically sensitive males to assimilate feminist insights to the masculine perspective', without fundamentally questioning this androcentric world-view (1987, p. 128). This concern was also the basis for Salleh's (1992) reply to deep ecologists' cavalier handling of ecofeminist concerns. She argues that, although deep ecologists have acknowledged that inequities exist within the human species, they refuse to explore how the domination that reinforces those inequities influences environmental ethics and policies.

In turn, deep ecologists have characterised ecofeminism as lacking adequate philosophical grounding. Allen Wittbecker points out that although 'Salleh treats feminine experience as the organic basis for philosophy, it is only part' (1986, p. 265). He claims that ecofeminism privileges the female human experience over both male human and non-human experience, which results in an inappropriate ethical response to environmental ethics. Michael Zimmerman (1987) summarises the ecofeminist critique of deep ecology as 'misguided'. He asserts that when deep ecology 'speaks of gender-neutral "anthropocentrism" as the root of the domination of nature', it reaches the cause of the problem. According to Zimmerman, the ecofeminist argument that '*androcentrism* is the real root' de-rails efforts to construct a radical ecological practice (p. 37). Fox (1989) maintains that the feminist emphasis on domination among humans is

overly simplistic, and its 'upshot is that there is no need to worry about any form of human domination other than that of androcentrism'. He argues that 'for deep ecologists, it's just another variation on the same old song – the song that reassures us that all will become ecologically well with the world if we just put this or that interhuman concern first' (p. 18). To Fox, and many other deep ecologists, ecofeminist insistence that oppressive economic and political structures must be abolished before humans will treat nature in a non-domineering manner illustrates human preoccupation with interhuman affairs, allowing continued obfuscation of our relationship with the nonhuman world. Deep ecologists prefer to view the negative ecological effects of androcentrism as a special case of anthropomorphism.

Supporters of deep ecology also have accused ecofeminists of claiming that women are 'closer to nature' than men (Wittbecker, 1986; Fox, 1989). For example, they attack Salleh's (1984, p. 340) claim that women's reproductive functions 'already ground women's consciousness' with nature and that women instinctively 'flow with the system of nature'.² Stearney (1994) claims that ecofeminism idealises the concept of mothering and 'fails to record mothering the Earth as a psychologically, emotionally, and physically demanding role' (p. 156). She argues that this failure threatens both women and the earth because it confers all responsibility for care of the earth onto women, and frees men to continue pursuing its destruction. Zimmerman (1987), in his comparison of feminist and deep ecology, argues that the radical feminist generalisation that women are more attuned to nature than men 'seems to suggest an essentialist and/or genetic doctrine of the differences between men and women: that man is thinker, woman is feeler' (p. 40), which is consistent in many ways with the patriarchal value-hierarchy feminists vehemently oppose. Critiques such as these charge ecofeminism with promoting an essentialist view of gender differences by privileging women's relationship to nature and their responsibility for environmental protection. They argue that if woman is considered 'better' than man, all we have done is turn the value-hierarchy on its head – forming a new, if different, rhetoric of oppression.

Ecofeminists have offered varied responses to this critique. Lahar (1991) urges ecofeminists to avoid the pitfall of promoting 'unintentionally an essentialist view of gender differences' (p. 39). Warren (1987) worries about radical feminism as a grounding for ecofeminist concerns, because:

framing the feminist debate over ecology in terms of the question, 'Are women closer to nature than men?' ... presuppose[s] the legitimacy of the nature-culture dualism. The idea that one group of persons is, or is not, closer to nature than another group assumes the very nature-culture split that eco-feminism denies. (p. 15)

She points out that it is preposterous to ask if humans, biologically or culturally, can be anything but 'close' to nature, since we, and all other organisms, are *part* of nature. In her reply to critics of ecofeminism, Salleh clarifies her previously

stated position by asserting that, 'it is nonsense to assume that women are any closer to nature than men' (1992, p. 208), in the biological sense. She differs with Warren, however, in claiming that patriarchal socio-economic constructs have positioned women in a more intimate relationship with nature. Mies and Shiva (1993) argue that just as women understand nature better than men, poor women living in the southern hemisphere understand it better than middle class women living in the northern hemisphere. They point out that this positioning is the result of economic, cultural, and political structures, and that because 'all women and all men have a body ... [they] have a material base' for achieving a more holistic understanding (p. 20).

While the dialogue among feminist and deep ecologists has clarified the thinking of both groups, it has also revealed points at which proponents of each perspective may stumble into reductionism. Deep ecology maintains that a sound environmental ethic depends upon the achievement of human self-realisation, which opens the way for biocentric equality. Feminist ecology grounds environmental ethics in the elimination of domination that results from an understanding of the self-in-relation. The 'deep' concept of selfhood, which emphasises the unity of all things, is vulnerable to a reduction of self to whole, which obscures the distinctions between individuals and their world. Alternatively, the feminist concept of selfhood depends so completely on personal experience that it is vulnerable to the reduction of whole to self. While deep ecology relies on the power of a biocentric world-view to eradicate localised, individual cases of domination (whether intra- or inter-species), feminist ecology relies on the power of localised, personal experience to eradicate an imperious world view. Deep ecologists avoid reducing the self to the whole by focusing on the individual action necessitated by a biocentric world-view. For example, the final plank in Naess' (1986, pp. 509-10) 'platform of the deep ecology movement' argues that 'those who subscribe to the foregoing [first seven] points have an obligation directly or indirectly, to participate in the attempt to implement the necessary changes'; and Devall (1980, p. 317) argues that deep ecologists, 'as their contribution to the development of ecological consciousness, ... prefer to act as exemplary models and to teach through acting'. Ecofeminists avoid reducing the whole to the self by focusing on the convergence of participation in efforts 'to keep alive the processes that sustain us' (Mies and Shiva, 1993, p. 2). Mies and Shiva (1993) detail how both the differences and similarities between women's struggles for survival in the face of oppressive patriarchal political structures 'evoke a sense of solidarity' among activists in Germany, India, Kenya, Japan, Ecuador, and countless other locales around the world (p. 5).

