

## policy

# Conceptual Ambiguities and Practical Challenges of Ecological Forestry: A Critical Review

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Although the importance of science is widely acknowledged among forestry researchers and practitioners, the normative and ethical foundations of forest management remain generally neglected. To illustrate this trend and explain why it is problematic, we discuss the example of “ecological forestry,” currently being proposed as a strategy and indeed a philosophy, of sustainable multiple-use forest management. We briefly summarize the theoretical underpinnings and conceptual development of ecological forestry, before critically examining the roots and implications of its pervasive normative and ethical ambiguities. Without clarification, these ambiguities create conceptual challenges that preclude a clear understanding of what ecological forestry is or aspires to achieve, allowing for a problematic range of variability in how it can be applied. We suggest that these conceptual ambiguities and practical challenges are not unique to ecological forestry and that any cohesive, enduring philosophy for sustainable natural resource management and conservation requires clear normative and ethical foundations.

**Keywords:** ecological forestry, conservation ethics, natural resource management, intrinsic value, normative

The past several decades have witnessed a flux of ideas about how we ought to tackle the “wicked problems” of natural resource management and conservation (Ludwig 2001). Often packaged as “buzzwords,” such as sustainability or health, these ideas seem to cycle in a quick and predictable pattern, from broad appeal to overuse to practical obsolescence (Callcott et al. 1999). Even as these ideas come and go, questions about how to manage the world’s ecosystems remain urgent, especially in light of growing concerns about human land-use pressures and global climate

change. Often we look to science for solutions (Steel et al. 2004). However, while decisions about natural resources are certainly based on scientific information *describing* how the world *is*, they also inevitably reflect normative ideas *prescribing* how the world *should be* (Nelson and Vucetich 2012). Unfortunately, ideas in natural resource management are usually discussed in overwhelmingly if not exclusively scientific or logistical terms, leaving their normative and ethical dimensions critically underdeveloped (Dietz 2003). Without normative substance, these ideas remain vague and equivocal (Callcott

et al. 1999), arguably precluding them from developing into durable or effective strategies for management and conservation.

The crippling effects of such normative deficiency are particularly evident in what seems liable to become another ephemeral idea in forest management, “ecological forestry.” As described in the literature over the past two to three decades, ecological forestry is based on natural processes of disturbance and succession, theoretically mitigating many of the adverse impacts associated with traditional forestry practices and thereby allowing managers to meet economic objectives without compromising the ecological values of forests (e.g., Seymour and Hunter 1999, Franklin and Johnson 2012). In the current literature, it seems that ecological forestry is being recommended as a science-based, “eco-friendly” brand of forestry, a promotional strategy likely to resonate with a global community striving to realize some enduring vision of sustainability (Millennium Ecosystem Assessment 2005). However, without clear normative foundations lending it cohesion or consistency, ecological forestry does not coalesce into the overarching philosophy of forest management and conservation it purports to be.

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Although ecological forestry has been gaining prominence in recent years, the literature about it has not been reviewed or, perhaps more importantly, critically evaluated. In this article, we will show how conceptual ambiguity leads to problematic philosophical and practical inconsistencies in ecological forestry. After briefly summarizing the extant literature, we explain how a poorly defined concept, “ecological,” both underlies and is perpetuated by normative and ethical ambiguities, which allow for variable and even conflicting interpretations of ecological forestry. We suggest that these normative and ethical ambiguities must be addressed in overtly normative and ethical terms, and we propose practical measures by which this might be achieved not only in the context of ecological forestry but also more broadly in natural resource management.

## Ecological Forestry: An Overview

The theory behind what is now commonly called “ecological forestry” has largely been developed in the literature about retention and disturbance-based management. We suggest that both of these practices fall under the umbrella of ecological forestry. This is not to say that self-described ecological forestry, retention, and disturbance-based management are entirely synonymous, but rather, to the extent that they share certain key ideas and, indeed, conceptual challenges, they exhibit a sort of “family resemblance” (Wittgenstein 1953) that allows us to group them together for discussion and critique. We will briefly discuss the key ideas from the retention and disturbance-based management literature cited as theory in the ecological forestry literature, before tracing the historical development of ecological forestry *per se*. To organize this section, we discuss the three bodies of literature separately, but subsequently when we refer to ecological forestry we will be referring to the cumulative body of literature.

### Retention

Unlike so-called traditional forestry practices, generally focused on what is removed from a harvested stand, ecological forestry primarily focuses on what is left behind or “retained” (Gustafsson et al. 2012). Although only recently associated with ecological forestry, the use of retention is not new. Retention has been used for centuries as part of various silvicultural systems for multiaged management, which, although

never applied as extensively as even-aged practices, have been implemented to meet a suite of timber and nontimber objectives (e.g., Westveld 1939, O’Hara 2014). In ecological forestry, the basic objectives of retention are to maintain and enhance structural heterogeneity; ensure the continuity of species assemblages from the preharvest to the postharvest stand (as known as “lifeboating”); and create landscape connectivity (Franklin et al. 1997, see also Lindenmayer and Franklin 2002). Although “retention” can refer to particular species assemblages (Franklin et al. 2007), more often it refers to structural elements such as snags, old trees, and logs (Franklin et al. 1997). These “legacies” are left to function as habitat for forest organisms and sustain key ecosystem functions (Franklin et al. 1997).

