SOME WILD-LIFE FOREST RELATIONSHIPS ON OUR PUBLIC FOREST AREAS

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A Thesis

Presented to the Faculty

of the

School of Forestry

Oregon State College

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science

June 1939

Approved:

[redacted]

Professor of Forestry

STATEMENT OF THE PROBLEM

It is my wish to present in this generalized discussion statistics and opinions that may exemplify the ever increasing need for a better correlation between the Science of Forestry and one of its more important associated resources, Wildlife.

It is important that we recognize the need for adjustments and provisions for game management on our public forest areas so we may produce and utilize on a sustained yield basis the maximum number of wild animals which are compatible with social needs and within the productive capacity of the forest areas. Today this is a major problem and one which our public forest administrators must give additional consideration if our needs in the form of a wildlife crop are to be satisfied in the not too distant future.

IMPORTANCE OF THE PROBLEM

Due to the many interrelated values that must be considered, if we are to place a price tag upon our wildlife resources, we have the common listing of economic, recreational, educational and esthetic values. It is an inherent trait among our American people to place the greater stress upon the economic value of any article. Statisticians are employed to calculate the annual amount of dollar turnover due directly or indirectly to our game resources. The real values that are associated with the social factors, and the

ones that are exceptionally hard to estimate in terms of dollars, are usually only referred to as a closing thought after the speaker or writer has exhausted the economic possibilities.

"If we accept the definition of value as "the property or properties of a thing by virtue of which it is useful or estimable" then the old time-honored list of values of wildlife named in the old-fashioned, outworn order of importance, as economic, recreational, educational, and esthetic, should be reversed. Esthetic is the science of the beautiful in Nature and Art. The American people have been all too reluctant to cultivate the science of the beautiful in Nature in their striving for economic benefits. The appreciation of grace and beauty is latent in all of us, even in the most enthusiastic of hunters and fishermen. The person who is not thrilled by the grace and beauty of a mother deer with fawns, by the sight of a covy of quail, the leaping of trout, or who is not moved by the eternal mystery of Nature when he views the spring and fall migrations of waterfowl, is a rare person indeed. So many things in Nature have that spiritual, inspirational and esthetic value to us that it is a waste of time to attempt to enumerate them.

"When we stop to think--it is the things in this world like air, water, sunlight, and friendships, the taste for good literature, art, the appreciation of things graceful and beautiful, that really make life possible, and delightful if you will...None of these good things can be evaluated in money." (1)

When we as individuals stop and reflect upon the values we have personally received from this wildlife resource we will undoubtedly place the higher price tag upon those lasting impressions of beauty, the mental rest in the form of recreation, the educational value derived from association with the wildlife in their native habitat, rather than upon the economic considerations in the form of the number of pounds of meat we brought home after a successful hunt or some comparable value.

Thus we realize that the proper weights must be attached to these more or less intangible values if the true importance of the problem as a whole is to be recognized. Today the forests serve as the great reservoirs of most of our big game and many of our upland game populations; they are the areas in which several species of big game that were formerly inhabitants of the more open plains areas are now making their last stand in their struggle for existence. Experiments have shown that wildlife has the ability, if given the very minimum amount of protection and scientific management, to come back and build up their population more rapidly than any other natural resource. This inherent quality alone should provide one very important reason, and one worthy of additional consideration, in regard to enhancing the forest habitat for our game resources by employing silvicultural practices that will improve the forest as a natural game range. Much additional research is needed to determine the benefits a game population may derive from various silvicultural practices, especially in regard to different cutting methods that may be employed. It is also important that we should know the loss incurred in the form of volume and quality increment the forest area would suffer, providing the optimum cutting method was employed with respect to improving the wildlife carrying capacity.

It is not my opinion that we should attempt to develop all of our public forest lands as wildlife areas. Each area or unit must be considered from the standpoint of optimum

use, correlated uses, and effect of any use that may operate as a decimating influence in so far as the greatest good to the greatest number policy is concerned. The close association between the art of forest management and wildlife management is due to the fact that both deal with the growth and production of natural species in an environment not greatly altered, but relying on partial control of a few factors to increase the yield above what unguided Nature would produce. The success in both depend upon the ability to select the proper factors influencing the ultimate yield and manipulating these controlling factors to the best advantage for the species in question, rather than a management program requiring heavy investments of labor or materials.

"In game, as in forestry and agriculture, there is no sharp line between the practice which merely exploits a natural supply, and the practice which harvests a crop produced by management." (2)

THE CORRELATION OF FORESTRY AND WILDLIFE MANAGEMENT

1. Historical review of the wildlife situation.

The practice of some degree of game management dates back to the beginning of human history. Perhaps the first record of some form of primitive management is to be found in laws for the regulation of hunting, more in the form of tribal taboos, that are recorded in the early stages of social evolution. The earliest written record is to be found in the Bible in the Mosaic Law dealing with the protection of birds:

"If a bird's nest chance to be before thee in the way, in any tree or on the ground, with young ones or eggs, and the dam sitting upon the young, or upon the eggs, thou shalt not take the dam with the young: thou shalt in any wise let the dam go, but the young thou mayest take unto thyself; that it may be well with thee, and that thou mayest prolong thy days." (Deuteronomy 22:6.) (2)

Leopold states that the first well-rounded system of game management for conservation purposes was found in the Mongol Empire under the rule of Kublai, "The Great Khan," (A.D. 1259-1294). This was recorded by Marco Polo, in the narrative of his travels across Asia. In this record it may be observed that even at this early period Kublai's technique had evolved beyond mere control of hunting and that he had made steps in what is usually the last form of management to be recognized, environmental control. He relates that:

"Near to this city* is a valley frequented by great numbers of partridges and quails, for whose food the Great Kahn causes millet, and other grains suitable to such birds, to be sown along the sides of it every season, and gives strict command that no person shall dare to reap the seed; in order that the birds may not be in want of nourishment. Many keepers, likewise, are stationed there for the preservation of game, that it may not be taken or destroyed, as well as for the purpose of throwing the millet to the birds during the winter. So accustomed are they to this feeding, that upon the grain being scattered and the man's whistling, they immediately assemble from every quarter. The Great Khan also directs that a number of small buildings be prepared for their shelter during the night; and, in consequence of these attentions, he always finds abundant sport when he visits this country; and even in the winter, at which season, on account of the severity of the cold, he does not reside there, he has camel-loads of the birds sent to him, wherever his court may happen to be at the time." (2)

* Is referring to the city of Changanoor in Cathay.

