Dead Wood: From Forester's Bane to Environmental Boon[1]

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Abstract

Forest managers are increasingly aware of the significance of Aldo Leopold's admonition that "to keep every cog and wheel is the first rule of intelligent tinkering." Dead wood, standing and down, is one of those "cogs and wheels." This was recognized in the 1970s and triggered additional research and evaluation of management action related to dead wood in managed forests. Much of this new information will be discussed at this conference. What will remain at the close is the essential need for synthesis of this new knowledge from research and management experience into a useable form for managers. This is the remaining challenge.

Introduction

When Patrick Shea approached me about giving this keynote address, I asked if he had thought about what comedian Jay Leno could do with a "government" conference on "dead wood." I accepted only after checking to see if the Office of Personnel Management was a co-sponsor. Then I began to consider why a retiree had been asked to deliver the keynote address and decided to quit thinking about such things. I remembered what my old friend and mentor Les Pengelly said when I congratulated him on a great keynote address at a conference on mule deer management: "Just remember what is happening when you are frequently selected to give keynote addresses. Your friends and colleagues remember you fondly, but know that you are really out of the game." Thank you for the honor and remembering me.

Dead Wood as the Bane of Forestry

There are a number of us in the room who can remember, in the early stages of our careers, when dead wood in any form was considered the bane of foresters who had been trained to focus on the most efficient commercial production of wood and wood fiber. Snags (standing dead trees) were considered a safety hazard to woodland workers and a potential source of spreading sparks that ignited spot fires. Down woody material was considered "fuel" that facilitated the spread of fire, a haven for vertebrate pests that hampered reforestation, and unsightly (Maser and others 1979).

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[1] An abbreviated version of this paper was presented at the Symposium on the Ecology and Management of Dead Wood in Western Forests, November 2-4 1999, Reno, Nevada.

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The Times They Are A'Changin'

Like the verse from the old Bob Dylan song, "The times they are a'changin'." At this conference, we are gathered to discuss the ecological role of dead wood in our dynamic search for means of attaining sustainable forest management.

Let me begin with a quote from Aldo Leopold (1953):

> The land is one organism. Its parts, like our own parts, compete with each other and cooperate with each other. The competitions are as much a part of the inner workings as the cooperations. You can regulate them cautiously but not abolish them…. If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first rule of intelligent tinkering (p. 146-147).

I often ponder why Aldo Leopold's admonition about keeping "cogs and wheels" is widely quoted and how often we are surprised at the consequences, both ecological and political, when it is ignored. By now, we should have learned that all the segments of a "naturally" functioning ecosystem play some role in that system whether or not we understand all the relationships. And we should have learned by now that biological systems are significantly simplified at some peril to the maintenance of that system.

System Simplification Implies Risk

Obviously, gross simplification of naturally occurring ecosystems has produced the means whereby dramatically increasing human populations could be supported. In some cases, such as in Western Europe, the U.S., and Canada, this has led to a life-style of the common people that would have been deemed impossible only one generation earlier. Today, however, experience is beginning to accumulate that such simplification may carry the seeds of diminution of productivity over the longer term.

The consideration of dead wood as one part of the essential functioning of forested ecosystems (including all of its component parts—biotic and abiotic) can be most instructive. We should keep in mind during these deliberations that dead wood is only one of many attributes of the forested ecosystems of the world. However, the discussion will undoubtedly elaborate Paul Ehrlich's corollary to Aldo Leopold's admonition about saving cogs and wheels. It is the "why" to the first rule of intelligent tinkering—"all things are connected and there are consequences to all manipulations of biological systems" (Ehrlich and Roughgarden 1987).

Recognizing the Importance of Dead Wood: Better Late Than Never

In retrospect, it is amazing that forest managers did not realize that dead wood was a critical habitat component—for vertebrate and invertebrate wildlife and for the forest itself. Elton (1966) succinctly described the role of dead wood as a critical habitat component:

> When one walks through the rather dull and tidy woodlands…that result from modern forestry practices, it is difficult to believe that dying and dead wood provides one of the two or three greatest resources for

> animal species in a natural forest, and that if fallen timber and slightly decayed trees are removed the whole system is gravely impoverished of perhaps more than a fifth of its fauna (p. 279).