Along with structural legacies, some proportion of live trees can also be retained at harvest (Franklin et al. 1997). Because the specific amount of green tree retention can vary, regeneration harvest using a retention approach is often referred to as “variable retention harvest.” Generally retention levels are not supposed to be lower than 5–10% of the total stand volume (Gustafsson et al. 2012). Green tree retention can be dispersed, with trees scattered throughout a harvested stand, or aggregated, with trees left in clusters (Franklin et al. 1997). Live trees are retained at least through a full harvest cycle, and the rotation length is supposed to be long enough for stands to develop the heterogeneous conditions occurring under so-called “natural” disturbance regimes (Franklin et al. 1997, 2007).

Lindenmayer et al. (2012) and Gustaf-

son et al. (2012) recently published influential reviews of the retention method, endorsing it for its ability to achieve conservation objectives in concert with other social or economic objectives (for an earlier, more critical review, see also Vanha-Majamaa and Jalonen 2001). The body of empirical work on retention has grown considerably since the turn of the century, with researchers particularly interested in its impacts on biodiversity (for meta-analysis, see Fedrowitz et al. 2014, Mori and Kitagawa 2014). The results tentatively indicate that using retention can sustain some (but not all) species across a harvest, at least in the short term (Rosenvald and Löhmus 2008, Fedrowitz et al. 2014, Mori and Kitagawa 2014).

### Disturbance-Based Management

Underlying ideas about retention of green trees and biological legacies in ecological forestry is an understanding of natural disturbance and its role in forest ecosystems. The study of disturbance increased dramatically after the 1980 eruption of Mount St. Helen (Franklin and MacMahon 2000). Parallel to the study of such catastrophic disturbances, an interest in small-scale disturbance events, which create gaps and enhance forest structural complexity over time, arose (e.g., Oliver 1981, Franklin et al. 2002). Disturbance is now considered an important driver of forest dynamics, creating heterogeneous conditions that provide habitat for a diversity of species and support critical forest ecosystem functions (Spies 1998).

Much like retention, the idea of using forestry to emulate natural disturbance has deep silvicultural roots (Smith et al. 1997).

## Management and Policy Implications

Forest management approaches encompassed by the phrase “ecological forestry” are being enthusiastically promoted around the globe. Our critique suggests that the normative and ethical underpinnings of an ecological forestry approach need to be openly communicated and justified before it can be widely understood, adopted, or endorsed. Advocates and practitioners of the approach need to be consistent in communicating an appropriate, normatively explicit vision for how forests should be managed—something that is not currently being done. This vision should be rooted in an ethic that differs fundamentally from the anthropocentric utilitarian ethic underlying traditional forest management to avoid perpetuating the problems associated with unsustainable management practices in the past. These implications are not limited to an ecological forestry approach. More broadly, managers and policymakers in natural resources should not only acknowledge but also meaningfully engage with the normative dimensions of management and conservation. Institutionalized forums should be created in management agencies to encourage open discussion of values and ethical beliefs as an integral part of decisionmaking processes. This action will ensure that management decisions are not just made for political, economic, or logistical expediency but in fact reflect managers’ best judgments about how the land should be managed.

Although prevailing forestry practices throughout the 20th century tended to deviate from the complex model of natural disturbance to favor efficiency and control (Puttmann et al. 2009), over the past several decades disturbance-based management seems to have experienced a renaissance, particularly in the boreal forests of Canada (Klenk et al. 2009, Kuuluvainen and Grenfell 2012). For example, Hunter (1993) hypothesized that forest biodiversity adapted to a particular natural disturbance regime would also be adapted to anthropogenic harvests modeled thereon. Several years later, he advanced similar ideas, more fully developed as part of a program of multiple-use management, under the label “ecological forestry” (Seymour and Hunter 1999; see below). Although Hunter (1993) mostly discussed the silviculture of disturbance-based management, Attiwill (1994) reviewed the current ecological knowledge about a broad spectrum of natural disturbances, arguing that managers who want to sustainably harvest timber need to understand and design prescriptions based on their forest’s natural disturbance regime. North and Keeton (2008) echoed this argument, emphasizing the potential of disturbance-based management to meet conservation objectives and sustain landscape connectivity, whereas Long (2009) highlighted the potential of “emulating natural disturbance regimes” to restore and enhance the resilience of forested landscapes. Similarly, the idea that humans mimic the role of disturbances as “editors...selectively remov[ing] or modify[ing] elements of an ecosystem while leaving others intact” (Franklin et al. 2000, p. 9) is central to ecological forestry, premised on the idea that if a harvest more closely resembles natural disturbance, damages to forest ecosystem processes, functions, and biodiversity can be minimized.