In the early history of European forestry we find a distinct relationship between the development of forestry as a science and the art of game management. At first the forests were considered as an undesirable encumbrance of the soil. With the growth of civilization in all countries has followed an increase in the demand for agricultural lands. This demand in turn invariably resulted in the wholesale destruction of virgin forest resources. The first attempt at forest protection in Europe was enacted by members of Royalty who wished to perpetuate the forest lands that they might continue to enjoy the chase which has to this day remained the favorite sport of Kings as well as Dictators. The following statement is from "History of Forestry," by Fernow:

> "Indeed, by the end of the 8th century the word Forst (voorst--foresta), which until then had been used merely to denote the king's property, was exclusively used to designate not necessarily woodland (the latter being referred to as silva or nemus), but any territory in which the hunt had been reserved.
>
> "This right to reserve the chase and the fishing, that is, to establish banforests was in the 10th century extended by the kings to territory not belonging to them, the right to the chase being according to the Roman doctrine a regal right over any property. Under this conception fields and pastures, woods and waters, and whole villages with their inhabitants became "inforested" grounds. The Norman kings, imbued with a passion for the chase, exercised this right widely, especially in England; the forests of Dean, Epping, and the New Forest being such inforested territories, the inhabitants of which were placed under special "forest laws," and adjudged by special "forest courts." (3)

When we compare the development of forest and wildlife management in Europe with that of the United States, we immediately recognize a number of basic differences in the

the trend of development. Development in Europe has been a slow process and many hundreds of years have elapsed since the first crude attempts of management were initiated, while in the United States our present forest and game policies have been developed in a very brief period. Differences in the principles of ownership as well as the fundamental concept of government has also had a very marked effect upon the management principles when comparing development in the United States with European development. The fact that European wildlife and forests were in most countries regarded as property of the Crown made control more easily accomplished than in the United States where these resources are regarded as the property of the people. In the United States it was the early contention of the government that all land should be placed in private ownership as quickly as possible. Thousands of acres were alienated under the various public land laws. The following is a rough historical outline of the acquisition and various methods used in the disposition of our Public Domain Lands:

Table 1.

ORIGIN OF UNITED STATES PUBLIC DOMAIN

1. The Northwest Territory - Ceded to the Federal Government by the original colonies at the close of the Revolution.

2. The Louisiana Purchase - Purchased from France. (1803)

3. The Texas cession - Ceded by Texas to the Federal Government (land outside present boundaries of Texas). (1848)

4. Mexican Territory - Obtained by conquest in the Mexican War.

5. Gadsden Purchase - Purchased from Mexico. (1853)

6. Oregon Territory - Obtained by exploration and settlement confirmed by treaty with England. (1846)

7. Alaska - Purchased from Russia. (1867)

Exceptions: All of the above territories contained some land that was in private ownership when the United States took possession. The U. S. Government confirmed all of these titles.

DISPOSITION:

1. Sales:

   a. Cash sales 1781-1862 at $1.00 to $2.00 per acre.
   b. Credit sales 1796-1820.

2. Military bonuses 1791 to date.

3. Grants for Internal Improvements, direct or to States.

   a. Railroads.
   b. Canals and waterways.
   c. Drainage.

4. Preemption

   a. Partial 1801-1843.
   b. Full preemption 1843-1892.

5. Educational Grants

   a. To Universities.
   b. To Agricultural Colleges.
   c. To States for Public Schools.

6. Timber Culture 1873-1891.

7. Desert Act - Private reclammation 1877 to date.

8. Carey Act - State Reclammation.

9. Homestead

   a. 160 acres - 1862 to 1934
   b. 320 acres - 1910 to 1934
   c. 640 acres - 1916 to 1934

10. Reserved

   a. National Forests
   b. Mineral Lands
   c. Indian Reservations
   d. Power Sites
   e. Reclammation Projects
   f. National Parks
   g. National Monuments
   h. Miscellaneous minor reservations

11. The Taylor Grazing Act. (1934 to date)

The following is a list showing disposition of the Public Domain:

1. Title passed from the U. S. as of June 30, 1934:

	Acres
Homesteads (approx.)	275,125,000
Cash sales and misc. disposals (approx.)	418,100,000
State grants for education or other purposes	181,679,623
Canal, river improvements, grants to states	6,842,921
Wagon road grants to states	3,359,188
Railroad grants to states	38,206,487
Railroad grants to corporations	94,219,087
Total area disposed of	1,017,532,306
Pending and imperfect land title	24,040,779

2. Title remaining with the U. S. as of June 30, 1934:

National Forests	138,120,193
National parks and Monuments	8,692,196
Indian Reservations (estimated)	56,676,535
Military, naval, experimental reservations, etc. (approx.)	1,000,000
Withdrawals (estimated net)	30,442,832
Unappropriated and unreserved public land	165,695,235
Total area remaining	400,627,235
Grand Total	1,442,200,320

One important exception to the Federal Government's policy of placing all lands in private ownership as quickly as possible developed about the year of 1891 when congress authorized the President to set apart any public land wholly or in part covered with timber or other growth, with commercial values or not, as National Forests. The large additions were made, however, during the administration of Theodore Roosevelt, "Father of Conservation," in 1904-5-6-7. Until Roosevelt was placed in office the idea of "Conservation through wise use," was unheard of. "Conservation" had until then been a lowly word, sleeping obscurely in the back of the dictionary. Few people knew the meaning of the word, but overnight it became an inspirational word used for a national issue.

