

# A Discussion of Wildlife Management, Fire and the Wildlife Landscape

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SOME THIRTY-ODD years ago, Aldo Leopold (1933) defined game management as “. . . the art of making land produce sustained annual crops of wild game for recreational use.” Recently, after a bibliographical journey through the pages of the *Journal of Wildlife Management* seeking fire references for Tall Timbers Research Station, I am left with the impression that Aldo Leopold’s message has been overlooked. By and large, the majority of the papers in this journal are concerned with recording events, life history, census, analysis of existing habitats and the like. Comparatively few papers deal with active habitat modification, creation of new habitats or the assessment of wildlife response to vegetation manipulation which in essence *is* wildlife management. Since the Journal is the official publication of a professional wildlife management organization, it should at least reflect orientation of research and professional ability to make land productive of wildlife.

If Leopold’s objective seems to be obscured here, Stoddard’s (1932) message on controlled burning in his 15th chapter of *The Bobwhite Quail* appears to have been likewise overlooked. Nowhere in the indexes in the twenty-nine volumes of the *Journal of Wildlife Management* do the terms “controlled burning” or “prescribed burning” appear as headings. Only a very few papers are concerned with

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Facts about game have been accumulating for a long time, but there has been only one previous attempt to synthesize from those facts a coherent system of principles. Adams, in his *Importance of Wild Life in Forestry*, presents exhaustive statistics on the economic value of wildlife, and interprets them in terms of biological principles, but he does not deal with the techniques of altering range for greater productivity, which is the principal subject of this volume.

It is unfortunate that at this late date, the report on *Wildlife Management in the National Parks* (Leopold et al., 1963) was compelled to state: "Active management aimed at restoration of natural communities of plants and animals demands skills and knowledge not now in existence."

The term "wildlife management" has been frequently used to cover many subjects which do not involve active manipulation of vegetation. This discussion therefore, uses the term "wildlife landscape management" to focus attention on active vegetation management to develop and maintain productive wildlife environmental conditions.

In the management of the wildlife landscape, the process involved is similar to landscape architecture which Webster's Dictionary (1965) defines as ". . . the art of changing the natural scenery of a place so as to produce the most attractive or desirable effect." Landscape architecture is an active creative effort. It is concerned with the creation of vistas, openings of grass, arrangement of shrubs, etc. Care and skill are required in the pruning of shrubbery, grass must be mowed, otherwise vistas disappear, lawns deteriorate and shrubs grow out of bounds. The need is obvious; the landscape is cared for.

Similarly, wildlife landscape management is primarily a creative effort. It is primarily concerned with creating vistas, openings of herbaceous vegetation and the arrangement of natural shrubbery, trees, and plants for wildlife's benefit. It should have the capability of caring for and the skill in pruning natural shrubbery, otherwise vistas disappear, openings close in and native shrubs grow out of bounds. The need may not be so obvious. The wildlife landscape is often disregarded or completely ignored.

Landscape architecture is judged on its ability to produce landscape in which the esthetic scene is the most desirable effect.

Again, wildlife landscape management and indeed the field of professional wildlife management, should be judged on its ability to produce esthetic landscape in which wildlife in reasonable or maximum abundance is the desirable effect.

Landscape architecture most always develops a well-trimmed, artificial scene, a readily recognizable condition. The wildlife landscape conversely, may look "unkept" or may appear so natural that to the casual observer management is not obvious. The experienced wildlife landscape manager, however, should be able to judge the basic quality of a wildlife landscape simply by inspection and should know how to maintain or improve it.

The final and ultimate goal of wildlife landscape management and also of wildlife management is the production of wildlife abundance. Wildlife management research when it stops short of this goal is simply academic wildlife research. If it can't maintain one bird in the bush or put an extra bird in the bush, it is ineffective and its information may be only of interest to the ornithologist.

The wildlife landscape like the architect's landscape is fundamentally a disturbed landscape. It depends on disturbance for survival. In its absence in most cases it deteriorates. In general, the basic condition of the wildlife landscape is variety: forest, brush, grass, weeds, lakes, ponds, creeks. Abundant historical records indicate that during primitive times, it was largely a fire landscape. It depended upon this agent as a source of disturbance to rejuvenate the quality, quantity and distribution of its vegetative composition to which wildlife increase responded, sometimes spectacularly. There are also many comparatively recent accounts that support this statement of which I cite one.

