Sage-Grouse Bibliography

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Methods for Construction of the Sage-grouse Bibliography

The primary purpose of our literature search was to establish a bibliography of the published, scientific literature for analysis of current knowledge about sage-grouse. References pertaining to sage-grouse were obtained from a variety of sources and entered into an electronic database (ProCite for Windows, version 5.0 software). Staff members of the USGS Northern Prairie Wildlife Research Center created the foundation for the database in July 2001, by searching several major bibliographic databases (Cambridge Scientific Abstracts, FirstSearch, and Wildlife Worldwide) for all citations with the terms "sage-grouse" or "Centrocercus urophasianus" in the title or as key words. After this initial search, we compared the resulting database with the references section of recent, key publications on sage-grouse (e.g., Schroeder et al. 1999, Connelly et al. 2000) and added citations as appropriate. The following types of citations were entered in the ProCite database: journal articles; articles in published proceedings of meetings, symposia, or workshops; theses or dissertations; articles in a numbered series published by a government agency or university; and books or chapters in books. Some additional types of material (e.g., federal aid job completion reports, abstracts, and articles in popular magazines) were entered, especially if they pertained to Oregon. (The database was developed as part of a contract completed for the Oregon Department of Fish and Wildlife.) Thus, for these categories ("gray" literature and articles in popular magazines), the database is incomplete and Oregon-centric. We did not intend to capture the complete body of unpublished literature on sage-grouse; instead, we wanted to collect a representative sample of that literature.

Several bibliographies on sage-grouse have been compiled or published, including those by Ryder (1964), Gill (1966), Boyce and Tate (1979), Hall (1998), and Salvo (2001). We used these existing bibliographies to check for omissions from our database, but did not include most popular articles or gray literature found in these bibliographies, nor did we include articles that focused primarily on other grouse species.

I will be updating the database periodically as new literature is published. Please send additions or corrections to: Mary Rowland at mrowland@fs.fed.us, or by calling me at 541-962-6582.

Acknowledgments

We are grateful to C. Goldade, D. H. Johnson, and K. Van Cleave of the U.S. Geological Survey, Northern Prairie Wildlife Research Center in Jamestown, ND for their assistance in literature searches, database compilation, and acquisition of reprints. E. Araki, B. Campbell, J. Penzien, and D. Woodworth of the National Science and Technology Center/BLM Library in Denver, CO were helpful in providing literature. J. Boyd, L. Farstad, and A. Koger assisted with database entry, filing, and ordering reprints. J. Boss of the Colorado Division of Wildlife provided copies of reports from that agency. We thank F. Hall of the California Department of Fish and Game and M. Salvo of the American Lands Alliance for sharing their extensive bibliographies on sage-grouse. E. Lawton, USDI Bureau of Land Management, also provided copies of sage-grouse bibliographies.

References

Boyce, M. S., and J. Tate, Jr. 1979. A bibliography on the sage-grouse (Centrocercus urophasianus). University of Wyoming Agricultural Experiment Station, Science Monograph 38. Laramie, Wyoming, USA. 12 pp.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage-grouse populations and their habitats. Wildlife Society Bulletin 28:967-985.

Hall, F. 1998. A sage-grouse bibliography. Unpublished report. On file with: Pacific Northwest Research Station, Forestry and Range Sciences Laboratory, 1401 Gekeler Lane, La Grande, OR, USA 97850.

Gill, R. B. 1966. A literature review on the sage-grouse. Colorado Department of Game, Fish and Parks, Game Research Division, and Colorado Cooperative Wildlife Research Unit. Special Report 6. 39 pp.

Ryder, R. A. 1964. A partial bibliography of references on the sage-grouse (Centrocercus urophasianus). Colorado State University, Fort Collins, USA. 28 pp.

Salvo, M. 2001. Literature cited and selected references: conservationist comments on draft interim management guidelines for sage-grouse and sagebrush steppe ecosystems. Unpublished bibliography. 149 pp.

Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage-grouse (Centrocercus urophasianus). A. Poole and F. Gill, editors. The birds of North America, Number 425. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, D.C., USA. 28 pp.

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Able, K. P. 2000. Sage Grouse futures. Birding 32:306-316.
Keywords: Sage Grouse/Taxonomy/Distribution-Mapping/Habitat Use-Selection/Genetics/Behavior.

Addison, E. M., and R. C. Anderson. 1969. Oxyspirura lumsdeni n. sp. (Nematoda: Thelaziidae) from Tetraonidae in North America. Canadian Journal of Zoology 47:1223-1227.
Keywords: Sage Grouse/Oxyspirura/Anatomy-Morphology/Disease-Parasites.

Aldrich, J. W. 1946. New subspecies of birds from western North America. Proc. Biol. Soc. Wash. 59:129-135.
Keywords: Sage Grouse/Distribution-Mapping/Physiology/Subspecies/North America/Taxonomy/Oregon/Washington/Anatomy-Morphology/Taxonomy.

Aldrich, J. W. 1963. Geographic orientation of American tetraonidae. Journal of Wildlife Management 27:529-545.
Keywords: Sage Grouse/Tetraonidae/Habitat Use-Selection/Distribution-Mapping.
Abstract: Differentiation of both species and genera within the grouse family (Tetraonidae) has been pronounced in North America. Each of its species has become adapted to specific types of habitat. These vary greatly, from arctic tundra to northern desert scrub and humid forest of both deciduous and coniferous types. All the species are racially variable in some degree, from the sage grouse (*Centrocercus urophasianus*), with 2 races, to the ruffed grouse (*Bonasa umbellus*), with 13. The races tend to be correlated with the ecological climax area in which they live. There are a few cases in which this correlation is not obvious and racial variation seems to be entirely the result of geographical isolation. The present status of grouse depends chiefly on the extent to which modification of required habitat has taken place; the greatest changes have occurred in the grasslands and the least in the arctic-alpine areas.

Aldrich, J. W., and A. J. Duvall. 1955. Distribution of American gallinaceous game birds. USDI Fish and Wildlife Service, Circular 34.
Keywords: Sage Grouse/Habitat Use-Selection/Water/Reproduction/Distribution-Mapping.

Aldridge, C. L. 1998. Status of the sage grouse (*Centrocercus urophasianus urophasianus*) in Alberta. Alberta Environ. Protection, Wildl. Manage. Div., and Alberta Conserv. Assoc., Edmonton. Wildl. Status Rep. 13. 23 pages.
Keywords: Sage Grouse/Habitat Use-Selection/Nesting/Brood rearing/Winter/Lekking/Behavior/Diet/Mortality-Survival/Alberta/Management/Agriculture/Roads/Weather-Climate/Mineral-Oil Development.

Aldridge, C. L. 2000. Reproduction and habitat use by Sage Grouse (*Centrocercus urophasianus*) in a northern fringe population. M.S. thesis. University of Regina, Regina, Saskatchewan, Canada. 109 pages.
Keywords: Sage Grouse/Reproduction/Habitat Use-Selection/Population trends/Nesting/Brood rearing/Distribution-Mapping/Lekking/Behavior/Diet/Mortality-Survival/Predation/Roads/Weather-Climate/Agriculture/Hunting/Recreation.

Aldridge, C. L., and R. M. Brigham. 2001. Nesting and reproductive activities of Greater Sage-Grouse in a declining northern fringe population. Condor 103(3):537-543.
Keywords: Sage Grouse/Nesting/Reproduction/Canada/Habitat Use-Selection/Brood rearing.
Abstract: In Canada, Greater Sage-Grouse (*Centrocercus urophasianus*) are at the northern edge of their range, occurring only in southeastern Alberta and southwestern Saskatchewan. The population in Canada has declined by 66% to 92% over the last 30 years. We used radio-telemetry to follow 20 female Greater Sage-Grouse and monitor productivity in southeastern Alberta, and to assess habitat use at nesting and brood-rearing locations. All females attempted to nest. Mean clutch size (7.8 eggs per nest) was at the high end of the normal range for sage-grouse (typically 6.6-8.2). Nest success (46%) and breeding success (55%) were within the range found for more southerly populations (15% to 86% and 15% to 70%,

respectively). Thirty-six percent of unsuccessful females attempted to renest. Fledging success was slightly lower than reported in other studies. Thus, reproductive effort does not appear to be related to the population decline. However, chick survival to >=50 days of age (mean = 18%) was only about half of that estimated (35%) for a stable or slightly declining population, suggesting that chick survival may be the most important factor reducing overall reproductive success and contributing to the decline of Greater Sage-Grouse in Canada.

Aldridge, C. L., and R. M. Brigham. 2002. Sage-Grouse nesting and brood habitat in southern Canada. Journal of Wildlife Management 66(2):433-444.
Keywords: Sage Grouse/Habitat Use-Selection/Nesting/Brood Rearing/Canada/Artemisia/ARCA.
***Notes*:** Well-designed study of Greater Sage-Grouse nesting and brood-rearing habitats in Alberta, at the periphery of the range of the species. Total canopy cover of sagebrush is less here than in other parts of the species' range.

Aldridge, C. L., S. J. Oyler-McCance, and R. M. Brigham. 2001. Occurrence of Greater Sage-Grouse x Sharp-tailed Grouse hybrids in Alberta. Condor 103(3):657-660.
Keywords: Sage Grouse/Behavior/Genetics/Hybrid/Alberta/ARCA/Lekking.
Abstract: Two distinct grouse were regularly observed at two Greater Sage-Grouse (*Centrocercus urophasianus*) leks in both 1999 and 2000 in southeastern Alberta. Physically and behaviorally, the birds exhibited characteristics of both Greater Sage-Grouse and Sharp-tailed Grouse (*Tympanuchus phasianellus*), suggesting they were hybrids. DNA analyses of blood and feather samples indicated that both birds were males with Greater Sage-Grouse mothers and thus, fathers that were likely Sharp-tailed Grouse.

Alexander, H. F., and C. E. Braun. 1976. Game bird survey: Evaluation of the effects of changes in hunting regulations on Sage Grouse nesting success and brood investigations. Project number: COLO. W-037-R-29/WK.PL.03/JOB 09/PT-2. Colorado Division of Wildlife. 15 pages.
Keywords: Sage Grouse.

Allemand, R. L. 1966. Upland game investigations: Population surveys. Sage Grouse survey. California Department of Fish and Game. 11 pages.
Keywords: Sage Grouse.

Allen, G. 1973. Guidelines for habitat protection in Sage Grouse range. Pages 18-32 *in* Proceedings and 1973 Questionnaire, Eighth Western States Sage Grouse Workshop, Lewistown, MT.
Keywords: Sage Grouse/Habitat Use-Selection/Diet/Nesting/Reproduction/Brood rearing/Winter/Summer.
***Notes*:** Page 17 is also a foreword, explaining the purpose of and need for the new guidelines. This article presents revised Sage Grouse guidelines for discussion; however, this paper is not the final set of approved guidelines.

Allred, W. 1946. Sage Grouse trapping and transplanting. 26:143-146.
Keywords: Sage Grouse/Translocation/Trapping/Habitat Restoration/Weather-Climate/Cropland/Behavior.

Allred, W. J. 1942. Predation and the Sage Grouse. Wyoming Wildlife 7:3-4.
Keywords: Sage Grouse.

Alsatt, A. L. 1995. The potential impact of raven predation on sage grouse production in Nevada. M.S. thesis. University of Nevada, Reno. 45 pages.
Keywords: Sage Grouse.

Alstatt, A., and M. S. Stigar. 1988. Statewide wildlife program: Sage Grouse population density, production and mortality. Project number: NV W-048-R-19/Job 1/Study XVII. Nevada Department of Wildlife. 42 pages.

Keywords: Sage Grouse.

Ammann, G. A. 1944. Determining the age of Pinnated and Sharp-tailed Grouses. Journal of Wildlife Management 8(2):170-171.
Keywords: Sage Grouse/Hunting/Anatomy-Morphology/Age.

Anderson, E. W., D. L. Franzen, and J. E. Melland. 1990. Forage quality as influenced by prescribed grazing. Pages 56-70 *in* General Technical Note RM-194. In the series analytic: Can livestock be used as a tool to enhance wildlife habitat? Paper presented at the 43rd annual meeting of the Society for Range Management, February 13, 1990, Reno, NV. USDA Forest Service, Rocky Mountain Research Station.
Keywords: Sage Grouse/Livestock grazing/Physiology/Habitat Restoration/Translocation/Weather-Climate/Meadow/ARAR/Understory-forbs/Diet/Scale.

Anonymous. 1948. A report on Wyoming Sage Grouse. Wyoming Wildlife 14-19, 32-33.
Keywords: Sage Grouse.

Anonymous. 1955. Using the cannon trap to capture and band sage grouse. Pages 6 *in* Idaho Wildlife Rev.
Keywords: Sage Grouse/Techniques-Methods.

Anonymous. 1997. Gunnison sage grouse conservation plan, Gunnison Basin, Colorado. Colorado Division of Wildlife, Fort Collins.
Keywords: Sage Grouse/Distribution-Mapping/Habitat Use-Selection/Lekking/Nesting/Brood rearing/Winter/Genetics/Gunnison Sage-Grouse.

Anonymous. 1998. Influence of fire on wildlife habitat in the Great Basin: A position statement by the Nevada chapter-The Wildlife Society, August 16, 1998. Transactions of the Western Section of the Wildlife Society 34: 42-57.
Keywords: Sage Grouse/Fire/Riparian/Seeding forage/Pinyon-Juniper/Population trends/Livestock grazing.

Apa, A. D. 1998. Habitat use and movements of sympatric Sage and Columbian Sharp-tailed Grouse in southeastern Idaho. Ph.D. dissertation. University of Idaho, Moscow, Idaho.
Keywords: Sage Grouse/Idaho/Habitat Use-Selection/Movement/Reproduction/Nesting/Brood rearing/Sympatric/Sagebrush/ARTRTR/ARTRVA/Other shrubs/Understory-forbs/Understory-grasses/Cheatgrass/Crested Wheatgrass/Juvenile/Yearling/Adult/Anatomy-Morphology/Predation/Models.
***Notes*:** Study of sympatric sage grouse and Columbian sharp-tailed grouse in southeastern Idaho. The dissertation is presented in 3 chapters, the 3rd of which deals exclusively with predation rates on artificial sharp-tailed grouse nests placed in the study area. Objectives were to determine nesting habitat use at both micro and macro scales, for both species, examine movements from lek of capture, determine nesting and hen success, and "determine nesting habitat niche breadth and overlap" for the 2 sympatric species in this locale. Captured 238 sage grouse, including 69 females, over the 4-year study.

Measured several vegetation characteristics at nest (or brood) sites, as well as dependent micro-habitat locations (near nests, but located randomly within 50-100 m from nest site) and at independent macro-habitat sites, using random UTMs to locate these sites in the study area. Median species richness was lower at non-native brood sites than at native, and was lower at macro-habitat sites than at micro-habitat sites near broods, which was lower than species richness at brood sites. Also, median species richness was greater at sage grouse combined brood, micro-habitat dependent, and macro-habitat independent sites compared to sharp-tailed sites.

Found that the 2 species partition nesting habitats in this area, and that sage grouse tend to use resources in a more specialized way than do sharp-tailed grouse. Land management activities in areas where the species overlap should thus be tailored to the more stringent habitat requirements of sage grouse.