Roosevelt was a man with a love for the out-of-doors, especially did he realize the value of such national resources as our virgin forest areas and the wildlife they were capable of supporting.

"The Roosevelt doctrine of conservation determined the subsequent history of American game management in three basic respects:

1. It recognized all these "outdoor" resources as one integral whole.

2. It recognized their "conservation through wise use" as a public responsibility, and their private ownership as a public trust.

3. It recognized science as a tool for discharging that responsibility." (4)

During the years previous to the Roosevelt administration, a new world's record was undoubtedly established by the citizens of the United States in the art of "Resource

Mining." As an example to show the rapidity with which this mining of certain resources progressed, I would like to present a chronological record of the extermination of the American buffalo. This is a shining example, and although all resources were not mined in a comparable manner, yet all resources suffered far beyond their ability for natural replacement.

Table No. 2.

The following statistics were presented by R.G.Johnson in his course A.H. 419:

1675-1825 - Indians first secured horses and changed their method of hunting buffalo.

1773 - It was estimated 100 millions of buffalo, horses and elk were grazing on the western range lands. Columns of buffalo were from 20 to 50 miles wide during seasonal migrations.

1825 - Last of the buffalo in southern Texas.

1864 - Buffalo population estimated at 15,000,000, Number milled 1,000,000; killed for hides, 40,000.

1865 - Union Pacific railroad reached Cheyenne. Split the buffalo herd into Northern and Southern herd.

1869 - Estimated population of the buffalo herds 14,000,000. Number killed, 1,600,000; killed for hides, 800,000.

1871 - Estimated population 7,500,000. Number killed, 4,000,000; killed for hides 3,200,000.

Kansas Pacific Railroad handled 2,160,000 pounds of buffalo meat. Santa Fee Railroad handled 500,000 pounds of meat and 1,000,000 pounds of buffalo hides.

Table 2. (Cont'd)

1883 - Last buffalo hunters operated in the Northwest.

1887 - Last buffalo hunters operated in the Southwest.

1888 - Last carload of buffalo robes shipped.

1888 - Estimated remaining buffalo population in the United States 150.

At the end of a period of 24 years we had remaining one buffalo for each original 100,000 at the beginning of the period. (1864)

THE IMPORTANCE OF WILD LIFE AS A BY-PRODUCT of OUR FOREST LANDS

1. Economic Importance

The position of wildlife in our national economic structure has been relatively unimportant until the last few years. Rarely has the question been raised as to the value of land when used for wildlife purposes as compared with its value when used for forestry or agricultural purposes. Another important consideration that is now being considered by a few of the forest administrators is the development of a planned broad forestry program. Under the broad planning program it is recognized that forests properly located have many values besides being a source of timber supply. These associated values can be made to serve multiple uses. Timber crops, unlike agricultural crops, require many years to develop from the seedling to maturity or to merchantable size. This requires a large initial invest-

ment with additional yearly expenditures in the form of interest, taxes, cost of protection, administration, etc., with an interval of many years between cutting operations, unless the unit is being operated on the sustained yield principle. It is entirely possible, under proper management, to obtain additional revenue from such associated crops as wildlife, grazing and recreation, to help pay the costs of producing the mature or merchantable timber. This revenue from associated products could be collected at short time intervals, usually annually, and the auxilliary revenue should pay the annual carrying costs on many operations.

The economic returns from wildlife on public forests would necessarily be calculated more on indirect values. Mr. W. L. McAtee in his studies of the economic relations of wildlife, has listed the following annual values; Meat and fur values of game and other undomesticated animals of the United States, $190,000,000; usefulness of insectivorous birds, $404,500,000; fishes as food, $14,000,000; hunters' license fees, $9,500,000; hunters expenditures, based on the population attributable to wildlife attractions, $254,500,000; estimated annual total, $1,031,000,000. Although a great proportion of this estimate is not related to our forest resources, we should realize the importance of wildlife as an economic consideration in our forest problem, regardless of how conservative an estimate we may use.

2. Social and Recreational Importance:

However great the value we may place upon our wildlife as an economic resource, the social value will be much greater. Especially is this true again with regard to our public

forest areas.

During the years prior to the beginning of the twentieth century when a much greater per cent of the population lived nearer the soil, wildlife was considered a part of every day existence. Fifty per cent of our population were previously engaged in some form of agriculture and lived in rural districts. Today, only twenty per cent of our total population are engaged in rural agriculture; it is estimated that with proper training and machinery, ten per cent of our population could produce enough food to satisfy the demand. With this ever increasing tendency toward urbanization, the value of wildlife as an element to satisfy the recreational demand is ever increasing.

H. H. Chapman describes forest value as follows: "The basis of value for forest property must be sought in the various uses which it serves and the benefits which it confers on the users." (5) If the social or recreational value of a forest property outweigh the value of production then the unit should be managed for the optimum use and forestry should become co-dominant or incidental in the management plan.

LAND PLANNING WITH RESPECT TO WILDLIFE:

Land planning means the adoption of policies which will provide for the future use of land in such a manner that its natural resources will be conserved and what it produces balances with consumption in terms of national or world economy.