### Ecological Forestry

Drawing on ideas from retention and disturbance-based management, ecological forestry attempts to mimic the effects of natural processes of disturbance and succession by strategically retaining certain elements of the preharvest stand. Although they were certainly not the first to express these ideas (Smith et al. 1997), Spurr and Cline (1942, p. 418) were the first to classify them as ecological forestry, when they argued that “correlate[ing] our forest practices with the natural factors operative in the forest” would yield stands of higher commercial value than

intensive management. Whereas Spurr and Cline’s primarily economic motivations may not be shared by many contemporary ecological forestry proponents, the core idea that management should reflect the natural dynamics of a forest has remained intact in the ecological forestry literature to the present day. However, as noted above, this idea was not widely applied in the 1940s, and commercial forestry mainly continued to simplify and homogenize forest stands for efficient production of timber (Curtis et al. 2007) until the final decades of the 20th century, when, in light of new scientific information about the complexity of forest ecosystems (Aber et al. 2000), traditional forestry methods began to appear problematic (Franklin 1993). Largely in response to a society increasingly attuned to the nontimber (e.g., aesthetic, recreational, and biodiversity) values of forests (Bengston 1994), by the early 1990s a new model of forest management was taking shape under the label “ecosystem management,” in which forests were supposed to be managed as multifaceted systems embedded in larger socioecological landscapes (Grumbine 1994). For timber production to continue in this context, a different type of forestry needed to be found.

Franklin (1989a, 1989b) rose to the challenge by proposing a “new forestry,” in which silvicultural prescriptions would be designed to imitate natural disturbance by leaving structural and biological legacies in the harvested stand. Although it represented a departure from the intensive management practices prevailing at the time, there was nothing particularly “new” about the forestry being proposed, which, as we have discussed, was essentially an amalgamation of ideas well established in silvicultural theory and practice (Westveld 1939, Smith et al. 1997). However, it is important to realize that Franklin (1989a) was advancing more than a silvicultural system when he recommended a new forestry. He also encouraged a view of forests as complex, integrated systems, which should be managed in a “kinder, gentler” manner than traditional forestry (Franklin 1989a). This overtly ethical stance marked a striking shift away from the dominant mentality of most of the 20th century, when forests were seen as mere resources for human use (Bengston and Iverson 2003). Against this backdrop new forestry appeared novel indeed, sparking an immediate flutter of conversation in the forestry world (Gillis 1990, Hansen et al. 1991,

DeBell and Curtis 1993, McQuillan 1993). And yet, although the novelty of new forestry was arguably ethical, rather than silvicultural, its ethical dimensions have been largely neglected since Franklin (1989a, 1989b) first brought them to light. Whereas the science and silviculture of new forestry received considerable attention throughout the following decade (Orians and Franklin 1990, Swanson and Franklin 1992, Franklin 1993, Franklin and MacMahon 2000, Franklin et al. 2000), its ethical underpinnings were never further developed.

The term “new forestry” was used periodically into the 21st century (e.g., Marshall 2000, Maguire and Chambers 2005, Ribe 2009), even as the phrase “ecological forestry,” which had been used only occasionally since 1942 (Powers 1987, Shiva 1993, Hansen et al. 1995), began appearing more frequently. As such, there may be some disagreement over whether what was once known as new forestry and what is now known as ecological forestry are essentially the same or distinct ideas. The literature suggests multiple interpretations. Pommerening and Murphy (2004), for example, differentiated between the two, identifying new forestry as a philosophy while classifying ecological forestry as an associate of ecosystem management (see also Simberloff 1999, who distinguished new from ecological forestry, but did not explain how they differ). Perevolotsky and Sheffer (2009), on the other hand, used new and ecological forestry simultaneously and apparently interchangeably. We suggest that the ideas now advanced as ecological forestry are coterminous with the ideas once labeled new forestry and that ecological forestry represents a development rather than a distinction, drawing on nearly three decades of additional science and, of course, keyed now to the social context of the early 21st century. Underscoring the conceptual development is the shift in terminology, whereby the ideas advanced are no longer identified by their novelty, suggested in the label *new* forestry, but by their allegedly scientific backing, hence, *ecological* forestry.

The phrase “ecological forestry” appears to have entered the contemporary mainstream when Seymour and Hunter (1999) introduced it as a form of matrix management, part of a landscape triad approach to multiple-use forest management. Since that time, self-described ecological forestry has been applied on the ground in only a handful of locations (Corace et al.



2009, Johnson and Franklin 2012), although variable retention harvest (e.g., Seymour et al. 2006, Wilson and Puettmann 2007) and disturbance-based management (e.g., Long 2009, Kuuluvainen and Grenfell 2012) have been implemented somewhat more extensively. More commonly, ecological forestry serves as an interpretive lens, adopted to explain or theorize about forest management in a specific geographic location (e.g., Stoneman 2007, Mitchell et al. 2009, Perevolotsky and Sheffer 2009, Franklin and Johnson 2012). And yet, even though it has been used predominantly as a conceptual framework, the meaning and practical implications of ecological forestry remain obscure because of persistent conceptual ambiguities. We now discuss some of these ambiguities, suggesting that they are both theoretically and practically problematic for ecological forestry.