Aslett, D. 1997. Sand Creek Wildlife Management Area: 50 years for wildlife. Idaho Wildlife 17:33-36.
Keywords: Sage Grouse/Idaho.

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Workshop. Rock Springs, WY. 6:94-99.
Keywords: Sage Grouse/Nets/Mortality-Survival/Cannon Net/Techniques-Methods.

Autenrieth, R. 1985. Sage Grouse life history and habitat management. Pages 52 *in* K. Sanders and J. Durham, editors. Rangeland fire effects: a symposium. Department of the Interior, Bureau of Land Management, Boise State Office, Boise, ID.
Keywords: Sage Grouse/Weather-Climate/Nesting/Brood rearing/Winter/Habitat Use-Selection/Lekking.

Autenrieth, R., W. Molini, and C. Braun. 1982. Sage Grouse management practices. Western States Sage Grouse Committee Technical Bulletin No. 1. 42 pages.
Keywords: Sage Grouse/Lekking/Brood rearing/Hunting/Livestock grazing/Habitat Use-Selection/Weather-Climate/Distribution-Mapping/Sagebrush/ARTR/ARTRTR/ARTRVA/ARTRWY/Understory-forbs/Riparian/Meadow/Nesting/Spring/Summer/Fall/Winter/Juvenile/Yearling/Adult/Environmental Requirements/Herbicides-pesticides/Fire/Mineral-Oil development/Recreation/Shrub Removal/Habitat Restoration/Reproduction/Population trends-Lek counts/Techniques-Methods/Water Development.

Autenrieth, R. E. 1969. Impact of strip spray on vegetation and Sage Grouse use on summer habitat. Pages 147-157 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Habitat Use-Selection/Herbicides-Pesticides/Summer/Migration/Idaho/ARTR/Brood rearing/Distribution-Mapping.

Autenrieth, R. E. 1973. Sage Grouse research in Idaho. Pages 51-52 *in* 8th Western States Sage Grouse Workshop Proceedings and 1973 Questionnaire. 8.
Keywords: Sage Grouse/Idaho/Nesting/Meadow/Brood rearing/Livestock grazing/Year round/Trapping/Hunting/Strutting/Fire/Agriculture/Migration.

Autenrieth, R. E. 1981. Sage Grouse management in Idaho. Idaho Department of Fish and Game.
Keywords: Sage Grouse/Idaho/Lekking/Nesting/Brood rearing/Winter/Predation/Habitat Use-Selection/Hunting/Livestock grazing/Water/ Fire/Seeding forage/Herbicides-Pesticides.

Autenrieth, R. E. 1986. Sage Grouse. Pages 763-779 *in* Audubon Wildlife Report.
Keywords: Sage Grouse/Lekking/Nesting/Brood rearing/Winter/Predation/Disease-Parasites/Population trends.

Back, G. N., M. R. Barrington, and J. K. McAdoo. 1987. Sage Grouse use of snow burrows on northeastern Nevada. Wilson Bulletin 99:488-490.
Keywords: Sage Grouse/Nevada/Winter/Behavior/Taxonomy.
Abstract: Apparently all species of Tetraoninae roost in snow for thermal conservation, provided that the snow is sufficiently deep and no ice crust occurs at the surface. However, the type of roost may vary with snow conditions or weather. The authors distinguish between 2 roost types: "snow forms" and "snow burrows." Snow forms are shallow depressions or open bowels in the snow in which the dorsal surface of the bird is exposed. Snow burrows are deep holes or tunnels in which the bird actively burrows completely under the snow surface.

Bailey, A. M. 1925. Segregation of the sexes in the sage-hen. Condor 27:172-173.
Keywords: Sage Grouse/Reproduction/Diet/Habitat Use-Selection/Hunting.

Barber, H. A. 1991. Strutting behavior, distribution, and habitat selection of Sage Grouse in Utah. M.S. thesis. Brigham Young University, Provo, UT.
Keywords: Sage Grouse/Behavior/Distribution-Mapping/Habitat Use-Selection/Utah/Strutting/Brood rearing/ARTR/Other sage/Grasslands/Movement/Reproduction/Population trends-Lek counts/Meadow/Cropland/Lekking/Nesting/Summer/Year-round/Juvenile/Adult/Anatomy-Morphology.
***Notes*:** Two-part study: in first, examined behavior of males on 5 geographically distinct leks to see if different. Found differences in behavior patterns (e.g., strutting sequence) between the areas. These findings should be considered in translocating grouse among areas. Also studied radiotelemetered grouse for habitat selection study: hens with broods, hens without broods, and males. Data recorded at grouse

locations included: distance to water, dis. to trail/road, closest lek, and nearest known herbicide sprayed area. Found hens with broods closer to roads and trails than the other groups. Also, hens with broods were somewhat closer to water and farther from leks. No relation seen in distance to suspected sprayed areas. Calculated MacArthur's Diversity index at locations, using shrubs, forbs, and grasses as 3 habitat "types." Hens with broods used areas of greatest diversity, and used areas with average sagebrush cover of 17%. Hens without broods used areas with average of 28.6% cover, and males, 23.3%.

Barber, T. A. 1968. Function of the cecal microflora in sage grouse nutrition. M.S. thesis. Colorado State University, Ft. Collins, Colorado.
Keywords: Sage Grouse/Diet/Microflora/ARTR.

Barber, T. A., J. G. Nagy, and T. A. May. 1969. Nutrition and dietary preference of penned sage grouse. Pages 180-188 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Diet/Distribution-Mapping/Movement/Herbicides-Pesticides/Captivity.

Barnett, J. K. 1992. Diet and nutrition of female Sage Grouse during the pre-laying period. M.S. thesis. Oregon State University, Corvallis, Oregon.
Keywords: Sage Grouse/Diet/Productivity/Reproduction/Oregon/Habitat Use-Selection.

Barnett, J. K., and J. A. Crawford. 1993. Diet and nutrition of female Sage Grouse during the pre-laying period in Oregon. Pages 15 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse/Oregon.

Barnett, J. K., and J. A. Crawford. 1993. Diet and nutrition of sage grouse hens during pre-laying period in Oregon. Oregon Agriculture Research Station Report 10-123.
Keywords: Sage Grouse.

Barnett, J. K., and J. A. Crawford. 1994. Pre-laying nutrition of Sage Grouse hens in Oregon. Journal of Range Management 47:114-118.
Keywords: Sage Grouse/Diet/Oregon/Population trends/ARAR/ARTRWY/Livestock grazing/Other shrubs/Understory-forbs/Understory-grasses/Lekking/Adult/Diet/Physiology/Habitat Use-Selection/Environmental Requirements/Reproduction.

Barry, J. 1988. King coal and the prince of the sage. Wyoming Wildlife 52(3):12-17.
Keywords: Sage Grouse/Mining.

Batterson, W. M., and W. B. Morse. 1948. Oregon Sage Grouse. Oregon Fauna Series No. 1.
Keywords: Sage Grouse/Oregon/Distribution-Mapping/Sagebrush/Lekking/Nesting/Brood rearing/Spring/Summer/Fall/Juvenile/Yearling/Adult/Diet/Anatomy-Morphology/Disease-Parasites/Environmental Requirements/Livestock grazing/Water Development/Translocation/Predation/Reproduction/Mortality-Survival/Population trends-Lek counts/Techniques-Methods/Weather-Climate.
***Notes*:** Begins with general review of sage grouse life history, including seasonal behaviours, appearance, and a map of current distribution in the state. Reviews status of grouse in Oregon, concentrating on 2 study areas in Baker County at the northeastern corner of the species' current range in Oregon. Reports lek count data for 8 leks in these 2 sites, for 7 years. Trends generally downward from 1941-1948, especially for males. The authors state that "livestock apparently cause little or no damage to sage grouse nesting," but this appears to be based on casual observation that no nests were observed to be trampled, despite this being early spring sheep range. In reporting outcomes for 131 nests followed during 4 years, ravens were by far the highest single cause of nest failure, and the authors recommended "control of wing predators" for sage grouse production. Overall nest success rate averaged 24%, with 66 of 131 nests destroyed by ravens.

Bean, R. 1941. Life history studies of the Sage Grouse (*Centrocercus urophasianus*) in Clark County, Idaho. M.S.

thesis. Utah Agricultural College, Logan, Utah.
Keywords: Sage Grouse.

Beani, L., and L. Fusani. 1997. Function and hormonal background of vocal display in non-songbirds. Advances in Ethology 32:31.
Keywords: Sage Grouse/Behavior.

Beck, J. L., and D. L. Mitchell. 2000. Influences of livestock grazing on Sage Grouse habitat. Wildlife Society Bulletin 28:993-1002.
Keywords: Sage Grouse/Livestock grazing/Interspecies relations/Habitat change/Loss of habitat/Agriculture/Understory-grasses/Herbicides-pesticides.
Abstract: Livestock grazing has been identified as one factor associated with the widespread decline and degradation of sage grouse (*Centrocercus urophasianus*) habitat. We identified n=17 positive and negative impacts of livestock on sage grouse and habitat. Little information is currently available concerning the direct impacts of livestock grazing on sage grouse habitat. Indirect impacts are better understood than direct impacts. Chemical and mechanical treatments intended to provide increased quantities of grass forage for livestock have indirectly reduced the acceptability of sagebrush (*Artemisia* spp.) rangelands for sage grouse. Our paper examines: 1) potential mechanisms whereby livestock grazing in big sagebrush (A. tridentata) communities can modify sage grouse habitat and 2) the indirect influences of livestock production on sage grouse habitat. Overall, livestock grazing appears to most affect productivity of sage grouse populations. Residual grass cover following grazing is essential to conceal sage grouse nests from predators. Future research needs are identified and management implications related to livestock grazing in sage grouse habitats are included.

Beck, T. D., R. B. Gill, and C. E. Braun. 1975. Sex and age determination of Sage Grouse from wing characteristics: Game information leaflet number 49. Colorado Division of Wildlife.
Keywords: Sage Grouse/Mortality-Survival/Hunting/Juvenile/Adult/Yearling/Age/Sex/Nesting.

Beck, T. D. I. 1975. Attributes of a wintering population of Sage Grouse, North Park, Colorado. M.S. thesis. Colorado State University, Ft. Collins, Colorado.
Keywords: Sage Grouse/Winter/Colorado/Movement/Distribution-Mapping/Predation/Habitat Use-Selection/Fertilization.
***Notes*:** Studied sage grouse in North Park, CO for 2 winters (about late December - early March). Vegetation is primarily a vaseyana site. Observed >5,000 birds; some were banded (about 280 each winter), but no radiotelemetry used. Identified 7 high use areas of only 85 km2 (out of 1,250 km2 total sagebrush-dominated land in North Park) that comprised most of the sightings. Over 400 km2 of the area has been altered through spraying, brushbeating, etc. since the late 1950s; only 4 of 199 flocks were observed in such areas. Vegetation in the high use areas was not different from other use areas. Most flocks were located on gentle slopes (<5%) with exposed sagebrush. Females were in more dense sagebrush than were males. A sex ratio of 62:38 females:males was observed in winter. In sites with great elevational changes, winter use is very dependent on snow depths. Flocks were highly sexually segregated, and female flocks were on average larger. Very few birds were observed that were not in flocks. Movements of banded birds indicated that birds moved freely about the entire study area, such that the birds formed only one population.

Beck, T. D. I. 1975. Game bird survey. Effects of sagebrush control on distribution and abundance of Sage Grouse: Attributes of a wintering population of Sage Grouse, North Park, Colorado. Pages 37-78 *in* Job Progress Report. Project number: COLO. W-037-R-28/WK.PL.03/JOB 08A. Colorado Division of Wildlife.
Keywords: Sage Grouse/Colorado/Strutting/ Hunting/Winter/Distribution-Mapping/Weather-Climate/Habitat Use-Selection/Movement.
***Notes*:** This is actually 2 reports, issued back to back in the Game Research Report, both by Beck, but with the same work plan and job numbers. The first, titled only "Effects of sagebrush control on distribution and abundance of Sage Grouse," is from pp. 37-46.

Beck, T. D. I. 1975. Winter ecology of Sage Grouse in North Park, Colorado. Journal of the Colorado-Wyoming Academy of Science 7:43.
Keywords: Sage Grouse.

Beck, T. D. I. 1977. Sage Grouse flock characteristics and habitat selection in winter. Journal of Wildlife Management 41:18-26.
Keywords: Sage Grouse/Habitat Use-Selection/Winter/Agriculture/Livestock grazing/Herbicides-Pesticides/Distribution-Mapping/Movement/Predation/Habitat Restoration.

Beck, T. D. I. 1977. Winter habitat of sage grouse in North Park, Colorado. Technical Paper. Abstract. In: Western States Sage Grouse Committee, Western Assoc. of State Game and Fish Comm. Annual Proceedings 1977.
Keywords: Sage Grouse/Colorado/Winter.

Beck, T. D. I., and C. E. Braun. 1978. Weights of Colorado Sage Grouse. Condor 80:241-243.
Keywords: Anatomy-Morphology/Sage Grouse/Colorado/Weight/Physiology/Taxonomy.

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Keywords: Sage Grouse.

Beck, T. D. I., and C. E. Braun. 1980. The strutting ground count: Variation, traditionalism, management needs. Pages 558-566 *in* Proceedings of the 60th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Strutting/Management/Population trends/Lekking/Adult/Yearling/Hunting/Habitat Use-Selection.

Beeny, L. 1998. Bomber volunteers. Wyoming Wildlife 62:36-41.
Keywords: Sage Grouse.

Bendire, C. E. 1877. Notes on some of the birds found in southeastern Oregon, particularly in the vicinity of Camp Harney, from November, 1874 to January, 1877. Proc. Boston. Soc. Nat. History. 19:109-149.
Keywords: Sage Grouse.

Bendire, C. E. 1892. Life histories of North American birds. U.S. Natl. Mus. Spec. Bull. 1, Vol. 1.
Keywords: Sage Grouse.

Benson, L. A. 1990. Avian response to burning in the big sagebrush type. Journal of the Colorado-Wyoming Academy of Science 22(1):26.
Keywords: Sage Grouse/Fire.

Benson, L. A., C. E. Braun, and W. C. Leininger. 1991. Sage Grouse response to burning in the big sagebrush type. Pages 97-104 *in* Proceedings, Issues and Technology in the Management of Impacted Western Wildlife, No. 5. Thorne Ecological Institute.
Keywords: Sage Grouse/Colorado/ARTR/Fire/Livestock grazing/Herbicides-Pesticides/Weather-Climate/Population trends/Distribution-Mapping/Habitat Use-Selection.

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Abstract: Sage grouse (*Centrocercus urophasianus*) intraseasonal movements have been well documented. Daily movements of males during the breeding season, movements by nesting and brood-rearing hens, and movements of birds in winter have been determined through the use of radiotelemetry. The findings presented here were the result of a study conducted from 1978 through 1981 to determine sage grouse use on an area that has potential for surface coal mining. Telemetry was initially used to determine nesting, brood-rearing, and wintering areas of grouse that displayed on arenas within the proposed mine area. Extended life of transmitters on hen sage grouse allowed us to replace the transmitters to get consecutive-year data on a number of females. These data indicated a divergence from traditional movement theories and suggested possible fidelity to breeding, nesting, brood-rearing, and wintering areas.