While deep and feminist ecology share the ideal of a world wherein all life is revered, they disagree regarding both the reasons for our current dilemma, and the best means for achieving a non-exploitative vision of life. Given that they suggest different, yet not necessarily incompatible, methods for resolving

environmental problems, the relevance of concepts derived from either/both will depend on the situation. What is needed is a structure within which policy makers can draw on both, without reducing one to the other. We now outline an ongoing paradigm shift in ecological science, and explore the potential of the resulting ecology as a partner with, rather than an adversary to, ecofeminism and deep ecology.

THE SCIENTIFIC CONCEPT OF ECOSYSTEM

Traditionally, an *ecosystem* has been defined as the biotic community plus its abiotic environment. In turn, the *community* was thought to be composed of variously interacting *populations* of plants, animals, and microbes which in turn consist of individual *organisms* of given species. Ecosystems were conceptualised in this hierarchical manner long before the term was coined by Tansley in 1935. While ecological concepts can be traced into antiquity in various cultures, ecology, as an area of systematic disciplinary interest, began developing out of the natural history movement in the 1700s with the work of Buffon, Malthus, and others. By 1802, Alexander von Humbolt had formulated a clearly ecological view of plant communities, made up of various plant populations, by relating plant distribution and association to physical environmental factors such as altitude, latitude, elevation, humidity, and temperature. The subsequent work of Warming, Darwin, Haeckel (who coined the word ecology in 1869), and others led to the formation of ecology as a separate scientific discipline. By 1876 the self-educated Stephen A. Forbes (1887/1925) outlined the concept of ecosystem in his classic *The Lake as a Microcosm*. Less than 30 years later, Clements (1916) analogised the organisation of the biotic community to the cells, organs, and organ systems of organisms, arguing that plant community succession toward 'climax' was primarily controlled by climate (climatic climax). Gleason (1926), one of the few ecologists who took exception to Clements' influential organismal view, argued that the immigration of plants into suitable habitat, and the environment (climate and soil), largely controlled vegetative processes. Additionally, he maintained that the biotic community alters the environment, environmental variability alters communities, and a large element of stochasticity is involved in the history of most communities.

Recently, considerable dissonance within the field regarding the concept of ecosystem has emerged. For example Begon, Harper, and Townsend (1986) view the terms community and ecosystem synonymously. After developing the concept of community, they state that:

Traditionally, another category of ecological study has been set apart: the *ecosystem*. This comprises the biological community together with its physical environment. However, ... the implication that communities and ecosystems can be studied as separate entities is wrong. No ecological system, whether individual, population or

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

community, can be studied in isolation from the environment in which it exists. Thus we will not distinguish a separate ecosystem level of organisation. (pp. 591-2)

They argue that because natural systems do not exist outside of a context, distinguishing a separate level known as 'ecosystem' is misleading at best. Allen and Starr (1982) suggest that one reason for this dilemma is that ecology deals with *middle-number systems*, or systems made up of too many parts for an individual accounting, but too few parts for these parts to be substituted for by averages (an approach used by physics) without yielding 'fuzzy' results. They call for the use of hierarchy theory as a tool for addressing ecological systems.

An Alternative Ecosystem Perspective

In *A Hierarchical Concept of Ecosystems*, O'Neill, DeAngelis, Waide, and Allen (1986) offer a simple, yet innovative, application of hierarchy theory to ecological systems. They argue that the concept of ecosystem typically has been approached from two dominant perspectives, yielding either a *population-community* or a *process-function* emphasis. Ecosystems, when viewed from the population-community emphasis, consist of producers, consumers, and decomposers (based upon populations of organisms), while the process-functionalists maintain that ecosystems are functions of energy capture, nutrient retention, and rate regulation. While each of these perspectives provide useful insights, the traditional concept of ecosystems (a single hierarchy) is limiting because it describes more than one entity as an 'ecosystem' and no single spatio-temporal scale is adequate for all investigations.

While the biota may interact with the abiotic environment, traditional community ecologists, following Clements, typically view the abiotic environment as a stage upon which the 'action' occurs. This organismic emphasis is understandable since organisms (and populations) are often reasonably discreet units that are easily discerned by humans and many important population interactions (e.g., predation, herbivory, parasitism) occur at this scale. Considering ecology's geneses in the natural history movement, it is not surprising, then, that this population-community emphasis first gained ascendance.

Functionalists saw the limitations of focusing exclusively on living organisms. Raymond Lindeman (1942) turned attention to energy flow within, and the processes and functions of, ecosystems. Odum's influential series of ecology texts refined this process-function approach and presented it to a mass audience. This perspective was an important breakthrough in ecology because it offered compelling explanations for such important observations as ecological 'pyramids' and 'food webs'. Lindeman's study of community energy flow indicated that there was approximately a 90% reduction in energy as it passed from one trophic level to another. Thus, the processes of energy capture and retention, and the ecological function of organisms at various trophic levels, explains why ecological pyramids exist and provides a reason for the interconnectedness of

food webs. However, the process-functionalists sometimes ignore the fact that energy capture, and many energy transfers, must be accomplished by organisms (often in diverse taxonomic groups) that should not be viewed as interchangeable inanimate objects.