## Ecological Forestry: A Critique

### Underlying Conceptual Muddle

Natural resource management is an application of ethics. Ethics reflect normative ideas about how we ought to behave or interact with the world around us (Nelson and Vucetich 2012). These ideas about how the world *ought to be* are grounded in beliefs about how the world *is*, which we might call a metaphysic (Mathews 1991) or, more simply, a worldview. A worldview, in turn, is solidified, i.e., translated from a philosophical abstraction into observable norms and behaviors, when its associated ethics are expressed through human actions and interactions in the real world (Vaske and Donnelly 1999).

The conventional, modern Western worldview posits two completely separate domains of existence: humans and nature (Plumwood 1993). This divisive, or *dichotomized*, worldview has historically engendered two different ethical interpretations. First, the human good is the only good, so nature (having no good of its own) can and should be used in whichever way will benefit the human species. This position is characteristic of what ethicists call an anthropocentric, utilitarian ethic, which is often used to justify human cultivation or control of nature (Callicott 1990). Second, nature is good to the extent that it is natural (i.e., not human), so humans ought to leave it alone. This position is characteristic of what ethicists call “natural law theory,” in which what is “natural” is right and ought to be (Nelson

and Vucetich 2012). Natural law is often used to justify a “hands-off” approach to management or nonintervention (Gore et al. 2011). Although the two ethics suggest very different ways of interacting with the world, both are rooted in and depend on the presumption that humans are separate from nature. In light of ecology and evolutionary theory, however, it has become clear that humans can no longer reasonably, i.e., nonarbitrarily, be set apart from the rest of the world (Berkes 2004). And yet, although the separation of humans from nature has increasingly been challenged in recent years (Mathews 1991, Manfredo et al. 2009, Callicott 2013), it remains a prominent and influential idea in natural resource management, as we see in ecological forestry.

The goal of ecological forestry is not to manage forests to be “natural,” per se. Instead, the goal is to manage forests to be “ecological,” hence “ecological forestry.” Although ecological conditions are purportedly based on natural conditions (i.e., non-anthropogenic processes of disturbance and stand development), unlike natural conditions, which by conventional definition would necessarily exclude humans, ecological conditions can be created, maintained, or restored by humans, e.g., using ecological forestry. By suggesting that common ground can and indeed does exist between humans and nature, the concept ecological seems to represent an alternative, nondichotomized worldview somehow integrating humans and nature. However, although it is apparent that ecological is neither purely natural nor entirely human, its meaning is not more specifically characterized. That is, nowhere does the literature indicate what ecological *is*, only what it is *not*. Without such a positive characterization, “ecological” can only default to the dichotomized lexicon of the worldview it otherwise seems inclined to undermine, remaining tethered to the conceptual separation of humans from nature. We see this in the definition of natural disturbance regimes, which serve as a reference for *managed* ecological conditions, but which are still identified by a lack of “significant” human impact, typically pre-European settlement (Seymour and Hunter 1999, Corace et al. 2009, Franklin and Johnson 2012). Essentially, ecological forestry suggests that humans can (and should) create nonhuman conditions, a confused and somewhat paradoxical directive that, far from synthesizing “humans” and “nature,” actually reinforces the distinction between

them (for a similar discussion, see Klenk et al. 2009). Although ecological forestry begins blurring the boundaries between humans and nature, in what appears to be an attempt to dismantle the dichotomized worldview, it lacks both the conceptual tools and, as we discuss next, the normative structure to consummate the effort.

### What Is “Ecological?”

In theory, collapsing the conceptual distinction between humans and nature also undermines the ethical frameworks predicated on it, necessitating the development of a new ethic. As discussed above, a worldview separating humans from nature lends itself to two fairly obvious ethical interpretations, anthropocentric utilitarianism and natural law. In contrast, the (partial and nondescript) ecological worldview suggested by ecological forestry does not immediately suggest such a clean ethical interpretation. Once the distinction between humans and nonhumans (previously “nature”) is dissolved, there are no easy or intuitive rules to help arbitrate interactions among them. Between complete nonintervention and absolute domination is a nearly infinite range of ways in which humans might inhabit the world. What set or subset of activities within this range constitutes the ecological relationship envisioned by ecological forestry? To answer this question, ecological forestry requires a normative or ethical framework, clearly defining the principles, norms, values, and beliefs that should guide and structure human behavior in an ecological world.

Although it may seem scientific when used in a general sense, the word “ecological,” as used in ecological forestry, is actually a normative term. Unlike properties such as mass or temperature, which can be quantified and measured, ecological conveys underlying beliefs about what sorts of conditions are good or desirable. Depending on the operative notions of “good” or “desirable,” ecological can be interpreted variably. For example, from a carbon storage standpoint, a light thinning in a stand of Douglas-fir (*Pseudotsuga menziesii*) might seem ecological. From a butterfly conservation standpoint, a regeneration harvest creating early seral conditions in the same stand might seem ecological. Both perspectives might be backed by credible science and both can reasonably be justified as ecological, but because they reflect different values, they entail different ideas about how the forest should be managed and, if implemented,

**Table 1. Examples from the literature identifying management objectives and desired future conditions as critical but exogenous variables determining ecological forestry prescriptions.**