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Keywords: Sage Grouse/Idaho/Agriculture/Distribution-Mapping/Habitat Use-Selection/Mortality-Survival/Hunting/Roads/Cropland/Migration/Sagebrush/Summer/Juvenile/Yearling/Adult/Physiology/Movement/Herbicides-pesticides/Scale.
Abstract: Die-offs of sage grouse (*Centrocercus urophasianus*) were verified in southeastern Idaho in 1981. We captured 82 apparently healthy grouse to quantify the effects of organophosphorus insecticides (OP's) and other pesticides on sage grouse in sagebrush (Artemisia spp.) bordering agricultural lands in July 1985 and 1986. Grouse were fitted with radio collars and tracked through part of each summer. At least 18% of 82 radio-tagged grouse in 1985-86 subsequently occupied fields at the time they were sprayed with OP insecticides dimethoate or methamidophos. Cholinesterase (ChE) assays of brains and residue analysis of crop contents indicated that 5 and 16% of the marked sample died from OP's in 1985 and 1986, respectively. Approximately 200 sage grouse were present in a block of alfalfa sprayed with dimethoate; 63 of these were later found dead and ChE activity in 43 brains suitable for assay were depressed > 50%. Maximum residues in crop contents of dead grouse were 18 mu g/g methamidophos and 30 mu g/g dimethoate. Our study indicates that certain pesticides have the potential for adversely affecting grouse populations.

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Keywords: Sage Grouse/Models/Brood rearing/Disease-Parasites/Genetics/Reproduction.

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***Notes*:** Lists published literature as well as a list of federal aid reports, by state and year. Gives sources searched, most through 1977. Not annotated.

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Abstract: The degree to which male sage grouse select lek sites and females select nesting sites to maximize proximity to the other sex was examined by contrasting male dispersions with the dispersions and movements of females in the months preceding incubation. Wintering females exhibit highly overlapping ranges due to shared use of central refuging areas. In late winter and early spring, females move an average 9 km from wintering areas to select nest sites and males begin occupying leks. Pooled evidence suggests that females select nest sites independently of male dispersion whereas males adjust lek occupation so as to maximize proximity to females. Relevant observations include females visiting nest sites before leks, moving further to select a nest site than to select a lek, and increasing their distance to leks as a results of selecting nest sites.

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***Notes*:** Summarizes literature to date on mortality and survival rates, as well as harvest estimates (as a % of population) for several grouse species, including sage grouse. Of the literature available at this time on sage grouse, there was little conclusive data about whether hunting mortality was compensatory or additive. However, several studies did report apparently robust data on mortality rates, about 59% on average.

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Keywords: Sage Grouse.

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Keywords: Sage Grouse/Distribution-Mapping/Extirpation/Habitat use-Selection/Population trends/Extermination /Dispersion/Agriculture/Urbanization/Roads/Power lines/Livestock grazing/Herbicides-pesticides/Predation/Hunting.
Abstract: Sage grouse (*Centrocercus urophasianus*) populations have declined throughout western North America. This species has been extirpated in five states and one province, all at the periphery of the original distribution. Breeding population size in each of three additional states and two provinces is estimated at less than 2,000 individuals. Declines in population size in Colorado have varied from 45 to 82% since 1980, depending upon area, and the range-wide estimate is at least 30% decrease since 1985. Major factors involved in the documented decreases in distribution and abundance are habitat loss (usually permanent), habitat fragmentation (usually permanent), and habitat degradation (usually short term, two to 30 years). No single factor is responsible for the observed declines and human-induced habitat changes are accentuated by periodic drought. No natural undisturbed habitats are known to exist and active management of sagebrush (Artemisia spp.) rangelands is needed on a management experiment basis.

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Keywords: Sage Grouse/Hunting/Wings/Nesting/Adult/Yearling/Oregon/Reproduction.

Braun, C. E. 2002. Executive summary: Oregon Sage-grouse wing analyses, 1993-2001. Unpublished white paper prepared for Oregon Dept. of Fish and Wildlife.
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Keywords: Sage Grouse/Colorado/Herbicides - Pesticides/Shrub removal.

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Keywords: Sage Grouse/Hunting/ARTR/Distribution-Mapping/Colorado .

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Keywords: Sage Grouse/ARTRVA/ARTRWY/Distribution-Mapping/Population trends/Weather-Climate/Mineral-Oil development/Herbicides-Pesticides/Colorado/Sagebrush/ARCA/Other shrubs/Lekking/Juvenile/Adult/Shrub removal/Hunting/Reproduction/Scale/Population trends-Lek counts.
Abstract: The need for knowledge about sage grouse responses to sagebrush treatments resulted in research studies in North Park, Jackson County, Colorado that spanned 30 years. Results from the original study indicated that sage grouse responses to the 1965 treatments were negative and resulted in a population decline as measured by number of active leks, total makes counted, and percentage young and young per hen in the harvest. These responses continued for at least 10 years following treatments. Findings from the 1965 through 1973 research efforts, in conjunction with results of studies in other states, greatly affected sagebrush management in Colorado and throughout the range of sage grouse through development of guidelines for habitat management. The weaknesses of the initial study spurred development and improvement of techniques for lek surveys, trapping procedures, harvest data collection and age/sex classification from wings. As a result, management of hunting recreation opportunities was enhanced. Further, the value of long-term collection of population data for management has been repeatedly demonstrated, as different habitat alteration actions have been suggested and implemented. However, any value has been severely restricted by lack of cause/effect studies of habitat-population relationships.

Braun, C. E., T. Britt, and R. O. Wallestad. 1977. Guidelines for maintenance of Sage Grouse habitats. Wildlife Society Bulletin 5:99-106.
Keywords: Sage Grouse/Nesting/Diet/Reproduction/Brood rearing/Winter/Summer/Fire/Livestock grazing/Herbicides-Pesticides/Habitat Use-Selection.
Abstract: The importance of sagebrush (Artemisia spp.) to maintenance of population stability of sage grouse (*Centrocercus urophasianus*) is documented from review of studies throughout the range of this species. Known effects of sagebrush control on sage grouse are presented. Guidelines for maintenance of sage grouse habitats promulgated by the Western Association of State Game and Fish Commissioners are given.

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Keywords: Sage Grouse/Mist Nets/Idaho/Sagebrush/Summer/Techniques-Methods.

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Keywords: Sage Grouse/Dispersal/Nesting/Brood rearing.

Browers, H. W.Jr., and L. D. Flake. 1983. Dispersal and harvest of Sage Grouse utilizing the Test Reactor Area on the Idaho National Engineering Laboratory. M.S. thesis. South Dakota State University. 346 pages.
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Keywords: Sage Grouse/Livestock grazing/Habitat Use-Selection/Cropland/Grasslands/Weather-Climate/Reproduction/Mortality-Survival/Hunting.
***Notes*:** This paper does not address sage grouse, but other prairie grouse species, e.g., sharp-tailed grouse, greater and lesser prairie chickens, and Montezuma quail. Author discusses possible reasons for declines in these species' populations, looking specifically at weather, especially precipitation patterns. Suggests that depletion of native grasslands by overgrazing of livestock, particularly in dry years, may be the problem. Recommends ungrazed refugia be maintained in Southwestern grasslands to maintain populations of these species.
Abstract: California quail, Gambel's quail and mountain quail evolved within comparatively moderate climates having winter-spring rainfall and a dry growing season. These so called Mediterranean species are characterized by boom or bust fluctuations in reproductive success which is an evolutionary adaptation to annual variations in precipitation related conditions. These scrub-adapted birds are thus able to rapidly exploit favorable situations and adjust to less favorable ones. Just the opposite is true for the grassland gamebirds that evolved with continental or tropical climatic regimes. Prairie chickens, bobwhite, Montezuma quail, sharp-tailed grouse and scaled quail all display less pronounced variations in reproductive success than Mediterranean species. Reproductive success in at least 3 of these species in Southwest is related to summer precipitation which, within the range of these species, is less variable than winter rainfall. Continental species are adapted to changes in overwinter survival and population fluctuations are, at least partially, responses to changes in perennial grass and/or food production. The reduction of either of these entities decreases the survival rate (and population level) by increasing the incidence of predation and starvation. The removal of herbaceous vegetation by livestock deprives these grassland birds (which are more or less cryptically colored) of their principal cover - residual grasses (see Mohler 1952: 16). Given a period of below average summer precipitation (and grass-forb production), grassland birds would be increasingly dependent on the residual grass cover of previous years for cover. Even a conservative utilization of forage in the neighborhood of 20 to 40 percent could be highly detrimental to grassland birds during drought periods because it could remove that percentage of the bird's cover habitat for the next year. Unless some areas are left free from livestock, grazing would then result in increased mortality and eventually more erratic population levels and the elimination of marginal

populations.

Bump, G. 1963. History and analysis of Tetraonid introductions to North America. Journal of Wildlife Management 27(4):855-867.
Keywords: Sage Grouse/Habitat Use-Selection/Diet/Weather-Climate.
Abstract: There has been considerable interest in the acclimatization of Old World Tetraonidae into North America. Between 1883 and 1950, 23 trials encompassing four species are recorded. Of these, 12 were releases of capercaillie (*Tetrao urogallus*) and 10 of black grouse (*Lyrurus tetrix*). Only one of these attempts was based on any scientific study, and none met all of the requirements currently considered to be the minimum necessary for an adequate test. All ended in failure. Source of stock, number of individuals released, their physical condition, and the year of liberation in relation to the cyclic abundance of grouse, both in the region of release and in the native range from which the stock was secured, are discussed. A description of habitat characteristics, food preferences, and climatic conditions in the range of capercaillie and black grouse in Europe and Asia is presented to facilitate comparison with conditions existing in the regions in which these species were released. Of 40 genera of plants commonly taken as food by these grouse, all are found in the United States. Average maximum and minimum temperatures in relation to precipitation, analyzed by months for the European range of capercaillie and black grouse, when compared with similar data for much of the northern United States and Canada, suggest a close relationship.

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Keywords: Sage Grouse/Reproduction/Anatomy-Morphology/Brood rearing/Hunting.

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Keywords: Sage Grouse/Washington/Mortality-Survival/Strutting/Water.

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Keywords: Sage Grouse/Fire/Oregon/Nesting/Hart Mountain/Brood rearing/Habitat Use-Selection/Population trends.

Cadwell, L. L., M. A. Simmons, J. L. Downs, and C. M. Sveum. 1994. Sage Grouse on the Yakima Training Center: a summary of studies conducted during 1991 and 1992. Technical Information Center, Oak Ridge, Tennessee. 50 pages.
Keywords: Sage Grouse/Washington.

Call, M. W. 1979. Habitat requirements and management recommendations for Sage Grouse. Technical Note 330. USDI Bureau of Land Management. 37 pages.
Keywords: Sage Grouse/Distribution-Mapping/Habitat Use-Selection/Water/Weather-Climate/Brood rearing/Nesting/Winter/Reproduction/Livestock grazing/Fire/Recreation/Mineral-Oil Development/Herbicides-Pesticides.

Call, M. W., and C. Maser. 1985. Wildlife habitats in managed rangelands--the Great Basin of southeastern Oregon: Sage Grouse (*Centrocercus urophasianus*). General Technical Report PNW-187. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR. 30 pages.
Keywords: Sage Grouse/Oregon/Distribution-Mapping/Weather-Climate/Predation/Mortality-Survival/Water/Habitat use-Selection/Reproduction/Nesting/Brood rearing/Winter/Fire/Summer/Livestock grazing/Recreation/Roads/Mineral-Oil Development.
Abstract: Survival of sage grouse (*Centrocercus urophasianus*) populations in Oregon and throughout the West depends on the maintenance of essential habitat components to meet the seasonal needs of grouse. The array of habitat components and some management tips to help perpetuate quality habitat for the grouse are presented.

Campbell, H. 1953. Habitat improvement for upland game birds in New Mexico. Pages 115-118 *in* Proceedings of the 32nd Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Habitat Restoration/New Mexico/Predation/Herbicides-

Pesticides/Hunting/Diet/Water/Livestock grazing/ARTR/Cropland/Translocation.

Campbell, R. W., N. K. Dawe, I. M. Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall. 1990. The birds of British Columbia. Royal British Columbia Mus., Victoria. Vol. 2.
Keywords: Sage Grouse.

Canadian Sage Grouse Recovery Team. 2001. Canadian Sage Grouse recovery strategy. 61 pages.
Keywords: Sage Grouse/Canada/Endangered species/Population trends/Monitoring/Viability.
***Notes*:** Sage Grouse have been listed as endangered in Canada since 1998. A group of stakeholders, representatives from government agencies, and land users in Saskatchewan and Alberta has formed as Sage Grouse Recovery Team, which in turn is overseeing the formation of Working Groups to develop Action Plans. The document summarizes "provides an overview of sage grouse ecology and population status, establishes population recovery goals and provides recommended strategies for recovery." It includes sections on biological, habitat, and sociopolitical considerations, recovery potential, considerations affecting recovery, and strategies for planning and recovery.

Cannon, R. W., and F. L. Knopf. 1981. Lek numbers as a trend index to prairie grouse populations. Journal of Wildlife Management 45(3):776-778.
Keywords: Sage Grouse/Lekking/Population trends.

Carhart, A. H. 1940. Sage Grouse investigations. Pittman Robertson Project 4-R, Colorado Game and Fish Commission; Bureau of Biological Survey, Cooperating. 32 pages.
Keywords: Sage Grouse/Colorado/Livestock grazing/Predation/Weather-Climate/Disease-Parasites/Hunting/Distribution-Mapping/Water/Diet/Mortality-Survival.
***Notes*:** Title page: "Sage Grouse investigations, Colorado, Vol. 1" and "Field Studies, Summer 1939, North Park".

Carr, H. D. 1966. Preliminary findings of effects of sagebrush control on Sage Grouse. Colorado Cooperative Wildlife Research Unit. Technical Paper 5. 11 pages.
Keywords: Sage Grouse.

Carr, H. D. 1967. Effects of sagebrush spraying on abundance, distribution and movements of Sage Grouse. M.S. thesis. Colorado State University, Ft. Collins, Colorado.
Keywords: Sage Grouse/Colorado/Herbicides-Pesticides/Shrub removal/ARTRVA/ARTR/Meadow/Other shrubs/Grasslands/Riparian/Year round/Lekking/Nesting/Brood rearing/Juvenile/Adult/ Habitat Use-Selection/Migration/Population trends/Sagebrush/Summer/Winter/Diet/Physiology/Movement/Hunting/Reproduction/Mortality-Survival/Population trends-Lek counts/Research needs.
***Notes*:** Studied sage grouse before and after spraying of 2,4-D on sagebrush in North Park, Colorado in 1965 (high mountain park, elevation 7900-8600 ft, grazed by cattle). This study focused on the post-spraying studies (post-spray 1965 and 1966). The spraying of 4,000 acres of sagebrush (BLM land, in cooperation with Colorado Game, Fish, and Parks) was designed to best evaluate effects of the spraying on sage grouse in particular, with inventory of grouse in the area before the application of 2,4-D. Each treated block had one lek. Looked at sprayed vs. control areas, as well as strip vs. block spraying. Determined population levels and productivity from lek counts, nest searches, and brood censuses. Movements determined by recording observations of individual, marked grouse (some tagged, some with radiotelemetry). Systematically searched for nests in 60 plots. Eleven active leks were on the study area, and had been censused since 1959. Brood routes were 20 miles long, and 5 were surveyed. Also flew in winter for distribution. Vegetation measurements were made according to protocols established before this study, and vegetation samples were analyzed for 2,4-D residues, as well as brain tissue from 12 grouse collected for this purpose.

