A Management Plan for Forest Grouse in California

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PURPOSE OF THE PLAN

The California Department of Fish and Game (CDFG) has been delegated by law to "...perpetuate all species of wildlife for the[ir] intrinsic and ecological values, and...maintain diversified recreational uses of wildlife...consistent with the maintenance of healthy, viable...populations...(California Fish and Game Code, Section 1801). On June 23, 1989, the California Fish and Game Commission called upon the Department of Fish and Game to develop species plans and management programs for each species of upland game. The present document is a species plan for the forest grouse of California, blue grouse *Dendragapus obscurus* and ruffed grouse *Bonasa umbellicus*. The purpose of the plan is to stimulate, plan and coordinate the conservation and management of California's forest grouse.

BLUE GROUSE

Blue grouse inhabit coniferous forests between 5,500 and 11,000 feet elevation in most mountainous regions of western North America. Three geographic forms of blue grouse inhabit California: Mount Pinos blue grouse *Dendragapus obscurus howardi*, Sierra blue grouse *D. o. sierrae*, and Oregon blue grouse *D. o. fuliginosus* (Grinnell and Miller 1944). It is important to recognize subspecies of blue grouse in California because differences in their habitats, plumage and behavior have important implications for conservation and management.

Blue grouse are relatively well-studied. The species is an important game bird in some regions, and has received considerable attention from certain conservation agencies. A series of in-depth studies in British Columbia (e.g., works by J.F. Bendell, R.A. Lewis, and F.C. Zwickel) and Colorado (e.g. works by R.W. Hoffman and C.E. Braun), have elucidated much of the behavior, population demographics and ecology of blue grouse in those regions. Few detailed studies have been conducted on blue grouse in the geographically diverse state of California, however, and as a consequence few reliable data exist on which to manage blue grouse in California. It is worthwhile to review here what is known of blue grouse outside California, because recent evidence indicates the ecology of blue grouse in California may differ considerably from where they have been observed elsewhere.

I. KNOWLEDGE AND STATUS OF BLUE GROUSE POPULATIONS.

The 1990 *Habitat Relationship System* (California Department of Fish and Game 1991a) estimates California's spring blue grouse population to be a minimum of 5 million individuals. The US Fish and Wildlife Service's 1990 Breeding Bird Survey suggests blue grouse populations have increased 3.5 % nation-wide (CDFG 1991a). Statewide hunting success for blue grouse in California has remained consistent over the past decade (CDFG 1991b). Even with these optimistic reports, however, it must be kept in mind that the abundance of blue grouse has never been adequately assessed in California, and that local declines in blue grouse are known

to be occurring in California.

The *Habitat Relationship System*'s population estimate assumes blue grouse occupy 25 million acres of forest at an average density of 50 birds/km^2. However, blue grouse are not evenly distributed in any California forest type, and the structure and composition of vegetation preferred by blue grouse in California have not been well documented. Any estimate of the acreage occupied by blue grouse in California is, therefore, premature. Furthermore, the 50 birds/km^2 density estimate used in the *Habitat Relationship System*'s population estimate is much higher than any figure reported for California, where densities are apparently much lower than at more northerly latitudes (Table 2). The results of California's Game Take Hunter Survey (GTHS) is also questionable in the case of blue grouse, as the survey's accuracy declines when the number of individuals taken is low (CDFG 1991b). Local declines or extirpations, like that of the Mount Pinos blue grouse in the Tehachapi Mountains (Weiss 1979), could be masked in state-wide or regional reports.

Few historical data exist on the former abundance of blue grouse in California. Some National Parks (e.g., Yosemite, Sequoia/Kings Canyon) and National Forests (e.g., El Dorado) have recorded blue grouse observation and collection sites, but these data are of limited use for detecting population changes because they were not collected systematically.

Mendocino National Forest conducted a more systematic roadside count of blue grouse from 1964 through 1976 (Bauer

1967). Although the technique used had serious limitations (Bland 1992), and produced widely fluctuating indexes, the count was re-instituted in 1992 in an effort to determine if the local population had declined dramatically, which it had not (Bland, in prep.). Department of Fish and Game Regional Biologists may also have kept historical records of brood counts, hoot counts, or hunter's bags, but these data were not filed at a central location and are difficult or impossible to access today.

There is good reason to suspect blue grouse numbers have declined in some parts of their California range. The best documented case is that of the Mount Pinos blue grouse of southern California. Isolated mountain-top populations of *D. o. howardi*, present in the Tehachapi Range in 1965 (Abbot 1965), have not been observed positively in recent years (Weiss 1979, L. Walsh, Los Padres Nat. For., pers. comm.). The greatest threat to blue grouse populations throughout California is the continued degradation of their habitats. Blue grouse are closely associated with firs, *Abies* and *Pseudotsuga*, and fir forests have been harvested heavily in California outside national parks and wilderness areas. Early studies of blue grouse in British Colombia (e.g., Bendell and Elliott 1966, Zwickel and Bendell 1972, 1985) and the Rocky Mountains (Martinka 1972) indicated blue grouse densities were highest in forests that had been harvested, and declined when canopy closure exceeded ca. 75%. These findings left many wildlife managers comfortable in the knowledge that timber harvest was beneficial to blue grouse. More

recently, however, studies conducted elsewhere have shown that old-growth forests support blue grouse densities as much as 45 times higher than re-vegetated clearcuts (Doerr et al. 1984). In California, Bland and Layne (in prep.) have confirmed that male Sierra blue grouse establish courtship territories at higher densities where large trees are more abundant. However, it is not yet known whether the density of males on territories is reflected in the density of the overall population. In any case, Bland and Layne's findings suggest the status of Sierra blue grouse may differ dramatically in `managed' (logged/grazed) forests and `unmanaged' (protected) forests.