O'Neill et al. (1986) use hierarchy theory to ground their proposed concept of ecosystems. A central precept of this theory is that the organisation inherent to medium-number systems results from differences in process *rates* occurring across both time and space, rather than taxonomic units, processes, or functions perceived at a human scale of observation. The global carbon cycle serves as a good example of how process rates can delineate levels of ecosystem organisation. Simplistically, the rate at which plants convert gaseous carbon dioxide (CO₂) into organic carbon via photosynthesis is rapid, as is the rate at which plants and animals respire, or the combustion of rain forests and fossil fuels releases CO₂ into the atmosphere (fractions of a second). The rate at which organic material from decaying animal and plant tissue are incorporated into the soil is slower (months to years, depending on the climate), while the formation of peat beds requires centuries and the establishment of coal and oil deposits, or the incorporation of organic material into calcareous rocks, requires hundreds of millions of years. Hierarchy theory, then, argues that the structure inherent to global carbon cycling is best delineated by the rate at which various processes involved occur. Thus, the functional structure of the natural world should be explicitly extracted from the data rather than from any *a priori* structure based upon human scales of observation, as both the population-community and process-function approaches tend to do.

O'Neill et al. maintain that forcing the population-community and process-function perspectives into a single hierarchy has rendered the resulting structure impotent. They propose a multiple hierarchical concept of ecosystems, arguing that the population-community and process-function perspectives are simply dual hierarchies, among many possibilities, in the natural world. They view the population-community perspective as a hierarchy consisting of individual organisms, populations of organisms, and communities made up of many populations and the process-function perspective as a hierarchy consisting of functional components (which may include organisms in many taxonomic categories and/or various abiotic components), ecosystems (which consist of interacting functional units), and the biosphere (which is composed of many ecosystems). Neither of these dimensions can be reduced to the other and each hierarchy makes sense when viewed from either the population-community or the process-function perspective of ecosystems – making the idea readily transferable.

This multi-hierarchical view has the advantage of being able to accommodate other perspectives toward ecosystems as well. For example, the burgeoning field of landscape ecology simply adds a third natural hierarchy, based upon the structure, function, and change of spatial patterning, to the population-commu-

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

nity and process-function emphases. A spatial hierarchy pertinent to landscape ecology consists of regions, landscapes, landscape elements, and tesserae (listed from largest to smallest relative size) (Forman and Godron, 1986). The spatial viewpoint is essentially absent from the process-function perspective, and has been considered in few population-community studies until recently. Additionally, landscape ecology includes humans and their impact on the natural world (which cannot be ignored at the landscape scale) to a far greater extent than do the other perspectives. While it is not fair to say a paradigm shift in ecologists' view of ecosystems has occurred, the work of Allen and Starr, O'Neill et al., and others is causing a major re-evaluation of how scientists conceptualise ecological systems. Although humanists routinely promote the practice of using multiple lenses to interpret reality as a rational response to the ubiquitous nature of symbolic mediation, this is a novel idea for scientists. Scientific ecology's discovery of the symbolic mediation between human perception of natural systems, and the reality of those systems, provides a rare opportunity for weaving radical ecology into the environmental policy tapestry.

POTENTIAL FOR CONVERGENCE

The term 'hierarchy' carries a negative connotation for many deep and feminist ecologists. For example, Zimmerman argues that, 'according to eco-feminists, only by replacing those categories – including atomism, hierarchalism, dualism, and androcentrism – can humanity learn to dwell in harmony with nonhuman beings' (1987, p. 21). Davis declares that, 'environmental philosophy ... has a moral obligation to address the feminist critique of hierarchy and patriarchy' (1986, p. 153). Similarly, Cheney asserts that 'the "deep ecology movement" seems to have answered the call for a nonhierarchical, non-dominating attitude toward nature' (1987, p. 116). Such comments imply a general feeling among deep ecologists and ecofeminists that hierarchy, by definition, is intrinsically domineering, anthropocentric, and androcentric. Warren and Cheney (1991, p. 194) characterise the name 'hierarchy theory', as 'most unfortunate', in its potential for predisposing feminist readers to reject the theoretical framework out of hand. Similarly, we hope that readers will not dismiss hierarchy theory without first examining its tenets.

Humans make use of many hierarchies that do not necessarily legitimate the subordination of nonhuman organisms, women, or children. For example, many societies measure existence with a nested hierarchy of time. Although this hierarchy is used to justify domination of children, it neither explains nor justifies the concomitant domination of nonhuman organisms or women. Further, society extracts only a small segment of time when justifying domination of children. O'Neill, et al. also rely on a hierarchical view of time (e.g., eras, epochs, years, days, minutes, nanoseconds) to describe the rate at which

processes occur within ecosystems. The same logic that justifies domination of children also justifies subordinating human needs to those of alligators (because they have lived on earth for hundreds of millions of years longer than humans). Clearly the nested hierarchy of time is not the problem. Rather, this hierarchy has been used to justify domineering human attitudes and practices.

As a social practice, domination develops out of material conditions, as well as abstract logics. As Warren (1990) maintains,

A logic of domination is not *just* a logical structure.... Contrary to what many feminists and ecofeminists have said or suggested, there may be nothing *inherently* problematic about 'hierarchical thinking' or even 'value-hierarchical thinking' in contexts other than contexts of oppression.... It is the logic of domination, *coupled with* value-hierarchical thinking and value dualism, which 'justifies' subordination. (pp. 128-9)

Thus, according to Warren, ecofeminists and deep ecologists should not reject a multiple hierarchical concept of ecosystems without first determining whether it is a value-hierarchy that generates a rhetoric of domination. While we do not accept Warren's implication that human thought can proceed in a 'value free' vacuum, her suggestion that hierarchies be judged on the basis of whether they promote domination is important. The hierarchy theory of O'Neill et al. deserves further consideration because it expands, rather than constricts, the options available to those interested in environmental policy. For example, it does not argue that one ecological perspective (e.g., process-function, population-community, spatial, or temporal) or component of ecological systems is more 'important' or 'valuable' than another. Rather, its organising principle recognises the mutual existence of diverse approaches to ecology and that ecological realities are a function of how we view the natural world.