Counts of males on leks were up in 1966 from 1965, but the overall trend since 1959 was downward. Sagebrush control did not appear to "adversely affect" leks or behavior on leks, nesting success, brood production and survival, or use of sprayed areas for nesting. Brood movements, however, appeared to be affected by spraying, by avoidance of sprayed blocks to reach traditional brood-rearing areas. Adults

avoided the block sprays outside the breeding season, apparently because habitat was deficient there. However, the lek on a large sprayed block was used after spraying. Results were varied, but sprayed blocks tended to have fewer shrubs and forbs and more grasses. The author recommends continued study to determine long-term effects of the spraying.

Carr, H. D. 1967. Game bird survey: Effects of sagebrush control on abundance, distribution and movements of Sage Grouse. Colorado Game, Fish and Parks Department. 112 pages.
Keywords: Sage Grouse.

Carr, H. D. 1968. Literature review on effects of herbicides on Sage Grouse: Special report 13. Colorado Game, Fish and Parks Department. 16 pages.
Keywords: Sage Grouse/Distribution-Mapping/Habitat Use-Selection/Nesting/Brood rearing/Dispersal/Reproduction/Soil/Herbicides-Pesticides/Colorado/Sagebrush/ARTR/Other sage/Other shrubs/Understory-forbs/Understory-grasses/Year round/Diet/Physiology/Environmental Requirements/Movement-Dispersal/Movement-migration/Fire/Livestock grazing/Scale.

Carr, H. D., and F. A. Glover. 1971. Effects of sagebrush control on Sage Grouse. Transactions of the North American Wildlife and Natural Resources Conference 35:205-215 .
Keywords: Sage Grouse/Herbicides-Pesticides/Livestock grazing/ARTRVA/Distribution-Mapping/Movement/Population trends/Productivity.
Abstract: Residues of 2,4-D were detected in sage grouse muscle and brain, but its effects were not determined. By 1.5 years after spraying, sagebrush control had not obviously affected strutting activities or grounds. Neither had it definitely affected nesting density or success; however, nests on sprayed areas tended to be near unsprayed areas. The effects of sagebrush control on nesting may become more evident as dead sagebrush deteriorates. Brood production and survival had not noticeably been affected. Sprayed sagebrush affected but did not hamper movements of adult sage grouse; however, they avoided block-sprayed areas (except for strutting), probably because necessary habitat requirements were lacking. Areas sprayed in 50-yard wide strips had no obvious effects on distribution or movements of adult sage grouse. Brood movements apparently were impeded by sprayed areas. These conclusions are preliminary. The ultimate effects on sage grouse will be influenced considerably by future vegetation changes, particularly deterioration and reinvasion of sagebrush. To properly evaluate the effects of sagebrush control on sage grouse, the Colorado Game, Fish and Parks Division is collecting additional data as vegetation changes and populations fluctuate.

Christensen, G. C. 1969. Guidelines for sagebrush control practices in Sage Grouse habitat in Nevada. Pages 157-164 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Nevada/Habitat Restoration/Meadow/Population trends/Habitat Use-Selection/Nesting/ARTR.

Clarke, L. F., H. Rahn, and M. D. Martin. 1942. Sage grouse studies. Part II. Seasonal and sexual dimorphic variations in the so-called "air sacs" region of the sage grouse. Pages 13-27 *in* Bulletin No. 2. Wyoming Game and Fish Department, Cheyenne, WY.
Keywords: Sage Grouse/Anatomy-Morphology/Physiology/Movement/Behavior/Strutting/ Dimorphic.

Coggins, K. A. 1998. Relationship between habitat changes and productivity of sage grouse at Hart Mountain National Antelope Refuge, Oregon. M.S. thesis. Oregon State University, Corvallis, Oregon.
Keywords: Sage Grouse/Oregon/Habitat Use-Selection/Productivity/Livestock grazing/Weather-Climate/Reproduction/Nesting/Brood rearing/Agriculture/Hart Mountain.

Colenso, B. E., M. S. Boyce, and J. Tate, Jr. 1980. Developing criteria for reclamation of Sage Grouse habitat on a surface coal mine in northeastern Wyoming. Pages 27-31 *in* D. H. Graves, editor. Proceedings, 1980 Symposium on surface mining hydrology, sedimentation, and reclamation. Office of Engineering Services, College of Engineering, University of Kentucky, Lexington.
Keywords: Sage Grouse.

Commons, M. L. 1997. Movement and habitat use by Gunnison Sage Grouse (*Centrocercus minimus*) in

southwestern Colorado. M.Sc. thesis. Natural Resource Institute, University of Manitoba, Winnipeg, MAN. 101 pages.
Keywords: Sage Grouse/Gunnison Sage-Grouse.

Commons, M. L., R. K. Baydack, and C. E. Braun. 1997. Gunnison Sage Grouse *Centrocercus minimus* use of fragmented habitats in southwestern Colorado. Wildlife Biology 3:283.
Keywords: Sage Grouse/Colorado/Habitat Use-Selection/Radiotelemetry/Population trends/Cropland/ARTR/Gunnison Sage-Grouse.
***Notes*:** (Abstract only).
Abstract: Gunnison's sage grouse *Centrocercus minimus* historically occurred throughout sagebrush *Artemisia* rangelands in southwestern Colorado, southeastern Utah, and northern New Mexico. Because of the reduction of sagebrush habitat for the enhancement of livestock grazing, agricultural use, and other human activities, only a few remnant populations remain in highly fragmented habitat in southwestern Colorado and extreme southeastern Utah. In 1994 and 1995, two geographically isolated populations of sage grouse were studied in southwestern Colorado to identify seasonal movements and habitat use. Radio transmitters were fitted to 55 male and 8 female sage grouse in Dove Creek, Dolores County, and at Dry Creek Basin/Miramonte Reservoir, San Miguel County, Colorado. The Dolores County population was separated by the town of Dove Creek and movements occurred between the two sites. Sage grouse in Dolores County were in agricultural fields (alfalfa, bean, and wheat) from May through September, and sagebrush and Gambel Oak *Ouercus gambelii* from October through February. Sage grouse in Dry Creek Basin were in areas with low sage *A. arbuscula*, snakeweed *Gutierrezia sarothrae*, black greasewood *Sarcobatus vermiculatus*, and winterfat *Eurotia lanata* while sage grouse near Miramonte Reservoir were in sagebrush *A. tridentata, A. nova*, wet meadows, and Gambel Oak throughout the year. Hamilton Mesa between Dry Creek Basin and Miramonte Reservoir was also used by sage grouse. Dominant vegetation of this site included forbs, grass, gambel oak, and serviceberry *Amelanchier* spp. Extensive movements occurred from Dry Creek Basin to Hamilton Mesa and to Miramonte Reservoir. Management considerations must include all three sites in San Miguel County and both sites in Dolores County if sage grouse are to persist in southwestern Colorado.

Commons, M. L., R. K. Baydack, and C. E. Braun. 1999. Sage grouse response to pinyon-juniper management. Pages 238-239 *in* S. B. Monsen and R. Stevens, editors. Proceedings: ecology and management of pinyon-juniper communities. RMRS-P9. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado.
Keywords: Sage Grouse/Pinyon-Juniper/Colorado/Predation/Mortality-Survival/Productivity/Livestock grazing/Fire/Population trends.
***Notes*:** (Pers. communication from M. Commons, 1/28/02): "Treatments were continued for at least 2 years...bird numbers...stabilized after that....more to do with capacity due to habitat availability rather than a predator or grazing issue." The author reported that, in 2001, the juniper and pinyon around the lek sites were "long gone," and the lek sites look as if they may have been brushbeat.

Commons, M. L., D. L. Rieden, and C. E. Braun. 1995. Sage Grouse investigations in Dove Creek, Dolores County, Colorado. Journal of the Colorado-Wyoming Academy of Science 27:24.
Keywords: Sage Grouse.

Connelly, J. W. 1987. Sage Grouse ecology problem analysis. Idaho Department of Fish and Game. 63 pages.
Keywords: Sage Grouse/Idaho/Research Needs.

Connelly, J. W., A. D. Apa, R. B. Smith, and K. P. Reese. 2000. Effects of predation and hunting on adult sage grouse *Centrocercus urophasianus* in Idaho. Wildlife Biology 6:227-232.
Keywords: Sage Grouse/Idaho/Predation/ Hunting/Mortality-Survival/ARTR/Radiotelemetry.
Abstract: Although sage grouse *Centrocercus urophasianus* have declined throughout their range in North America, little is known about annual mortality patterns of this species. Thus, we summarize a long-term data set on timing and causes of mortality of sage grouse. Predation was the most common cause of death for radiomarked sage grouse. For adult males, 83% of deaths were attributed to predation and 15% to hunting. However, for adult females, 52% of deaths were caused by predation while 42% were attributed to

hunting. We rejected the hypothesis that type of mortality (predation vs hunting) was independent of gender of sage grouse. For males, 70% of deaths occurred during spring and summer (March-August) and 28% occurred in September-October. For females, 52% of mortalities occurred during spring and summer and 46% occurred in September-October. We rejected the hypothesis that time of death is independent of the gender of sage grouse. In six of 15 years (40%), harvest rates for adult females may have exceeded 10% while this rate was only exceeded in two of 15 years (13%) for adult males.

Connelly, J. W., W. J. Arthur, and O. D. Markham . 1981. Sage Grouse leks on recently disturbed sites. Journal of Range Management 34:153-154.
Keywords: Sage Grouse/Lekking/Idaho/Habitat Use-Selection/Management.
Abstract: Three sage grouse (*Centrocercus urophasianus*) leks located on recently disturbed areas within the Idaho National Engineering Laboratory Site are described. A possible increase in the grouse population and lack of suitable natural clearings in the general vicinity of these leks are suggested as reasons for the bird's use of these areas. This species' acceptance of newly cleared sites for display areas may have potential as a management tool.

Connelly, J. W., and I. J. Ball. 1978. The ecology of sage grouse on the Idaho National Engineering Laboratory Site. Pages 224-235 *in* Ecological studies on the Idaho National Engineering Laboratory Site. Progress Report, Pocatello, Idaho.
Keywords: Sage Grouse/Habitat Use-Selection/Movement/Weather-Climate/Strutting/Population trends/Reproduction/Migration/Brood rearing/Water/Distribution-Mapping.

Connelly, J. W., and I. J. Ball. 1984. Sage Grouse census methods and populations in southeastern Idaho. Pages 325-337 *in* O. D. Markham, editor. Idaho National Engineering Laboratory Radioecology and Ecology Programs: 1983 Progress Reports. 337 pages.
Keywords: Sage Grouse/Population trends/Lekking/Brood rearing/Behavior/Idaho/Distribution-Mapping/Habitat Use-Selection/Migration.

Connelly, J. W., and I. J. Ball. 1984. Sage grouse on the Idaho National Environmental Research Park. Pages 347-356 *in* O. D. Markham, editor. Idaho National Engineering Laboratory Radioecology and Ecology Programs: 1983 Progress Reports . 356 pages.
Keywords: Sage Grouse/Idaho/Adult/Juvenile/Habitat Use-Selection/Migration/Agriculture/Summer/Winter.

Connelly, J. W., and L. J. Blus. 1991. Effects of pesticides on upland game: a review of herbicides and organophosphate and carbamate insecticides. Pages 92-97 *in* M. Marsh, editor. Proceeding: pesticides in natural systems - how can their effects be monitored? U.S. Environmental Protection Agency, Seattle, WA.
Keywords: Sage Grouse/Herbicides-Pesticides/Cropland/Mortality-Survival/Predation/Behavior.

Connelly, J. W., and C. E. Braun. 1997. Long-term changes in Sage Grouse *Centrocercus urophasianus* populations in western North America. Wildlife Biology 3:229-234.
Keywords: Sage Grouse/Population trends/Distribution-Mapping/Reproduction/Weather-Climate/Livestock grazing/Fire.
Abstract: Available data indicate that sage grouse *Centrocercus urophasianus* have declined throughout their range. This species presently occurs in 11 U.S. States and in two Canadian provinces. In nine states having long-term data, breeding populations have declined by 17-47% (mean = 33%) from the long-term average. Six states have long-term information on sage grouse production. In five of these states, production has declined by 10-51% (mean = 25%) from the long-term average. Habitat deterioration, loss, and fragmentation have reduced the quantity and quality of nesting and early brood-rearing habitat causing population declines. Factors appearing to be largely responsible for the changes in habitats and, ultimately, sage grouse populations over wide areas of western North America are discussed, and hypotheses that could be tested to provide better insight into sage grouse population declines are suggested. Once these changes are better understood, conservation strategies that address protection and rehabilitation of

sagebrush *Artemisia* spp. rangelands should be developed and implemented in each state and province to halt the decline of sage grouse and initiate recovery.

Connelly, J. W., H. W. Browers, and R. J. Gates. 1988. Seasonal movements of Sage Grouse in southeastern Idaho. Journal of Wildlife Management 52:116-122.
Keywords: Sage Grouse/Idaho/Migration/ Habitat Use-Selection/Population trends/ARTR/ARAR/Distribution-Mapping /Adult/Juvenile/Cropland.
Abstract: The authors studied seasonal movements of sage grouse (*Centrocercus urophasianus*) on, and adjacent to, the Idaho National Engineering Laboratory (INEL) in southeastern Idaho from summer 1977 through fall 1983. Movements by females during spring were also slow and meandering compared to the relatively rapid and direct movements by males. Distances moved were not entirely influenced by the proximity of seasonal habitats, suggesting that seasonal movements tend to be traditional. Sage grouse populations should be defined on a temporal and geographic basis. Protection of sagebrush habitats within a 3.2 km radius of leks may not be sufficient to ensure the protection of year-long habitat requirements.

Connelly, J. W., and L. A. Doughty. 1990. Sage Grouse use of wildlife water developments in southeastern Idaho. Pages 167-173 *in* G. K. Tsukamoto, editor. Proceedings of the Wildlife Water Development Symposium.
Keywords: Sage Grouse/Water/Summer/Habitat Use-Selection/Idaho /Migration/Distribution-Mapping.

Connelly, J. W., R. A. Fischer, A. D. Apa, K. P. Reese, and W. L. Wakkinen. 1993. Renesting by Sage Grouse in southeastern Idaho. Condor 95:1041.
Keywords: Sage Grouse/Idaho/Nesting/Predation/ARTR/ARTRVA.