Logging on National Forests may have a secondary impact on blue grouse populations by dramatically increasing public access to formerly remote regions. California's burgeoning human population has access to hundreds of miles of new logging roads each year. The effects of recreational blue grouse use, although thought to be insignificant, are not well understood. Given the likely adverse effects of excessive timber extraction, over-grazing, and increased recreational activity, there is a clear and urgent need to assess and monitor blue grouse populations throughout the species' California range.

Population densities

Across the North American continent, blue grouse densities are greatest at the center of the species' range and decrease gradually to the north and south (Bendell and Zwickel 1984), ranging from as high as 240 birds/100ha to as low as 3

birds/100ha. Tables 1 and 2 list some blue grouse densities reported in different regions and forest types. Within a given forest type, local densities may also vary according to local vegetation characteristics (Bendell and Zwickel 1984, Redfield 1973) and precipitation (Brown and Smith 1980, Bendell and Zwickel 1984). Bendell and Zwickel (1984) concluded from an extensive survey of blue grouse that `summer ranges with the greatest interspersion of forbs, shrubs, grasses and coniferous and broad-leaved trees produced the most grouse.' Redfield (1973) found that the density of grouse on Vancouver Island clearcuts increased annually for the first 7 years after the cut, and then declined.

Table 1. Reported blue grouse densities outside California

Density	Location	Forest Type	Author(s)
90 males /100ha	Vancouver Island British Columbia	*Tsuga/Psuedotsuga*	Bendell 1955
19.2 males /100ha	"	"	Donaldson and Bergerud 1974
18-29 males /100ha	"	"	Lewis 1984
32-136 males /100ha	"	"	Bendell and Elliott 1967
1.7-29 females /100ha	"	"	Redfield 1973
5.7-22 males	"	"	"
19.6-46 yearlings /100ha	"	"	"
67.5 males /100ha	Alberta	*Psuedotsuga/Pinus*	Boag 1966
41 males /100ha	Utah	"	Mussehl 1960

Table 2. Reported population densities within California

Density	Location	Forest Type	Author(s)
2 males /100ha	Humboldt County	*Psuedotsuga* /pasture	Zwickel et al. 1985
7 males /100ha	"	*Psuedotsuga* forest alone	"
7.7-13 males /100ha	Sierra Nevada Mountains	*Abies/Pinus*	Bland & Layne (in prep.)

The mating system and seasonal habitat associations of blue grouse have made some population attributes more difficult to assess than others. Adult males inhabit primarily forested habitats, where they establish territories of approximately 1ha area (Bendell and Elliott 1967, Lewis 1985). Adult females inhabit both meadow and forest habitats, and use large, broadly-overlapping ranges. Juveniles range widely in loose aggregations of from 2 to 11 birds of mixed sex (Boag 1966). An observer can estimate the number and density of hooting male grouse with as few as 5 visits to a hooting area. However, each population of blue grouse is composed of many such hooting groups unevenly distributed over a large area (Bendell and Elliott 1967, see II below). In order to determine the density of territorial males over a larger area, one must also determine the number and size of hooting groups present.

The sex ratio of blue grouse populations is normally 1:1, at least in British Columbia where they have been most intensively studied (Zwickel 1972, Zwickel et al. 1975, Zwickel and Bendell 1985). The total number of grouse in a population can thus be estimated as twice the number of males. However, a number of non-

hooting, non-territorial males also exist in each population (Bendell and Zwickel 1984, Lewis 1984). Redfield found the proportion of these young birds to be greater in more open habitats. He developed a technique for estimating the number of females and juveniles based on the ratio of hens with and without broods (Redfield 1973).

Population demographics

Those blue grouse populations studied to date average about 70% yearlings and 30% adults (Table 3).

Table 3. Reported age ratios of blue grouse populations.

% Yearlings	% Adults	Location	Authors
65-69	31-35	Arizona	Brown and Smith 1980
49-75	45-52	Vancouver Island	Redfield 1973
75	25	Alberta	Boag 1966

Mossop (1988) found the numbers of breeding blue grouse to be "remarkably stable" in light of the "large variations" observed in annual natality and mortality of young: "Once birds entered the breeding component of the population, they apparently disappeared at about 30% annually, a value that did not vary significantly from year to year." Zwickel et al. (1975) also observed an adult mortality rate of 30 %, but found mortality among juveniles to range from 50-85%. Mossop found that chick production always exceeded annual adult mortality.

Mossop's studies on Vancouver Island indicated key demographic characteristics differed significantly between increasing, stable and declining populations (Table 4).

Table 4. (Mossop 1988)

Population status	Age str. (% < 1yr)	Adult mort. (%)	Nest failure (%)	Chick loss (%)
Increasing	37	30-35	14	16
Stable	41	37	57	38
Declining	27	43	43	53

Several authors have noted that population densities of blue grouse are closely correlated with certain intrinsic behaviors (Bergerud and Hemus 1975, Mossop 1988). Mossop (1988), for example, found different levels of aggressive and escape behaviors in declining and increasing populations. It appears that densities of blue grouse may be limited by such intrinsic behaviors. A thorough investigation of California's blue grouse should address demographic patterns and related behavioral patterns because, as several blue grouse experts have suggested, the answer to maintaining a high abundance of blue grouse may ultimately lie in an understanding how behavior and habitat limit the recruitment of excess young into breeding populations (Zwickel 1980, Zwickel et al. 1983, Lewis 1984, Mossop 1988).

Hunting

The GTHS suggests hunter harvest of blue grouse in California is relatively low in relation to the estimated total population, averaging approximately 7,950 birds/year and approximately 1.25 grouse per hunter (CDFG 1991b). Clearly, blue grouse are not as important a game bird in California as they are further north (Rogers 1963). The reasons for this lack of

popularity has never been determined satisfactorily, but may include: availability of preferred species in California, distance of blue grouse habitats from human population centers, conflicting hunting seasons, and the lack of a history of hunting forest grouse among California immigrants.