Ecologists' Perspectives Toward Each Other

The similarities between scientific, deep, and feminist ecology have received less critical attention than have the differences between feminist and deep ecology. Deep ecologists, however, have stated repeatedly that their views, at least in part, are grounded in science. Naess (1973) maintains that, 'ecological knowledge and the life-style of the ecological field-worker have *suggested, inspired, and fortified* the perspectives of the Deep Ecology movement' (p. 98). Devall (1980), when discussing sources of reference for the deep ecology movement, lists 'the scientific discipline of *ecology*' as the fourth of five such important touch stones (p. 307). Devall and Sessions (1985, pp. 79-108) formulated a list of 12 important influences from which deep ecology derives its essence, discussing the science of ecology third. Deep ecologists assert that their ecosophy encompasses much more than just the science of ecology, however. Devall and Sessions summarise this perspective by arguing that deep ecology

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

'goes beyond the so-called factual scientific level to the level of self and Earth wisdom' (p. 65). Ecological science, in other words, provides necessary, but not sufficient, impetus for developing environmental policy.

Few scientific ecologists are aware of deep ecology's existence, much less its potential benefits to policy formation. In a rare discussion of deep ecology written from the perspective of traditional ecology, Golley (1987) found that the two central norms of deep ecology (self-realisation and biocentric equality) can be viewed in a manner 'consistent' with a scientific view of ecosystems. He concludes that the ecological concepts of the exchange of energy, material, and information as well as the development of species seem to form a bridge between deep and scientific ecology and that 'conceptually it appears that deep ecology norms can be interpreted through scientific ecology' (p. 45). Golley does not, however, discuss the distortions that inevitably will result if deep ecology is re-presented in these terms.

The ecofeminist critique of establishment ecology resembles that offered by deep ecologists, but adds the need to deconstruct rationalism as a universalising environmental ethic. Some feminists argue that all sciences, including ecology, are anthropocentric and androcentric by definition – making the formation of a non-oppressive hierarchy by *science* an oxymoron. For example, in Harding's (1991) deconstruction of science, she shows how patriarchal discourse relegates women's experience to the margins while celebrating men's experience as 'objective' fact. Merchant's (1980) analyses focus more explicitly on the patriarchal character of environmental science. Plumwood (1991) argues that the rationalist tradition upon which modern science is based is 'inimical to both women and nature' (p. 3). Benston (1988) agrees that rationalism is inimical to women, and credits this fact to the different experiences men and women have growing up. Boys and men are expected to learn a world view that 'emphasises objectivity, rationality, control over nature and distance from human emotions' (p. 15). Girls and women, on the other hand, learn 'to be good at interpersonal relationships ... and ... to be less rational, less capable of abstract, "objective" thought' (p. 15). However, while there are taxonomic, cultural, and gender biases in science, the activist nature of ecofeminism directs ecologists to seek means for changing, rather than simply studying these biases.

Lahar (1991) writes that ecofeminism's base in grassroots activism offers appropriate guidance for scientific ecologists and others who are concerned about the future of the earth. When comparing ecofeminist views with scientific ecology's current concept of ecosystems, Warren and Cheney (1991) found that the notion of ecosystems expressed by O'Neill et al. had ten important similarities with ecofeminist philosophy, establishing 'the need for, and benefits of, ongoing dialogue between ecofeminists and ecosystem ecologists' (p. 179). These similarities include an acknowledgement of the simultaneously autonomous and relational existence of individual selves, the importance of context in determining any 'objective' reality, and a rejection of reductionism.

In sum, the divergent foundations of deep, feminist, and scientific ecology do not preclude collaboration. For example, Naess maintains that traditional science contributes to deep ecology, Golley concludes that deep ecology can be consistent with traditional science, and Warren and Cheney argue that data resulting from appropriate scientific investigations enriches feminist ecology. The Mukti Sangarsh Movement described by Mies and Shiva (1993, pp. 306-12) demonstrates that the critique of mainstream science and technology is most productive as a basis for re-interpreting, rather than rejecting, scientific conclusions. Further, despite the feminist critique of science's proclivity to rationalism and abstraction, the science of ecology is often criticised by scientists for being too intuitive (Romesburg, 1981; Peterson, 1991) and is probably the most synthetic science. Finally, feminist ecology's emphasis on localised activism can provide scientific ecologists an ethical basis from which to move beyond cultural relativism when translating scientific discovery into environmental policy.

The 'Balance' of Nature

To explore the potential for convergence among the perspectives of feminist, scientific, and deep ecology we now evaluate their diverse conceptualisations of the 'balance of nature'. This abstraction is commonly discussed by all three groups, although each re-presents it somewhat differently.

Many scientific ecologists have viewed 'undisturbed' nature as static. For example Forbes (1887/1925) stated that:

Perhaps no phenomenon of life in such a situation [a lake] is more remarkable than the steady balance of organic nature, which holds each species within the limits of a uniform average number, year after year, although each one is always doing its best to break across boundaries on every side. The reproductive rate is enormous and the struggle for existence is correspondingly severe... yet life does not perish in the lake, nor even oscillate to any considerable degree, but on the contrary the little community secluded here is prosperous as if its state were one of profound and perpetual peace.
(p. 549)

The concept of a natural biotic equilibrium that could be *disturbed* by humans grounded Aldo Leopold's understanding of deer irruptions such as those occurring on the Kaibab plateau in Arizona. He 'found no record of a deer irruption in North America antedating the removal of deer predators', arguing that 'those parts of the continent which still retain the native predators have reported no irruptions' (1944, p. 360). This led him to surmise that predator removal predisposed deer herds to irruptions. Although some influential ecologists, such as Elton (1930), argued that "the balance of nature" does not exist, and perhaps never has existed' (p. 17), it was not until the 1970s that scientific ecologists began making consistent use of nonequilibrium models of ecological phenomena.