"There are two concepts involved in land planning: one, the use of the land so as to get the most out of it considering its physical features and its relation to other land areas and, second, the use of land in such a way that its products will answer the various needs of the nation. In other words land planning means administration of the natural resources of the nation to meet its social and economic needs." (6)

Prior to and during the World War, agricultural production was greatly stimulated by unusual demand that had been created by a number of abnormal circumstances. Previous to 1900 immigration increased the population of the United States each year by hundreds of thousands. Then came the World War which stimulated our foreign export markets until thousands of acres of submarginal lands were placed under cultivation. When conditions began to adjust themselves after the close of the war, demand decreased rapidly, foreign markets were lost and agriculture became an industry suffering from unbalanced production. Advances in mechanization have led to the withdrawal of some 27,000,000 acres which were formerly needed to produce feed for approximately 9,000,000 draft animals which since 1921 have been replaced with machinery. The logical choice of land use for the millions of acres withdrawn from agricultural production appears to be to replace submarginal areas with forest cover or develop the forage cover upon the areas unsuited to the production of forest products; however, here

is where properly developed national land use planning is an important consideration. If after intensive research, the land planning boards determine the number of acres of timber land needed to produce enough lumber to satisfy national demands and as much export trade as it is logical to expect, then is it not important to try to develop some of the alternate uses for which timber land is suited on at least portions of the remaining unneeded acreage to maintain balanced production?

POSSIBILITIES AND LIMITATIONS OF ASSOCIATING WILDLIFE WITH OTHER LAND USES

It is probable that our knowledge is less complete regarding wildlife than it is regarding any other single physical factor. Many contributions have been made by the Biological Survey but as a whole the sum total of the information in relation to wildlife is so meager that it is of little value to the land planner.

Life histories and food habits of wild animals are still incompletely known for all species, as well as for the same species for different parts of the country. Ecological research must be completed before any definite statements can be made in regard to the possibility of growing the various types of game animals in harmony with certain enterprises; however, for the greater number of forest enterprises, especially where extensive forestry is practiced, wildlife apparently can be provided for without detracting from the productivity of the area.

Even with our limited knowledge of wildlife, ecology and the biologic value of wildlife, foresters and naturalists have long recognized that animal life is intimately interrelated with plant life. Man's interference with nature's balance may be followed by disastrous results if this balance is disturbed beyond certain natural limits.

Under certain circumstances it must be recognized that some species of wildlife and game animals do cause considerable damage to forest areas. Where heavy concentrations of deer or elk occur upon a limited area, serious damage results to both the forage and forest reproduction. Game areas are divided into natural ranges by certain physiological features. The balance between summer and winter range is one of the most important items the game manager must consider. Areas that have been improperly managed soon result in problem areas.

In Oregon we have an example of such a problem area in the Murderer's Creek unit, located in the Malheur National Forest. This is a large area of forest land surrounded by a limited area of winter range. The majority of the winter range is in private ownership. The deer on this forest area have been protected for a number of years until the population exceeded the carrying capacity of the winter range. Inelastic State game laws prevented adjustment being made when it should have been and the result has been a serious reduction in the food supply beyond the margin of safety. Either the excess population must be reduced by the taking

of both excess does and bucks from the area by man, or Nature will effect a balance by removing the greater percent of the entire herd during the first severe winter.

In 1927-28, the Pennsylvania Department of Forests and Waters, carried on a study to determine the deer damage to forest trees in Pennsylvania. The study was made by using plots one-fourth acre in size. Observations were made in such a manner that only deer damage was recorded. Previous studies have confused damage by deer with damage caused by other animal species, chiefly by damage caused by members of the Rodent family. In this study actual observations of the deer browsing were made and hoof prints in the snow leading from tree to tree were observed and the damage to the trees and seedlings recorded.

"Among the conclusions that have been developed from this preliminary study of deer damage to forest trees are as follows:

1. Deer frequently damage forest tree plantations and natural forest growth by eating the buds, leaves, and younger, more succulent twigs. This damage is likely to prove fatal at any time during the life of a stand until the trees reach a height of at least six feet.

2. Deer feed indiscriminately upon plantations and natural growth. The damage ranges from a partial destruction of the stand and crippling of the individual trees to complete destruction. Crippled trees that have not been killed are usually deformed and made practically worthless for future lumber production.

3. Deer feed upon practically all kinds of forest growth. If a preference is shown the conifers, it appears to be for pitch pine and white pine.

4. Excessive injury may be confined to a comparatively limited area, while tree growth in the surrounding regions may not be extensively damaged.

5. Deer damage unless checked, will result in the ruin of extensive areas of plantations and young natural growth under 10 years of age.

6. The establishment of forest tree plantations upon thousands of acres of State-owned as well as privately-owned forest land, located in these regions where deer are abundant is impractical at this time.

7. The damage now being done to natural forest growth precludes the possibility of lumbering in many sections of the State and the successful carrying on of improvement cutting for the purpose of encouraging the development of young trees of valuable species. To clear cut in these particular localities would mean the disappearance of valuable tree growth, such areas becoming barren.

8. It is apparent that if the forest lands of Pennsylvania are to be restored to productivity, something must be done to control the deer population in such a way as will not seriously interfere with timber production, which is the primary purpose of forestry.

European experiments show that if deer populations were managed so as not to exceed one deer to every 40 acres of forest land, there would be little or no damage to forestry by their grazing." (6)

This record of damage is an example of a problem area and is not a characteristic example. All such areas are the result of improper management. In many instances improper management is the result of many indirect influences that prevent the proper action being taken to correct the situation. There are many examples of laws and regulations that prevent practical game management. The practice of passing blanket or statewide laws is a common mistake throughout the entire United States. In recent years we are beginning to realize that each natural game range unit constitutes an individual game management problem. If laws are inelastic and cannot be applied to fit individual units it is only a

matter of time until problem areas develop. A better understanding of game problems will in time secure legislation that will be better suited to the demands of the wildlife manager. As more elastic regulations and laws are secured, less conflict will exist on our managed areas and the possibility of developing wildlife as a more important associated resource will be possible on a far greater per cent of our entire forest domain.