Recent studies suggest hunting mortality may be additive to the natural mortality of forest grouse (Bergerud 1985, Small et al. 1991). But with blue grouse, studies also indicate that hunting mortality does not decrease either the number of young annually recruited into the breeding population or the number of breeding adults (Zwickel 1982, Zwickel et al. 1983, Hoffman 1985). In California, it may be more important to determine the characteristics of hunters than the effect they have on blue grouse populations. Such information is needed for communicating with and educating grouse hunters, and for managing hunting activities.

II. KNOWLEDGE AND STATUS OF BLUE GROUSE HABITATS.

Blue grouse are most often associated with forests dominated by true firs *Abies*, Douglas-fir *Psuedotsuga*, and pines *Pinus*. Stands occupied by blue grouse normally have either a relatively open canopy, or are closely associated with meadows or other open terrain. In the north of the species' range, blue grouse migrate from higher elevations in winter to lower elevations in spring and summer. Further south, migration appears to diminish until winter and summer ranges are essentially the same. Both migratory

and resident groups are thought to occur in California (Hoffman 1956, Bland, in prep.), but this has never been confirmed by telemetry. Whether the transition from migratory to resident status in California is related to latitude, elevation, or both, is unknown.

Thorough descriptions of blue grouse habitats are not available for any California location. Given the degree of variability in California's topography and phytogeography, it would be unadvisable to assume that findings from Canada or Montana are applicable in California.

Summer habitat

One of the most intriguing, and challenging, aspects of blue grouse ecology and management is the fact that individuals of different sex and age use different--though sometimes overlapping--habitats in the breeding season. Three kinds of breeding habitat can be considered: general summer range, breeding habitat, and brood-rearing habitat.

general summer range

Blue grouse summer range is highly variable. Bendell and Zwickel (1984) surveyed blue grouse summer habitats over the species' range and concluded that most consisted of "open landscapes" with forbs, shrubs, grasses and trees in varying proportions. Doerr et al. (1984), however, found *D. o. sitkensis* breeding in mature coastal forest in southeast Alaska. No adequate description is available for the general breeding habitat of blue grouse anywhere in California. Given the wide

range of topographic and phytogeographic features in the ranges of the three California subspecies, no single description is likely to be adequate. Breeding habitats and winter habitat probably overlap to a great degree in California.

breeding habitat

Courtship territories of adult male blue grouse are often associated with openings in or edges around forest stands. Canopy cover over territories is commonly reported to average between 30 and 50% (Martinka 1972, Donaldson and Bergerud 1974). Groups of hooting males tend to be clustered around these openings rather than evenly distributed through a stand. Adult males return to their traditional hooting area each spring, until vegetation at the site becomes undesirable for hooting. Earlier literature emphasized the importance of extensive openings, such as clearcuts, to hooting grouse, because this was the case at the few Canadian locations that had been studied (e.g., Bendell and Elliott 1967, Martinka 1972, Niederleitner 1987). In 1984, however, Doerr et al. (1984) found densities of hooting males in southeastern Alaska to be 45 times higher in old-growth forests than in clearcuts. Similarly, Bland and Layne (in prep.) recently found hooting *D. o. sierrae* more abundant where trees having diameters (dbh) greater than 28cm (11.5in) were more abundant. A thorough description of *D. o sierrae* hooting territories will be presented in their forthcoming publication. A tentative description of the courtship/mating habitat of *D. o. sierrae* in California would include open, mature *Abies/Pinus* forests on or

near ridges between 5,500 and 9,000ft elevation, in areas where snowpack melts early. At least a few fir or pine trees with diameters (dbh) exceeding 122cm (50in) are normally present, often in clumps of from 3 to 6 individuals. Understory vegetation consists of scattered clumps of woody shrubs, herbs or grasses, but one of these components may be absent.

Summer ranges of females, subadults, and non-breeding adults include the courtship territories of hooting groups as well as surrounding areas (Bendell and Elliott 1967, Lance 1970). On Vancouver Island, females nest within 100-200m of a territorial male (Lance 1970, Hannon et al. 1982). In Montana, Mussehl (1960) found nests in prairie vegetation 200 to 600m from the forest edge. On Stuart Island, WA, Bergerud and Butler (1985) found a wide range of vegetation within female territories, with no clear preference for fir forest or rocky areas. Studies of female territorial behavior suggest the location and dispersion of nests may result more from female-female avoidance than from the selection of certain vegetative characteristics.

brood-rearing habitat

Brood rearing can take place in forested habitats in the vicinity of hooting territories (Lance 1970, Hannon et al. 1982), or in more open meadow habitats at somewhat lower elevations (Mussehl 1963, Zwickel 1972, Stauffer and Peterson 1986). Stauffer and Peterson (1986) in Idaho, and Mussehl (1963) in Montana, found broods more frequently in habitats where herbaceous plants exceeded 50cm in height, and where open ground

provided travel lanes and occasional trees and shrubs provided escape cover. The woody plants may be especially important when the herbaceous vegetation dies back or becomes trampled by livestock.

Winter habitat

Bendell and Zwickel (1984), in their extensive survey of blue grouse habitats, concluded that winter range consists of "loosely associated single or clumps [of firs or pines] on the tops and sides of hills, ...the amount of forest rang[ing] from small patches of less than a hectare to immense expanses." Canopy cover of winter habitats is generally higher than that of breeding habitats, ranging from 40 to 90% (Bendell and Zwickel 1984, Stauffer and Peterson 1986, Hines 1987). In winter these habitats are normally blanketed in a layer of snow, and the birds spend most of their time either feeding on the needles of large, clumped or single conifers (Stauffer and Peterson 1986, Cade and Hoffman 1990), or burrowed in snow (Bendell and Zwickel 1984).

