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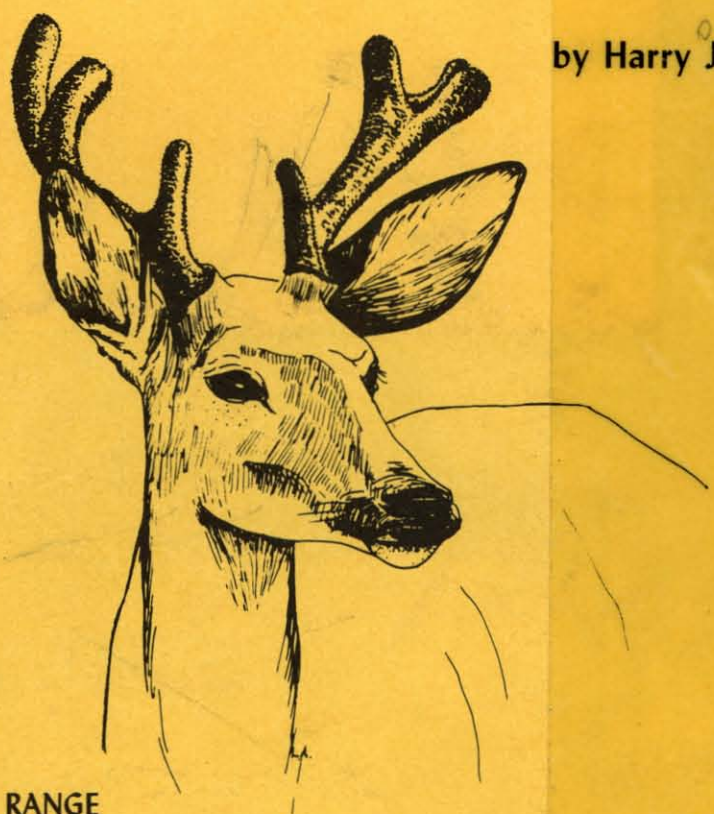
WHITE-TAILED DEER HABITAT MANAGEMENT GUIDELINES

by Harry Jageman



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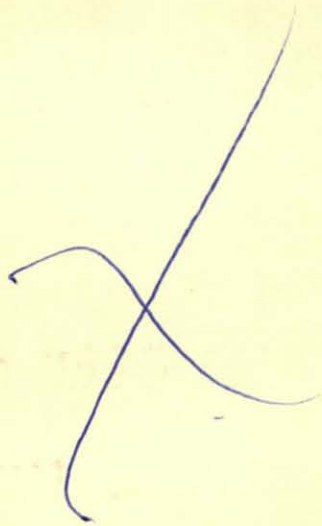

WHITE-TAILED DEER HABITAT MANAGEMENT GUIDELINES

by Harry Jageman

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FOREWORD

The need to provide guidelines for land managers, planners, private landowners and others who are interested in retaining white-tailed deer habitat on lands used for a variety of purposes was the stimulus for this project. These guides are based on available information plus discussions with individuals experienced in managing whitetail habitats and populations in the region. While these guides will help to ensure that whitetail habitat is retained or enhanced, they must be used with judgment and should be modified to meet specific needs on a case-by-case basis. The following individuals provided helpful comments: Lew Brown, Bureau of Land Management, Coeur d'Alene; Dan Davis, Clearwater National Forest, Orofino; Dean Graham, Nezperce National Forest, Grangeville; Paul Hanna, Idaho Department of Fish and Game, Coeur d'Alene; Paul Harrington, Idaho Panhandle National Forest, Coeur d'Alene; Loren Hicks, Plum Creek Timber, Inc., Seattle; Steve Judd, Colville Confederated Tribes, Inchelium; Keith Lawrence, Nezperce Indian Tribe, Lapwai; Tom Leege, Idaho Department of Fish and Game, Coeur d'Alene; John Mundinger, Montana Department of Fish, Wildlife, and Parks, Kalispell; James Peek, University of Idaho, Moscow; Gary Power, Idaho Department of Fish and Game, Kamiah; Pete Zager, Idaho Department of Fish and Game, Coeur d'Alene. Funding for the project was provided by Colville Confederated Tribes, Idaho Department of Fish and Game, U. S. Bureau of Land Management and U. S. Forest Service.

White-tailed Deer Habitat Management Guidelines

by Harry Jageman

INTRODUCTION

The white-tailed deer (*Odocoileus virginiana*) is widely distributed across northern Idaho. Approximately 8,000 whitetails are harvested each year by northern Idaho hunters (Pehrson 1974, Nielson 1974). Whitetails are also enjoyed by many nonhunters, and because they often live near human habitation, they are frequently observed. The whitetail will continue to be important in northern Idaho in the future.

Few investigations into whitetail habitat relationships are available in this region. A knowledge of spring, summer, and fall habitat use is particularly lacking. Information on the relationship of whitetail habitat to forest management activities is needed. The purpose of this paper is to summarize what is known about white-tailed deer habitat use patterns in this region and present interim forest management guidelines for managing whitetail habitat. This information is intended to serve as a foundation for further analysis and refinement.

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LITERATURE REVIEW

Food Habits

White-tailed deer subsist primarily on browse throughout most of the year in northern Idaho (DeNio 1938. Pengelly 1961, Roberts 1956, Thilenius 1960). DeNio (1938) and Roberts (1956) found whitetails use new grass following green-up in spring. Allen (1968), Martinka (1968), and Kamps (1969) also showed that whitetails switch to grass in the spring in Montana. Martinka (1968) found that Montana deer also used agricultural crops and forbs (alfalfa (*Medicago sativa*) and pasqueflower (*Anemone patens*)) in the spring when available. This forage pattern likely occurs in northern Idaho as well.