R. Y. Edwards (1954) in the *Journal of Wildlife Management* gives a before and after account of an intense fire that ". . . completely denuded some 200 square miles of forested land" in the Wells Gray Park of British Columbia in 1926. This paper is primarily concerned with the decline of the woodland caribou and the author states elsewhere that the destruction of deep forest by the fire appeared to be the primary cause of decline. However, in a later paper (Edwards, 1956) he states that deep snows may have contributed to reduction in numbers of this mammal. I make note of this for

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the caribou is not discussed in the following quotation. Edwards writes:

Reliable local knowledge and study of present conditions provide a general history of the larger and better known mammals in and about the valley through the past thirty years. It is a history of change in mammalian populations concurrent with fire, and no less abrupt change of the land itself from dark forests deep in mosses and lichens to bare soil baking in the sun.

Mule deer and caribou were the main ungulates in the timbered valley. A small deer population wintered in warm canyons to the south among Douglas firs and dispersed in summer to open meadows above timberline or to small patches of young forest healing recent lowland burns. Deer avoided heavy forest except in travelling through it. A few goats occurred as outpost populations from larger herds in more rugged terrain to the north. Cougars and coyotes, like deer climbed to lush meadows in summer where mice were numerous and travelling was easy. Marten were common throughout the dense forests. Beaver and other fine fur species were well distributed. Wolverine ranged alpine meadows in summer and timbered lowlands in winter. Black bears were found sparingly throughout the lowlands, and grizzlies roamed in the high country, descending into the valley in spring. The whole scene was one that had been long established, with that evidence of permanence that has led to the concept of climax.

The fire that followed was catastrophic. In a few hours its destruction changed the scene in the valley from one of intricate complexity to one of relative simplicity. The changes that it wrought would fill volumes if all were known, chemistry, structure, fauna and flora of the soil, vegetation with its dependant animal life, the very climate of the place were abruptly changed in a sudden fury of destruction. A tangled, wet forest penetrated only by miserable trails became a desert-like area where a horse could roam at will.

I interrupt this quotation only to note that this is the wildlife landscape of Smokey Bear. Since Smokey's message has appeared so frequently on radio and TV, I don't feel at all embarrassed if I appear to be repetitious. However, I do find myself a little irked with the widely circulated statement that says "only you can prevent forest fires" when Ed has been telling us how abundant lightning-set fires really are and that some of these are really lulus. But I am curious about Smokey Bear's landscape, not only to learn how nature heals

the scars and how wildlife adjusts to catastrophe but also to learn more about what Smokey's benefactors are doing to re-landscape the scene for the birds and other animals. Nature has admirably provided for the restoration and perpetuation of her wildlife species through periods of catastrophe, and it is apparent that even from catastrophe it is possible to learn something of value. To stop here we learn nothing constructive. Edwards continues:

For a few years, the habitat was desolate, with some deer mice scurrying in the ashes and a few deer wandering among charred forest remains. Fireweed and willow began to heal the land that had been like a desert changed to one supporting an abundant growth of willow, birch and aspen. The new vegetation created a new world for mammals. The fire that had destroyed a rich vegetation with a varied mammalian community in which few species were abundant made new and extensive range for a number of species. The fire had totally removed the marten for decades, in destroying the dark forests. It had restricted the lowland wandering of wolverine and grizzly bear. At the same time it created new habitat for others. There was a spectacular increase in mule deer which almost swarmed in abundant browse. Dozens could be seen in a day where they were infrequent wanderers in deep forest. Cougars became so common that one hunter took eighteen in one season where a few years previous it was unusual to see tracks. Coyotes suddenly flourished in this new, prairie-like valley where deer mice had increased and Columbia ground squirrels were abundant where previously unknown. Beaver found new food abundance and increased. Black bears found berries and other foods abundant as they never had been. Goats, among the few species whose ranges were mainly above the fires, were affected but little.

Moose were unknown in this valley before the fires. Wanderers colonized the valley in the early 1930's and increased until the winter of 1945 when homesteaders watched moose browsing close by and children on their way to school dodged them. Moose found extensive winter range in hundreds of square miles of browse and summered in the damp subalpine forests at and below timberline.

With the establishment and increase in moose, wolves increased markedly from a previously low population density. The new mammalian abundance probably figured strongly in this and other increases in mammalian predators of the valley.