The Land Planning Committee of the National Resources Board make the following conclusions in regard to the possibilities and limitations of association and production of wildlife with other land uses:

"1. Wildlife production may be definitely coordinated with all other land uses on the national forests.

"2. Many biological relationships, basic to complete coordination, remain to be investigated.

"3. Coordination must be applied locally. Dominant use may vary within regions, national forests, drainages, or smaller units.

"4. Sustained production of wildlife implies regulated use, necessary to control populations within available food supplies, and, in varying degree, within other land use requirements.

"5. Adjustments between uses, involving priority ratings must be expressed in integrated plans for management of wildlife and other national forest resources." (7)

PLANNING FOR WILDLIFE ON FOREST LANDS

As a basis for the majority of our game administration policies two factors have been incorporated in practically every management attempt: first,we have the regulation of abuse by exercising police powers, and second, an attempt

to control management practice on private lands without the cooperation of the land owner. This second step is rarely successful; game may be planted and the kill regulated to a certain extent but without the owner's cooperation and the right to control environment, the possibility of producing a sustained game crop is rare indeed.

Game managers are constantly realizing a greater importance must be attached to environmental control, especially on intensively managed game ranges. This in turn diverts the attention of the men interested in the development of intensified game management to public lands, at least this time it seems that experimental development must be carried out on public lands by some form of public administrative agency.

The following is a common expression among wildlife men: "Scientific wildlife development now stands upon the threshold of expansion and is in a comparable position to that held by scientific forestry thirty years ago." When we analyze the growing demand for recreation and wildlife, surely this statement cannot be entirely a pipe dream. Our public lands should serve wildlife much in the same way they serve forestry; they should supply an area upon which scientific research may be carried out and they should serve as areas upon which we may perpetuate and produce sustained crops of native game species.

The possibility of developing and putting into effect a land use plan in the immediate future is more favorable

for all public lands than for private areas; however, there are many unrelated agencies delegated the power or responsibility of administering public lands. Under the Federal government we have such agencies as the Forest Service, Park Service, Biological Survey, Indian Service, etc., and in addition to Federal agencies we have State and County departments. To further complicate matters we are faced with the theory, migratory waterfowl excepted, that the states shall have jurisdiction over our wildlife resources; this theory developed from the reserved powers clause granted to the States by the Constitution. It was only through an international treaty making agreement that migratory waterfowl could be protected and regulated under Federal authority. In some respects it is an advantage to have wildlife regulation under state authority due to the local problems arising within each state and within each section of each state, but due to the complete lack of coordination of policies as well as the great number of systems used in the various states to provide for administering our game resources, there is room for much improvement and revision of methods employed.

Three outstanding changes needed to improve the status of wildlife in so far as our state set-ups are concerned are obvious:

1. Provide for and develop a satisfactory land use plan.
2. Provide technically trained game managers for our state game departments.
3. Take the game department out of politics.

In the federal departments we have a greater per cent of technically trained personnel. Also more rapid progress in the field of land planning is being made, but much constructive work is blocked by the states having all the power of legislation. Unless we can improve the state departments and state legislation the federal departments are limited as to the number of improvements they may develop.

When we analyze the many problems that confront the wildlife manager under our present set-up we cast a hopeful glance in the direction of planned land use, but here again we encounter the difficulties that are ever present in a new field. At the present time we realize the need for land planning but lack the research and background necessary to set up a land use plan on a broad enough basis to meet our immediate wildlife needs.

"As a basis for merging emergency with permanent planning, the following points are suggested for consideration. There should be:

1. An effort to identify and classify, with types and specimens, the land-use problems of the Nation, by regions or other divisions.

2. An effort to recognize, integrate, and utilize all existing agencies so as to identify the gaps and to take steps to fill them.

3. A selection of type specimens of problems and problem areas, for experimental attack on permanent solutions or difficulties of all sorts. In part, such procedure will follow that which is now in effect, but in part only." (8)

Following such a procedure it should be possible to isolate current problems and problem areas; such areas could then be given immediate attention. Perhaps the problem of

correlation of the numerous agencies will be the first and most difficult step. Some federal authority should be organized to bring into focus the various departments so a central policy may be developed. Under this agency it will be necessary to provide for Regional, State, and District or Unit organizations.

The actual wildlife planning under an organization of this size will be only a small part of the master plan; however, given a definite position in the national plan it is assured improved status.

IMPORTANT FACTORS TO BE CONSIDERED IN THE CORRELATION of FOREST MANAGEMENT WITH WILDLIFE MANAGEMENT

A. Modifications necessary in the present wildlife management practices to correlate them with proper forest management.

I think it logical to assume the existence of certain groups whose single interest is in the production of one or the other of the natural resources. We might call the members of such groups "Pure foresters" or "Pure wildlife managers," however, the use of the word "Poor foresters" or "Poor wildlife managers" would more nearly apply if we rate them under the "greatest good to the greatest number policy" as adopted by the Forest Service. The day of the "To Hell with the Public" policy as applied by either private timber owners or public administrative agencies has passed. The public welfare and public demands must be considered; only by enacting forest utilization plans which provide for production of each resource the area is capable of supporting, can this multiple use principle be satisfied.

If we are to develop cooperation between the single interest groups, certain changes in existing laws and customs must be made before optimum results can be secured. Perhaps the most important change the wildlife group could enact to better correlate wildlife and forest management would be changes in laws governing or limiting the flexibility of proper wildlife management; also more scientific methods for the development of such laws should be developed. Our present laws are usually enacted by state legislatures following a request by the political group known as the State Game Commission. Most state game commissions are made up of members whose professions may vary from farmer to banker; they may include some members from the group who call themselves sportsmen and whose knowledge of game is limited to the distance a deer may be killed with a 30-30, or whether a Royal Coachman or a Grey Hackle will give the best results on a dark afternoon. Again the commission members may be party leaders who have been granted this honorary position as a political plum.