Connelly, J. W., R. A. Fischer, K. P. Reese, A. D. Apa, and W. L. Wakkinen. 1993. Renesting by Sage Grouse in Southeastern Idaho. Pages 19 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado. The Condor 95:1041-1043.
Keywords: Sage Grouse/Idaho/Nesting/Mortality-Survival/ARTR/Adult/Yearling.

Connelly, J. W., and O. D. Markham. 1983. Movements and radionuclide concentrations of Sage Grouse in southeastern Idaho. Journal of Wildlife Management 47:169-177.
Keywords: Sage Grouse/Idaho/Movement/Radionuclide/Summer/Summer/Fall/Juvenile/Adult/Physiology/Movement-Dispersal/Movement-migration/Scale.
Abstract: Movements and radionuclide concentrations of sage grouse (*Centrocercus urophasianus*) summering near nuclear facilities on the Idaho National Engineering Laboratory in southeastern Idaho were studied from 1977 through 1980. From 10 July through 7 September, 95% of all locations of radio-marked grouse were within 2 km of their feeding areas on lawns surrounding the facilities. During October and November, 82% of all radiolocations were greater than 2 km from these areas. Radionuclide concentrations (primarily radiocesium) were higher in sage grouse summering near a facility with liquid radioactive waste storage than in grouse summering near a solid radioactive waste disposal area or in control areas. The short biological half-life of the ingested radionuclides and the timing of sage grouse movements from summering areas reduced any potential radiation dose to a person consuming 1 of these birds.

Connelly, J. W., K. P. Reese, R. A. Fischer, and W. L. Wakkinen. 1994. The effects of fire on sage grouse populations in southeastern Idaho. Proceedings of the 19th Western States Sage and Columbian Sharp-tailed Grouse Workshop, Reno, NV, July 1994.
Keywords: Sage Grouse/Fire/Idaho.

Connelly, J. W., K. P. Reese, R. A. Fischer, and W. L. Wakkinen. 2000. Response of a Sage Grouse breeding population to fire in southeastern Idaho. Wildlife Society Bulletin 28:90-96.
Keywords: Sage Grouse/Fire/Lekking/Habitat Management/Habitat/Reproduction/Ecological requirements.
Abstract: Prescribed burning is a common method to eliminate sagebrush (Artemisia spp.) and has been suggested as a tool to enhance the habitat of sage grouse (*Centrocercus urophasianus*). Effects of this practice on sage grouse have not been evaluated rigorously. We studied effects of prescribed fire on lek (traditional breeding display areas) attendance by male sage grouse occupying low-precipitation (< 26 cm)

sagebrush habitats in southeastern Idaho from 1986 through 1994. During the preburn period (1986-89), average declines for male attendance were 48% and 46% for treatment and control leks, respectively. Lek counts were similar for treatment and control leks during the preburn years (G-test, 0.25>P>0.10). During the postburn period (1990-94), male attendance at treatment leks declined 90% and control leks declined 63%. Although declines were similar between treatment and control leks during the preburn period, postburn declines were greater for treatment than control leks (0.05< P < 0.10). We rejected the null hypothesis that for the 2 largest leks in both the treatment and control areas, counts were independent of years for preburn and postburn periods and concluded that breeding population declines became more severe in years following fire. Prescribed burning negatively affected sage grouse in southeastern Idaho and should not be used in low-precipitation sagebrush habitats occupied by breeding sage grouse.

Connelly, J. W., K. P. Reese, W. L. Wakkinen, M. D. Robertson, and R. A. Fischer. 1994. Sage grouse ecology report. Job Completion Report. W-160-R-19. Subproject 9. Idaho Department of Fish and Game, Boise, ID.
Keywords: Sage Grouse.

Connelly, J. W., K. P. Reese, W. L. Wakkinen, M. D. Robertson, and R. A. Fischer. 1994. Sage grouse ecology. Study I: Sage grouse response to a controlled burn. P-R Project W-160-R-21. Idaho Department of Fish and Game, Boise, ID. 90 pages.
Keywords: Sage Grouse/Movement/Distribution-Mapping/Lekking/Mortality-Survival/Nesting/Habitat Use-Selection/Brood rearing/Fire/ Reproduction/Idaho/Migration/Winter.

Connelly, J. W., K. P. Reese, W. L. Wakkinen, M. D. Robertson, and R. A. Fischer. 1994. Sage Grouse response to a controlled burn: Movements, distribution, survival, and reproduction of Sage Grouse before and after a fire (Job 1). The effects of a controlled burn on Sage Grouse winter and nesting habitat (Job 2). Idaho Department of Fish and Game.
Keywords: Sage Grouse/Distribution-Mapping/Mortality-Survival/Nesting/Lekking/Reproduction/Fire/ARTR/Idaho.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage Sage Grouse populations and their habitats. Wildlife Society Bulletin 28:967-985.
Keywords: Sage Grouse/Home-range/Mortality-Survival/Reproduction/Ecological Requirements/Brood rearing/Habitat change/Habitat management/Conservation/Weather-Climate/Habitat restoration/Habitat use-selection.
Abstract: The status of sage grouse populations and habitats has been a concern to sportsmen and biologists for >80 years. Despite management and research efforts that date to the 1930s, breeding populations of this species have declined throughout much of its range. In May 1999, the western sage grouse (*C. urophasianus phaios*) in Washington was petitioned for listing under the Endangered Species Act because of population and habitat declines (C. Warren, United States Fish and Wildlife Service, personal communication). Sage grouse populations are allied closely with sagebrush (Artemisia spp.). Despite the well-known importance of this habitat to sage grouse and other sagebrush obligates, the quality and quantity of sagebrush habitats have declined for at least the last 50 years. Braun et al. (1977) provided guidelines for maintenance of sage grouse habitats. Since publication of those guidelines, much more information has been obtained on sage grouse. Because of continued concern about sage grouse and their habitats and a significant amount of new information, the Western States Sage and Columbian Sharp-tailed Grouse Technical Committee, under the direction of the Western Association of Fish and Wildlife Agencies, requested a revision and expansion of the guidelines originally published by Braun et al. (1977). This paper summarizes the current knowledge of the ecology of sage grouse and, based on this information, provides guidelines to manage sage grouse populations and their habitats.

Connelly, J. W., W. Wakkinen, D. Musil, and M. Robertson. 1989. Sage Grouse ecology. Job Progress Report, Project No. W-160-R-15; July 1, 1988 to June 30, 1989. Studies I and II. Idaho Department of Fish and Game.
Keywords: Sage Grouse/Idaho/Fire/Translocation/Distribution-Mapping/Movement/Mortality-Survival/Nesting/Winter.

Connelly, J. W., W. L. Wakkinen, A. D. Apa, and K. P. Reese. 1991. Sage Grouse use of nest sites in southeastern Idaho. Journal of Wildlife Management 55:521-524.
Keywords: Sage Grouse/Idaho/ARTRWY/Habitat Use-Selection/Nesting/ARTRVA/ARTRTR/Livestock grazing/Fire/Herbicides-Pesticides.
Abstract: We investigated nest site selection by sage grouse (*Centrocercus urophasianus*) in southeastern Idaho from 1987 to 1989. During 3 breeding seasons, 79% of 84 nest sites were found under sagebrush (Artemisia spp.) Nest success averaged 53% for grouse that used sagebrush and 22% for birds that used nonsagebrush nest sites. Total vegetative cover for sagebrush and nonsagebrush nest sites was similar. However, grass height was shorter (P = 0.01) at sagebrush compared to nonsagebrush nest sites. Herbaceous cover was important to nesting sage grouse but the relatively low nest success of nonsagebrush nest sites indicated they might provide less than optimal nesting habitat.

Connelly, J. W., W. L. Wakkinen, and K. P. Reese. 1989. Sage grouse nest locations: a new look at an old guideline. Pages 10 *in* Proceedings of the 16th Biennial Western States Sage Grouse Workshop. Moses Lake, WA.
Keywords: Sage Grouse/Nesting.

Connelly, J. W., Jr. 1982. An ecological study of Sage Grouse in southeastern Idaho. Ph.D. dissertation. Washington State University.
Keywords: Sage Grouse/Idaho/Radionuclide/Movement/ARAR/ARTR/Agriculture/Distribution-Mapping.
Abstract: This study was conducted between June 1977 and April 1981 on the Idaho National Engineering Laboratory (INEL) site in southeastern Idaho. The first section of this dissertation describes movements and radionuclide concentrations of sage grouse (*Centrocercus urophasianus*) summering near 3 INEL facilities; the Test Reactor/Idaho Chemical Processing Plant (TRA/ICPP) complex, the Radioactive Waste Management Complex (RWMC), and the Central Facilities Area (CFA). From July through September, 95% of all radiolocations were within 2 km of INEL facilities. During October and November, 82% of all radiolocations were greater than 2 km from these areas. Mean summer home range was 406 ha for adult female sage grouse and 94 ha for juveniles. Radionuclide concentrations in TRA/ICPP grouse were significantly higher than in RWMC or control birds. The highest estimated potential dose commitment to a person consuming a grouse from an INEL facility was 2.37 mrem, and would have resulted from eating an adult male grouse that had summered near TRA/ICPP.

The second section describes sage grouse seasonal movements, flocking characteristics, and habitat use. Fall movements from INEL
facilities to winter range were slow and meandering. Mean fall home range for 5 radiomarked grouse was 2,246 ha. Spring movements of females from leks to summer range were also slow and meandering but male movements appeared rapid and direct. Mean spring home range for 7 radiomarked females was 882 ha. Sage grouse remained in segregated flocks during early summer, but the number of mixed sex flocks increased in late summer. Mixed sex flocks were significantly larger than other flock types. Sage grouse occurred in segregated flocks throughout the winter and mean flock size was significantly different among all flock types. Agricultural areas were an important component of sage grouse summer range. Sage grouse winter range was generally characterized by sagebrush stands with 11 to 30% canopy coverage and a mean height of less than 40 cm.

Cram, D., and R. L. Patterson. 1949. The status of the Sage Grouse in the West. Pages 148-152 *in* Proceedings of the 29th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Distribution-Mapping/ARTR/Agriculture/Livestock grazing/Hunting/Urbanization/Population trends/Nesting/Brood rearing/Management/Water/Population trends-Lek counts/Research needs.

Crawford, J. A. 1982. Factors affecting Sage Grouse harvest in Oregon. Wildlife Society Bulletin 10:374-377.
Keywords: Sage Grouse/Hunting/Oregon/Population trends.

Crawford, J. A. 1982. History of Sage Grouse in Oregon. Oregon Wildlife 37:3-6.
Keywords: Sage Grouse/Oregon.

Crawford, J. A. 1990. A report on the 1989 grouse harvest and a summary of data collected at grouse wing bees

from 1980 to 1989 in Oregon. Oregon Department of Fisheries and Wildlife, Oregon State University .
Keywords: Sage Grouse/Oregon/Hunting/Distribution-Mapping/Population trends/Reproduction/Anatomy-Morphology/Wings.

Crawford, J. A. 1992. Report on the 1991 grouse harvest and a summary of data collected at grouse wing bees from 1980 to 1991 in Oregon.
Keywords: Sage Grouse/Hunting/Wings/Oregon/Distribution-Mapping/Reproduction/Population trends/Sex/Age.

Crawford, J. A. 1992. Sage grouse in Oregon. Abstract paper presented at the Desert Conference, 25 April, 1992. Oregon Department of Fisheries and Wildlife, Game Bird Research Program, Oregon State University. 10 pages.
Keywords: Sage Grouse.

Crawford, J. A. 1993. Relationship of herbaceous vegetation to reproductive success of Sage Grouse. Pages 20 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse.

Crawford, J. A. 1993. Reproductive behavior of Gunnison sage grouse: Do mating barriers exist? C. E. Braun, compiler. Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse/Gunnison Sage-Grouse/Behavior.

Crawford, J. A. 1997. Importance of herbaceous vegetation to female Sage Grouse *Centrocercus urophasianus* during the reproductive period: A synthesis of research from Oregon, USA. Wildlife Biology 3:271.
Keywords: Sage Grouse/Diet/Reproduction/Artemisia/Habitat Use-Selection/Understory-forbs/Understory-grasses/Oregon/Brood rearing/Juvenile.
***Notes*:** Only an abstract published.
Abstract: Sage grouse C*entrocercus urophasianus* were once common to abundant in Oregon, USA. During the past century, however, both distribution and numbers have declined, which prompted research that began in 1987. Previous work revealed the importance of sagebrush *Artemisia* spp. for many of the life-history needs of sage grouse. Little research emphasis has been placed, however, on the potential importance of herbaceous components of sage grouse habitat. Results of work in Oregon indicated that forbs are an important component of the diet of pre-laying hens and may be related to reproductive success. Several studies revealed that the amount of residual tall grass cover and medium height sagebrush were related closely to nest success. Further, forb availability influenced habitat used by hens with broods, and the amount of forbs and insects in chick diets may be related to recruitment of young. These studies indicated that forbs and residual grass cover are of substantially greater importance to sage grouse reproductive success than previously realized.

Crawford, J. A. 2001. The importance of herbaceous vegetation to female Sage Grouse during the reproductive period. Pages 7 *in* 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001.
Keywords: Sage Grouse/Reproduction/Habitat Use-Selection/Diet/Predation/Nesting/Grasslands.
***Notes*:** This is an expanded abstract.

Crawford, J. A., M. Byrne, and D. Davis. 1999. Sage grouse and prescribed fire studies field report. Oregon State University, Dept. of Fisheries and Wildlife, Game Bird Research Program. Corvallis, OR.
Keywords: Sage Grouse.

Crawford, J. A., and M. W. Byrne. 1999. 1998 annual report: sage grouse breeding season-season habitat use at Hart Mountain National Antelope Refuge . Oregon State University , Department of Fisheries and Wildlife, Game Bird Research Program , Corvallis , OR.
Keywords: Sage Grouse/Oregon/Hart Mountain.

Crawford, J. A., and D. M. Davis. 2002. Habitat use by Greater Sage-grouse on Sheldon National Wildlife Refuge. Final report submitted to the U.S. Fish and Wildlife Service. Game Bird Research Program, Oregon State University, Corvallis, Oregon, USA. 119 pages.
Keywords: Sage Grouse/Nevada/Habitat Use-Selection.
***Notes*:** This is an expanded version of Davis' thesis.

Crawford, J. A., and A. K. Delong. 1993. Relationships between vegetative structure and predation rates of artificial sage grouse nests. Final report submitted to BLM. Oregon State University, Corvallis , OR.
Keywords: Sage Grouse.

Crawford, J. A., M. S. Drut, and M. A. Gregg. 1989. Research study plan: habitat use by female Sage Grouse during the breeding season in Oregon. Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR.
Keywords: Sage Grouse/Oregon/Habitat Use-Selection.

Crawford, J. A., M. A. Gregg, M. S. Drut, and A. K. DeLong. 1992. Habitat use by female Sage Grouse during the breeding season in Oregon. Final report, BLM Coop. Res. Unit, Oregon State University, Corvallis.
Keywords: Sage Grouse/Habitat Use-Selection/Oregon/Reproduction/Nesting/Brood rearing/Trapping/ARTR/Livestock grazing/Fire/Agriculture/Urbanization/Seeding forage/Predation/Habitat Restoration.