Status of habitats in California

The *Habitat Relationship System* (CDFG 1991a) has estimated there are 25.5 million acres of habitat occupied by blue grouse in California. This figure is actually an estimate of the aerial coverage of various vegetation types thought to be inhabited by blue grouse, and is probably a gross overestimate of occupied grouse habitat given Bland's (in prep.) observations of the discontinuous distribution of hooting groups. The amount and status of blue grouse habitats in California are insufficiently

well understood, and deserve urgent attention given the extent to which they may currently be impacted.

Grouse habitats in California are impacted primarily by timber harvest and livestock grazing. Human activities that do not directly alter vegetation do not appear to degrade grouse habitats. Blue grouse are apparently quite tolerant of humans under most circumstances.

Timber harvest can be either beneficial or detrimental to grouse habitats, depending on the circumstances. In Canada, blue grouse clearly benefit from clear-cutting of *secondary forests* (Bendell and Elliott 1967, Zwickel and Bendell 1985). Such clearings were preferred over the more dense and regularly spaced secondary forests available. Doerr, et al. (1984), however, found far fewer grouse in Alaskan clearcuts than *old-growth forest*. In the Sierra Nevada Mountains of California, Bland (in prep) found hooting groups of male blue grouse only in mature fir/pine stands with a relatively high frequency of trees greater than 28cm (11.5in) dbh.

Given the apparently universal use of canopy openings by blue grouse, selective harvest can probably be practiced in blue grouse habitat, so long as adequate precautions are taken. Such harvests must be conducted in such a way as to retain the essential structural characteristics of hooting territories. Nine (35%) of the 26 Sierra Nevada hooting areas located by Bland (in prep.) had been selectively harvested, but 30 - 55 % of the trees remaining at the sites still exceeded 28cm (11.5in) dbh. A top

priority for conserving blue grouse must be to maintain traditional hooting sites that occur on managed forest lands. Responsible agencies, particularly the US Forest Service, must document the locations of traditional hooting sites, be aware when they may be affected by a timber sale, and assure that minimum structural characteristics are retained after harvest.

Heavy grazing by livestock has long been recognized as detrimental to the brooding habitats of blue grouse (Mussehl 1960, Zwickel 1972). Livestock tend to concentrate their activities around meadows and water, quickly eating and trampling the herbaceous growth that broods depend on for food, insects, and cover. Another top priority for conserving blue grouse, then is to protect key meadow habitats from overgrazing. Responsible agencies must document the locations of brood-rearing areas associated with traditional hooting sites, and closely regulate the timing and amount of grazing at those sites in a fashion that retains the vegetative characteristics needed by grouse broods (see Mussehl 1963).

III. RESEARCH NEEDS

A. Population Research

1. **Determine the location and management authority of high density blue grouse areas, particularly in managed forests.**

Rationale: Dispersion patterns of grouse in California are poorly known, and existing data are not readily accessible. To maintain high density populations, local management authorities should be

made aware of the values of blue grouse, and encouraged to maintain these birds at high population levels.

Approach: Conduct roadside surveys of hooting groups that occur in the managed forests of each Forest District and develop working maps of the distribution of groups on each Forest District.

2. **Determine the size and dispersion of hooting groups.**

Rationale: The size and dispersion of hooting groups must be known to determine and monitor population density from hoot surveys.

Approach: Roadside and trail-side surveys to determine locations of groups, field checks to estimate relative size (e.g., large, medium or small).

3. **Determine the ratio of hooting males to non-territorial males and females.**

Rationale: These demographic traits must also be known to accurately estimate population density.

Approach: Trap and mark and observe individuals at sites chosen for intensive study.

4. **Determine nesting density, nesting success, and brood survival in a range of habitat types.**

Rationale: The location and characteristics of high grouse-producing habitats is not known for California. The characteristics of these sites should be emulated elsewhere in management.

Approach: Determine nesting density by searching with trained

dogs, and nesting success and brood survival with repeated road-side and trail-side surveys of selected brood habitats (Mussehl 1963, Redfield 1973).

5. **Determine the characteristics of blue grouse hunters and the overall importance of blue grouse hunting.**

Rationale: It is currently impossible to characterize California blue grouse hunters. The GTHS provides annual estimates of the number of blue grouse hunters and the number of blue grouse hunter days, but it is uncertain whether these hunters are in the field primarily for blue grouse or for other game with overlapping seasons such as deer or mountain quail. In order to accurately assess the economic importance of blue grouse in CA, as well as communicate more effectively with blue grouse hunters, we should be able to identify blue grouse hunters as a group.

Approach: Include an additional page with the GTHS Survey, on a trial basis, which asks more specific questions of blue grouse hunters, including distance traveled, meals and lodging expenses, etc. Develop and maintain a database on known blue grouse hunters. Collect names and addresses through the GTHS, personal contact in the field, and a telephone `networking' survey. Query these hunters whenever questions arise regarding blue grouse hunters and hunting. Send summary reports and updates to participants to maintain interest in the program.

6. **Identify and rank important blue grouse hunting areas.**

Rationale: If important blue grouse hunting areas of the state were known, efforts of assess hunter take, and its effect on

local populations, could be assessed most efficiently at these sites.

Approach: Query CDFG wardens, agency biologists, and known blue grouse hunters. Delineate hunting areas in relation to access routes and major geographic features. Monitor hunter take and use at access `bottlenecks' with manned check stations or volunteer collection boxes (Hoffman 1981).

B. Habitat Research

1. **Determine the key vegetative features of breeding and wintering habitats at selected locations throughout the state.**

Rationale: The optimal vegetation for blue grouse in California has not been described in detail, and probably varies widely throughout the state. Descriptions of exceptional habitats are needed to serve as models for habitat management elsewhere.

Approach: Select representative summer and winter habitats from those resulting from A.1. above. Follow the methods of Bland (in prep.) and Bland and Layne (in prep) to document and analyze key features of hooting territories and winter roost sites. Collect similar data from nearby unoccupied habitat for comparison.