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

Similarly, deep ecologists ground their environmental ethic, in part, upon the 'balance of nature'. Naess (1973) states that his ecosophy is 'a philosophy of ecological harmony or equilibrium' (p. 99). Devall (1980) states that '*there is wisdom in the stability of natural processes un-changed by human intervention*' (p. 311). Wittbecker (1986) maintains that 'deep ecology attempts to preserve the balance of humanity and other diverse species. Balance is an ecological value, as is flexibility and richness' (pp. 268-9). These comments exemplify the deep ecologists' claim that if humans would only leave ecological systems alone, they would tend toward eventual stability, balance, and harmony.

Feminists have articulated a similar theme. Warren (1987) states that ecofeminists place 'emphasis on the independent value of integrity, diversity, and stability of ecosystems' (p. 10). Shiva (1988) discusses the fragility of this balance, claiming that society has failed in its responsibility to *protect* nature. Merchant (1980; 1989) shows how the cultural practices encompassed in a technological world-view that has gained credibility from the Enlightenment to the present have destroyed the balance of nature.

Both deep and feminist descriptions of the balance of nature harmonise with scientific definitions used until the 1970s, but increasingly conflict with the current perception of a dynamic nature. Daniel Botkin (1990) chronicles the historical development of human (and scientific ecology's) perceptions of nature. He demonstrates how the myths of 'earth as the divine' and 'earth as the machine' 'both lead to the conviction that undisturbed nature, or perhaps a nature with human beings playing their "natural" roles, is good, while a changing nature is bad' (pp. 12-3). He marshals considerable evidence demonstrating that life on earth is indeed dynamic, rather than static, and that many life-forms require periodic disturbance to survive. Botkin (p. 6) argues that an appropriate ecology for the twenty-first century requires recognition of the dynamic properties of the Earth and its life-support system, and acceptance of a global view of life.

While most scientific ecologists have moved away from the view of a stable nature to one more like Gleason's (1926) individualistic community, ecofeminist and deep ecological discourse still emphasises stability as a virtue. Can this difference be reconciled without doing violence to either perspective? Is the 'discordant' conceptualisation of community stability called for by Botkin compatible with feminist and deep ecology? Although we cannot provide definitive answers in this essay, we suggest that the three approaches can be compatible. For example, Naess (1984) has modified his views somewhat, stating that 'some of the key terms such as *harmonious* and *equilibrium*, which were highly valued as key terms in the sixties, are, I think, less adequate today' (p. 269). Additionally, the ecofeminist emphasis on relations among multiple interdependent, yet individual beings seems consistent with scientific ecology's turn toward a more dynamic view of nature. We maintain that scientific, feminist, and deep ecologists are actually 'seeing' the same phenomena from contrasting angles, and that the quality of future environmental policy is largely dependent on understanding each of their perspectives. Further, a multi-hierar-

chical view of ecosystems can provide a flexible structure within which these three perspectives can mutually enrich each others' contribution to environmental policy formation.

Reinterpreting a Forest with Multiple Hierarchy Theory

To explore this possibility, let us hike along the spongy forest duff in an ancient Douglas fir forest in the Oregon Coast Range. We are awed by the gigantic 500-year-old Douglas firs, the hardwoods along a nearby tumbling stream, and the birds we hear in the canopy. Indeed the forest appears unchanged for centuries – the picture of stability. Upon further investigation we notice large numbers of western hemlocks, ranging in size from seedlings to mature trees, growing among the Douglas firs. Several moss-covered Douglas fir lay on the forest floor, fairly bristling with western hemlock seedlings rooted in their decaying mass. There are few Douglas fir seedlings and no saplings.

Clements, if he were with us, might explain that we are simply observing the process of forest succession. From his organismic perspective the Douglas fir forest is a 'fire disclimax'. In the absence of fire, or other disturbances such as logging, the Douglas fir forest will eventually be replaced by the 'climatic climax' of this biotic region – western hemlock and/or western red cedar. If we protested that the forest appeared static, Clements might chuckle and reply that many of the hemlock trees are already more than three hundred years old and that forest succession takes many hundreds of years in this climatic region. From Clements' perspective, our forest cannot be expected to be stable or in equilibrium until climax is reached. It then would be in a dynamic equilibrium unless fire, human activity, pathogens, severe winds, geologic activity, or other catastrophic events 'disturbed' this balance. Once disturbed, however, succession would simply be reinitiated and eventually (possibly thousands of years later) the climax forest, and dynamic equilibrium, would again hold sway.

Gleason would take exception (as usual) to some of Clements' ideas. Classic Clementian succession may well occur on this specific few hectares, but what about over the ridge where soil characteristics are different, or on a nearby site with poor drainage and saturated soils? Surely, he would argue, the idea of vegetative succession being based on climate alone is overly simplistic, and additionally, chance may be more important than any other factor. For example, what if a fire burned an area that was immediately reseeded with western hemlock from a nearby seed source? Then, simply by chance, the successional progression (including the Douglas-fir stage) would not occur, indicating that biotic communities are individualistic rather than organismic.