Crawford, J. A., and R. S. Lutz. 1985. Sage Grouse population trends in Oregon, 1941-1983. Murrelet 66:69-74.
Keywords: Sage Grouse/Population trends/Distribution-Mapping/Oregon/Mortality-Survival/Productivity.
Abstract: Sage Grouse (*Centrocercus urophasianus*) reportedly were abundant during the 19th century throughout Oregon east of the Cascade Mountain range, except in forested habitats. By the early 1900's, however, reports of the game and forestry wardens suggested populations were declining. A.E. Burghduff reported that Sage Grouse were threatened with extinction in Oregon during the 1920's. Low populations during the 1930's led to management efforts, research, and prohibition of hunting from 1932 through 1948. Personnel of the Oregon Department of Fish and Wildlife initiated counts of males on leks in 1941. The purposes of this paper are to describe the status and population trends of Sage Grouse in Oregon and to report changes in productivity and survival since 1950.

Crawford, J. A., and B. A. McDowell. 1999. 1998 annual report: Sage Grouse habitat and Sage Grouse response to prescribed burning in Oregon. Oregon State University, Department of Fisheries and Wildlife, Game Bird Research Program. Corvallis, OR.
Keywords: Sage Grouse/Habitat Use-Selection/Fire/Oregon/ARAR /ARTRWY/Pinyon-Juniper/Distribution-Mapping/ARTRVA/ARTRTR/Nesting/Brood rearing/Lekking.

Crawford, J. A., and N. Swanson. 1998. Beaty's Butte allotment final report. Oregon State University , Department of Fisheries and Wildlife, Game Bird Research Program. Corvallis , OR.
Keywords: Sage Grouse.

Crawford, J. A., N. Swanson, and M. Pope. 2002. Oregon grouse harvest report 2001. 30 pages.
Keywords: Sage Grouse/Oregon/Hunting.

Crawford, J. E., Jr. 1960. The movements, productivity, and management of Sage Grouse in Clark and Fremont Counties, Idaho. M.S. thesis. University of Idaho, Moscow, Idaho. 72 pages.
Keywords: Sage Grouse/Strutting/Brood rearing/Weather-Climate/Winter/Distribution-Mapping/Productivity/Mortality-Survival/Movement/Reproduction/Habitat Restoration.

Crunden, C. W. 1963. Age and sex of Sage Grouse from wings. Journal of Wildlife Management 27:846-849.
Keywords: Sage Grouse/Hunting/Juvenile/Adult/Wings/Age/Sex.
Abstract: A technique is described for determining age and sex of sage grouse (*Centrocercus urophasianus*) from wings collected during August and September hunting seasons. Easily discernible primary molt characteristics (retention of primaries 1 and 2 in juveniles and the difference in length of primaries 2 and 3 between adults and juveniles when primary 3 has not yet molted) have been combined

with four basic wing measurements in an age and sex key. The relatively slow method of measuring primaries with a ruler is replaced by a measuring board with a backstop and three lines scribed across its face for use with the age and sex key. Wings are measured in a flat and straightened position from the skin-covered wrist joint to the tip of the desired primary and compared to the appropriate lines on the measuring board. Statistics estimating the probability of misclassification for each of the four measurement categories are given.

Cummings, M. S. 1964. A cooperative approach to range rehabilitation for livestock and game. Pages 155-157 *in* Proceedings of the 44th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Habitat Restoration/Roads/Water/Seeding forage/Cropland/Livestock grazing/Herbicides-Pesticides.
***Notes*:** Does not specifically address sage grouse. Summarizes importance of cooperation between BLM and state in managing wildlife habitat on rangelands for game and livestock.

Dalke, P. D., D. B. Pyrah, D. C. Stanton, J. E. Crawford, and E. Schlatterer. 1960. Seasonal movements and breeding behavior of Sage Grouse in Idaho. Transactions of the North American Wildlife and Natural Resources Conference 25:396-407.
Keywords: Sage Grouse/Movement/Behavior/Reproduction/Idaho/Strutting/Livestock grazing/Nesting/Predation.
Abstract: A study of seasonal movements and strutting ground behavior of sage grouse was undertaken by the Idaho Cooperative Wildlife Research Unit in 1952 in an area comprising parts of three counties in southeastern Idaho directly west of Yellowstone National Park. The study area is mostly high sagebrush plains with scattered irrigated farming, and livestock grazing is the principal use of the sagebrush-grass lands. Sage grouse travel 50 to 100 miles from the summer range, westerly and southwesterly, to winter ranges which have only 3 to 6 inches of snow for short periods. Adult males arrive on their strutting grounds on the Red Road area north of St. Anthony during late March while snow is still on the ground. The breeding population is at a maximum on the Red Road strutting grounds from April 7 to 21 during most years. Marking of males and females show movements up to 3.3 miles. Females are more likely to move to other strutting grounds than males. The annual high-count of males on strutting grounds is a useful population-trend tool, but may, in some years, fail to provide the game manager with the means of forecasting the annual crop of sage grouse in some areas. The numbers of grouse returning to the strutting grounds in 1959 indicated a high yield of subadult birds. Adverse weather conditions at the time when 75 per cent of the eggs were hatching resulted in the lowest population of young birds in the seven years of the study. Brood-count routes at least 20 miles in length give reliable results until about July 30; however, there is only a small decline in average brood size after July 15. By the third week in July information is available for reliable forecasting of the annual crop of sage grouse which will be available to hunters in the September hunting season.

Dalke, P. D., D. B. Pyrah, D. C. Stanton, J. E. Crawford, and E. F. Schlatterer. 1963. Ecology, productivity, and management of Sage Grouse in Idaho. Journal of Wildlife Management 27:811-841.
Keywords: Sage Grouse/Ecology/Productivity/Management/Idaho/Migration/Reproduction/Habitat Use-Selection/Nesting/Brood rearing/Strutting/Population trends/Weather-Climate.
***Notes*:** Summary of 9 years of data on sage-grouse in eastern Idaho, just west of Yellowstone National Park. Includes information on lek locations, movements of grouse, seasonal habitat use and description, and aging techniques. Concluded that brood censuses during summer were a reliable index of reproductive success until late July, when brood structure deteriorates.

Dantzker, M. S., G. B. Deane, and J. W. Bradbury . 1999. Directional acoustic radiation in the strut display of male Sage Grouse *Centrocercus urophasianus*. Journal of Experimental Biology 202:2893-2909.
Keywords: Sage Grouse/Auditory sense/Behavior/Reproduction/Communication/Intraspecies relationships/Lekking/Pair formation/Study methods/Techniques-Methods/Vocalization/Acoustics/Physiology/California/Sagebrush/ Meadow/Adult.
Abstract: We present evidence that the acoustic component of the strut display of male sage grouse *Centrocercus urophasianus* is highly directional and that the nature of this directionality is unique among measured vertebrates. Where vertebrate acoustic signals have been found to be directional, they

are most intense anteriorly and are bilaterally symmetrical. Our results show that sage grouse acoustic radiation (beam) patterns are often asymmetric about the birds' anterior-posterior axis. The beam pattern of the 'whistle' note is actually strikingly bilobate with a deep null directly in front of the displaying bird. While the sage grouse display serves to attract potential mates, male sage grouse rarely face females head on when they call. The results of this study suggest that males may reach females with a high-intensity signal despite their preference for an oblique display posture relative to those females. We characterized these patterns using a novel technique that allowed us to map acoustic radiation patterns of unrestrained animals calling in the wild. Using an eight-microphone array, our technique integrates acoustic localization with synchronous pressure-field measurements while controlling for small-scale environmental variation in sound propagation.

Danvir, R. E. 2002. Sage Grouse ecology and management in northern Utah sagebrush-steppe. A Deseret Land and Livestock Wildlife Research Report. Deseret Land and Livestock Ranch and the Utah Foundation for Quality Resource Management.
Keywords: Sage Grouse/Utah/Livestock grazing/Population Trends/Fire/Movement/Predation/Productivity/Diet/Mortality-Survival/Habitat Restoration/Habitat Use-Selection.

Dargan, L. M., R. J. Keller, H. R. Shepherd, and R. N. Randall. 1942. Sage Grouse survey, Colorado, Vol. 4: survey of 1941-42, food studies, parasite relations, habitat requirements. Including preliminary data on sharp-tail grouse in Moffatt and Routt Counties. Pittman-Robertson Project, Colorado 4-R, Season of 1941-1942, Colorado Game and Fish Commission.
Keywords: Sage Grouse/Colorado/Diet/Disease-Parasites/Habitat Use-Selection/Mortality-Survival.

Deal, J. W., K. P. Reese, and J. W. Connelly. 1994. Pooling sage grouse harvest management areas in Idaho. Proceedings of the 19th Western States Sage and Columbian Sharp-tailed Grouse Workshop, Reno, NV, July 1994.
Keywords: Sage Grouse/Idaho/Hunting.

Deblinger, R. D., and A. W. Alldredge. 1996. Golden Eagle predation on pronghorns in Wyoming's Great Divide Basin. Journal of Raptor Research 30:157-159.
Keywords: Sage Grouse/Predation/Behavior/Wyoming/Great Divide Basin/Pronghorn.

Deibert, P. A. 1995. Effects of parasites on sage grouse (*Centrocercus urophasianus*) mate selection. Ph.D. dissertation. University of Wyoming. 127 pages.
Keywords: Sage Grouse/Disease-Parasites/Behavior/Wyoming/Lekking.
Abstract: Research was conducted in southeastern Wyoming to clarify the role of the Hamilton and Zuk hypothesis in evolution and maintenance of lekking in sage grouse (*Centrocercus urophasianus*). Three parasites, avian malaria (Plasmodium pediocetii) and two species of lice (Lagopoecus gibsoni, Goniodes centrocerci, Order Phthiraptera) influence male sage grouse mating success.

Breeding male sage grouse had lower hematocrits than nonbreeders. No other morphological comparison was significantly different between these groups. But, breeders attend the lek and display more frequently than nonbreeders. Avian malaria negatively influenced male mating success by reducing lek attendance. Infected breeders secured copulations late in the season, when females are likely to be yearlings or adults in poor condition. The presence of lice was associated with increased body mass, longer body lengths, shorter bills, longer tarsi, and higher condition indices. We were unable to demonstrate that any of these features were related to female mate choice. "Lousy" breeders secured fewer copulations than uninfected breeders, and bred late in the season. Prevalence of both parasites varied among years, which may provide evidence of a constantly changing hostparasite interaction. Females were less likely to bear either parasite than males.

A reduction of parasite prevalence in yearling birds was related to intensity of female choice for unparasitized males and relative fitness of
unparasitized males indicates sage grouse may have a heritable resistance to malaria, but not lice. Therefore, malaria data support the Hamilton and Zuk hypothesis for sage grouse. The lice data are more consistent with a parasite avoidance model.

Electrophoretic analysis of blood enzymes revealed sage grouse have genetic variability comparable to

other birds even though expected
effective population sizes for lekking species are small. Interlek migration may help maintain variability in this species. Significant allelic frequency differences were found between birds with and without malaria and adult males and females. Also, yearling males were less heterozygous than adult males. These results suggest malaria, intersexual differences in selection pressures, and heterosis may also maintain genetic variability in sage grouse.

Deibert, P. A. W., and M. S. Boyce. 1997. Heritable resistance to malaria and the evolution of lek behaviour in Sage Grouse *Centrocercus urophasianus*. Wildlife Biology 3:284.
Keywords: Sage Grouse/Lekking/Behavior/Reproduction/Sexual selection/Malaria.

DeLong, A. K. 1993. Relationships between vegetative structure and predation rates of artificial sage grouse nests. M.S. thesis. Oregon State University, Corvallis, Oregon.
Keywords: Sage Grouse/Predation/Nesting/Oregon/ARAR/ARTRVA/ARTRWY/ARTRTR/Distribution-Mapping.

DeLong, A. K., and J. A. Crawford. 1993. Influence of grass cover on fate of artificial Sage Grouse nests. Pages 18 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse.

DeLong, A. K., J. A. Crawford, and D. C. DeLong, Jr. 1995. Relationships between vegetational structure and predation of artificial Sage Grouse nests. Journal of Wildlife Management 59:88-92.
Keywords: Sage Grouse/Predation/Nesting/Hart Mountain/Fire/Herbicides-pesticides/Livestock grazing/Oregon/Sagebrush/ARTRVA/ARAR/Other shrubs/Understory-forbs /Understory-grasses/Nesting.
Abstract: Because of high nest predation and long-term declines in sage grouse (*Centrocercus urophasianus*) productivity in Oregon, we assessed the effects of vegetational cover and height on predation of artificial sage grouse nests (n = 330). Artificial nest fate was positively associated with tall grass cover and medium-height shrub cover collectively (P = 0.01). No other vegetation, predator, temporal, or spatial variables explained any additional variation in the probability of predation. This study supports the hypothesis that greater amounts of tall grass and medium-height shrub cover at nest sites lower risk of nest predation for sage grouse. Management practices that increase cover and height of native grasses in sagebrush communities with medium-height shrubs are recommended to enhance sage grouse productivity.

Dingman, J. D. 1980. Characteristics of sage grouse leks, North Park, Colorado. M.S. thesis. University of Denver, Denver, Colorado.
Keywords: Sage Grouse.

Dobkin, D. S. 1995. Management and conservation of Sage Grouse, denominative species for the ecological health of shrubsteppe ecosystems. High Desert Ecological Research Institute, Bend, Oregon. 18 pages.
Keywords: Sage Grouse/Dispersal/Juvenile/Habitat Restoration/Connectivity-Fragmentation/Models/Population trends.

Donoho, H. S., and J. Roberson. 1985. Summary of sage grouse questionnaires, Vol. I through XXIII. A report of the Western States Sage Grouse Committee. 72 pages.
Keywords: Sage Grouse/Hunting/Population trends/Strutting/Reproduction/Livestock grazing/Cropland/Herbicides-Pesticides/Agriculture/Brood rearing/Habitat Restoration/Disease-Parasites/Mortality-Survival.
***Notes*:** Summarizes 5 basic questions (those currently asked) of the 22 questionnaires to date, to bring together this information in one publication and evaluate the usefulness of the questionnaires, as well as "analyze trends in research and management." The years included are 1954 - 1981. Questionnaires were annual, with some exceptions, between these years, and the number of questions varied.

Drew, L. 1994. The bellowing bird that could. National Wildlife 32(4):16-21.
Keywords: Sage Grouse/Livestock grazing/Strutting/Behavior/Mortality-

Survival/Reproduction/Nesting/Brood rearing/Habitat Use-Selection/Diet.

Drovetski, S. V. 1996. Influence of the trailing-edge notch on flight performance of galliforms. Auk 113:802-810.
Keywords: Sage Grouse/Anatomy-Morphology/Models.

Drut, M. S. 1992. Habitat use and selection by sage grouse broods in southeastern Oregon. M.S. thesis. Oregon State University, Corvallis , Oregon.
Keywords: Sage Grouse/Habitat Use-Selection/Oregon/Brood rearing/Diet/Productivity/Management/ARAR/ARTR/ARTRTR/ARTRVA/ARTRWY/Other sage/Other shrubs/Grasslands/Understory-forbs/Understory-grasses/Riparian/Meadow/Pinyon-Juniper/Nesting/Juvenile/Adult/Reproduction/Mortality-Survival/Scale.