Today the situation is only slightly changed. Shrubbery is

older and higher, and the ground is not quite so bare. Young conifers are slowly repopulating the burn but are still absent from large areas. Deer are not so abundant, nor are cougars and coyotes, but moose in hundreds wander down from the mountains to the lowland in autumn. Mice and ground squirrels are still abundant. The former are a major factor in arresting coniferous reinvasion, for they are efficient gatherers of tree seed.

Such accounts of the aftermath of wildfire pose some interesting questions: Where in our national parks, national forests or other public lands has a wildlife fauna so rich in species and numbers been produced by planned, deliberate manipulation of the vegetation without benefit of accident by destructive wildfire? Must we depend on destructive wildfire to generate productive wildlife landscape? Can the Smokey Bear landscape be re-captured for wildlife and re-designed to produce a Walt Disney wildlife landscape? Must we accept mediocrity or less as a measure of wildlife abundance? How to produce the favorable wildlife response so frequently produced by wildfire, without the associated destruction of scenic and forest values should be a major concern of wildlife management. Thus far it has shown little aggressive interest. It has been to a large extent pre-occupied with academic, passive wildlife research.

It is doubtful if any attempt has ever been made to cultivate the wildlife landscape following a wildfire. No wildlife organization seems willing to accept the challenge and capture the scene for wildlife. Usual procedure is to let nature take its course, accept what nature doles out and with the passage of time beneficial wildlife effects become obscure. Twenty-eight years following fire, Edwards states in his last paragraph: "Deer are not so abundant, nor are cougars and coyotes . . ."

But much can be learned of practical value in the management of the wildlife landscape from such catastrophic fire, simply by observing causes of wildlife response followed by experimentation on the land to determine how beneficial effects may be perpetuated. It is probable that destructive wildfires will be with us for a long time and may even increase where highly combustible hazard has been allowed to accumulate. When they do occur, close and continued observation may reveal clues which might well result in the use of controlled fire where its use previously had been thought impossible.

Surely here is an opportunity to cultivate the wildlife landscape instead of letting it go to pot as it surely must if nature's processes are not controlled.

The success of efforts to manage the wildlife landscape will depend upon how well we learn to arrange the natural shrubbery and to a large extent upon how much skill is developed in pruning and controlling the distribution of this shrubbery largely through the use of controlled fire. This conviction is based on the simple judgment that if fire can create a productive wildlife landscape, fire under control should be able to maintain wildlife productivity. To exploit the beneficial effects of fire, much on-the-land experimentation is needed. The objective is to develop know-how, to learn how to cultivate the wild landscape economically, to learn how to make the land produce wildlife economically. This experimentation may involve a one-acre experimental plot, a hundred acre habitat or a thousand acre range. If nature did the job in haphazard, destructive fashion, man following Nature's ways should be able to do the job in constructive fashion.

It will take men with vision having keen powers of observation and who have become intimately acquainted with the vegetations, atmospheric conditions, fire behavior and the like, of the immediate areas in which they are operating. Adequate and generous experimental areas where safety is assured by natural and man-made barriers, which seem to be limited, are essential to this effort. It is on these areas, acting as proving grounds, that techniques can be tested in safety and personnel can develop experience and confidence in themselves as well as generate the confidence of policy making administrators.

The foresters and range men have already, to a considerable extent mastered the use of high intensity fire in the West. Slash from timber harvest, in quantities measured in tons to the acre and generating convection columns to twenty thousand feet when burned, is safely disposed of for forest regeneration site preparation by prescribed burning. A ten thousand acre controlled burn on Indian grazing land in the Southwest to remove brush was safely executed at a humidity of two percent which was essential to insure continued propagation of the fire. And again in the Southwest, a whole watershed has been experimentally burned to increase water supply. In the Southeast,

foresters have perfected, by means of experimental research, a technique in low intensity prescribed burning which has been safely applied over hundreds of thousands of acres. It is doubtful if any habitat management operation executed specifically for wildlife can anywhere near approach in magnitude the scale of this activity by southern foresters, which, while a forest management operation has side benefits to many species of wildlife. One might ask, can wildlife management offer any practical proven suggestions to implement this activity?

By comparison, the field of professional wildlife management appears to be lagging in the use of controlled fire, and there is every reason to believe that the need is as great or even greater. Certainly, once the wildlife landscape has been developed to a maintenance basis, it is doubtful that controlled fire in anything like the intensity used for some purposes in the West will be required for wildlife management purposes.