2. **Determine the spatial relationships and connectivity between breeding and winter habitats.**

Rationale: The degree to which blue grouse migrate seasonally in California is poorly understood, but probably varies widely throughout the state. It is not known whether migration routes have characteristics vegetation and topographic features that

should be managed. Where breeding and wintering habitats are disjunct, cooperation between two or more management authorities may be required.

Approach: Radio-telemetry at sites that are likely to show a range of migration distance.

3. **Determine the impact of small clearcuts, selective harvest, livestock grazing, and fire on the breeding and winter habitats.**

Rationale: Hooting territories can persist after logging or fire under certain circumstances (Bland and Layne, in prep.), but the degree to which different levels of timber extraction or fire affect grouse abundance is unknown. The degree to which various levels of livestock grazing affect the quality of brood-rearing habitats is also unknown. Foresters should know where traditional breeding and winter habitats are located, and should be encouraged to abide by certain criteria when planning for timber extraction or grazing at those sites. Controlled burns could be an important tool for maintaining understory vegetation at optimal levels for grouse.

Approach: Conduct censuses before and after various levels of timber extraction and fire. Compare use of grazed and ungrazed (fenced) brood habitats.

4. **Determine the degree to which non-hunted, non-harvested forests supplement fall grouse numbers on nearby hunted, harvested forests.**

Rationale: It may be possible to maintain more grouse on public hunting areas than the areas naturally produce if protected areas

are sufficiently close for birds to move from high-density protected areas to lower density hunting areas (Small et al. 1991).

Approach: Radio-telemetry, marking, band returns.

IV. MANAGEMENT NEEDS

1. **Establish blue grouse management zones, based on the different habitat requirements of blue grouse throughout the state.**

Rationale: The habitats and population parameters of blue grouse appear to be sufficiently variable throughout the state to require management on a regional scale.

Approach: A CDFG biologist should establish tentative management zones based on available information, collect additional habitat data, and refine the zone boundaries over time.

2. **Establish regional population and harvest goals, based on the findings of research on the density, demographics, and historical take of local populations.**

Rationale: Hunter harvest, and grouse populations goals, should be established in accordance with the densities and productivity of local populations, which probably vary throughout the state.

Approach: A staff member of CDFG's Upland Game Section in Sacramento should coordinate with a biologist at each Region who has agreed to help carry out the blue grouse management plan. These Sacramento and Regional personnel should develop tentative regional population and harvest goals, collect additional population data, and refine the population and harvest goals over

time.

3. **Establish a program of inter-agency coordination, cooperation, and joint funding for blue grouse management and research.**

Rationale: Blue grouse populations and habitats normally fall under the jurisdiction of several agencies. Most of these agencies have a legal obligation to conserve and manage blue grouse. Improved blue grouse management is likely to benefit these agencies in return.

Approach: An inter-agency blue grouse working group should be assembled and directed by personnel of CDFG's Upland Game Section in Sacramento.

4. **Encourage all land management agencies to incorporate blue grouse values into timber management, harvest plans, and grazing allotments.**

Rationale: Most agencies are not aware of the recreational and economic benefits, or ecosystem services blue grouse provide. Let them know.

Approach: Assess the economic value of blue grouse, describe the ecological role of blue grouse in forest ecosystems, and make all concerned agencies aware of this information. Use reason and legal obligations to encourage various agencies to include blue grouse in management considerations.

5. **Encourage land management agencies to maintain optimal vegetation characteristics at known breeding and wintering sites and along any habitat corridors that connect the sites.**

Rationale: Same as III.B.3. above.

Approach: A staff member of CDFG's Upland Game Section in Sacramento should coordinate with a biologist at each Region who has agreed to help carry out the blue grouse management plan. Sacramento and Regional personnel should contact and encourage responsible personnel of local agencies.

6. **Monitor grouse populations state-wide.**

Rationale: Many species of wildlife are in decline in California because of habitat loss and environmental degradation. There is evidence that certain local populations of blue grouse have also declined. Regional grouse populations must be monitored in order to confirm their status over time.

Approach: Conduct hoot counts of and within hooting groups on each Forest District or similar administrative unit. Counts of the number of hooting groups indicate the status of grouse over a large area. Counts of individuals within ho/ting groups show how habitats affect population densities (Bland, in prep.). Conduct brood counts at known brooding areas (Mussehl 1963). Monitor harvest with the HGTS, queries to known grouse hunters (see III.A.6. above), manned check stations, and/or volunteer wing collection boxes.

V. ACTION PLAN

1. Continue and expand ongoing hoot censuses.
2. Disseminate the blue grouse management plan to CDFG Regional Offices, land management agencies, and interested sporting and environmental organizations. Solicit their participation

in a Blue Grouse Working Group (BGWG).

3. Assemble members of the BGWG
4. Establish tentative blue grouse management zones and habitat management goals.
5. Establish tentative population and harvest goals for each management region.
6. BGWG prioritizes research goals.
7. BGWG solicits research funding.
8. Research begins, in order of priority.
9. Management zones, habitat management goals, and population and harvest goals are adjusted as research findings accumulate.

RUFFED GROUSE

Within California, the Oregon ruffed grouse (Bonasa umbellus sabini) is sparsely distributed through Humboldt, Trinity, Siskiyou and Del Norte Counties. Although the ruffed grouse may be one of the best-studied of all game animals (Atwater and Schnell 1989), no detailed study has been conducted on the species in California. California populations of ruffed grouse occupy atypical habitat at the southwestern extreme of the species, cross-continental distribution. The many management techniques available for mid-continental populations cannot be applied in these atypical habitats without careful adjustment to local circumstances. As long as the biology and ecology of Oregon ruffed grouse remain poorly understood, truly effective ruffed grouse management will not be possible in California.