Drut, M. S. 1994. Status of sage grouse with emphasis on populations in Oregon and Washington. Audubon Society of Portland, Oregon.
Keywords: Sage Grouse.

Drut, M. S., J. A. Crawford, and M. A. Gregg. 1994. Brood habitat use by Sage Grouse in Oregon. Great Basin Naturalist 54:170-176.
Keywords: Sage Grouse/Brood rearing/Habitat Use-Selection/Population trends/Pinyon-Juniper/ARAR/ARTR/Diet/Hart Mountain/Oregon.
Abstract: Habitat use by Sage Grouse (*Centrocercus urophasianus)* hens with broods was examined at Jackass Creek and Hart Mountain, Oregon, from 1989 through 1991. Sage Grouse hens initially selected low sagebrush (*Artemisia* spp.) cover types during early brood-rearing, big sagebrush cover types later in the brood-rearing period, and ultimately concentrated use in and near lakebeds and meadows. Areas used by Sage Grouse broods typically had greater forb frequency than did random sites. Hens at Jackass Creek selected sites with forb cover similar to that generally available to broods at Hart Mountain, but home ranges were larger at Jackass Creek because of lower availability of suitable brood-rearing habitat. Differences in habitat use by broods on the two areas were reflected in dietary differences; at Hart Mountain, chicks primarily ate forbs and insects, whereas at Jackass Creek most of the diet was sagebrush. Larger home ranges, differences in diets, and differences in availability of forb-rich habitats possibly were related to differences in abundance and productivity between areas.

Drut, M. S., W. H. Pyle, and J. A. Crawford. 1994. Technical note: Diets and food selection of Sage Grouse chicks in Oregon. Journal of Range Management 47:90-93.
Keywords: Sage Grouse/Diet/Oregon/Mortality-Survival/Livestock grazing.

DuBose, R. T. 1965. Pox in the Sage Grouse. Bulletin of the Wildlife Disease Association 1:6.
Keywords: Sage Grouse/Pox/Bacteria/Fungi/Disease-Parasites.

Dunkle, S. W. 1977. Swainson's hawks on the Laramie plains, Wyoming. Auk 94:65-71.
Keywords: Sage Grouse/Wyoming/Reproduction/Nesting/Habitat Use-Selection/Behavior/Predation/Mortality-Survival/Diet/Productivity.

Dunn, P. O. 1983. Game bird survey: Dispersal and recruitment of chick Sage Grouse. Project number: CO W-037-R-36/Wk.P1. Colorado Division of Wildlife. 36 pages.
Keywords: Sage Grouse.

Dunn, P. O. 1984. Dispersal and recruitment of juvenile Sage Grouse. M.S. thesis. Colorado State University, Ft. Collins, Colorado. 46 pages.
Keywords: Sage Grouse/Dispersal/Juvenile/Herbicides-Pesticides/Habitat Use-Selection/Movement/Reproduction.
***Notes*:** Study of grouse in northeastern Colorado over 3 years, with primary focus on natal dispersal, summer habitat use, and lek fidelity. Found that male and female juveniles dispersed similar distances. Most marked yearlings attended the lek closest to their natal area (8 leks in the study area; 5 marked yearlings found one spring and 20 the next). Chicks steadily moved away from natal areas until late November, when locations were too difficult to make. Distances moved by each grouse were related to

date and age of bird but not movement rate (i.e., birds didn't move at different rates during dispersal; rather, movements were more steady). Movements to winter areas estimated from a few birds; these seemed to be largely weather-driven, based on snow accumulations and availability of sagebrush cover. Summer habitat use was based on 14 radio-tagged grouse. Summer ranges appeared to be distinct from winter, thus both seasonal ranges need to be considered and protected in management.

Dunn, P. O. 1984. Game bird survey: Dispersal and recruitment of juvenile Sage Grouse. Final report. PROJECT NUMBER: CO W-037-R-37/Wk.Pl. 03/Job 14. Colorado Division of Wildlife. 106 pages.
Keywords: Sage Grouse/Dispersal/Juvenile/Colorado/Habitat Use-Selection.

Dunn, P. O., and C. E. Braun. 1985. Natal dispersal and lek fidelity of Sage Grouse. Auk 102:621,624-625.
Keywords: Sage Grouse/Dispersal/Lekking/Juvenile/Movement/Yearling/Adult/Reproduction/Colorado/Wyoming/Sagebrush/Pinyon-Juniper/Brood rearing/Summer/Mortality-Survival/Movement-Dispersal.
Abstract: Natal dispersal and lek fidelity (attendance within and between years) of Sage Grouse (*Centrocercus urophasianus*) were studied on Cold Spring Mountain, northwestern Colorado, from July 1981 through May 1984. Female Sage Grouse followed the typical avian pattern of dispersing farther than males. However, there was no difference between proportions of male and female yearling grouse attending the lek closest to their juvenile banding location. Fifteen percent of all individually marked juveniles (24/157 birds) were known to have attended leks as yearlings. There was no difference between yearling and adult lek attendance rates for either sex; however, females attended leks less often than males. Yearling females, but not yearling males, visited 2 or more leks more often than adults. These differences may be related to yearlings' inexperience with breeding or to a strategy to enhance reproductive success.

Dunn, P. O., and C. E. Braun. 1986. Late summer-spring movements of juvenile Sage Grouse. Wilson Bulletin 98:83-92.
Keywords: Sage Grouse/Dispersal/Juvenile/Movement/Spring/Summer/Behavior/Mortality-Survival.
Abstract: Late summer to early spring movements of radio-marked juvenile Sage Grouse (C*entrocercus urophasianus*) were studied on Cold Spring Mountain, northwestern Colorado, from July to February 1981-82 and August to May 1982-83. Movements were analyzed from 118 locations (N = 8 grouse) during July-November 1981 and 213 locations (N = 10 grouse) during August-November 1982. Grouse steadily moved away from capture sites until November each year when they moved to winter-use sites. Movements to wintering areas in late November were related to snowfall and subsequent availability of sagebrush. Maximum one-way distance to wintering areas was 30.3 km (N = 4 radio-marked grouse). Sage Grouse generally followed topographic features and avoided areas without sagebrush cover.

Dunn, P. O., and C. E. Braun. 1986. Summer habitat use by adult female and juvenile Sage Grouse. Journal of Wildlife Management 50:228-235.
Keywords: Sage Grouse/Summer/Habitat Use-Selection/Juvenile/Adult/Distribution-Mapping/Nesting.
Abstract: Use of summer habitat by sage grouse (*Centrocercus urophasianus*) was examined in northwestern Colorado during July-September 1982. Habitat use by 14 radio-marked grouse (5 juveniles, 7 unsuccessfully nesting hens, and 2 hens with broods) was analyzed from 192 transects at sage grouse locations and 40 randomly located transects. Univariate and stepwise discriminant function analyses (DFA's) indicated that sage grouse selected habitat (use in proportion to availability) near edges of cover types with more cover (both horizontal and vertical) and less variation in shrub densities and intercept distances of line transects; i.e., the density and size of shrubs were more homogeneous than random. Within these sites, grouse roosted beside shrubs that were larger than average. DFA revealed no differences ($P < 0.05$) in habitat use between juveniles and adult females. Summer habitat for sage grouse should be managed for a greater homogeneity of structure and density of sagebrush (Artemisia spp.) than normally exists within sagebrush stands. Among stands, structure and density characteristics of shrubs should differ, along with the type of cover (sagebrush, meadow, and aspen [*Populus* spp.]); additionally these different cover types should exist in close proximity.

Dunn, P. O., and R. A. Ryder. 1982. Summer movements of juvenile Sage Grouse. Journal of the Colorado-Wyoming Academy of Science 14:56.

Keywords: Sage Grouse/Movement.

Eberhardt, L. E., and L. A. Hofmann. 1991. Sage Grouse on the Yakima Training Center: A summary of studies conducted during 1989 and 1990. Battelle Pacific Northwest Labs, Richland, Washington; Department of Energy, Washington, DC. 80 pages.
Keywords: Sage Grouse/Washington.

Edelmann, F. B., M. J. Ulliman, M. J. Wisdom, K. P. Reese, and J. W. Connelly. 1998. Assessing habitat quality using population fitness parameters: a remote sensing/GIS-based habitat-explicit population model for Sage Grouse (*Centrocercus urophasianus*). Technical report 25 of the Idaho Forest, Wildlife and Range Experiment Station. College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho. 33 pages.
Keywords: Sage Grouse/Habitat Use-Selection/Population trends/Models/Nesting/Sagebrush/ Understory-forbs/Understory-grasses/Brood rearing/Winter/Juvenile/Yearling/Adult/Reproduction/Mortality-Survival/Research needs/Scale/Environmental Requirements.

Edwards, G. D. 1942. A comparative study of the leg muscles of some gallinaceous birds of the Pacific Northwest. M.S. thesis. Washington State University, Pullman, WA.
Keywords: Sage Grouse.

Ellis, K. L. 1984. Behavior of a lekking Sage Grouse in response to a perched Golden Eagle. Western Birds 15:37-38.
Keywords: Sage Grouse/Behavior.

Ellis, K. L. 1987. Effects of new transmission line on breeding male sage grouse at a lek in northwestern Utah. J. Chairman Roberson, editor. 15th Sage Grouse Workshop Transactions of the Western States Sage Grouse Committee; Western Assoc. of Fish and Game Agencies, Midway, UT, 28-30 July, 1987.
Keywords: Sage Grouse/Power lines/Utah/Lekking.

Ellis, K. L., J. R. Murphy, and G. H. Richins. 1987. Distribution of breeding male Sage Grouse in northeastern Utah. Western Birds 18:117-121.
Keywords: Sage Grouse/Utah/Lekking/Reproduction/Weather-Climate/Distribution-Mapping/Dispersal/ARTR/Spring/Juvenile/Adult/Movement.

Ellis, K. L., J. R. Parrish, and J. R. Murphy. 1984. Breeding season movements and distribution of male Sage Grouse in northeastern Utah. Encyclia 61:204.
Keywords: Sage Grouse/Movement/Distribution-Mapping/Utah/Habitat Use-Selection/Reproduction.

Ellis, K. L., J. R. Parrish, J. R. Murphy, and G. H. Richins. 1989. Habitat use by breeding male Sage Grouse: A management approach. Great Basin Naturalist 49:404-407.
Keywords: Sage Grouse/Utah/Habitat Use-Selection/Distribution-Mapping/Sagebrush/Lekking/Spring/Yearling/Adult/Movement.
Abstract: Radio telemetry was used to study habitat use of breeding male sage grouse (*Centrocercus urophasianus*) at a lek in northeastern Utah during 1983 and 1984. Objectives were to determine if grouse day-use areas differed significantly in sagebrush characteristics from adjacent nonuse areas and to establish a simplified method for use by land managers in identifying grouse use areas. We determined that male grouse used areas of greatest sagebrush height and cover. Our methods provide a means for land managers to identify habitat associated with a lek that is suitable for male sage grouse day use in the event sagebrush alteration is planned within 3 km of a lek.

Ellsworth, D. L., R. L. Honeycutt, and N. J. Silvy. 1995. Phylogenetic realtionships among North American grouse inferred from restriction endonuclease analysis of mitochondrial DNA. Condor 97:492-502.
Keywords: Sage Grouse/Genetics/Behavior/Anatomy-Morphology/Taxonomy/Reproduction/Population trends.
Abstract: Systematic relationships among North American grouse and ptarmigans (Tetraoninae) are not well defined because traditional classifications were based on morphological and behavioral characteristics

with limited taxonomic utility. Restriction enzyme analysis of mitochondrial DNA (mtDNA) was used to generate a phylogeny for North American tetraonines that was then utilized to test previous phylogenetic hypotheses for the group and to examine the origin and evolution of complex reproductive behaviors and morphological features characteristic of grouse and ptarmigan species. Nucleotide sequence divergence among congeneric species derived from mtDNA restriction fragment patterns varied extensively, ranging from 0.28% in prairie grouse (Tympanuchus) to 4.06% among ptarmigans (Lagopus) and 10.15% between Blue Grouse (Dendragapus obscurus) and Spruce Grouse (D. canadensis). Using the Northern Bobwhite (Colinus virginianus) as an outgroup, the molecular phylogeny partitioned species into three primary groups: (1) Tympanuchus; (2) Lagopus, Dendragapus obscurus, and Tetrao urogallus (the European Capercaillie); and (3) the Ruffed Grouse (Bonasa umbellus), Dendragapus canadensis, and Sage Grouse (*Centrocercus urophasianus*). Prairie grouse were genetically distinct from other grouse species, but a polyphyletic distribution of haplotypes and limited mtDNA differentiation within Tympanuchus suggest that divergence among the prairie grouse occurred very recently. Within Lagopus, the Willow (L. lagopus) and Rock (L. mutus) Ptarmigans were more closely related to each other than either was to the White-tailed Ptarmigan (L. leucurus). Dendragapus canadensis grouped with Bonasa umbellus; whereas D. obscurus was allied with Lagopus and Tetrao. Thus, the genus Dendragapus as currently constructed is polyphyletic (i.e. D. canadensis and D. obscurus have had separate evolutionary histories) and the morphological similarities between the two species may be attributable to convergent adaptation to coniferous forest. We inferred from the molecular phylogeny that the complex reproductive systems in tetraonines have arisen independently and that corresponding morphological and behavioral specializations may reflect parallel evolutionary trends.

Ellsworth, D. L., R. L. Honeycutt, and N. J. Silvy. 1996. Systematics of grouse and ptarmigans determined by nucleotide sequences of the mitochondrial cytochrome-b gene. Auk 113:811-822.
Keywords: Sage Grouse/Anatomy-Morphology/Behavior/Reproduction/Genetics.

Emmons, S. R. 1979. Game bird survey: Evaluation of the effects of changes in hunting regulations on Sage Grouse populations: Evaluation of censuses of males. Project number: COLO. W-037-R-32/WK.PL.03/JOB 09B. Colorado Division of Wildlife. 29 pages.
Keywords: Sage Grouse/Hunting/Colorado.

Emmons, S. R. 1980. Game bird survey: Evaluation of the effects of changes in hunting regulations on Sage Grouse populations: Evaluation of censuses of males. Pages 43-114 *in* Job Final Report W-37-R-33, WP-3, J-9b. Colorado Division of Wildlife.
Keywords: Sage Grouse/Colorado/Hunting/Population trends/Habitat Use-Selection/Distribution-Mapping/Lekking/Reproduction/Juvenile/Adult.
***Notes*:** Appears to be a copy of Emmons thesis.

Emmons, S. R. 1980. Lek attendance of male Sage Grouse in North Park, Colorado. M.S. thesis. Colorado State University, Fort Collins, Colorado.
Keywords: Sage Grouse.

Emmons, S. R., and C. E. Braun. 1980. Breeding season movements and habitat selection of male Sage Grouse in North Park, Colorado. Journal of the Colorado-Wyoming Academy of Science 12:36.
Keywords: Sage Grouse/Habitat Use-Selection/Movement/Colorado/Dispersal.
***Notes*:** This is published as an abstract only.