Citation	Statement about management objectives/desired future conditions
Swanson and Franklin (1992)	“A major challenge to ecosystem scientists and managers is merging the design of forest stands, landscape patchworks, and stream/riparian networks to produce the most desirable future landscape conditions and levels of productivity. The difficult social aspect of this challenge is to determine those desirable future conditions” (p. 271).
Franklin et al. (2000)	“The question of how much is conceptually easy but practically difficult to answer. Obviously, legacies should be retained at levels sufficient to achieve the desired management goals!” (p. 6).
Lindenmayer and Franklin (2002)	“Identifying and prioritizing management objectives, which defines the tradeoffs between economic and conservation goals, must precede the development of a silvicultural prescription (Gibbons and Lindenmayer 1996, Franklin et al. 1997). Once management objectives are defined and the relevant information assembled, silvicultural prescriptions that provide for structural retention can be developed” (p. 167).
Mitchell and Beese (2002)	“As with other silvicultural systems, successful implementation of the retention system requires clear identification of a desired future condition of the stand and landscape” (p. 402).
Franklin et al. (2007)	“The implementation and expression of ecological forestry concepts will vary in practice based upon specific goals for management” (p. 1).
Long (2009)	“ENDR is one of several similar conceptualizations...with the goal of approximating a desired reference condition” (p. 1868).
Franklin and Johnson (2012)	“[R]estoration should center on restoring resilience and functionality in the context of desired future conditions, even while learning from the past” (p. 430).
Gustafsson et al. (2012)	“The necessary area or volume to retain within stands will vary with and should be adapted to local conditions, but we suggest 5–10% as a strict minimum, and considerably more is often likely to be needed to achieve the desired ecological objectives” (p. 635).

lead to very different forest conditions on the ground. Unfortunately, as discussed below, where normative clarity is critical we find only ambiguity in the ecological forestry literature, which does not clearly define or characterize the word “ecological,” leaving its meaning and implications open to variable and potentially conflicting interpretations.

Although the scientific and silvicultural dimensions of ecological forestry are discussed extensively in the literature, its normative dimensions are either neglected entirely or treated in the most superficial fashion. For example, management objectives and desired future conditions are clearly identified as critical determinants of ecological forestry prescriptions (Table 1). Management objectives and desired future conditions, of course, reflect normative ideas about how a forest *should* be managed. However, far from explicitly articulating these underlying normative ideas, ecological forestry does not even define its own objectives or desired future conditions, treating them instead as exogenous variables that are developed separately, before ecological forestry treatments are prescribed: “Answering the question of how much to retain is conceptually very simple—it depends on the management objectives for the harvest unit” (Franklin et al. 1997, p. 12). Without defining or otherwise limiting the sorts of objectives it might be used to pursue, ecological forestry can be applied in a problematically wide range of ways to achieve a problematically wide range of outcomes.

Similar is the ubiquitously stated commitment to managing for a plurality of values (Table 2). Although ecological forestry ostensibly “integrates” or “balances” multiple values, the meaning, logistics, and implications of these claims are unclear. Should “ecological” objectives automatically take precedence over conflicting “social” or “economic” objectives? What constitutes an appropriate balance of values? How should managers negotiate compromises and make tradeoffs between competing objectives? These sorts of normative questions demand normative answers, which are never provided in the ecological forestry literature.

If ecological forestry were being proposed as a set of tools or a methodology, clear conceptual foundations and normative or ethical guidelines might be unnecessary. By and large, however, ecological forestry is presented not as a mere set of tools, but as a “philosophical basis” for forest management (Franklin and Johnson 2013, p. 430), a “fresh *philosophy* that distinguishes [it] from traditional forestry” (Franklin 1989b, p. 38; emphasis added). Some level of variability in interpretation is perhaps inherent in any philosophical framework, but a set of ideas so unconstrained as to allow for fundamentally conflicting, even contradictory, interpretations cannot be called a philosophy (Callicott 1993). And although it is perhaps unrealistic to set site-specific objectives or identify appropriate tradeoffs at a theoretical level, it is possible and indeed paramount that a self-identified “philosophy” of forest management be unified by a clear, consistent

conceptualization of how forests should rightly or appropriately be managed. Without normative or ethical clarity, ecological forestry can be applied in ways that are incommensurable with one another in intention, outcome, or both, and such a loose amalgam does not constitute a viable philosophy (Callicott 1993).

### **False Hopes**

Certain ideas expressed in the literature might encourage the impression that ecological forestry advances a clear normative philosophy of forest management. For example, Franklin et al. (2007, p. 23) write that ecological forestry “always include[s] ecological objectives,” which may seem to suggest that ecological forestry is oriented toward “eco-friendly” or “green” agendas. However, without value-explicit definition, “ecological objectives” can mean virtually anything. This phrase can refer to plants, animals, stream temperature, or soil nutrients, to name just a few variables. It might refer to individual organisms, one species, a forest community, or an entire ecosystem. It can be gauged at the stand or the landscape scale, over the short or long term. It may or may not include human societies. In short, without clarification, the descriptor “ecological” does little to define a discrete or normatively consistent set of management objectives. Franklin et al. (2007) do not explain what they mean by ecological objectives, nor do they specify to what extent they should be “included,” particularly relative to nonecological objectives.