I. KNOWLEDGE AND STATUS OF RUFFED GROUSE POPULATIONS.

Status

Yocum (1978) characterized ruffed grouse as an uncommon breeder throughout its range in northwestern California. The 1990 Habitat Relations System (California Department of Fish and Game 1991a) estimated California's spring ruffed grouse population to be between 133,280 and 1.7 million individuals. This estimate assumes ruffed grouse occupy 5 million acres of habitat, and that the average density of ruffed grouse is 3 - 38 acres per bird (2.5 - 33 individuals/100 acres). Neither of these assumptions, however, has been verified with field data.

Recent trends in California's ruffed grouse populations are unknown. According to Grinnell and Miller (1944), the species was once more widespread, and 'fairly common locally.' By the 1940's they reported it had become 'rare, having disappeared completely from most places whence formerly reported (for example, the Van Duzen River).' Yocum (1978) observed that the species did not appear to respond positively to increased forest harvest on the north coast after World War II, though it did in the Midwestern United States where Populus is a more important component of early-successional stands.

Trends in hunting success are often use as an indication of status, but hunting success for ruffed grouse in California is uncertain because harvest estimates for ruffed grouse are reported in conjunction with those for blue grouse (CDFG 1991b). It may not be possible to separate ruffed grouse harvest from blue grouse harvest because many hunters have difficulty distinguishing between the two species (Giesen 1984).

Population densities

Very little is known of the population characteristics of ruffed grouse anywhere in the western United States (Rusch and DeStefano 1989). Compared with populations in the upper midwest, north, and northeast, densities tend to be relatively low (Stauffer 1989). The few published densities for populations in the western US are shown in Table 5.

Table 5. Reported densities for ruffed grouse in the western US.

ind/100ac	subspecies	location	forest type	reference
1-15	B.u. incaca ?	se. ID	aspen-fir	Stauffer 1989, Stauffer & Peterson 1985a, 1985b
11.1-21.3	B.u. phala	n. ID	'cut-over white pine'	Hungerford 1951
36	B.u. sabini ?	w. WA	?	Brewer 1980

Estimates of population densities are complicated by the fact that ruffed grouse are seldom evenly-spaced in a given region or vegetation type. In spring, male ruffed grouse often drum in 'clusters.' Some authors believe these clusters occur when aggressive young males position themselves to challenge dominant males occupying high quality habitat. In central Wisconsin, Kubisiak et al. (1980) found drumming males stationed along the contour of an upland-lowland interface. The spacing between these males varied considerably from year to year: anywhere from 30 to 200 meters.

While populations of ruffed grouse in Canada and the Lake States fluctuate on an approximately ten-year cycle, more southerly populations are probably stable over time under normal conditions (Rusch and DeStefano 1989).

Population demographics

Fall populations of ruffed grouse are composed of from 65 to 85 % young of the year (Stauffer 1989). Juvenile mortality is relatively high in fall and winter in northern deciduous forests because juveniles are displaced into poor cover, where they are

more vulnerable to predators (Barber et al. 1989). Thus, while Rusch and Keith (1971) found juvenile mortality to be between 66 and 79% in Alberta, Brewer (1980) found it to be only 17 and 25% in western Washington.

Hunting

The degree to which hunting can decrease grouse populations is uncertain. Heavy hunting pressure is known to reduce population densities in some areas (Small et al. 1991), but not in others (Kubisiak 1989). Light hunting probably has a negligible impact on ruffed grouse, because most birds taken in fall are immatures that will not survive through winter (Kubisiak 1984). It is possible that a few areas in California receive heavy grouse hunting pressure, but in general hunting pressure is relatively low. The degree to which California populations can withstand any level of hunting depends on local productivity and over-winter survival, however, and both of these parameters are currently unknown. Since ruffed grouse habitats in California are considered marginal, there is good reason to believe productivity and survival are relatively low. Before California ruffed grouse populations can be harvested at a maximum sustainable rate, their demographics need to be thoroughly investigated.

II. KNOWLEDGE AND STATUS OF RUFFED GROUSE HABITATS

The abundance of ruffed grouse is closely tied to the quantity and quality of successional plant communities (Barber et al. 1989). Until we understand: 1) the structure and composition

of successional habitats used by ruffed grouse in California, and 2) how these habitats are created and maintained under current land management regimes, the status and population characteristics of ruffed grouse in California will remain unknown.

The continental distribution of ruffed grouse is closely correlated with, but not entirely limited to, the distribution of trees of the genus Populus. Where Populus are uncommon, ruffed grouse sometimes use other genera of catkin-bearing trees, including Betula, Alnus, and Salix. In northwest California, the main catkin-bearing trees are red alder (Alnus rubra) white alder (Alnus rhombifolia), willow (Salix), and black cottonwood (Populus trichocarpa). These early- and mid-successional species create a dense shrubby layer in forest openings and riparian zones. The importance of coniferous trees in ruffed grouse habitats is uncertain. In southeast Idaho, Stauffer and Peterson (1985b) observed extensive use of conifer and mixed aspen/conifer forest, particularly in fall. In the southeastern portion of their range, ruffed grouse make extensive use of evergreen cover in winter, presumably because insufficient snow accumulates there for the birds to make snow burrows (Barber 1989). However, in Minnesota (Gullion and Marshall 1968) and Alberta (Rusch and Keith 1971), predation of ruffed grouse is known to increase as conifers increase. Apparently in these northern habitats tall conifers with clean boles and dense canopies are advantageous to aerial predators.

While the composition of ruffed grouse habitat may vary widely across the species' geographic range, habitat structure remains fairly uniform. Typical grouse habitat can be described as brushy woodlands with an interspersion of early- and mid-successional stands and an abundance of low-herbaceous and fruit-bearing plants. In northwestern California, such habitats most commonly occur along rivers and streams and in areas disturbed by timber harvest, fire, and landslides.