To ecologists informed primarily from the process-function view of ecosystems (e.g., Lindeman, Hutchinson, Odum), the notion of any forest being 'balanced' would be largely irrelevant. The changing forest community may alter the complexity or details of the food web, but the timeless processes of

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

energy capture, nutrient retention, and regulation of energy transfer rates continue whatever happens successionaly. Succession simply changes the cast of actors upon the ecosystem stage, sometimes simplifying, sometimes complicating the plot.

Alternatively, landscape ecologists might argue that if we looked at the entire coastal region of Washington, Oregon, and British Columbia on the scale of tens of thousands of years, that forest patches, including those dominated by Douglas fir and western hemlock, simply move about in space as time progresses and disturbances occur. At this scale the overall effect may be that the forest has not substantively changed in millennia (except for the blip caused by humans during the last century).

Deep ecologists would probably combine Clements' organismic perspective with a process-function view. Further, they might add a spiritual dimension to our forest experience, inviting us to explore the interconnections among humans and other life-forms. They would express deep-seated respect, and even veneration, for the forest; recognising its intrinsic value, as well as the deep pleasure it affords humans. The norms, rules, postulates, and value priorities Naess offers would lead to questions regarding how this forest escaped harvest, when nearly all other coastal forests were cut. Answers to these questions would contribute to development of policies to ensure its continued protection. Attempts to understand and preserve ecological harmony and equilibrium in this coastal forest would attain global significance, as they relate to forest preservation in the nearby Cascade range, as well as in ancient forests around the world.

Ecofeminists also would probably endorse a combination of Clementian and process-function views. Although they would take exception to some of deep ecology's claims, they would join deep ecologists in adding a personal dimension to our forest experience. They would explain the destruction of the remaining ancient forests as one manifestation of the destructive power of patriarchy. When discussing future forest policy, they would point out that without an accompanying intra-societal critique, appropriate policy cannot be developed. While this critique should be informed by abstract theory, it also must be grounded in experiential knowledge. For example, ecofeminists would urge us to become acquainted with neighbouring human communities, and their needs. Finally, they would caution against over-generalisation of policies appropriate for this specific US forest, when making policy for other regions of the world.

Each of these perspectives describe the 'balance of nature' differently and affords varying significance to balance. A Clementian view argues that the forest is moving toward balance in the form of climatic climax, while a Gleasonian perspective argues that, because all forests are dynamic, balance is improbable. Because process-functionalists focus on energy and nutrient dynamics, 'balance' simply refers to the current condition of the food web. Landscape ecologists would argue that the forest is balanced, if viewed at an appropriately

broad scale. Because human domination has not destroyed its 'equilibrium', deep ecologists and ecofeminists would view the forest as balanced. Multi-hierarchy theory answers the question of whether the forest is static, balanced, or in equilibrium by asking what the perspective of inquiry is. Hierarchy theory provides a conceptual structure within which the perspectives described above, as well as an unlimited set of alternatives, can co-exist.

In turn, deep and feminist ecologists critique those underlying cultural assumptions upon which humans rely when defining the relationship between themselves and other life-forms. They point out that re-presentation, and even observation, of nature is a function of material situations combined with theoretical perspectives. By combining insights from a hierarchical view of ecosystems with those gleaned from radical ecology, policy makers could develop an awareness that human understanding of forest 'balance' depends upon the spatial and temporal scale of inquiry, as well as normative (whether explicitly articulated or not) visions of the world. Although multiple-hierarchy theory lacks the ethical grounding needed to determine appropriate human interaction with the ancient forest, it provides a flexible structure within which to investigate and implement alternatives suggested by the ethical foundations of deep ecology and/or ecofeminism.

THE STRENGTH OF DIVERSITY

Our summary of deep, scientific, and feminist perspectives toward nature indicates that, while some aspects of each are fundamentally antithetical to others, other aspects are complementary. The paradigm shift occurring in scientific ecology presents those who seek radical change in human attitudes toward nature with a unique window of opportunity because scientific ecologists may be more amenable to including new perspectives in their self-definition while their science is in the process of redefining itself. Additionally, since hierarchy theory explicitly acknowledges the simultaneous existence of multiple 'realities', deep ecology and ecofeminism now may seem less threatening. As the foregoing illustration of different perspectives toward the 'balance of nature' existing in a forest indicates, scientific, deep, and feminist ecology offer different, yet not incompatible approaches to environmental policy. Although these divergent guides may render our journey through the forest somewhat disconcerting, we understand both the individual forest and the concept of balance more completely than would have been possible with any single perspective.

These different perspectives become glaringly evident when we approach the conundrum of human population growth. Smith's (1992) commonly used introductory ecology text summarises scientific ecology's view of human population growth:

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

Globally, human populations are experiencing exponential growth... Already the environment is unable to support such huge populations. Ultimately in one way or another – birth control, war, famine, disease, or mass migration – they will decline sharply, because no environment can support sustained exponential growth. (pp. 182-3)

Smith offers no preferred method for dealing with what he clearly views as a serious problem. Similarly, after discussing the momentum of population growth,³ Begon et al. (1986) state that ‘while we can derive some comfort (or complacency?) from the recent declines in birth rates in developing countries, we must still face up to a problem of quite frightening proportions’ (pp. 162-3). Again, no method for dealing with this ‘problem’ is suggested.

Deep ecologists have shown considerable interest in the phenomenon of exponential growth of human populations, and have not been reticent to suggest solutions to the problem. These primarily revolve around using technology to limit fecundity. Devall (1980) argues that an:

Optimal human carrying capacity should be determined for the planet as a biosphere and for specific islands, valleys, and continents. A drastic reduction of the rate of growth of population of *Homo sapiens* through humane birth control programs is required. (pp. 311-2)

The exponential increase in human numbers is viewed as simply another example of humankind’s anthropocentric arrogance. Gary Snyder, a poet who has been described as a spiritual leader of deep ecology, seeks a 90% reduction in human population as an essential step toward restoring the earth’s biotic integrity (Sale, 1986).