While the techniques developed by forestry and range management may well be useful in the management of the wildlife landscape, the needs of wildlife differ and experimentation in developing other techniques can be visualized. The forester seeks clean burns and complete coverage; wildlife burning may be less intense with incomplete coverage to provide sufficient cover until new growth appears. Season of burning, frequency of burning, purpose and size of burn for wildlife purposes do not necessarily coincide with needs of other land uses and, accordingly, will vary with species, habitat and region. Much of the controlled burning for wildlife may well follow more closely the practice of the south Florida cattleman than that of the forester. The cattleman was concerned with providing new growth of grass over longer periods and accordingly his burning was staggered to "stretch out" winter grazing. Protection and distribution of cover, development and maintenance of scenic vistas, the production of berries, mast, seeds and other food plants are not the primary concern of the forester or range manager but are of essential importance to the wildlife manager. Restricted use of controlled burning such as the "spot" burning of Stoddard, which is entirely different from the spot burning of the forester, may have special application, and the exercise of ingenuity should produce new techniques. As an example, I cite the case of a perfect spot burn made by a manager

of a North Carolina quail plantation and observed by Stoddard many years ago. The manager noted that snow had melted irregularly leaving large snow free areas, which he set afire in complete safety and in complete perfection. In this connection, experimentation in the use of chemicals for fireproofing vegetation to serve as fire breaks might well be considered for local application and special use, as well as, chemicals for desiccating green vegetation to permit burning localized situations, both of which have received attention in the Southwest.

Controlled grazing tests on burned versus unburned native cattle range conducted at a number of agriculture experiment stations including Florida, Georgia, Mississippi and Kansas have shown significant gains on cattle on burned range. It is reasonable to assume that a similar favorable response might be obtained on control burned range occupied by native wild ungulates. I would guess that similar information based on controlled experimentation is very limited, if it exists at all, both as to species and region.

Much of our wildlife research energy seems to have been used in evaluating and measuring wildlife populations as they exist with comparatively little effort directed toward manipulating vegetation to effect increased productivity. It would be interesting to know for how many species of wildlife, land has been made available for experimentation, as is done on agriculture experiment stations, expressly and entirely for the purpose of determining maximum yields of a particular species. I am inclined to believe that if this information were available, the showing would be poor, and this leads to a pertinent question: For how many species of wildlife has active experimentation shown how to make the land produce maximum populations?

Within a comparatively short time the population of the Attwater prairie chicken has shrunk to a point where the bird has been placed on the list of endangered species. It is my impression that this species has never received benefit of land devoted exclusively to determine how to produce maximum numbers through habitat manipulation. Research work was done primarily or entirely on grazing land. To my knowledge use of controlled burning in the management of this species has never been investigated, though, historically at least, effects of fire indicate that controlled burning possibly might be of great

importance in maintaining the productivity of its habitat.

Despite the fact that Stoddard pioneered the use of controlled burning on game lands more than thirty years ago, the field of wildlife management, except in a few cases, has contributed little to the advancement of the art and in many cases depends upon techniques developed by the foresters. As early as 1956, the Florida Forest Service published a bulletin on controlled burning which was reprinted in the proceedings of the first Fire Ecology Conference. Recently, the Southern Region of the U.S. Forest Service released a superbly illustrated booklet titled, "A Guide to Fire by Prescription." It is a credit to both of these agencies who were at one time antagonistic to the use of any fire, that they could reverse themselves, successfully develop a practical burning program through experimental research, and apply the results of this research on a large scale.

In contrast, the use of controlled fire in wildlife management has been scattered and there appears to be no organized effort, either in experimentation or application, on a scale comparable to that existing in the forestry profession. There are no published guides in the use of controlled burning specifically for wildlife management purposes and there is great need for such a publication. There is a voluminous bibliography concerning the seeds, berries, browse and green matter that are valuable wildlife foods and there is reason to believe that large numbers of these are adjusted to fire and require the pruning action of fire for their culture. However, experimental research to obtain such useful, practical information has been very limited.

Recognizing the need for high producing wildlife foods that may be economically cultured, Tall Timbers Research Station established a project last year to evaluate the seed production ability of various strains of wildlife food plants many of which will be obtained through the cooperation of the U.S. Soil Conservation Service. To exploit this objective further, the Coastal plains Experiment Station at Tifton, Georgia has been approached for assistance in applying modern plant breeding methods to develop high seed producing native wildlife food plants through selection and hybridization. The hope is to develop the production of such improved strains through modern agricultural and seed processing methods in large quantities for wildlife improvement projects even to include seeding by aircraft on lands

where controlled burning, in progress, will cultivate and perpetuate them.