Ruffed grouse habitat can be divided into four seasonal types: courtship (drumming), nesting, brood-rearing, and winter habitats. Seasonal habitats have been described in detail in eastern and central states (Atwater and Schnell 1989) and occasionally in northwestern states (Hungerford 1951, 1953, Phillips 1964, Brewer 1980, Stauffer and Peterson 1985a, 1985b), but never in California. The status of ruffed grouse habitats in California will be uncertain until we better understand: 1) the composition of preferred habitats, 2) the distribution of preferred habitats, and 3) the ways in which these habitats are created and maintained through current land management practices. The following habitat descriptions are based on the few studies conducted in interior mountainous regions of the western United States. Apparently no studies of ruffed grouse habitat have been conducted in coastal areas.

Courtship habitats

In spring, male ruffed grouse advertise their presence to other grouse by `drumming' from a prominent `stage.' Drumming

stages often consist of fallen trees at least 20cm in diameter. Rocks, boulders, ant hills and snowbanks are also used. Courtship habitats are centered around one or more drumming stages. They are relatively open at ground level to provide good visibility of other grouse, and have dense cover at the shrub layer to provide protection from aerial predators. Trees and shrubs are primarily deciduous, and a high density of woody stems is said to create a `prison effect, providing a virtually impenetrable drumming stage. According to Barber et al (1989), males prefer sites with slopes less than 45%, and drumming logs that tend to lie parallel to the contour. In central Wisconsin, Kubisiak et al. (1980) found drumming grouse most often along an interface between upland and lowland habitats. In most regions male grouse remain within a few hundred meters of their courtship area throughout the year.

Nesting habitat

Characteristics of nesting habitat have not been well documented anywhere, in part because of the difficulty in finding ruffed grouse nests. According to Barber et al. (1989), the best nesting sites are hardwood stands with tree stems 5 to 13cm (2-5in) in diameter and an unobstructed forest floor.

Brood-rearing habitat

According to Barber et al. (1989), young ruffed grouse chicks `prefer small forest openings or equivalent habitats supporting a diverse mixture of herbaceous plants that provide succulent leaves or fruits and host an abundance of insects. The

growth at ground level should be relatively open and free of dense grasses that would impede the travel of chicks [or conceal a predator]. Patchy overhead cover of tree saplings, shrubs, brush, and brambles protects the birds from avian predators.' Where deciduous cover is lacking, broods may also use conifer stands.

Wintering habitat

In fall, ruffed grouse prefer habitats that provide an abundance of food and adequate cover. As winter approaches, protection from cold and wet weather becomes increasingly important. Ideal winter habitat consists of dense brushy vegetation, hardwood saplings, or conifers with dense cover at about 4.5m (15 ft) height (Barber et al 1989). In mountainous areas, grouse favor middle to upper slopes in winter, apparently in response to temperature inversions (Stauffer and Peterson 1985b). Where there is sufficient snowfall for burrowing, grouse select winter habitats with an open canopy so snow will accumulate. Where little or no snow accumulates, ruffed grouse roost in conifers in or near stands of deciduous trees. In winter ruffed grouse feed heavily on the buds of *Populus* and related trees, so winter habitats will include a good supply of these buds.

III. RESEARCH NEEDS

A. Population Research

1. **Locate ruffed grouse population centers.**

Rationale: The distribution of ruffed grouse in California appears to be quite irregular. Most population centers are probably known to at least a few people, but there is no central depository for this information. Documenting these areas is the first prerequisite for more in-depth studies.

Approach: Distributional information could be gathered very efficiently by soliciting information from biologists, bird watchers, sportsmen and other reliable observers who frequent north coast forests. One person, either a CDFG employee or private individual, should develop an informant network of 25 - 30 reliable observers, send these observers annual questionnaires regarding the number and location of ruffed grouse observed, and catalog and map accumulated data over time. This program could tentatively be called the Ruffed Grouse Information Network (RGIN). Record distributional data in a Geographic Information System (GIS) compatible with those used by local resource agencies.

2. **Study the phenology of drumming behavior.**

Rationale: The beginning, peak, and end of the drumming season, as well as its annual variations, must be determined before drumming counts can be used reliably. Drumming counts are the best available census technique for ruffed grouse.

Approach: Record the number of drums heard each morning and evening from April through June at several population centers, preferably for 2 to 5 years in succession. Compare/confirm findings with information from Oregon and Washington, if

available.

3. **Document the density of drumming males in a range of habitats and determine the factors that limit densities.**

Rationale: Densities of ruffed grouse are thought to be relatively low in California but actual densities, and the factors that affect them, are poorly known.

Approach: Select census areas/routes from RGIN findings. Include a range of forest types and population densities. Census by drum count (Petraborg et al. 1953, Gullion 1966, McBurney 1989). Record vegetation and landscape features of each site. Compare/confirm findings with data from Oregon and Washington, if available.

4. **Determine the nesting density, reproductive success, and over-winter survival of ruffed grouse in a range of habitats.**

Rationale: Anecdotal observations and the presumption of marginal habitat suggest that ruffed grouse populations in California are not highly productive. Ideally, harvest goals should be in accord with productivity. Three initial steps in determining the productivity of California's ruffed grouse populations are to determine the density of nesting females, reproductive success, and over-winter survival.

Approach: Select nesting, brooding, and wintering sites from RGIN data. Determine nesting density by flushing nesting hens with dogs along strip transects. Record vegetation and landscape. Determine reproductive success by monitoring hen:chick ratios from spring through fall along strip transects through known

brooding habitat. Record vegetation, landscape, and presence/absence of livestock at brood-rearing sites. Determine over-winter survival by monitoring radio-equipped birds (juveniles and adults) in different habitats. Compare/confirm findings with data from Oregon and Washington, if available.