Ecofeminists argue that this approach deflects our attention from the fundamental question of oppression. While agreeing that solutions to the problem of population growth are critical, they claim that current discussions of population control have serious sexist and racist dimensions. Salleh (1990) highlights the hypocrisy of northern appeals to control population growth in the southern hemisphere, pointing out that ‘each infant born into the so-called advanced societies will use about fifteen times more global resources during his or her lifetime than a person born in the Third World’ (pp. 251). Guha (1989) points out that the deep ecological emphasis on biotic integrity deflects attention from the more fundamental ecological problems of overconsumption by élites (in both the industrialised and developing regions of the world), and growing militarisation. Ruether (1975) and Pietila (1990) suggest that the vigour with which men push the adoption of population control programs may indicate more about their fear of female power than their fear of overpopulation.

Clearly, all three groups understand that the rate of human population growth is entangled with any questions regarding environmental policy. Yet, because the discursive screens through which each group views environmental issues differ, their emphases vary. Surely a combination of ecological scientists’

explanation of the earth's limited capacity to support exponential growth in human numbers, deep ecologists' anger at human arrogance, and ecofeminists' refusal to be sidetracked from the issue of domination, could help provide more appropriate responses to such dilemmas. Just as feminist theory has been radicalised by theorists such as hooks, to encompass the lives and ideas of women on the margins of human society, so must ecofeminism stretch to encompass the marginalisation of nonhuman life-forms. Conversely, deep ecology must move beyond the anthropocentric-biocentric construct to encompass the issues of overconsumption and militarisation. Scientific ecologists need to examine the politics behind their investigations, rather than pretending that science proceeds in a vacuum. Both deep and feminist ecology offer constructs that could enable scientists working from a multiple hierarchic perspective to explore the ethics which guide their research, rather than retreating behind the fear that social constraints will pollute their science. In turn, scientific ecology offers hierarchy theory as a common epistemological basis for adding feminist and deep ecological precepts to scientific ecology and thus incorporating them into environmental policy formation. The problem-solving potential of such an alliance more than justifies a struggle to explode the boundaries afforded by each group's unique image of nature.

NOTES

¹ For an ecofeminist explanation of self-in-relation see Mies and Shiva (1993).

² Wittbecker (1986, p. 265) understands Salleh's comments to be 'genetically' deterministic and Fox (1989, p. 17) states that 'in Salleh's version of feminism, women already "flow with the system of nature" by virtue of their essential nature'. There may be an argument, however, for neither claim being justified by Salleh's text. In her review of this manuscript, Salleh requested us to clarify that she did not use the word 'instinctive' in her essay.

³ The momentum of population growth refers to the fact that if a population is growing rapidly, most members are either in their pre-reproductive or reproductive years. Thus, even if the number of young per female is reduced to two, the total number of individuals in the population would still roughly double before population growth ceases (Begon et al., 1986, pp. 162-3).

REFERENCES

- Allen, Timothy F.H. and Thomas B. Starr 1982. *Hierarchy: Perspectives for Ecological Complexity*. Chicago: University of Chicago Press.
- Begon, Michael, John L. Harper and Colin R. Townsend 1986. *Ecology: Individuals, Populations, and Communities*. Sunderland, MA: Sinauer Associates.
- Benston, Margaret L. 1988. 'Women's Voices/Men's Voices: Technology as Language'. In Cheri Kramarae (ed.) *Technology and Women's Voices*, pp. 15-28. New York: Routledge and Kegan Paul.

ECOLOGY: DEEP, SCIENTIFIC AND FEMINIST

- Botkin, Daniel B. 1990. *Discordant Harmonies: A New Ecology for the Twenty-first Century*. New York: Oxford University Press.
- Cheney, Jim 1987. 'Eco-feminism and Deep Ecology', *Environmental Ethics* **9**: 115-45.
- Clements, Frederic E. 1916. *Plant Succession: An Analysis of the Development of Vegetation*. Washington, DC: Carnegie Institution of Washington, Publication 242.
- Davis, Donald 1986. 'Ecosophy: The Seduction of Sophia?', *Environmental Ethics* **8**: 151-62.
- Devall, Bill 1980. 'The Deep Ecology Movement', *Natural Resources Journal* **20**: 299-322.
- Devall, Bill and George Sessions 1985. *Deep Ecology: Living as if Nature Mattered*. Layton, UT: Gibbs M. Smith.
- Elton, Charles 1930. *Animal Ecology and Evolution*. Oxford: Clarendon Press.
- Forbes, Steven A. 1887/1925. The Lake as a Microcosm. *Bulletin of the Illinois Natural History Survey* **15**: 537-50.
- Forman, Richard T.T. and Michel Godron 1986. *Landscape ecology*. New York: John Wiley & Sons.
- Fox, Warwick 1989. 'The Deep Ecology-Ecofeminism Debate and its Parallels', *Environmental Ethics* **11**: 5-25.
- Gilligan, Carol 1982. *In a Different Voice: Psychological Theory and Women's Development*. Cambridge: Harvard University Press.
- Gleason, Henry A. 1926. 'The Individualistic Concept of Plant Succession', *Bulletin of the Torrey Botanical Club* **53**: 7-26.
- Golley, Frank B. 1987. 'Deep Ecology from the Perspective of Ecological Science', *Environmental Ethics* **9**: 45-55.
- Gonzalez, Alberto and Tarla Rai Peterson 1992. 'Enlarging Conceptual Boundaries: A Critique of Research in Intercultural Communication', In Sheryl Perlmutter Bowen and Nancy Wyatt (eds.) *Feminist Critiques in Communication Studies*, pp. 249-78. Cresskill, NJ: Hampton Press.
- Guha, Ramachandra 1989. 'Radical American Environmentalism and Wilderness Preservation: A Third World Critique', *Environmental Ethics* **11**: 71-83.
- Harding, Sandra 1991. *Whose Science? Whose Knowledge? Thinking from Women's Lives*. Ithaca, NY: Cornell University Press.
- hooks, bell 1984. *Feminist Theory: From Margin to Center*. Boston: South End Press.
- hooks, bell 1994. *Outlaw Culture: Resisting Representations*. New York: Routledge.
- Lahar, Stephanie 1991. 'Ecofeminist Theory and Grassroots Politics', *Hypatia* **6**: 28-45.
- Leopold, Aldo 1944. 'Deer Irruptions', *Transactions of the Wisconsin Academy of Sciences, Arts and Letters* **36**: 351-66.
- Lindeman, Raymond L. 1942. 'The Trophic-dynamic Aspect of Ecology', *Ecology* **23**: 399-418.
- Merchant, Carolyn 1980. *The Death of Nature: Women, Ecology, and the Scientific Revolution*. San Francisco: Harper and Row.
- Merchant, Carolyn 1989. *Ecological Revolutions*. Chapel Hill: University of North Carolina Press.
- Mies, Maria and Vandana Shiva 1993. *Ecofeminism*. London: Zed Books.
- Naess, Arne 1973. 'The Shallow and the Deep Long-range Ecology Movement. A Summary', *Inquiry* **16**: 95-100.
- Naess, Arne 1984. 'A Defence of the Deep Ecology Movement', *Environmental Ethics* **6**: 265-70.