Forbs increased in importance, but leaves of woody plants were still the number-one food item for Idaho whitetails in summer (Table 1). Thilenius (1960) found that the use of grass was almost nonexistent during the summer. Roberts' (1956) data show that browse constituted 63 percent of the whitetail diet in early June, and forbs accounted for 37 percent. A total of 52 species of forbs were browsed by whitetails, but 4 species made up the bulk of the diet. These were Canada milkvetch (*Astragalus canadensis*), American vetch (*Vicia americana*), Sierra Nevada pea (*Lathyrus nevadensis*), and Scarlet painted-cup (*Castilleja miniata*). The amount of browse gradually increased in the summer diet until September, when browse made up 100 percent of the diet. Deer also make heavy use of forbs and agricultural crops in summer if these plants are available (Martinka 1968, Hildebrand 1971, Allen 1968, Kamps 1969).

Roberts (1956) reported that by fall deer were subsisting almost entirely on deciduous browse in northern Idaho, relying mainly on the same four species used in the summer.

Montana investigators (Kamps 1969, Allen 1968, Martinka 1968) have also noted an increase in browse consumption during the fall, although deer still used a substantial amount of forbs, agricultural crops, and green grass (only after the fall rains). Martinka (1968) found that forbs remained the most important forage class (most occurring as dry unidentifiable species). Alfalfa use declined, but the use of wheat in the form of seed heads increased.

Table 1. Browse species used in summer by deer (Roberts 1956, Thilenius 1960)

Scientific name	Common name
Amelanchier alnifolia	Serviceberry
Berberis repens	Oregon grape
Ceanothus sanguineus	Redstem ceanothus
Holodiscus discolor	Ocean spray
Lonicera ciliosa	Vine honeysuckle
Lonicera utahensis	Utah honeysuckle
Pachistima myrsinites	Pachistima
Philadelphus lewisii	Syringa
Physocarpus malvaceous	Ninebark
Ribes viscosissimum	Ribes
Rosa sp.	Rose
Salix sp.	Willow
Spiraea betulifolia	Spiraea
Symphoricarpos sp.	Snowberry
Vaccinium caespitosum	Dwarf huckleberry
Vaccinium membranaceum	Huckleberry

Northern Idaho whitetails exist almost entirely on a diet of browse during the winter (Roberts 1956, Pengelly 1961). Use of arboreal lichens when they are available has also been noted by field personnel of the Idaho Department of Fish and Game (Leege, draft comment). As winter progresses, deer make more and more use of coniferous browse, especially Douglas-fir and western redcedar. DeNio (1938) found that consumption of conifers reached a high point in February. Important species in winter diet are listed in Table 2.

Foraging Areas

Whitetails are frequently seen feeding in fields, pastures, and other openings in spring. Gladfelter (1966) noted that deer were often observed feeding at night in meadows and clearings after snow melt in the spring on the Palouse Range. Owens' (1981) data indicated that deer selected similar habitats for foraging and resting in summer. Some use of fields at dusk in areas where deer inhabited forest-agricultural ecotones, was noted by Owens (1981) and Mundinger (1980). Mundinger (1980) believed deer were adapted to mature, sub-climax forbs and that they consistently used timbered uplands for foraging in the Swan Valley of Montana. Deer used areas near mesic sites such as creek bottoms, marshes, potholes, or meadows. Some summer ranges included recent clearcuts, but use was apparently confined to the edges.

Other investigators have noted extensive use of clearcuts, fields, and openings for foraging in the summer. This has been particularly true when the investigator considered nocturnal and crepuscular data. Gladfelter (1966), for example, found that northern Idaho deer were often found feeding in small clearings or willow patches at night. Nelson (1979) found that Minnesota deer retreated to thick cover during midday, but that by late afternoon they moved into clearcuts to feed. Deer fed and bedded in the cutting during the night but moved back to the timber at dawn. Montgomery (1963) in Pennsylvania, Thomas et al. (1964) in Texas, Marchington and Jeter (1966) in Alabama, and Tibbs (1967) in Pennsylvania have noted similar activity patterns.

Gladfelter (1966) frequently found deer in openings where browse was available during fall. Use of grassy open areas has been reported to increase during the fall in contrast to use over the summer (McCaffrey and Creed 1969, Martinka 1968). Thermal cover is apparently required by whitetails wintering in northern climates (Owens 1981, Mundinger 1980, Pengelly 1961, Telfer 1970, Ozoga 1968, Webb et al. 1956). During the coldest months and deep snow conditions, deer appear to select habitats for the cover value and eat whatever is available in these habitats. Under milder conditions when movements are not restricted, forage areas are probably more important than cover in determining habitat selection (Leege, draft comment).

Moen (1968) reported that deer in agricultural habitats of western Minnesota did not always seek heavier cover during extremely cold weather. He stated that during a

Table 2. Winter browse species modified from Pengelly (1961)

Rating	Scientific name	Common name
EXCELLENT:	*Cornus stolonifera*	Red osier dogwood
	Thuja plicata	Western redcedar
	Ceanothus sanguineus	Redstem ceanothus
GOOD:	*Amelanchier alnifolia*	Serviceberry
	Acer glabrum	Maple
	Pachistima myrsinites	Pachistima
	Salix sp.	Willow
	Arctostaphylos uva-ursi	Kinnikinnick
	Prunus virginiana	Chokecherry
	Pseudotsuga menziesii	Douglas-fir
	Berberis repens	Oregon grape
	Vaccinum membranaceum	Huckleberry
	Rhamnus purshiana	Cascara
	Taxus brevifolia	Western yew
FAIR:	*Abies grandis*	Grand fir
	Crataegus sp.	Hawthorn
	Pinus ponderosa	Ponderosa pine
	Rosa sp.	Rose
	Pinus monticola	White pine
	Spiraea betulifolia	Spiraea
POOR:	*Alnus* sp.	Alder
	Populus trichocarpa	Cottonwood
	Sambucus racemosa	Elderberry
	Tsuga heterophylla	Hemlock
	Lonicera spp.	Honeysuckle
	Pinus contorta	Lodgepole pine
	Menziesia ferruginea	Menziesia
	Physocarpus malvaceus	Ninebark
	Holodiscus discolor	Oceanspray
	Rubus parviflorus	Thimbleberry
	Symphoricarpos albus	Snowberry
	Philadelphus lewisii	Syringa
	Larix occidentalis	Western larch

week of extremely cold weather where temperatures did not rise above 0°F, deer continued to be in open fields and feed on corn, soybeans, and dry, sweet clover. He postulated that deer on poorer diets may need to seek cover to maintain a positive energy balance. Wheat, alfalfa, and hay fields adjacent to forest cover often provide forage throughout the winter in areas of intermittent snow cover. In such situations, the high energy obtained from these types of forage may substitute for cover to some extent.