The time required to place a new law into effect or to make changes in any existing law through State Legislative activity is another limiting factor to scientific game management. Fluctuations in wildlife populations may occur in very short periods of time and immediate changes in the management plan may become necessary. Such changes may occur locally or over larger areas and the ponderous state system of law making is entirely inadequate to meet the present requirements of the game manager. If excessive populations of

game animals build up upon a particular forest unit, extensive damage may result to the forest property before corrections can be made under our present system. This condition calls for a change that will place more authority in the game commission so they may provide means of correcting current problems as they develop. This in turn requires a change in the method of selection of game commission members. The commissions must be composed of members who are capable of analyzing correctly the various situations as they exist and develop. They must also have the ability to devise corrective measures.

B. Modifications Necessary in the Present Forest Management Practices to Correlate them with Proper Wildlife Management.

When we study the problem of management of two national resources that are so closely interrelated as our forests and our wildlife, we find that the relationship of the ecology of each resource is unquestionably the most important item to consider.

Perhaps the ecology of the wildlife is the more complex, as we find a difference in demand for each species, for each season of the year and by each species in regard to their optimum habitat requirements.

The other complex to be considered is the ecology of the forest. It is the problem of the Forest-Wildlife Manager to manipulate the physical changes upon the forest area, that are brought about through silvicultural practices, in such a way as to secure as nearly as possible optimum forest development conditions.

One of the first requirements for combinations of forestry and wildlife work is to develop a working plan for each unit, determine as nearly as possible the optimum use for the area, and decide what improvements can be made for the development of both resources. This requires a bird'seye view of the situation and the manager who is qualified to make the decision regarding the practices to be used on such an area must be a man who has a thorough knowledge of the ecological requirements of both resources. The antagonism that has developed in past years between the forestry and wildlife interests has probably developed due to the personnel in each field having a single objective, that of improving the status of the single resource in which they were interested; little consideration was given to the associate products of the area.

THE RELATION OF TIMBER STAND IMPROVEMENT TO WILDLIFE MANAGEMENT

Many silvicultural practices can be employed that will improve the area for both resources. Other practices produce optimum environment for one resource at the expense of the other and vice versa, depending upon the intensity of operation.

The development of mixed stands favors wildlife and at the same time improves the site for many forest areas insofar as timber production is concerned. Cuttings have been practiced only to a limited extent in our American forests during past years but as more intensive management develops they will become more important during the development of

young stands. Cuttings may be made to improve the food supply and to prolong the habitability of our forest areas for wildlife during the development of a stand from the youthful stage to maturity. Weedings and improvement cuttings increase the habitability of forest areas for as much as ten to twenty years for certain game species.

On many of our forest lands the canopy of trees has closed over vast areas that are unbroken by a change in type. It is well recognized by game management men that a dense growth of mature trees in which the crown canopy has closed over a considerable area, does not afford a favorable environment for the majority of our species of forest wildlife.

Forest areas of this type fail tolet through enough light to permit favorable growth of forage and browse plants on the forest floor and influence self pruning to such an extent that the lower limbs of the greater majority of the standing trees are dead or have dropped off far above the reach of game animals. Such species of big game as deer and elk depend to a large extent upon feed in the form of moss and lichens during adverse seasons and must secure the majority of this type of food from the low hanging limbs. Other unfavorable environmental factors created by this shading process is loss of food from the understory plants, and what is equally important, the lack of favorable game cover for protection from predators.

In many cases only slight alterations in the management practices upon an area will increase the game carrying capacity many times. It is not the opinion of game managers

that such cultural practices are applicable to all forest areas, as here again we must weigh the importance of all factors involved when considering what practices are warrantable on our wild land areas. This is a question that must be worked out on the ground for each area and must be provided for in our land planning procedure.

Experimental research has been carried out on some forest areas to determine the applicability and value of environmental manipulations. In Pennsylvania an experiment of this nature was carried out under the joint action of the United States Forest Service, Pennsylvania Department of Forests and Waters, and the Pennsylvania Game Commission. This experiment was carried out on lands known as the State Game Lands, totaling 573,458 acres, and distributed in fifty-three of the sixty-seven counties.

In this experiment, plans were developed in which consideration was given to the cutting operations employed so that wildlife and timber might obtain mutual benefit from the adjustment made.

"The cuttings undertaken were principally of four kinds, namely, release cuttings, slashings, thinnings, and felling timber for sale." (9)

Release Cuttings

The release cuttings were carried on chiefly to remove competitive growth about game food producing species such as grapevine, wild apple, hawthorne, black berries, mountain ash, dogwood, beech, huckleberries, sumacs, and many other

food producing trees, vines, and shrubs.

A number of plots were used and the plots varied in size from a fraction of an acre to several acres, depending upon the needs of game and on local conditions. Plots were scattered about one quarter of a mile apart, wherever there was suitable material for releasing. The majority of the plots were confined to low grade soil areas or patches having a low site quality. Areas that had been previously opened by cutting operations and being reclaimed by timber growth were reopened. Special attention was given to the release of all forms of game food where it could be done without seriously interfering with forest conditions in general.

Slashings in Plots

On areas where the timber growth was not large enough to market and where the food and living conditions were unsatisfactory, strip plots were established and cutting on these plots was carried out to stimulate sprouting, develop shrubs and other forms of growth that would enhance the value of the area for use by wildlife. Another way of creating the "edge" effect so necessary for optimum game development upon a forest area is through use of slash burning plots. On some of the plots the brush was piled and burned to provide for more forage, on other plots the brush was piled in such a way as to supply additional escape cover. It is recommended that slashing strips should be zigzag courses to furnish greater area with the "edge" effect.