By using the example of Wyndam Wood in England, Elton (1966) described the number of species that might be related to dead wood as habitat: "Indexes of the Ecological Survey contain 456 species of animals (including invertebrates)… living in wood or under bark where decay has begun or already gone far. Another 518 species are known to occur in this habitat elsewhere in Britain…." (p. 279).

By the 1970s, researchers and forest managers were becoming increasingly aware of the role of dead wood in the ecology of the managed forest. The important implications of decomposing woody debris in mineral cycling, nutrient immobilization (Fogel and Cromack 1977, MacMillan and others 1977), and nitrogen fixation (Cornaby and Waide 1973) had been put forward. Logs were recognized as frequently serving as substrates for fungal hyphae, rhizomorphs, and sporocarps (Ausmus and others 1975, Cromack and others 1975). Harvey and others (1976) had demonstrated the role of decaying logs as sites for colonization of ectomychorrhizal fungi that aided in the survival of several species of trees. Mychorrhizal fungi had been shown to aid processes of nitrogen fixation (MacMillan and others 1977). Cromack and others (1975), Maser and others (1978), Miller and Halls (1969), and Trappe and Maser (1976) had identified fungi associated with dead wood as an important food source for both vertebrate and invertebrate wildlife. Earlier, Graham (1925), Kimmey and Furniss (1943), and Savely (1939) had noted that decaying logs provided varying attributes of wildlife habitat, depending on the state of decay.

Researchers, most of whom were associated with the USDA Forest Service research unit at La Grande, Oregon, began multi-disciplinary cooperative studies in the late 1970s to further expand knowledge about mortality factors associated with the western spruce budworm *(Choristoneura occidentalis)* (Campbell and others 1983, Campbell and Torgerson 1982, Torgerson and Campbell 1982). They identified and quantified the major effects of insectivorous birds (most of whom were secondary cavity nesters) and foliage-foraging predaceous ants as regulators in the dynamics of low-level budworm populations. There were 13 species of ants (11 of which were associated with dead wood) identified as predators on the budworm (Genus *Camponotus* and *Formica*) (Torgerson and others 1990).

Bull and others (1992) determined that a major portion of the diet of pileated woodpeckers *(Dryocopus pileatus)* were the same species that were major predators on spruce budworm. Torgerson and Bull (1995) collaborated in the characterization of logs that were habitat for ants and used by pileated woodpeckers for foraging.

They found that budworm outbreaks occur about every 40 years (Swetnam and others 1995). After trees are killed, some become snag-habitat for woodpeckers, secondary cavity nesting insectivorous birds, and ant predators of the budworm. The snags become down logs, which then become the home for colonies of ants and forage for woodpeckers. Ants and birds are dominant regulatory forces on budworm populations at low population levels. Decaying wood simultaneously plays a role in nutrient cycling. Outbreaks eventually occur, tree mortality results, and the cycle begins anew (Torgerson, pers. comm.).

Everything Is Connected to Everything Else

At this meeting, we will discuss the role of dead wood in forested ecosystems, including its role in associated aquatic systems. We will examine at least some of the connections between dead wood and "everything else" in the healthy forest, and this is only the beginning of knowledge. As Aldo Leopold (1953) stated: "The outstanding scientific discovery of the twentieth century is… the complexity of the land organism. Only those who know the most about it can appreciate how little we know about it…" (p. 146).

Yet, it is clear that there can be no respite from our tinkering with natural systems. As with all our fellow creatures, human populations must exploit the environment in order to live. There is no question about that. The question, then, becomes one of how such exploitation occurs. The challenge of the new millenium for natural resource managers is the question of how we can exploit our environment and maintain its productivity and health (defined as the capacity for renewal)—not only for the short term but also for the centuries. That is what the buzzwords such as "sustainability," "ecosystem management," and "forest health" mean. At least for the foreseeable future, this will be a challenge because of the increasing human population.

The Growing Need for Synthesis and Re-synthesis

In this conference, we will address a small piece of the concerns of how forest managers can combine the objective of meeting people's needs and, simultaneously, maintain forest health. The journey of learning and understanding more and adjusting management will be a continual feedback loop that will require constant adjustments in management. This is inevitable and should be accepted as part of routine business.