Cover

Hiding cover is considered to be vegetation capable of hiding 90 percent of a standing adult deer from the view of a human at a distance equal to or less than 200 feet during all seasons of the year in which deer normally use the area. Thermal cover is vegetation used by deer to help maintain comfortable body temperatures with minimal energy expenditure. For this report, thermal cover is considered a stand of coniferous trees 35 feet or more tall with an average crown cover exceeding 70 percent. Cover use appears reduced in spring, although deer use conifers during inclement weather (Ozoga 1968). Kearney and Gilbert (1976) found that in the spring in Ontario this cover often takes the form of trees 50 to 60 feet tall.

Owens (1981) found that in summer deer preferred dense cover types, despite a large proportion of forest clearing in deer home ranges. Deer selected mesic sites in the grand fir (*Abies grandis*)/pachistima (*Pachistima myrsinites*) and redcedar (*Thuja plicata*)/pachistima habitat types. Average stand height was 28.5 feet with an average DBH of 5.9 inches. Height to the lowest live limb of the overstory trees was 9.5 feet. Average stand age was 30-50 years. Overstory species included 40 percent grand fir, 3 percent larch, 1 percent ponderosa pine, 16 percent Douglas-fir, and 21 percent cedar. Mean canopy closure was 88 percent. Understory density as measured by coverboard analysis viewed from 200 feet was

0 - 1.6' = 51% Coverage
1.6 - 3.3' = 53% Coverage
3.3 - 4.9' = 53% Coverage
4.9 - 6.6' = 58% Coverage
6.6 - 8.2' = 65% Coverage

Shaw (1962) noted a strong preference for north and east facing slopes of the cedar/pachistima habitat type during the months of July and August. Heavy use of creek bottoms also occurred during this time. Howard (1969) noted that high temperatures caused deer to extend their diurnal bedding periods during the summer months and seek areas with cover and cooler temperatures. Mundinger (1981) found heavy use of closed-canopy forest in summer. Gladfelter (1966) reported that on the Palouse Range, deer bedded near feeding sites. During summer and fall, deer bedded on partially open or brushy ridges, generally just below ridge tops, close to cover such as mature shrub species or the forest edge.

Fall habitat has probably been the least studied component of year-round white-tailed deer habitat use. It represents the transition between summer and winter range. Thermal cover is not as critical, and because of forage availability, there is a tendency to use more open types than in both summer or winter (Gladfelter 1966). Sparrowe and Springer (1970) noted that deer used the heaviest cover available during hunting seasons.

In summary, fall use of cover is probably similar to that found in the summer. Deer utilize clearings and openings to obtain forage (especially in the evening, at night, and early in the morning) and retreat into cover during the middle of the day.

In the winter, deer are usually located at lower elevations in association with river bottoms and lake shores. Pengelly (1961) found in his studies on the Coeur d'Alene National Forest that most good whitetail winter ranges were below 2300 feet elevation in the interior of the forest near Wallace and below 2500 feet elevation on the western margin of the forest near Coeur d'Alene (Table 3). Southwest slopes just above the river bottom were often preferred habitats. Douglas fir/ninebark, and grand fir/ pachistima habitat types (Daubenmire and Daubenmire 1968) often predominate on these southwest aspects, especially on the western margin of the forest near Coeur d'Alene. Deer make use of the sidehills for feeding during the milder weather or more favorable snow conditions. Small openings may be used at this time, provided snow conditions do not preclude access.

When temperatures decrease or snow depth increases on the more open Douglas fir/ninebark and grand fir/pachistima sites, deer will retreat to dense coniferous stands of the cedar/pachistima habitat type which are commonly found near the river bottom. Snow depths usually preclude the use of large natural openings and clearcuts by whitetails (Mundinger 1981, Owens 1981, Kearney and Gilbert 1976).

Table 3. Winter range classification, Coeur d'Alene River, Idaho (Pengelly 1961).

Rating	Classification
EXCELLENT:	Food species - dogwood, willow, maple, serviceberry, chokecherry, redstem ceanothus, western redcedar, and Douglas-fir reproduction.
	Broken canopy of coniferous trees - islands of dense canopy occurring occasionally.
	Cover and forage interspersed quite evenly.
	Usually wide river or stream bottoms and bordering flats - the larger the flats, the better.
	Lower edges bordered by south and west slopes with similar dense cover.
GOOD:	Browse species similar.
	Less canopy, usually due to logging.
FAIR:	Interspersion of food and cover out of balance.
	No food where there is cover.
	Undesirable browse species.
POOR:	Extensive timber lands of more than 70% crown cover where the understory is either barren or herbaceous.
	Extensive open areas almost devoid of cover.
	Dense hemlock or extensive rocky outcrops are usually poor habitat.

Water

Gladfelter (1966) observed deer at watering areas mainly in the evening and just after sunset in the summer. Deer took 15 to 20 laps at watering sites. Only a few times in the winter were deer seen at water sites, but they were often observed licking snow. Maynard et al. (1935) and Hosley and Ziebarth (1935) also observed little use of open water when snow was present. Nicholl (1938), in experiments with penned deer in Arizona, found daily water consumption rates of three quarts per hundredweight in winter. Mundinger (1980) found that each home range of the deer he radio-tracked included a wet area such as a creek, lake, or marsh.