**Table 2. Examples from the literature suggesting ecological forestry can be used to manage for multiple values.**

Citation	Statement about multiple values
Franklin (1989a) Swanson and Franklin (1992)	“[W]e have finally begun developing a sound ecological basis for the concept of multiple use forestry” (p. 549). “The intent of these programs [ <i>New Perspectives, New Forestry</i> ] is to better match management practices with the broad array of human values and philosophies concerning natural resources” (p. 263).
Franklin et al. (1997)	“[T]he creation and maintenance of structurally complex managed stands is being developed as the primary approach to managing forests for multiple, complex objectives, including production of wood products” (p. 112).
Lindenmayer and Franklin (2002)	“Ecologically sustainable forest management [ <i>using retention forestry</i> ] perpetuates ecosystem integrity while continuing to provide wood and non-wood values” (p. 6).
Palik et al. (2002)	“In all cases, the ultimate objective is to facilitate implementation of natural disturbance-based silviculture without ignoring the economic goals of commercial timber management or the interests of stakeholders concerned about biodiversity” (p. 353).
Franklin et al. (2007)	“[S]ome fundamental principles for ecological forestry transcend systems, conditions, objectives, and context, and can be applied in varying degrees in virtually all settings where melding of ecological and economic goals is an objective” (p. 1).
Franklin and Johnson (2012)	“We view our restoration strategy as a credible alternative to the extreme choices with which stakeholders are currently being presented of either managing federal lands for intensive wood production, on the one hand, or effectively preserving all of it for owls, on the other” (p. 437).
Gustafsson et al. (2012)	“[R]etention forestry...is highly adapted to the sustainable management of forests for environmental, economic, and cultural objectives” (p. 643).
Lindenmayer et al. (2012)	“Global adoption of the retention approach in implementing sustainable forest management is critical to balancing the ecological, social, and economic values of forests” (p. 428–429).
Franklin and Johnson (2013)	“Management approaches using ecological forestry principles do not attempt to optimize singular outcomes but, rather, integrate multiple ecological, economic, and cultural objectives” (p. 430).

Using natural disturbance as a model might also seem to limit the management actions that can be called ecological forestry. On reflection, however, this line of reasoning also falters. Natural disturbances come in all shapes and sizes, such that “there are probably few human disturbances for which a counterpart cannot be found in nature” (Oliver and Larson 1996, p. 92). Even without a great feat of rhetoric, it is not difficult to argue that any management action is somehow based on natural disturbance. Not only is there a vast spectrum of disturbances from which to choose, at multiple spatial and temporal scales, (Attiwill 1994), but there are also many ways for management to be based on natural disturbance, ranging from the most literal to the most liberal interpretations of “based on.” The literature never suggests where within this range practitioners should aim:

managers should determine how similar to the reference condition a stand needs to be to achieve ecological forestry goals. The answer is driven by objectives. (Franklin et al. 2007, p. 34)

Because, as we have already demonstrated, objectives in ecological forestry are undefined and apparently unconstrained, this statement essentially provides ecological forestry practitioners free license to adhere to (or deviate from) a given model of natural disturbance to any degree.

### The Problem with Variability

In some ways, variability of interpretation and application might be considered a

merit of a management program, allowing managers to respond to site- or context-specific conditions (Olsson et al. 2004). However, technical or operational flexibility should not be confused with normative or philosophical inconsistency. An analogy will illustrate the point. A captain needs freedom to maneuver his ship, responding to changes in the wind or turbulent waters, but he should always steer by a compass pointed toward his known destination. In a forest management philosophy, normative guidelines serve much the same function as the compass for our captain, ensuring that, even though prescriptions may vary site by site, they are all pointed in the right direction. Lacking such a normative compass, ecological forestry can only steer blindly toward some abstractly desirable but otherwise ill-defined “ecological” state, which may or may not be where we need to go. As long as a prescription is somehow based on natural processes and designed to achieve multiple objectives, at least one of which can in some sense be considered ecological, anything from a 1% retention regeneration harvest to the harvest of a single tree can be called ecological forestry.

Far from merely creating conceptual challenges, normative ambiguity and the wide range of variability it permits are problematic for very practical reasons as well. First, normative ambiguity heightens the likelihood of misunderstanding, miscommunication, or even misrepresentation. For example, certain environmentally inclined

sectors of the public might tentatively support ecological forestry on the assumption that it will be used to pursue “ecological objectives,” only to become outraged when a dramatically different, perhaps more financially motivated idea of ecological objectives than they envisioned is realized in practice. Forestry is already plagued by a climate of polarization and distrust (Winkel 2014), a situation that can only be exacerbated by a lack of transparency, particularly with regard to values (e.g., Siegrist et al. 2000).