Stump Height Experiment

Studies were made to determine what height stump would produce the most vigorous sprout growth. "Due to variations in the work of individuals making the cuts, we were unable to group enough trees cut the requested height to make satisfactory statistical study and graph the results.

Readings taken on several stumps in each section, after one growing year, however, provide the following data:

(a) On all plots the greatest average growth was from stumps cut 12" from the ground.

(b) Trees cut 18" to 24" high yielded a higher percentage of growth from the stump cambium. Whether this growth will continue to live as the stump dies, is problematical.

It is apparent from observations made that trees felled by cutting the stumps 6" to 12" high will yield more vigorous sprout growth than those cut 18" to 24" high. (9)

Sustained Yield

Sustained yield ranks at the head of the list of timber cutting methods in so far as benefit to wildlife is concerned. The development of sustained yield forest management has been a great boon to the forest wildlife populations.

Most sustained yield operations employ a relatively short cutting cycle which permits the forest canopy to be opened on the same area, or approximately the same area, every few years. This permits not only a sustained removable crop of timber but also a greatly increased forest carrying capacity for game by periodically retarding or setting back the regular forest succession.

The optimum game range is said to have about the following composition: Climax species 30 to 35 per cent, intermediate species of the plant succession 35 per cent, area near the lower stages of the succession, just above the erosion danger point 10 to 20 percent. On most forest areas the 10 to 20 per cent class of low value land is fairly well distributed and by sustained yield cutting the proper ratio between climax and intermediate succession stages is more likely to be secured than by any other method of harvesting the timber crop.

CONCLUSIONS

In summarizing the importance of the wildlife-forest relationships and the need for a better correlation which might result in a greater total derived value being secured from the two resources, I will list some of the factors that seem to stand out as those factors which should receive prior consideration in attempting to improve the status of each resource and the relationship of each resource to the other.

1. We have passed beyond the era of conservation. By this I mean that conservation alone is no longer a solution; proper management of the resource should be considered as the cornerstone for proper handling of all natural resources. If the management is adequate the resource will in turn be adequately produced so long as the resource is naturally replaceable.

2. Proper land use planning should be an important

means of improving the relationship between forestry and wildlife. Proper land use planning involves an accurate determination of the various land use values. A better recognition of wildlife values will unquestionably improve its status in the near future. In order to secure accurate values we must work out a comparable base and be able to evaluate each resource on a given area. If the development of the various resources do not conflict with each other, then we can develop each resource to the optimum. Where we have conflicts developing, then the area should be given consideration from the "Bird's Eye" view point and the management plans worked out accordingly. The very principle of multiple use requires not merely the forester's viewpoint, nor the wildlife manager's viewpoint, but demands an unbiased analysis of the problem as a whole.

3. One of the greatest needs, if we are to improve the wildlife manager's position, is the development of more flexible game regulations.

State wide game laws, political interference, untrained personnel making up the State Game Commissions, difficulty of obtaining appropriations for wildlife research are all important difficulties encountered at the present time. Steps should be taken to correct these deterrents to better management.

4. As a final suggestion I believe that modifications in forest management plans are essential. Revised plans

should make provisions for adequate consideration of each forest resource, whether it be grazing, wildlife, recreation or timber, and in return each resource should receive attention more or less in relation to its relative importance upon the unit area. If we have an area of low forest producing capacity and high game producing capacity is it not better management to try to secure the highest combined return from the area rather than confining our management almost entirely to timber, merely because it is a forested area? If, on the other hand, the forest producing capacity far exceeds the game producing capacity, then the expenditures for forest management should naturally exceed the amount expended on wildlife improvements.

The Wildlife-Forest manager must realize the importance of the consideration of demand, relative importance, ecological factors, and perhaps most important of all, what is the highest combined use or returns possible from a given area in terms of esthetic, recreational, educational and economic values.

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APPENDIX

COMPARING PER ACRE RETURNS ON A NATIONAL FOREST AREA

After completing the foregoing work regarding Wildlife-Forest relationships, I have found little material available that would show the comparative values or returns from different natural resources upon the same area. Believing that there is an existing need for some method whereby such comparative values may be worked out, I have set up the following example. For this method I have selected the per acre return as the basis for comparisons.

In 1938 a "Check in-Check out" system was used during part of the hunting season in the Ochoco National Forest and as I have those statistics available, through the kindness of Mr. N. J. Penick of the Ochoco Supervisor's staff, I will use the Ochoco as a sample area. It will be necessary to assume some of the data to complete the comparisons but such assumed data will be indicated as being assumed.

A. Number of registered hunters, 1938.

During 1938 campfire permits were required only until September 30th. For this reason the check of hunters was very incomplete. For the period covered by campfire permits 5500 hunters (in round numbers) were recorded. The estimate for the entire season is conservatively placed at 7,000. Check-out reports were secured from 1256 hunters who spent 4060 man days hunting and killed 479 deer. This shows an average of 3.3 days hunting per man and a success ratio of 2.6 hunters for each buck killed. Using the same figures we get an

average of 8.5 days hunting for each buck bagged. Due to the way in which private land is integrated with national forest land in this area part of the hunters who registered were hunting on private lands, but to offset this inconsistency there were also many local hunters who would hunt from their homes and not establish a camp within the forest. Most of the local hunters for this reason did not register, therefore, the two groups should just about offset each other.

Some assumptions will have to be made in order to arrive at the average expenditure for each hunter. This figure must be determined if we are to secure a per acre return estimate. The only record I have been able to find in regard to individual hunter expenditures on a similar area was a survey made on the Kaibab national forest. During this study each hunter was interviewed and an average expenditure per man was found to be $27. This was higher than the expense would run for the Ochoco area due to inaccessibility of the Kaibab. The following figures are all hypothetical and are also very conservative:

Hunting license	$3.00
Gasoline (5 gal.per man)	1.00
Food (3.3 days at .60)	2.00
Cartridges	1.50
Miscellaneous	2.50
Total per man . . .	$ 10.00

Area of Ochoco national forest:

Gross area --	961,225 acres
Net N.F. area	758,020 acres

758,020 divided by 7,000 (number of hunters) would give

Fungi in Douglas fir Slash

Research has disclosed that Douglas fir slash is attacked by many fungi. Following is a fairly complete list compiled from the literature on the subject:

Ascomycetes

Penicillium sp.