Old Growth

Old-growth stands of most value to whitetails have a mixture of age classes and often contain numerous small openings. Whitetails utilize these areas during the winter because of the interspersion of forage and high-quality cover. Old-growth stands which intercept substantial amounts of snow may be more important in areas where deer must winter in snow over 18 inches deep. Mundinger (1981) found high usage of old-growth grand fir sites in Montana's Swan Valley. However, Owens (1981) found that conifers 30-50 years old with an average height of 33 feet gave adequate shelter for wintering white-tailed deer on the Palouse Range. Gill (1957) in Maine and Boer (1978) in New Brunswick have reported winter cover requirements similar to those reported by Owens. While old growth may be preferred habitat in some areas for white-tailed deer, younger forest types which intercept snow and provide forage can also be used.

Salt

Use of salt is most frequent in April and May when deer turn to fresh green herbaceous foods (Dasmann 1971). Sodium is the element sought, and the drive is common to both sexes and to all age groups except nursing fawns (Weeks and Kirkpatrick 1976). They speculate that sodium loss is due to intake of green vegetation which is high in potassium and water. Excess potassium and water must be

removed from the system, and some of the needed sodium is lost along with potassium and water in urine and feces. They also note that lactation and antler development may remove sodium and account for continued use of salt over the summer. Weeks and Kirkpatrick (1976) found no evidence of reduced productivity due to lack of sodium. Behavioral and physiological mechanisms in deer appear sufficiently well-developed to allow maintenance of a positive sodium balance under most circumstances.

Movements and Home Range

Owens (1981) found that most whitetails on the Palouse Range have two distinct home ranges: a summer range used from late March until early August, and a winter range used the rest of the year. Some deer are known to remain on the winter range year long. Deer moved an average of eight miles between summer and winter range, as has been noted elsewhere in northern climates (Table 4).

Table 4. Distances traveled between summer and winter home ranges by northern white-tailed deer.

Author	Distance traveled between seasonal home range (miles)	Study area
Dahlberg and Guettinger (1956)	3.5 miles	Wisconsin
Carlsen and Farmes (1957)	5 miles	Coniferous forest, Minnesota
Carlsen and Farmes (1957)	9.4 miles	Prairie-deciduous forest, Minn.
Rongstad and Tester (1969)	11.4-14.3 miles	Cedar Creek, Minnesota
Verme (1973)	8.7 miles	Upper Michigan
Meske (1977)	9 miles	Clearwater River, Idaho
Mundinger (1980)	15.5 miles	Swan Valley, Montana
Owens (1981)	8 miles	Palouse Range, Idaho

Owens (1981) reported a mean home range size of 700 acres during summer. These home ranges had an average of 6 openings with a mean opening size of 30 acres. An average of 24 percent of the home range was considered open. Daily movements betwen radio locations were approximately 1770 feet. Gladfelter (1966) observed movement during summer mainly on ridges between small drainages.

Owens (1981) reported back and forth movement between summer and winter ranges, starting in August and lasting until October 4, on the Palouse Range. Mundinger (1980) found deer concentrated on winter range by mid-December. Deer may also use intermediate areas between summer and winter ranges in fall and spring.

Winter home-range size varies with winter severity. Drolet (1978) found that during years of heavy snowfall and cold temperatures, home range size was smaller than it was during more moderate winters. Home range sizes have varied from 160 to 363 acres in Montana and Idaho (Mundinger 1980, Owens 1981). Deer tend to congregate in areas surrounding winter range in late fall and then gradually reduce range size as severity of weather increases. Gladfelter (1966) found that general movements tended to follow the pattern of least resistance, and deer avoided areas of snow accumulations such as ridges and openings. General movement was up and down creek bottoms and draws, with very little movement across ridges.

Disturbance

ROADS

White-tailed deer are particularly vulnerable to highway accidents when roads traverse frequently used lowlands and riparian zones. An average of 107 road-killed white-tailed deer were reported annually from 1973-1981 in north Idaho (Oldenburg 1982). These numbers represent approximately 3 percent of known whitetail mortality and appear to be increasing. One hundred and fifty seven whitetails were lost in 1981.

The effect of open secondary roads on white-tailed deer is largely unknown. Little information exists on the response of deer to traffic along roads. Drolet (1978) reported that deer used roads in clearcuts as travel lanes, and browsing 100 feet from the road was only 35 percent of the level occurring along the road. Likely, white-tailed deer distribution will be less adversely affected by traffic on roads than elk distributions. Deer have smaller home ranges and are thus less apt to show pronounced changes in distribution when roads are being used, especially when adjacent cover is dense.

POACHING

Whitetails are probably subject to more illegal hunting than any other species in northern Idaho because they frequently exist near human habitations and are readily handled. Idaho Department of Fish and Game reports for the years 1973-1981 (Oldenburg 1982) reveal that approximately 10 illegal white-tailed deer kills are reported each year in northern Idaho. Due to the difficulty of detection, this number is undoubtedly a fraction of the animals lost to poaching.

DOGS

Dogs can have a significant impact on white-tailed deer, especially in localized areas. It appears that problem is most severe during the winter season. In the Coeur d'Alene River region, where residences are interspersed along the river, dogs killed at least 12 deer during the winter of 1975 (Lowry and McArthur 1978). Some deer were killed outright, others were forced into the river and drowned. As many as nine dogs in a pack were observed chasing deer. Harassment by dogs is probably most critical within five miles of human population centers. An annual average

of 52 cases of dogs harassing big game were reported in northern Idaho from 1975-1981 (Oldenburg 1982). An average of 15 deer were reported killed. These figures represent a fraction of the animals chased and lost to dogs, because of the difficulty of detection.

Progulske and Baskett (1958) concluded that dogs were not effective predators on deer when there was no snow. In six and one-half years they had only two reports of dogs killing deer under such conditions. However, some breeds, such as hounds, are more effective predators of deer than breeds which have trouble following a scent.

SNOWMOBILES

Dorrance et al. (1975) found that heavy snowmobile traffic caused deer to move away from areas within 200 feet of snowmobile trails. Deer responded to very low intensities of vehicular traffic, and movements increased sharply when snowmobiles were operating. Deer were significantly farther from trails during the day than at night.

Deer remained away for the duration of disturbance but returned near the trails less than 24 hours after snowmobiles left. Deer using ranges restricted of public access responded more dramatically to snowmobiles than did those on the public areas.