5. **Identify popular ruffed grouse hunting areas, and characterize ruffed grouse hunters and hunting in California.**

Rationale: Very little is known about ruffed grouse hunters or ruffed grouse hunting in California. It is uncertain how many hunters are in the field primarily to hunt ruffed grouse. In order to accurately assess the economic importance of ruffed grouse hunting (the *Final environmental document regarding resident game bird hunting* misleadingly lumps the economic importance of ruffed grouse with that of blue grouse), as well as communicate more effectively with ruffed grouse hunters, it is important to identify ruffed grouse hunters as a group.

Approach: Include an additional page with the GTHS Survey, on a trial basis, which asks more specific questions of ruffed grouse hunters, including distance traveled, meals and lodging expenses, etc. Develop and maintain a database on known ruffed grouse hunters. Collect names and addresses through the GTHS, personal contact in the field, and a telephone `networking' survey. Query these hunters whenever questions arise regarding ruffed grouse hunters and hunting. Send summary reports and updates to participants to maintain interest in the program.

B. Habitat Research

1. **Analyze, classify, and rank the types of vegetation used by ruffed grouse in California.**

Rationale: Little is known of the habitat relationships of ruffed grouse in California. Maintaining sufficient habitat in optimal condition is the most basic management need for ruffed grouse in California, but insufficient information currently exists to do this.

Approach: Select habitat study sites from RGIN data. Conduct seasonal strip censuses through the variety of plant communities that occur at the sites, following Stauffer and Peterson (1985a, 1985b), for example. Record vegetation and landscape data in a GIS system compatible with those used by local resource agencies. Compare/confirm findings with data from Oregon and Washington, if available.

2. **Assess seasonal movements and juvenile dispersal.**

Rationale: Clues to understanding the irregular distribution of ruffed grouse in California may be found by studying movement and dispersal and potential barriers to movement and dispersal.

Approach: Radio-telemetry of juveniles and adults.

3. **Assess the response of ruffed grouse to forest harvest and succession across a range of forest types.**

Rationale: Ruffed grouse are said to prefer early- and mid-successional plant communities throughout their range, in part because *Populus* do well in such areas. In northwestern California, however, *Populus* are not common, so the importance of

successional habitats in California needs to be confirmed. In particular, the importance of riparian zones and forest clearcuts should be studied.

Approach: Select habitat study sites from RGIN data. Conduct seasonal strip censuses (eg., Stauffer and Peterson 1985a, 1985b) through a variety of plant communities, and including a range of seral stages and forest stands scheduled to be harvested. Record vegetation and landscape data in a GIS system compatible with those used by local resource agencies. Monitor grouse densities over time. Compare/confirm findings with data from Oregon and Washington, if available.

IV. MANAGEMENT NEEDS.

1. **Determine what ruffed grouse management activities other resource agencies are currently conducting, including agencies in Oregon and Washington.**

Rationale: Certain Western agencies may have ongoing research or management programs for ruffed grouse. CDFG should become aware of these programs, and encourage more inter-agency communication and cooperation in the future.

Approach: Make telephone and written enquiries to various agencies. Record and file findings so they will be available to future investigators.

2. **Establish California population and harvest goals.**

Rationale: Such goals will be helpful for optimizing the conservation and utilization of California's ruffed grouse

resource.

Approach: Base population goals on research findings (see RESEARCH NEEDS above) regarding population densities and availability of preferred habitat. Base harvest goals on research findings regarding accessibility and productivity of grouse populations.

3. **Encourage private land owners and government agencies to manage lands for increased ruffed grouse densities and hunter access.**

Rationale: Since preferred ruffed grouse habitats appear to be early- and mid-successional, such habitats must be created occasionally to maintain good grouse populations. Maximum utilization of California's ruffed grouse resource will entail hunter access onto lands controlled by many agencies and private interests.

Approach: The State of California should offer private land owners incentives such as grouse management equipment, materials, etc., in exchange for controlled hunter access. CDFG should endeavor to make public land management agencies aware of the economic and ecological importance of ruffed grouse, as well as encourage these agencies to fulfil their legal obligations to conserve ruffed grouse on the lands they administer.

4. **Monitor ruffed grouse populations at selected sites.**

Rationale: Questions of whether bag limits are appropriate, whether ruffed grouse numbers are increasing or decreasing, and whether certain land management practices adversely affect ruffed

grouse populations can best be addressed through an objective monitoring program.

Approach: Select habitat study sites from RGIN data. Conduct drumming counts and seasonal strip censuses in a variety of plant communities. Record vegetation and landscape data in a GIS system compatible with those used by local resource agencies. Compare/confirm findings with data from Oregon and Washington, if available. Repeat censuses annually for the first few years, then every 3-5 years thereafter.

V. ACTION PLAN

1. Create and implement a Ruffed Grouse Information Network (RGIN) (III.A.1).
2. Establish contacts and correspond with other resource agencies, including agencies in Oregon and Washington. Become familiar with ongoing ruffed grouse programs and encourage cooperation and communication between agencies (IV.1).
3. Locate and record ruffed grouse population centers (III.A.1).

FIRST LEVEL FIELD STUDIES

4. Study drumming phenology (III.A.2).
5. Study ruffed grouse hunters and hunting (III.A.5).
6. Monitor ruffed grouse populations and habitats (IV.4).

SECOND LEVEL FIELD STUDIES

7. Study ruffed grouse habitat associations (III.B.1).

8. Study ruffed grouse densities in a range of habitats (III.A.3).

THIRD LEVEL FIELD STUDIES

9. Study ruffed grouse movements (III.B.2).
10. Study ruffed grouse productivity (III.A.4).
11. Study the creation and maintenance of ruffed grouse habitats (III.B.3).

APPLICATION OF RESEARCH FINDINGS

12. Establish population and harvest goals (IV.2).
13. Encourage habitat management and hunter access on private and public lands.

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