I predict there will be, at the end of our deliberations, a sense of confusion among the managers in attendance about the information and insights presented here. Managers will probably be overwhelmed with the various bits of new information, insights into the role of dead wood in forested ecosystems, and the various suggestions for the management of the dead wood component. That inevitable confusion will require synthesis of the myriad pieces of information into some useful, and defensible, form for the use of managers. And, who will do that chore? It seems likely, if past is indeed prologue, that the essential synthesis will be "blowing in the wind," as the individual presenters retreat into their specialized niches in research organizations.

Synthesis: It Has Been Done Before

It does not have to turn out that way. I hope that before this conference ends an *ad hoc* team has been formed that is pledged to the synthesis of the material presented here, and material that can be found elsewhere, into a useful treatise on the subject of the role and management of dead wood in managed forests. This can be done. It has been done before, beginning with some chapters entitled "Snags" (Thomas and others 1979) and "Dead and Down Woody Material" (Maser and others 1979) in the document *Wildlife Habitats in Managed Forests—The Blue Mountains of Oregon and Washington* (Thomas 1979).

Synthesis: Not for the Faint of Heart

It took nerve to go forward with the synthesis of the extant information (which was sparse compared to what will be presented at this conference), make informed "guesses" when detailed understanding based on "hard data" was lacking, and then make suggestions to management. Frankly, it will take nerve to take the next step. Synthesis and management guides are not for the faint of heart. In this action lies the bridge from creation of knowledge and pontification to responsibility.

There was some applause and some criticism. One critic criticized us in a meeting with the accusation that we had "guessed" at some critical points. I conceded that he was correct, but that we offered no apologies. The "guesses" (we preferred the descriptive term of "informed opinion") were clearly identified as such. But, if nothing else, we had put forward a number of hypotheses that he and a number of other researchers—including ourselves—were chasing. In the meantime, we had certainly brought attention to the need to consider dead wood in forest management. Changes could be made in response to better research-based data when such was available. I am certain that we will see a great deal of that improved knowledge at this conference.

We considered that 71 species of birds and 51 mammals (122 out of 378 vertebrate species in the Blue Mountains—32 percent) depended to some degree on snags as a habitat component. When we further considered that snags were becoming ever more scarce under the forest management regimes in place, it was clear that there was a problem developing (Thomas and others 1979). That problem could take the form of an impending collision with the Endangered Species Act of 1973. Or, more likely, there was a problem that was related to the purpose of that Act ("to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved" [Endangered Species Act of 1973, Sec. 2 (b) (1)]).

This was likewise true of down woody material. We believed that 5 amphibians, 9 reptiles, 116 birds, and 49 mammals (179 out of 378 vertebrate species—47 percent) made some use of logs and other down woody materials (Maser and others 1979).

Synthesis: The Two Choices Are "Too Soon" and "Too Late"

We were criticized by some of our colleagues who maintained that we were "premature" in our findings and in our recommendations for management. We looked those colleagues squarely in the eye and announced that, in our minds, we had two choices—"too soon" or "too late." We opted for the former and challenged managers to test the hypotheses and develop a deeper understanding of the role of dead wood in the forests. Our view was summed up in the following statement from Thomas (1979):

> Perhaps the greatest challenge that faces professionals engaged in forest research and management is the organization of knowledge and insights into forms that can be readily applied. To say we don't know enough is to take refuge behind a half-truth and ignore the fact that decisions will be made regardless of the amount of information available. In my opinion it is far better to examine available knowledge, combine it

with expert opinion on how the system operates, and make predictions about the consequences of alternative management actions.

Synthesis? Just Do It

This is the challenge I present to you today. Do not walk away from this conference content with a publication of dozens of additional pieces of disjunct information and recommendations. That leaves the job half-done. Surely, in this audience is a team just waiting to be formed that can and will produce a summary treatise on the role of dead wood in managed forests that will help guide managers as they struggle toward sustainable forestry. If not, I suggest that we may just have wasted our time and produced one more publication to add to a thousand others on library shelves where it will reside until someone seeks synthesis. Through experience, I have found that pontification is far less risky, and far easier, than assumption of responsibility. But, in the exercise of responsibility lies the ability to make change and be accountable. Take the responsibility.

It has been done before, 20 years ago, with much less information than exists today, and it made a difference. This conference will significantly reinforce the base of information and understanding.

Now is the time. The need is apparent. There is more and better information than ever before. All that is required is courage, some "street smarts," the will, hard work, credibility, and the guts to put reputations on the line. My final plea is do it, just do it.

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