Eckstein et al. (1979) also found that deer moved about 200 feet away from existing snowmobile trails. Snowmobiling increased deer activity during a normally inactive period (1900-2200 hours). Darkness reduced reaction of deer to disturbance, and finally deer reacted more dramatically to cross-country skiers when they used snowmobile trails.

Neither Eckstein et al. (1979) nor Dorrance et al. (1975) could find a measurable change in home range size or habitat utilization as a result of snowmobile traffic. Dorrance et al. theorized displacement of deer on poor range or during severe winters could be detrimental to their energy budget. During mild winters or on good range, the effect may be negligible. They suggested that trails be routed away from areas where deer concentrate and that use of particular trails be restricted on consecutive days.

SUBDIVISIONS, DAMS, AND OTHER MAN-MADE STRUCTURES

Winter ranges are critical to the welfare of whitetails in the Northwest. They are especially vulnerable to encroachment by human activity, because they often occur along river bottoms and lake shores, and their loss tends to be permanent. Reservoir projects are particular offenders. For example, the Dworshak Dam on the North Fork of the Clearwater River flooded an estimated 10,000 acres of big-game range and displaced several thousand white-tailed deer (U. S. Fish and Wildlife Service 1960). Such loss of habitat is especially critical when one considers that areas suitable for winter range may constitute as little as 5 percent of the total land base. Subdivisions in rural areas also reduce habitat, since humans, like white-tailed deer, often prefer property overlooking a lake or river with a southern exposure. The effect of this type of habitat loss is often compounded by an increase in human-related activities, such as snowmobiling, cross-country skiing, and unrestrained running of dogs. Relocation of development away from critical winter range appears to be the only feasible way to avoid this type of conflict. Zoning ordinances may be applicable, but they are bound to be politically controversial. Loss of winter range should be a factor in selection of reservoir and other development sites. If development must occur along rivers and lakes, sites with northerly exposures should be favored.

LIVESTOCK

McMahan (1966) found that in Texas free-ranging deer avoided pastures stocked with livestock whenever possible. Whitetails avoid cattle more than mule deer do (Kramer 1973). Deer tended to remain 50 yards or more from cattle.

Cattle operations in northern Idaho are typically small, and usually consist of a rural family running a few head of cattle to supplement income. This type of cattle grazing did not substantially reduce the food supply for deer (Thilenius and Hungerford 1967). Moderate summer grazing by cattle may even stimulate new growth and be beneficial to deer. Since cattle are removed from most whitetail range during the winter, competition is not as keen as it might be otherwise. However, excessive browsing by cattle can change shrub understories to bluegrass (*Poa* spp.) dominated communities in northern Idaho. Thus, there is a need to manage cattle so that this type of whitetail range deterioration does not occur, and to ensure that cattle are not allowed to occupy good whitetail range during the winter months. This is especially critical on riparian habitats.

FOREST MANAGEMENT RECOMMENDATIONS

Inventory

The first step to incorporate deer habitat management with forest management is to map the key areas used by deer (Telfer 1970). Winter range is a critical element and should be given first consideration in this mapping process.

The winter range description found in Table 3, topographic maps, aerial photography, and a knowledge of local weather conditions should help guide this search. Major considerations follow.

1) Winter range is usually located at lowest elevations associated with river bottoms and lake shores.

2) Lower south slopes just above river bottoms are favored.

3) Little use occurs in areas where snow accumulates over 18 inches in winter.

4) Dense coniferous cover types are preferred during winter in deep snow areas.

5) Whitetail winter range usually occurs below 3000 feet elevation in northern Idaho, depending on locality. Pengelly (1961) found most winter range was below 2300 feet near Wallace and below 2500 feet near Coeur d'Alene.

After the areas are located on aerial photos and topographic maps, they should be field checked and evaluated to determine current use and condition. The area within 15 miles of each winter range should be considered available to deer using that range (Table 4). Each winter concentration area and its surrounding summer range may be connected as a white-tailed deer habitat management unit.

An effort should be made to determine the existing cover-opening ratio on the winter and summer range. A major assumption of this paper is that forage production in forest openings will be declining when tree regeneration reaches 20 feet in height. Length of time for trees to reach 20 feet tall–as taken from the site index curves of Haig (1932), Brickell (1968), and Alexander (1966)–agrees with reported shrub-field life lengths following timber harvest. Mueggler (1965) reported that maximum shrub cover is reached at 20 to 30 years following clearcutting in cedar. Nyquist (1972) reported a similar pattern in hemlock/pachistima habitat type. Zamora (1975) found that herbaceous species dominated clearcuts in the grand fir/pachistima habitat type for approximately 8 years following burning. Shrubs became dominant at approximately 12 years and remained dominant at least until 23 years (the oldest clearcuts studied); they could last as long as 40 years. Wittinger et al. (1977) reported that maximum shrub development in hemlock/pachistima occurred at less than 10 years, but duration of shrub fields was much longer on dry sites.

SUMMER RANGE MANAGEMENT RECOMMENDATIONS

1. *Silvicultural systems*–Logging which creates a mosaic of small patches and strips of different age classes can benefit deer (Telfer 1974, Krefting and Phillips 1970). Gill (1957) points out that group selection is the best silvicultural method known for providing an interspersion of food and cover. He states, "The practice can be organized to favor either browse production or shelter through specification of group sizes and distributions as well as cutting cycles." Where group selection is impractical, a series of small scattered areas clearcut and burned may be the best timber harvest practice for whitetail habitat management in northern Idaho (Pengelly 1963).

Where group selection cuts are impractical and where clearcutting is not indicated (e.g., drier Douglas-fir and ponderosa pine habitat types where conifer regeneration is difficult to establish), seed tree or shelterwood harvests followed by underburning are the best alternatives. Harvest systems which do not incorporate burning are the least desirable because of reduced response of preferred browse species.

Pre-commercial and commercial intermediate cuts are less desirable on whitetail summer range because resulting slash depths are often greater than 12 inches. Commercial thinnings also reduce cover value and do not provide a corresponding increase in forage production. Intermediate harvests also tend to increase disturbance factors. Under a system of intermediate harvest, an area may be entered four or five times over the rotation.