Perhaps more troubling, though, is the danger that forests could continue to sustain significant damage under the aegis of ecological forestry. Mounting evidence suggests that low (less than 15%) levels of retention do not mitigate many of the adverse impacts associated with intensive harvests (Aubry et al. 2004, Rosenvald and Löhmus 2008, Johnson et al. 2014). Is this potential for continuing degradation consistent with the promise of ecological forestry, as a solution to the problems associated with traditional forestry (Franklin 1989b, Seymour and Hunter 1999)? We suggest it is not, and yet, based on the existing literature, management implementing such low levels of retention can quite readily be enacted under the banner of ecological forestry. Only a normative framework clearly defining appropriate goals and expectations for sustainable (or ecological) forest management will limit the variability currently allowed within ecological forestry, lessening the risk that it will be



**Table 3. Examples of statements in the ecological forestry literature that can be interpreted from both an anthropocentric and a non-anthropocentric perspective.**

Citation	Ethically ambiguous statement
Franklin (1989a)	“Incorporating ecological knowledge into management systems for the compatible production of commodities and protection of ecological values is critical. Such a new forestry concept should occupy a central place in the current debate as the basis for sharing some of the pie, rather than dividing it” (p. 549).
Orians and Franklin (1990)	“As I look around at the different practices that we could change, the most important single thing that I could see that would maintain ecological values would be to leave some big green trees behind on cutovers...large amount of diversity is associated with the big green trees and with the standing dead-and-down material that they eventually become, so that we can provide a lot of function and a lot of habitat with green-tree retention” (p. 448).
Franklin et al. (1997)	“Variable retention harvest prescriptions are appropriate where management objectives include maintenance or rapid restoration of environmental values associated with structurally complex forests” (p. 115).
Lindenmayer and Franklin (2002)	“Conserving biodiversity for its own sake is only one of many possible goals of matrix management. Another is the production of commodities, such as wood, and services, such as well-regulated flows of high-quality water” (p. 7).
Long (2009)	“[I]t is anticipated that ENDR will be an effective tool in the conservation of biodiversity which will, in turn, provide buffering with respect to ecosystem processes” (p. 1869).
Mitchell et al. (2009)	“Ecological forestry has been often used when conservation of biodiversity is a major goal, but it is also relevant to maintaining or enhancing ecological services” (p. 395).
Franklin and Johnson (2012)	“[R]estoration should center on restoring resilience and functionality in the context of desired future conditions, even while learning from the past” (p. 430).
Gustafsson et al. (2012)	“Although forest composition, structure, and dynamics vary among different forest types around the globe, the goals for the sustainable management of forests and the basic ecological principles guiding their use are the same. Timber harvesting or any other extraction of biomass should not reduce the possibilities for the future long-term provision of biodiversity and other ecosystem services” (p. 643).

used in ways that perpetuate the problems it ostensibly solves.

### A New Ethic?

We opened by observing that buzzwords in natural resources tend to come and go, often without appreciably improving our approach to management and conservation. We suggest that this occurs because the ideas fail to reach to the root of the problem. A solution is only adequate if it solves the problem it seeks to address; hence, the inadequacy of so-called “band-aid” solutions, which staunch the wound but fail to treat the underlying ailment. Ecological forestry, like new forestry before it, purportedly represents a solution to the perceived problem of traditional forestry (Franklin 1989b, Seymour and Hunter 1999). To determine whether this solution is adequate, we first need to identify the precise nature of the problem with traditional forest management. Many adverse biophysical impacts have been associated with intensive forestry (Aber et al. 2000), but arguably these negative outcomes are merely symptomatic of a more fundamental pathology, a flawed ethical orientation treating forests as mere resources for human exploitation (White 1967, Plumwood 1993). If the root problem of traditional forest management is an antiquated, inappropriate ethic, ecological forestry needs to advance an alternative, more appropriate ethic.

Natural law theory and anthropocentric utilitarianism are both relics of the

worldview underlying traditional forest management, in which humans are held separate and distinct from nature. If no such separation exists between humans and nature, however, an ethic valuing one to the exclusion of the other appears arbitrary and inconsistent with reality, and therefore inappropriate. The question we must ask is whether the ethics of ecological forestry more closely align with its dichotomized origins or its nondichotomized aspirations. Unfortunately, the literature is ambiguous in its ethical stance. It seems clear that ecological forestry does not follow natural law theory:

[New forestry] does not constitute a ‘naturalistic ideology’ in the sense of managing ecosystems for the sake of naturalness. Rather the strategy is to use knowledge of natural ecosystems to develop practices of sustainable ecosystem management. (Swanson and Franklin 1992, p. 291)

At times, however, ecological forestry does seem aligned with the second, arguably more problematic ethic that follows from separating humans from nature, anthropocentric utilitarianism:

the adoption of the retention approach within forests that are logged is important for: (1) maintaining multiple forest values and societal expectations of the global forest estate and (2) generating economic benefits for governments, private landowners, and trust managers. (Lindenmayer et al. 2012, p. 422)

And yet, on the whole, the literature is ethically noncommittal, failing to identify

ecological forestry with any ethic, let alone one clearly diverging from the problematic ethical underpinnings of traditional forestry (Table 3).