Despite the appeal of wildlife and the volume of popular and semi-popular writing it supports, it is sometimes questionable if many of our people really appreciate what constitutes a wildlife landscape and what keeps it going. The forest has been promoted so long with wildlife as an associate and the past history of forest destruction has been repeated so many times that forest preservation has automatically meant wildlife preservation. To preserve forest was to preserve wildlife. But in a great many cases the reverse has been true. Browse has grown out of reach of big game animals and herbaceous plants have been smothered out by competing vegetation. Trees have marched into the open areas upon which wildlife in reasonable abundance once depended and many wildlife landscapes have become solid, sometimes monotonous, forest landscapes. Many of our parks have actually become nothing more than forests where openings exist only by accident of soil conditions or other environmental factors. Yet one dictionary definition (Webster, 1963) of a park is, “. . . an open space surrounded by woodland,” a basic attribute of the wildlife landscape. Space, abundant in berries, weeds, grasses, brush, grasshoppers, butterflies and the like has been disregarded, and it appears that the need for such space is considered unimportant or its absence is taken for granted, for this is frequently ignored by writers.

An article by Harvey Broome (1965) long time champion of the wilderness may serve to illustrate the point. In *The Living Wilderness* commenting about wild turkeys during an outing in the Great Smoky Mountains National Park in 1950 he writes, “. . . the four we saw must represent a large portion of, if not the entire, turkey population of the Greenbriar. Yet there are historic accounts of flocks of 40 and 60 even a hundred.” And he writes further, “I wonder how many of these royal birds the Smokies support. We know of several around Gregory Bald and in the fall we saw evidences of turkeys on Silers Bald. Four is the most I have seen at one time and only twice I have seen that many . . .” Later he asks, “How many acres are required to support one bird?” But he does not ask the significant question; Why don't I or why can't I see fifty or a

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hundred turkeys in Greenbriar? That few people, except sportsmen, ask such questions is indicative that the general public has been taught to accept wildlife conditions as is, especially in our national parks.

To anyone who knew Greenbriar as my brother and I did some thirty years ago the answer is obvious. There were no wild turkeys then because people ran them off. At one time about fifty families lived in Greenbriar Cove and only a few families were left in 1933 since the land was condemned for park development. However, it was still wildlife landscape, full of blackberries, fallow fields, hedgerows, weeds, grasses, grasshoppers and butterflies, and a birdwatcher could run up a pretty good bird list. I am confident that if this landscape had been cared for, the wild turkeys could have found good nesting cover and a good summer food supply. They at least, would have had a fair chance of multiplying and of increasing with protection from hunting. But managed open space, disturbance of vegetation for wildlife production, has not been part of the scheme of our national parks. You would never know Greenbriar today. It is a practically solid, young hardwood forest—and this is not prime wild turkey habitat, a fact that does not need further researching.

That the thrill generated by the sight of a flock of wild turkeys or of other wildlife is a valuable public esthetic and recreational experience and should be preserved is a concept no one will contest, but the profession of wildlife management it appears, has shown little interest in developing methods to demonstrate how to display wildlife. That the possibility of an individual enjoying this experience has deteriorated, has been reduced or entirely eliminated through neglect of managing the primitive landscape in our national parks is clearly indicated in the Leopold report, and to a great extent this may well apply to other public lands. How to recreate the primitive scene, a disturbed wildlife landscape, where the public has been taught disturbance was a desecration, will be difficult and real wildlife developments, accordingly, may be limited and long in coming. Disturbance, however, has been a part of the management of our national forests and they have great potential in developing into areas of abundant wildlife in the future.

While Harvey Broome did not elucidate on the scarcity of wild turkeys in the Smokies, the Editor of *The Living Wilderness* sought

further information from Mr. Arthur Stupka, biologist of the Great Smoky Mountains National Park. The story told could be repeated many times and applies to much of our wildlife on other public lands. In a footnote (p. 13) the Editor writes:

Regarding the number of acres required to support one wild turkey, Mr. Stupka hesitated to make an estimate, pointing out that the answer depends on the amount of acceptable food items available, such as acorns and beechnuts in the autumn and winter and insects in the warmer half of the year. Moreover, the amount of open lands which attract the turkeys is becoming less in the Great Smokies due to the termination of lumber and high-level grazing activities, the control of fire and the return of former homesteads to forest. In the opinion of Mr. Stupka, the protection against hunting which the birds now receive is more than offset by habitat disadvantages resulting from the rapid return of the forests.