Recommendations: On summer range, group selection cuts or small clearcuts in conjunction with burning are preferred, but seed tree or shelterwood systems combined with underburning are acceptable if needed to meet other forest management objectives. A system without intermediate harvests is preferred; if stands must be entered, care should be taken not to reduce cover value below 50-percent crown closure.

2. *Cutting unit size*–Table 5 lists recommendations from several studies. Small openings which incorporate a maximum of edges appear most useful to whitetails.

Recommendations: Unit sizes as small as are economically practical are recommended. Openings should not exceed 800 feet in width or a maximum size of 20 acres.

3. *Cover Opening Ratio*–The mean percentage of openings on home ranges utilized by white-tailed deer in grand fir/pachistima and cedar/pachistima habitat types was 24 percent during the summer (Owens 1981). Openings include all areas not classified as thermal or hiding cover. Openings are important sources of forage, but forage may also be present in the forest understory and riparian areas (Mundinger 1980). High deer populations may also be associated with relatively open agricultural types.

Recommendations–Nonagricultural areas:
About 20 to 30 percent of the summer range should be maintained in openings, with 25 percent ideal in cedar, grand fir, and hemlock habitat types, and 20 percent more realistic in Douglas-fir and ponderosa pine habitat types.

Recommendations–Agriculturally-influenced areas:
A combination of forest openings and agricultural openings which does not exceed 50 percent of the land base should provide best whitetail habitat.

4. *Rotation Age*–When nontimber values are considered, timber rotations may be shortened or lengthened by comparison with similar calculations based on timber values alone (Calish et al. 1978). Two methods commonly used for selecting a rotation age are culmination of mean annual increment (MAI) and economic return. MAI rotations are normally longer and are designed to maximize timber value over time. Economic rotations are designed to maximize present net worth. Rotation age is the most critical factor affecting the character of the forest commun-

Table 5. Recommended cutting unit size on summer range.

Author	Study area	Recommended unit size
Owens 1981	Palouse Range, Idaho	20 acres
Mundinger 1980	Swan Valley, Montana	20 acres
Lyon and Jensen 1980	Western Montana, includes data on both white-tailed deer and mule deer.	Optimum size: 59 acres. Reduction in use by half if opening size is either halved or doubled.
Boer 1978	New Brunswick	49 acres
Reynolds 1966	Mule Deer, New Mexico	Preferred size: 10-30 acres. Deer droppings slightly higher than surrounding forest for 600 ft. into opening. Opening should not exceed 1200 ft. in width.
Halls 1973	Southeast	20-100 acres
Drolet 1978	New Brunswick	Clearcuts up to 148 acres were fully utilized by deer.
McCaffrey and Creed 1969	Wisconsin	Deer made much greater use of clearings less than 5 acres or 5 chains wide.

ity in the managed forest. In general, shorter rotations mean more openings and less habitat diversity. The ideal goal of maintaining 20 to 30 percent of the land base in openings will mean different rotation lengths depending on habitat type and site quality.

Assuming that openings start to deteriorate when tree heights reach approximately 20 feet can provide an approximate index to opening life. This opening life can then be used to compute an approximate rotation age (Table 6). These ages can be compared with rotation ages calculated for timber purposes. The presence of natural or agricultural openings may also influence choice of rotation age. If a substantial portion of the range is in natural or agricultural openings, rotation may be increased to provide more cover. For example, suppose 35 percent of the range is composed of agricultural openings and the predominant habitat type is cedar/pachistima with an average site index of 60. Our standard wildlife rotation age from Table 6 to produce 25 percent openings would be 104 years. Using this rotation age on the timbered portion of the range would give 60 percent of our land base in openings, too much for whitetails. A 173-year rotation would provide approximately 15 percent openings and an overall cover-opening ratio of 50 percent. The necessity for a good habitat inventory is to be emphasized. Logging a 20-acre clearcut might be quite beneficial to whitetails in a densely forested area, but very detrimental where cover is limiting.

Recommendations–Nonagriculturally-influenced areas:

Rotation lengths should be selected which will maintain the desired cover-opening ratio over time. Opening life is critical in selecting this length and will vary considerably by location. In the absence of local data, rotation lengths recommended in Table 6 can be used. These, however, should be applied with caution, since they are only approximations based on site index curves.

Recommendations–Agriculturally-influenced areas:

Longer rotation lengths than recommended in Table 6 may be needed around agricultural areas to preserve cover values. In some cases it may be desirable to go to uneven-aged management or to forego timber harvest to maintain cover integrity.

5. *Entry Period*–An entry period of approximately one-tenth the rotation age in each summer range area would probably be ideal management for white-tailed deer. Ten percent of the forest land base should be treated each entry. This would ensure that stands in the herbaceous, shrub, and timber classes would be available to deer at all times. Approximately 10 age classes of timber would be created under this system, which would also ensure an adequate supply of timber to justify costs of moving equipment. When costs of road construction must be amortized, harvesting 20 percent of the forest land base and then skipping the next entry period might be an alternative on the initial entry sale.

Recommendations: The ideal described above serves as an objective to work toward in areas where whitetails are important. The program outlined should be modified to suit local conditions, and cooperation between forester and wildlifer is paramount.

6. *Forest Plantations*–Plantations tend to decrease diversity and often to reduce the amount of time areas are available for browse production. Rutske (1969) recommends that not all clearcut blocks be planted. He suggests unplanted openings be reserved in large clearcuts. This will not only prolong the life of the clearcut for forage production, but allow some diversity in the developing forest. Halls (1973) suggests plantations be planted at wider spacings in areas of good deer range.

Table 6. Comparison of timber rotation ages recommended for timber production and those for enhancement of white-tailed deer summer range.