Ceratostomella pilifera

Pyrenomycetes

Hypoxylon cohaerens

Phacidales

Discomycetes

Chlorosplenium aeruginosum

Guepiniopsis sp.

Basidiomycetes

Tramellales

Dacrymyces aurantia

D. palmatus

Tremellodon gelatinosum

Hymeniales

Thelephoraceae

Aleurodiscus penicillatus

A. subcruentatus

A. amorphus

Coniophora cerebella

Thelephoraceae (cont.)

Corticium Pseudotsugae

C. racemosum

C. vagum

Hymenochaete rugispora

H. spreta

Peniophora carnosa

P. crassa

P. glabra

P. odorata

Stereum Chailletii

S. sanguinolentum

Thelephora terrestris

Sparassis radicata

Hydnaceae

Echinodontium tinctorium

Hydnum Auriscalpium

H. coralloides

H. Erinaceum

H. Ochraceum

Polyporaceae

Polyporus volvatus

Fomes annosus

F. laricis

F. pinicola

F. putearius

F. roseus

F. ungulatus

Polyporaceae (cont.)

Fomes applanatus

Ganoderma oregonense

Lenzites hetermorpha

Lenzites sepiaria

L. trabea

Merulius americanus

M. brassicaefolius

M. lacrimans

Polyporus abietinus

P. adjustus

P. amarus

P. aurantiacus

P. benzoinus

P. cutrifractus

P. frondosus

P. giganteus

P. hispidus

P. Peakensis

P. Pseudotsugae

P. Schweinitzii

P. stipticus

P. sulphureus

Polystictus hirsutus

P. pargamenus

P. serialis

P. versicolor

Coriolus abietinus

Poria carbonaria

Polyporaceae (cont.)

Poria dichroa

P. incrassata

P. Medulla-panis

P. subspadicea

Trametes hispida

T. protracta

T. sepiaria

T. pini

T. setosus

Agaricaceae

Armillaria mellea

Lentinus lepideus

Lepiota xylophila

Pholiota ventricosa

Atrichia glomerulosa

Gelatinosporium abietinum

Helvella infula

Naematelia encephala

Figure 7

A corner of the pathology laboratory, showing the slash fungi cultures in the background.

BIBLIOGRAPHY FOR FUNGI

1. Anonymous, Penecillium as a Wood Destroying Fungus, Ann. Bot. 12:565-566. 1898.

2. Anonymous, Enzyme Action in Polyporus volvatus and Fomes igniarius, Jour. Gen. Physiology, 3:795-800.

3. Anonymous, Studies in Physiology of the Fungi, Ann. Mo. Bot. Gard., V.4, no. 2, p. 93-164.

4. Buller, A. H. R., Researches on Fungi, 1909.

5. Burt, Edward Angus, The Thelephoraceae of North America--IX Aleurodiscus, Ann. Mo. Bot. Gard., Vol. 5, no. 3, p. 177-203.

6.

6. Fritz, Clara W., Cultural Criteria for the Distinction of Wood-destroying Fungi, Proc. Trans. Roy. Soc. Canada, Series 3, vol. 17, Sec. V, pp. 191-288.

7. Heald, F. D., Manual of Plant Diseases. McGraw-Hill Book Co., 1926.

8. Hedgcock, G. G., Studies Upon some Chromogenic Fungi which Discolor Wood, Mo. Bot. Gard., 17: 59-113.

9. Hubert, E. E., A study of Laboratory Methods Used in Testing Relative Resistance of Woods to Decay, Univ. of Idaho Bull. No. 13:2.

10. Hubert, E. E., Diagnosis of Decay in Wood, Jour. Ag. Rsch., 29: 523-567. Dec. 1927.

11. Hubert, E. E., Manual of Woodrots, The Timberman, Portland, Oregon, 1927.

12. Hubert, E. E., Fungi as Contributory Causes of Windfall in the Northwest, Jour. For. 16: 696-714.

13. Long, W. H. & R. M. Harsch, Pure Cultures of Wood-rotting Fungi on Artificial Media, J. Ag. Rsch. 12: 33-82, 1918.

14. Lyman, G. R., Culture Studies on Polymorphism of Hymenomycetes, Boston Soc. Nat. Hist. Proc. 33, no. 4, 1907.

15. Murrill, W. A., Agaricales, No. Amer. Flora, V.9, pt.4, p. 296, 1915.

16. Richards, C. A., Methods of Testing the Relative Toxicity of WoodsPreservatives, Proc. Amer. Wood Pres. Assoc., 19: 127-135, 1923.

17. Rumbolt, C. T., Blue Staining Fungi Found in the United States, Phytopath., 19: 597-599, 1929.

18. Seymour, Arthur Bliss, Host Index of the Fungi of North America, Harvard Univ. Press, Cambridge, Mass., 1929.

19. Schmitz, H., The Wood Destroying Properties of Polyporus volvatus, Jour. For., 21:1-2, 1923.

20. Weir, J. R., Notes on Wood Destroying Fungi, I Phytopath. 4:271-276. 1914.

21. White, J. H., The Biology of Fomes applanatus, Trans. Roy. Canad. Inst., 12:133-174,

22. Zeller, S. M., Lenzites sepiaria, with Special Reference to Enzyme Activity, Ann. Mo. Bot. Gard., 3: 439-512, 1916.