When he proposed new forestry, Franklin (1989b, p. 44) entreated, “Let us adopt a forest ethic. Let us approach forest ecosystems with the respect that their complexity and beauty deserve.” Although this overtly ethical thread never again appeared in the literature, perhaps we might take it up now and speculate about what sort of “forest ethic” might best support ecological forestry. Unlike anthropocentric (literally, “human-centered”) ethics, which attribute intrinsic value and direct moral standing to humans alone, more inclusive, nonanthropocentric ethics attribute intrinsic value to broader sets of entities, such as individual animals and plants or even species and ecosystems, and also accord them direct moral standing (Nelson and Vucetich 2012). Whereas anthropocentrism maintains both a conceptual and an ethical distinction between humans and the rest of the world, nonanthropocentrism rejects these distinctions outright. We therefore suggest that only a nonanthropocentric ethic will suffice to structure and navigate a nondichotomized, “ecological” worldview of the sort implied by ecological forestry. To handle the heightened complexity of a moral realm that includes both humans and nonhumans, this nonanthropocentric or ecological ethic must be robust enough to resist defaulting to fa-

miliar patterns of thinking, e.g., by automatically prioritizing human interests above all others. This is not to suggest that nonhuman interests should by default be prioritized over human interests either. There are no categorical distinctions between moral entities in an “ecological” world nor are there fixed templates for the tradeoffs and prioritizations that must inevitably be made, which is why, as we discuss below, it is absolutely critical that practitioners and students of natural resources become comfortable and adept with ethics. However, we do suggest that the ethics of an ecological worldview should start by assuming the moral standing of nonhumans and realizing with “appropriate humility” (Franklin 1989b, p. 44) that humans are but one species among many, all of whom have a legitimate interest in not just surviving, but indeed flourishing on this planet.

## Conclusions and Future Directions

In this article, we briefly summarized the literature on ecological forestry before making a critique of its normative and ethical deficiencies. We argued that a conceptually complex worldview has not been duly supported by a clear normative or ethical framework, leaving ambiguities that allow a broad spectrum of different and potentially conflicting management actions to be called “ecological forestry.” This wide range of variability is problematic not only conceptually but also practically, impeding communication in a contentious and often highly polarized social context, and permitting forestry practices that may perpetuate the problems, particularly those of an ethical nature, that ecological forestry purports to redress.

The attempt to integrate humans and nature is not unique to ecological forestry. We see the same effort motivating a suite of concepts in management and conservation, such as sustainability, health, and resilience, and the related conceptual challenges highlighted in this article are also broadly shared. Inattention to values is widespread in natural resource management (Dietz 2003) and although it has become fairly common to acknowledge the critical role of ethics (e.g., Brand and Jax 2007, Spies et al. 2010), the time for mere acknowledgment has passed. Natural resource management is as much a normative or ethical enterprise as it is a scientific or silvicultural one (Murie 1954, Leopold 1966, Cornett and Thomas 1996).

Natural resource managers and decision-makers are already doing the work of ethics. We merely suggest that they do so in a more rigorous, transparent, and deliberate manner.

What does this entail? The measures we propose, although deceptively simple on paper, are without question difficult to implement in practice: in short, researchers, practitioners, and stakeholders in natural resource management need to become more proficient handling ethical issues. This requires systemic change, from educational institutions to agencies to professional societies and journals, in how we think and talk about natural resources. Ethics, like stream ecology or conservation biology, is an academic discipline, and, like statistical analysis or GIS, it requires certain skills. These skills can of course be learned, but only if they are being taught. We therefore recommend that at least basic ethics should be an integral component of curricula in university natural resource programs. Ethical discourse can also involve debate over deeply personal values, which requires a capacity for empathy and a dispositional openness that, while perhaps difficult to “teach” per se, can nonetheless be cultivated in both academic and professional settings.

Outside of the university, individuals are unlikely to push for ethical dialogue in a culture that is otherwise resistant to ethics. Therefore, ethics needs to be institutionalized in the routine practice of natural resource management. Minter and Collins (2005) suggest that the natural resources community begin building a database documenting and cataloguing case studies of management handling ethical issues. We can think of several other suggestions. For example, environmental assessments could include ethical analyses of proposed management alternatives (for an example, see Lynn 2011). In conjunction with best management practices, managers could be encouraged to develop and follow best ethical principles, which would be evaluated and, as necessary, revised adaptively over time. Interdisciplinary teams could include not only forest hydrologists and social scientists but also formally trained ethicists. Professional meetings and conferences could include plenaries and workshops on ethics, and ethical certification could be required as a professional standard for practicing foresters.

Turning back to ecological forestry, we suggest that a critical next step might include a forum (e.g., a conference, symposium, or

informal working group) for the ecological forestry community to engage in careful deliberation about what it means for forestry to be “ecological.” Speculatively, the outcomes of such a forum might include value-explicit ethical precepts that can be used to inform management objectives and ultimately decisions on the ground. For example, it might be decided that the recovery of one species should not be prioritized, if doing so puts many other species at risk, or achieving economic solvency for a local community justifies risks to threatened species, but pursuit of excessive profit does not. In addition, since management issues are inevitably context-specific, members of this forum might also more generally commit to manifesting certain virtues, such as respect for all interests at stake or humility in the face of uncertainty (Heller and Hobbs 2014).

These are just starting points, and the work of developing a normative framework for ecological forestry will without doubt be difficult and complex. However, we believe that by adopting a bold approach to overtly ethical forest management, ecological forestry, or any such popular yet ambiguous buzzword in management and conservation, has the potential to overcome its conceptual challenges and develop into a consistent, novel, and enduring management philosophy.

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