Site index	Approximate opening life (years)*	Rotation age for timber production (years)**	Cover opening ratio which should result from the timber production rotation	Ideal cover opening ratio for white-tailed deer on summer range	Recommended rotation age to achieve desired cover opening ratio for deer
WHITE PINE, GRAND FIR, HEMLOCK, SPRUCE TYPES:[1]					
90 or better	18 years	90 years	80/20	75/25	72 years
70 to 80	22 years	100 years	78/22	75/25	88 years
50 to 60	26 years	110 years	76/24	75/25	104 years
40 or less	30 years	120 years	75/25	75/25	120 years
LARCH, DOUGLAS FIR, PONDEROSA TYPES:[2]					
90 or better	11 years	100 years	90/10	80/20	55 years
70 to 80	14 years	110 years	92/8	80/20	70 years
60 or less	20 years	120 years	83/17	80/20	100 years
LODGEPOLE PINE TYPE:[3]					
60 or better	20 years	80 years	75/25	75/25	80 years
50 or less	30 years	100 years	70/30	75/25	120 years

* Estimated from site index curves (time for trees to reach 20 feet in height).
** Wikstrom and Alley (1968)–system in current use by U. S. Forest Service.

1 Based on interpolation, Site index curve: Haig (1932).
2 Based on interpolation, Site index curve: Brickell (1968).
3 Based on interpolation, Site index curve: Alexander (1966).

Recommendations: When plantations that exceed recommended opening sizes are established on prime white-tail range, wider spacings or unplanted areas should be considered. If plantations are established, it may be necessary to reduce rotation ages to ensure an adequate cover-forage ratio for white-tailed deer.

7. *Slash*

Recommendations: Reduce slash depths below 12 inches in all treatment areas. Broadcast burning is the preferred treatment method in clearcuts. Underburning is preferred on shelterwood and seed tree cuts. Pre-commercial thinnings should be planned before trees reach 2 inches DBH to speed natural decomposition rates.

8. *Fire*–White-tailed deer will use larger burns, particularly in dry habitats, as efficiently as mule deer (Keay and Peek 1980). Low-intensity ground fires which do not destroy canopies favor white-tailed deer (Mundinger 1980). Smaller burns used in conjunction with site preparation and slash burning following logging is likely to benefit whitetails by stimulating herbaceous and shrub production (Merrill et al. 1980, 1982). Orme and Leege (1976) found fall burning is more desirable for producing white-tailed deer forage than spring burning.

Recommendations: Prescribed burning in the fall is preferred as a disposal and site preparation method on clearcuts. Under-burning is desirable on seed tree or shelterwood units.

Active suppression of all low-intensity ground fires may not be desirable, and a fire management policy which allows low-risk fire to burn should be considered.

WINTER RANGE RECOMMENDATIONS

1. *Silvicultural systems and cutting unit size*–Manipulation of white-tailed deer winter habitat centers largely around providing an interspersion of cover and forage. Individual prescriptions will depend on the site in question and will be based primarily on improving these two factors. If cover appears to be limiting, one should try to improve the quality of the existing cover. Care should be taken, however, not to reduce crown closure below 70 percent

(Mundinger 1980, Gill 1957, Boer 1978). Establishment of forest plantations should also be given consideration where cover is limiting.

In more heavily timbered areas, it may be desirable to promote forage production. Gill (1957) suggests that group selection cuts are the preferred method of harvest on white-tailed deer winter range. In areas where group selection cuts are impractical, small clearcuts in the 5- to 10-acre range, or strip clearcuts less than 200 feet wide offer a reasonable alternative (Gill 1957, Verme 1965, Telfer 1974, Boer 1978). Table 7 summarizes studies relating to cutting unit size on white-tailed deer winter range.

Recommendations: Group selection, small clearcuts (less than 10 acres), or strip clearcuts (less than 200 feet wide) are the preferred methods of harvest on winter range. Commercial thinnings are not recommended because of the difficulty of maintaining adequate thermal cover. Care should be taken not to fragment the range or leave small isolated patches of timber which have no cover value.

Table 7. Cutting unit size on winter range.

Author	Winter range	Cutting unit size
Owens 1981	Palouse Range, Idaho	20 acres
Mundinger 1980	Swan Valley, Montana	5-acre clearcuts; 20-acre selection cuts; crown closure not reduced below 70%
Boer 1978	New Brunswick	10 acres; no wider than 197 feet
Wetzel et al. 1975	Minnesota	Little use of browse over two chains from cover
Telfer 1974	Nova Scotia	No cuts over 330 ft. wide
Krefting 1962	Minnesota	Recommends strip clearcuts no wider than 75 feet
Gill 1957	Maine	Strip clearcuts no wider than 75 feet
Gill 1957	Maine	Strip clearcuts no wider than 100 feet

2. *Cover-Opening Ratio*–Boer (1978) recommends 50-60 percent of the winter range should be in stands at least 33 feet high and with a crown closure of 70 percent (see Table 4). Telfer (1970) suggests that 50-60 percent of the area should be in an age class 35 years or older at all times. Owens (1981) found that deer use was disproportionately centered on denser cover types and that during winter, deer home ranges had an average of 21 percent openings.

Recommendations: A cover-opening ratio of approximately 40 percent openings to 60 percent cover is recommended for whitetail winter range in the pachistima habitat types. Fewer openings appear to be needed on the drier Douglas-fir and ponderosa types because they are more open naturally. A cover-opening ratio of 85:15 is recommended in these drier types. On ranges where snow depths are seldom limiting, summer range recommendations may apply, and more flexibility exists. Table 8 presents suggested rotation lengths on whitetail winter range.

3. *Rotation Length*–Longer rotation ages may be required on winter range, especially on sites low in productivity. Mundinger (1981) suggested a rotation age of 250 years for the Swan Valley range. In Idaho, it appears that such a long rotation may not be needed in most cases (Table 8). Optimum rotation age should be one that maintains the preferred cover-opening ratio over time; this will vary with site quality.

Recommendations: Rotation ages should be selected which will maintain the desired cover-opening ratio over time. Opening life is a critical factor in selecting this length and will vary considerably by location. In the absence of local data, rotation lengths in Table 8 can be used. Caution is needed, however, since these are only gross approximations based on site index curves.

4. *Entry Period*–**Recommendations**: Numerous small entries are desirable on winter range. An entry period of one-tenth of the rotation would probably be ideal. This could be modified to achieve various silvicultural and management goals.