That the preservation of the natural wildlife landscape has been influenced little by the profession of wildlife management is sometimes obvious. In the Great Smokies, Greenbriar once a wildlife landscape has been returned to the forest; on Thunderhead, where in that inhospitable climate of about 6,000 feet one controlled burn in perhaps 15 or 20 years might save them, grassy balds are being taken by brush, and the big valley of Cades Cove has gone to grass: A managed landscape of sleek black cattle on improved pasture is the scene, a scene as far removed from the primitive as one could possibly get.

The scope of managing our wildlife landscapes is vast and may range from a hundred acre bird sanctuary to a whole mountain watershed. The opportunities for real accomplishments in the conservation of wildlife are great, that is, if we sincerely and seriously, accept a modern definition of conservation, which has been defined as ". . . planned management of a natural resource to prevent exploitation, destruction, or neglect." If wildlife management assumes a complacent attitude and accepts the dictum that the unbroken forest, that an undisturbed condition was the primitive wildlife landscape, it must admit neglect; it must admit that the native scene, albeit due to "destructive logging and fire" was a better place for wildlife in which to live; it must plead ignorance or lack of creative ability. In my opinion it is the responsibility of wildlife management to

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provide aggressive leadership in planning, developing and maintaining the wildlife landscape. This is after all its primary field, the reason to a large extent for its existence. I do not subscribe to a concept of neglect, where wildlife must necessarily exist largely by accident of undisturbed conditions or accident of other land use. Wildlife has sufficient esthetic and recreational value to demand more care of its landscapes than it now gets.

There are big jobs to be done and there are hopeful signs that big jobs are being tackled. On the Appalachian National Forest in Florida, the U.S. Forest Service is re-designing the forest landscape for the benefit of game and other wildlife species. Large blocks of land have been pre-treated by brush chopping all vegetation. Starting from scratch, pines have been planted in checkerboard fashion with alternate areas assigned to game and wildlife production. Wildlife obtains much needed space in the forest for permanent habitat development in this new design where prescribed burning has been part of forest management. It will be interesting to watch it develop. Similarly, the Fish and Wildlife Service on the St. Marks Wildlife Refuge is tearing up the ground to re-design the landscape for waterfowl. Work is progressing in the development of an experiment to determine the use of sea water in managing the succession of marsh vegetation, a practical approach to the problem. Provision for drying up impoundments and use of fire in reconditioning pond beds periodically, if necessary, has been incorporated into planning.

These are examples of active wildlife experimentation. This is the type of experimentation that is badly needed to gain experience in how to develop and manage the wildlife landscape.

Much knowledge already exists concerning food habits, general habitat requirements, analysis of existing habitats and life history, and further investigation along these lines cannot take the place of practical experience gained through experimentation in manipulating vegetation *on the land* to assess its value in wildlife production. Big questions are left unanswered. How do you roll back a thirty year old forest in Greenbriar that a park visitor, might within reason, see a flock of wild turkeys? What can professional wildlife management offer to replace the modern, manicured livestock scene in Cades Cove? What are the mechanics of producing the original dis-

turbed natural scene? How do you preserve it and make it esthetically attractive? How do you proceed in converting a burned out valley to a wild landscape abundant in wildlife and keep it that way? How do you adjust the public mind to accept disturbance and fire as part of the original native landscape? What do you do to a hundred acre bird sanctuary to add a species or two to a birdwatchers list? How do you put birdlife in a forest landscape for possible insect control? How do you cut a hole in the forest that a hiker might see a doe and her fawns in the morning mist? Where do you put it? How do you maintain it? How do you create a wild flower garden as part of the natural scene? Can you bring the humming bird to its flowers? If so, how? How do you put the sound of wildlife in the native landscape that a camper might hear the call of the sandhill, the cry of the limpkin, the wail of a coyote or the melody of abundant birdlife? In short, *how* do you put wildlife in the native landscape? In conclusion, this paper calls for a reorientation of wildlife research effort in the direction of on-the-land experimentation to develop practical methods in producing wildlife landscape.

There are big questions that still require answers. When the professional field of wildlife management has developed a capability to answer questions, based on experience derived from experimentation with the land, it will have achieved what I have long felt Aldo Leopold visualized when he wrote, "Game management is the art of making land produce sustained annual crops of wild game for recreational use."

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