- Naess, Arne 1986. 'Intrinsic Value: Will the Defenders of Nature Please Rise?'. In Michael E. Soulé (ed.) *Conservation Biology: The Science of Scarcity and Diversity*, pp. 504-15. Sunderland, MA: Sinauer Associates.
- Offen, Karen 1988. 'Defining Feminism: A Comparative Historical Approach', *Signs: A Journal of Women in Culture and Society* **14**: 119-57.
- O'Neill, Robert V., Donald L. DeAngelis, J.B. Waide and Timothy F.H. Allen 1986. *A Hierarchical of Ecosystems*. Princeton, NJ: Princeton University Press.
- Peterson, Markus J. 1991. 'Wildlife Parasitism, Science, and Management Policy', *The Journal of Wildlife Management* **55**: 782-9.
- Pietila, Hilka 1990. 'The Daughters of Earth: Women's Culture as a Basis for Sustainable Development'. In J. Ronald Engel and Joan Gibb Engel (eds.) *Ethics of Environment and Development: Global Challenge, International Response*, pp. 235-44. Tucson: University of Arizona Press.
- Plumwood, Val 1991. 'Nature, Self, and Gender: Feminism, Environmental Philosophy, and the Critique of Rationalism', *Hypatia* **6**: 3-27.
- Ruether, Rosemary 1975. *New Woman – New Earth*. New York: Dove.
- Romesburg, H. Charles 1981. 'Wildlife Science: Gaining Reliable Knowledge', *The Journal of Wildlife Management* **45**: 293-313.
- Sale, Kirkpatrick November 1986. 'The Forest for the Trees: Can Today's Environmentalists Tell the Difference?', *Mother Jones* **11**: 26, 32.
- Salleh, Ariel Kay 1984. 'Deeper than Deep Ecology: The Eco-feminist Connection', *Environmental Ethics* **6**: 339-45.
- Salleh, Ariel 1990. 'Living with Nature: Reciprocity or Control?'. In J. Ronald Engel and Joan Gibb Engel (eds.) *Ethics of Environment and Development: Global Challenge*, pp. 245-53. Tucson: University of Arizona Press.
- Salleh, Ariel 1992. 'The Ecofeminism/Deep Ecology Debate: A Reply to Patriarchal Reason', *Environmental Ethics* **14**: 195-216.
- Shiva, Vandana 1988. *Staying Alive: Women, Ecology and Development*. London: Zed.
- Smith, Robert L. 1992. *Elements of Ecology*, third edition. New York: Harper Collins Publishers.
- Steeves, H. Leslie 1988. 'What Distinguishes Feminist Scholarship in Communication Studies?', *Women's Studies in Communication* **11**: 12-7.
- Stearney, Lyn M. 1994. 'Feminism, Ecofeminism, and the Maternal Archetype: Motherhood as a Feminine Universal', *Communication Quarterly* **42**: 145-59.
- Warren, Karen J. 1987. 'Feminism and Ecology: Making Connections', *Environmental Ethics* **9**: 3-18.
- Warren, Karen J. 1990. 'The Power and Promise of Ecological Feminism', *Environmental Ethics* **12**: 125-46.
- Warren, Karen 1991. 'Introduction', *Hypatia* **6**: 1-2.
- Warren, Karen J. and Jim Cheney 1991. 'Ecological Feminism and Ecosystem Ecology', *Hypatia* **6**: 179-97.
- Warren, Karen J. and Jim Cheney 1993. 'Ecosystem Ecology and Metaphysical Ecology: A Case Study', *Environmental Ethics* **15**: 99-116.
- Wittbecker, Allen E. 1986. 'Deep Anthropology: Ecology and Human Order', *Environmental Ethics* **8**: 261-70.
- Zimmerman, Michael E. 1987. 'Feminism, Deep Ecology, and Environmental Ethics', *Environmental Ethics* **9**: 21-44.