5. *Forest Plantations*–**Recommendation**: Forest plantations may be used for improving or creating winter thermal cover where none presently exists for white-tailed deer. This potential should be recognized. Mixtures of more than one species should be planted whenever possible.

6. *Slash*–**Recommendations**: Reduce slash depths below 12 inches in all treatment areas. Burning is preferred to increase browse production.

7. *Fire*–Fires which remove canopy cover that whitetails rely on for winter shelter are detrimental. Whitetails preferred unburned Douglas-fir/ninebark stands over burned areas for most of the winter in central Idaho (Keay and Peek 1980). However, burning increases palatability of less palatable shrubs (Keay and Peek 1980), and sprouting species such as scouler willow, redstem ceanothus, serviceberry, mountain maple, ninebark, oceanspray and syringa increase in density after fire (Mueggler 1965, Pengelly 1961). Owens (1981) found that increased productivity of palatable shrubs was highest where crown mortality was greatest. Lightly burned canopies were actually less productive than unburned canopies. Leege (1969, 1979) suggested that some small forage areas, particularly those on south and west aspects, should be kept in an early stage of succession by repeated burning.

Recommendations: Fire–particularly fall burning–is a useful tool for improving forage production on winter range. Burns intended to improve winter range should be small (less than 10 acres) and located close to good winter cover.

Table 8. Comparison of timber rotation ages recommended for timber production and those for enhancement of white-tailed deer winter range.

Site index	Approximate opening life (years)*	Rotation age for timber production (years)**	Cover opening ratio which should result from the timber production rotation	Ideal cover opening ratio for white-tailed deer on summer range	Recommended rotation age to achieve desired cover opening ratio for deer
WHITE PINE, GRAND FIR, HEMLOCK, SPRUCE TYPES:[1]					
90 or better	18 years	90 years	80/20	80/20	90 years
70 to 80	22 years	100 years	78/22	80/20	110 years
50 to 60	26 years	110 years	76/24	80/20	130 years
40 or less	30 years	120 years	75/25	80/20	150 years
LARCH, DOUGLAS FIR, PONDEROSA PINE TYPES:[2]					
90 or better	11 years	100 years	90/10	85/15	73 years
70 to 80	14 years	110 years	92/8	85/15	93 years
60 or less	20 years	120 years	84/16	85/15	133 years
LODGEPOLE PINE TYPE:*[3]					
60 or better	20 years	80 years	75/25	80/20	100 years
50 or less	30 years	100 years	70/30	80/20	150 years

* Estimated from site index curves (time for trees to reach 20 feet in height).
** Wikstrom and Alley (1968) system in current use by U. S. Forest Service.
*** When long rotations are impossible to maintain, conversion of lodgepole pine to other species may be desirable.
1 Based on interpolation, Site index curve: Haig (1932).
2 Based on interpolation, Site index curve: Brickell (1968).
3 Based on interpolation, Site index curve: Alexander (1966).

8. *Roads*–**Recommendations**: Roads invite human disturbance on winter range. Roads through whitetail range should be closed during the winter. In locating new roads, it is desirable to avoid locations along creeks or rivers.

9. *Snowmobile and Cross-Country Ski Trails*–**Recommendations**: These trails should be located away from winter range areas.

10. *Housing Developments*–**Recommendations**: These also should be located away from winter range areas.

11. *Dogs*–**Recommendations**: Local residents should be encouraged to keep their pets tied or penned up, especially during the winter months.

12. *Poaching*–**Recommendations**: Public education through programs like Project WILD and public participation through programs like Citizens Against Poaching appear to be some of the best ways to combat illegal killing of whitetails.

DIRECT HABITAT IMPROVEMENT RECOMMENDATIONS

1. Agricultural crops like alfalfa can be planted or a portion of a crop can be left unharvested near deer ranges.

2. Nut or fruit trees are often quite attractive to deer. Apples, for example, are readily used by deer when they are available. Care should be taken not to plant trees in areas where deer could become a nuisance to other land owners.

3. Browse plants can be seeded or planted in forest openings.

4. Grassy openings can be maintained for use in the spring. For best results these should be located in close proximity to deer wintering areas.

5. Decadent tall brush can be slashed on wintering areas to help promote forage production through basal sprouting.

6. Watering areas can be developed on dry sites.

7. Salt blocks can be placed on spring ranges.

OPTIONS FOR THE SMALL WOODLOT OWNER

Many of the recommendations outlined above are designed for large industrial or public lands. There is, however, a large proportion of northern Idaho white-tailed deer habitat (especially winter range) in the hands of small private landowners. Most of these small landowners are not interested in timber production or results over the length of a timber rotation. Most enjoy wildlife and would like to see results they can enjoy in their lifetime. For many of these owners, a "small" 20-acre clearcut would mean cutting all or a large percentage of their ownership. This is an alternative most private landowners do not wish to consider.

One alternative which might be more desirable to these owners is a selective system of timber harvest. An uneven-aged management system based on the group selection method appears to offer the best prospect for success. High logging and management costs are usually not as much of a problem to individual owners. They can do much of the work themselves, and their goals for harvesting timber are not necessarily tied to the profit motive. Generally speaking, forage production will be the usual limiting factor on most small acreages due to the reluctance of most small landowners to clearcut. With the group selection method, the private owner can stimulate some forage production in small openings, and, at the same time, maintain the forested condition desired.

In addition to timber harvesting, there are many direct approaches the small landowner can take to improve white-tailed deer habitat. Many of these measures are impractical on a large-scale basis due to the time and management expense involved. Planting or leaving a portion of an agricultural crop like alfalfa could be beneficial. Mast or fruit trees are often attractive to deer, which eat the fruit. Browse plants could also be planted or seeded in forest openings; sod openings could be maintained for use in the spring, salt blocks can be made available to deer; and if necessary, water areas can be developed. Also, browse cuttings on wintering areas can help promote forage production. Finally, efforts can be made to keep dogs tied to reduce harassment to deer, especially during the winter.

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