Emmons, S. R., and C. E. Braun. 1984. Lek attendance of male Sage Grouse. Journal of Wildlife Management 48:1023-1028.
Keywords: Sage Grouse/Lekking/Nesting/Brood rearing/Population trends/ARTR/Weather-Climate/Movement.
Abstract: Sage grouse (*Centrocercus urophasianus*) management has primarily been based on counts of males at leks in April and estimates of nesting success and brood size obtained in July and August. Studies of black grouse (Lyrurus tetrix) and sharp-tailed grouse (Tympanuchus phasianellus) suggest that < 50% of the male population is present on a lek at any given time. The objective of this study was to examine the daily attendance patterns on leks of male sage grouse during the breeding season. The study area was in

North Park, 16 km northwest of Walden, Jackson County, Colorado.

Emmons, S. R., and B. E. Petersen. 1979. Telemetry investigation of Sage Grouse in North Park, Colorado. Pages 215-218 *in* Proceedings of the International Conference of Wildlife Biotelemetry.
Keywords: Sage Grouse/Lekking/Movement/Spring/Nesting/Radiotelemetry/Colorado/Brood rearing/Winter/Weather-Climate/Reproduction/Behavior/Sagebrush/ARTR/Other shrubs/Juvenile/Adult.

Emslie, S. D. 1986. Late pleistocene vertebrates from Gunnison County, Colorado. Journal of Paleontology 60:170-176.
Keywords: Sage Grouse/Colorado/Habitat Use-Selection/Archaeology/Stratigraphy/TaphonomyAnatomy-Morphology.

Emslie, S. D., and T. H. Heaton. 1987. The late Pleistocene avifauna of Crystal Ball Cave, Utah. Journal of Arizona-Nevada Academy of Science 21:53-60.
Keywords: Sage Grouse/Pleistocene/Utah/Avifauna/Predation.

Eng, R. L. 1952. A two-summer study of the effects on bird populations of chlordane bait and aldrin spray as used for grasshopper control. Journal of Wildlife Management 16:326-337.
Keywords: Sage Grouse/Population trends/Herbicides-Pesticides/Chlordane/Aldrin/Nesting/Mortality-Survival.
***Notes*:** The article summarizes effects of chlordane and aldrin, as applied for grasshopper control, on bird populations in Montana. Sage grouse were not a focus of the study and were mentioned only once, in Table 4. This table reports 0.5 "sage hens" per day on the control plot from June 21-July 7 and none seen on the sprayed plot, either before or after spraying. The study sites were primarily grasslands. Overall, found no "positive" evidence of mortality of birds from the toxicity of the pesticides. The adverse effects on bird populations that were noted, e.g., declines in the "bird population index," appeared to be caused by the decline in grasshopper numbers.

Eng, R. L. 1954. Use of aerial coverage in Sage Grouse strutting ground counts. Pages 231-233 *in* Proceedings of the 34th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Strutting/Habitat Use-Selection/Roads/Aerial/Montana.

Eng, R. L. 1955. A method for obtaining Sage Grouse age and sex ratios from wings. Journal of Wildlife Management 19:267-272.
Keywords: Sage Grouse/Hunting/Juvenile/Wings/Age/Sex/Adult.

Eng, R. L. 1960. Small game research: factors affecting Sage Grouse production. Montana Fish and Game Department.
Keywords: Sage Grouse.

Eng, R. L. 1961. Sage grouse-spring strutting activity. Naturalist 2(2):15-20.
Keywords: Sage Grouse/Lekking/Behavior.

Eng, R. L. 1962. Small game research: Factors affecting Sage Grouse production. Montana Fish and Game Department. 4 pages.
Keywords: Sage Grouse.

Eng, R. L. 1963. Observations on the breeding biology of male Sage Grouse. Journal of Wildlife Management 27:841-846.
Keywords: Sage Grouse/Strutting/Reproduction/Nesting/Montana/Lekking/Yearling/Adult/Anatomy-Morphology/Behavior/Physiology.
Abstract: Eighty-eight male sage grouse (*Centrocercus urophasianus*) were collected throughout the 1959 strutting season. Testis development of adult and subadult males was compared to observed seasonal breeding sequence. Subadult males appear on the strutting grounds after, and cease strutting activities

before, adult males. These differences in apparent breeding activity between the two age classes are supported by similar differences in testis development. Observations of infertility in late clutches suggest that a limitation to renesting is imposed by the male.

Eng, R. L. 1969. For survival--Sage Grouse need sagebrush. NOW 5(3):6-7. Montana State University.
Keywords: Sage Grouse.

Eng, R. L. 1971. Two hybrid Sage Grouse X Sharp-tailed Grouse from central Montana. Condor 73:491-493.
Keywords: Sage Grouse/Sharp-tailed Grouse/Hybrid/Montana/Juvenile/Hunting/Sagebrush/Grasslands/Anatomy-Morphology/Taxonomy.

Eng, R. L. 1973. Inter-strutting ground movements of Sage Grouse hens in central Montana. Pages 45-46 *in* Proceedings of the 8th Biennial Western States Sage Grouse Workshop, Lewistown, MT.
Keywords: Sage Grouse/Lekking/Movement/Montana/Trapping/Cannon Net/Techniques-Methods.

Eng, R. L., E. J. Pitcher, S. J. Scott, and R. J. Greene. 1979. Minimizing the effect of surface coal mining on a Sage Grouse population by a directed shift of breeding activities. Pages 464-468 *in* G. A. Swanson, editor. General Technical Report RM-65. From: The Mitigation Symposium: A National Workshop on Mitigation Losses of Fish and Wildlife Habitat. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.
Keywords: Sage Grouse/Livestock grazing/Agriculture/Distribution-Mapping/Roads/Dispersal/Nesting/Reproduction/Mineral-Oil Development.

Eng, R. L., and P. Schladweiler. 1967. Ecological effects of chemical and mechanical sagebrush control: Winter distribution and habitat use by Sage Grouse. Pages 9-16 *in* Montana Fish and Game Department.
Keywords: Sage Grouse.

Eng, R. L., and P. Schladweiler. 1972. Sage Grouse winter movements and habitat use in central Montana. Journal of Wildlife Management 36:141-146.
Keywords: Sage Grouse/Habitat Use-Selection/Movement/Winter/Montana/Herbicides-Pesticides/Distribution-Mapping/ARTR.
Abstract: Movements and habitat use by sage grouse (*Centrocercus urophasianus*) were studied in central Montana during the winters of 1965-66 and 1966-67. Two and three female sage grouse were radio-equipped and tracked during the two respective winters. Winter ranges of the five instrumented females ranged from approximately 2,615 to 7,760 acres. A 4-square-mile primary study area, containing over half of the relocations of the five instrumented birds, was separated into two big sagebrush (Artemisia tridentata) canopy cover classes on 16-inch:1-mile aerial photographs. Fifty-five percent of the primary study area was in the more dense (over 20 percent canopy coverage) and 45 percent in the less dense (under 20 percent canopy coverage) category. Observed use of the two canopy coverage classes was significantly ($P < 0.01$) different, a decided preference for the more dense stands being indicated. The characteristics of central Montana sage grouse winter areas (large expanses of dense sagebrush with little if any slope) make them prime targets of sagebrush control programs. Removal of sagebrush from these areas would greatly reduce their capacity to support wintering sage grouse.

Enyeart, G. W. 1956. Responses of Sage Grouse to grass reseeding in the pines area, Garfield County, Utah. M.S. thesis. Utah State University, Logan, Utah.
Keywords: Sage Grouse/Weather-Climate/Seeding forage/Ecology/Distribution-Mapping/Behavior/Strutting/Nesting/Brood rearing/Movement/Diet/Livestock grazing/Management/Water.

Eustace, C. D. 1995. Sage grouse--they used to darken the sky. Pages 24-27 *in* Montana Outdoors.
Keywords: Sage Grouse.

Evans, C. C. 1986. The relationship of cattle grazing to Sage Grouse use of meadow habitat on the Sheldon National Wildlife Refuge. M.S. thesis. University of Nevada, Reno, Nevada. 199 pages.
Keywords: Sage Grouse/Livestock grazing/Habitat Use-Selection/Habitat Restoration/Diet/Distribution-

Mapping/Nevada.

Evans, C. C., and D. A. Klebenow. 1984. The relationship of cattle grazing to Sage Grouse use of meadow habitat. Pages 37 *in* Society for Range Management. Annual Meeting, Abstracts.
Keywords: Sage Grouse.

Everin, W. J. 1959. A basis for upland game bird management. Pages 1-32 *in* Montana Wildlife.
Keywords: Sage Grouse.

Feist, F. G. 1968. Breeding-bird populations on sagebrush-grassland habitat in central Montana. Montana Fish and Game Department, Project No. Montana W-105-R. Montana Fish and Game Department.
Keywords: Sage Grouse/Habitat Use-Selection/Reproduction/Montana/Livestock grazing/ARTR/Herbicides-Pesticides/Nesting.

Fischer, R. A. 1994. The effects of prescribed fire on the ecology of migratory Sage Grouse in southeastern Idaho. Ph.D. dissertation. University of Idaho. 150 pages.
Keywords: Sage Grouse/Migration/Fire/Weather-Climate/Nesting/Yearling/Habitat Use-Selection/Idaho_.
Abstract: I investigated the effects of fire on sage grouse (*Centrocercus urophasianus*) breeding, nesting, and broodrearing habitat, and summer migration, for 3 years after a 5,800 ha latesummer fire (postburn) on the Big Desert, southeastern Idaho. During March and April, 199092, 655 sage grouse (514 males, 141 females) were captured on or near leks. The fire removed sagebrush canopy cover around leks within and adjacent to the burn. Thirty active leks were identified in 1987; in 1989(1year preburn) 25 leks were active; and in 1993 (4years postburn) 11 leks were active. Although the number of active leks declined, I did not detect a difference in the number of active leks between burned and unburned habitat before and after fire. The number of active leks was highly correlated ($r = 0.964$, $P = 0.005$) with maximum count of attending males, suggesting that counts of active leks may be used as an index to abundance. Eighty-four of 116 (72%) female sage grouse were located during the nesting season, and 49 (58%) were found on nests. Nest success was 53 and 52% in burned and unburned areas, respectively. I found no differences in habitat characteristics at nest or random sites in a multivariate comparison between burned and unburned habitat. Ground cover, lateral cover, and elliptical area of nest bush were consistently higher at nests than dependent sites for preburn, postburn, and pooled analyses. Fire appeared to negatively impact insect abundance in 1 of the 3 insect orders that are most important in sage grouse diets. However, cover of forbs important in sage grouse summer diets was similar in burned and unburned habitat. Although the fire created a mosaic of sagebrush areas interspersed with open areas having abundant grasses and forbs, there was no positive response of sage grouse to the burned area. My results provided evidence for excluding fires that eliminated large blocks of vegetation in brood habitat within xeric regions, because of its impacts on insects. Moisture content of forbs and sagebrush at grouse and random locations was similar throughout the summer. Timing of sage grouse migration varied among years, and was negatively correlated with vegetal moisture content. The majority of birds began migrating from the study area when forb moisture content declined to about 60% water. Data suggested that there was a threshold of moisture content that provided a cue for birds to initiate summer migration. Land managers should continue to use fire with caution in sage grouse habitat. Fire appeared to negatively influence insect abundance, but results were not so clear for breeding males and nesting females. Drought conditions and a declining grouse population may have masked differences between burned and unburned habitat for breeding and nesting grouse, although the longterm response of grouse should be closely monitored. Results of this study should stimulate similar research on sage grouse populations that are nonmigratory or reside in different sagebrush habitat types. (Abstract shortened by UMI.).

Fischer, R. A., A. D. Apa, W. L. Wakkinen, K. P. Reese, and J. W. Connelly. 1993. Nesting-area fidelity of Sage Grouse in southeastern Idaho. Condor 95:1038-1041.
Keywords: Sage Grouse/Lekking/Nesting/Idaho/Reproduction.

Fischer, R. A., A. D. Apa, W. L. Wakkinen, K. P. Reese, and J. W. Connelly. 1993. Nesting-area fidelity of Sage Grouse in Southeastern Idaho. Pages 17 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.

Keywords: Sage Grouse.

Fischer, R. A., and K. P. Reese. 1996. Influence of vegetal moisture content and nest fate on timing of female Sage Grouse migration. Condor 98:868-872.
Keywords: Sage Grouse/Seasonal movements/Plant phenology/Migration/Idaho/Snake River/Weather-Climate/Physiology/ARTRWY/Understory-forbs/Understory-grasses/Lekking/Nesting/Brood rearing/Spring/Summer/Yearling/Adult/Habitat Use-Selection/Movement-migration/Reproduction.
Abstract: Sage Grouse (*Centrocercus urophasianus*) are mainly herbivorous birds that occupy sagebrush (*Artemisia* spp.) dominated habitats of western North American shrub-steppe deserts. Sage Grouse populations are either migratory or nonmigratory, presumably depending on moisture content of vegetation, vegetal cover, elevation, and proximity of seasonal habitats. However, no empirical data exist to document timing and progression of plant desiccation, how weather variables might influence desiccation, or how migrational timing may be influenced by plant moisture content. We hypothesized that (1) cumulative annual precipitation and temperature influence timing of spring and summer vegetal desiccation, (2) vegetal moisture content would be higher in plants collected at sites used by Sage Grouse than at random sites, and (3) annual timing of Sage Grouse migration is related to vegetal moisture content and nest fate.

Fischer, R. A., K. P. Reese, and J. W. Connelly. 1996. An investigation on fire effects within xeric Sage Grouse brood habitat. Journal of Range Management 49:194-198.
Keywords: Sage Grouse/Fire/Brood rearing/Mortality-Survival/Habitat Use-Selection/ARTRWY/Weather-Climate.

Fischer, R. A., W. L. Wakkinen, K. P. Reese, and J. W. Connelly. 1997. Effects of prescribed fire on movements of female Sage Grouse from breeding to summer ranges. Wilson Bulletin 109:82-91.
Keywords: Sage Grouse/Year round/Movement-migration/Reproduction/Brood rearing/Nesting/Summer/Lekking/Population trends/Agriculture/Fire.
Abstract: We compared summer movement patterns of female Sage Grouse (*Centrocercus urophasianus*) in southeastern Idaho before (1987-1989) and after (1990-1992) a prescribed fire which removed vegetation cover, primarily Wyoming big sagebrush (Artemisia tridentata wyomingensis), from approximately 57% of a 5800 ha area. Grouse moved 1-69 km (x super(-) = 17.8 plus or minus 2.0 km [SE]; N = 81) from breeding and nesting areas to summer ranges, predominantly in northwest or southwest directions during the 6-year period. There was no difference in timing, distance, or direction moved between birds captured in burned and unburned habitats. The data provided further evidence of traditional migration routes for Sage Grouse breeding and nesting in the Big Desert.

Flinders, J. T. 1999. Restoration of sage grouse in Strawberry Valley, Utah, 1998-1999 report. Utah Reclamation Mitigation and Conservation Commission, Progress Report. Brigham Young University, Provo, UT.
Keywords: Sage Grouse.

Fremont, J. C. 1845. Report of the exploring expedition to the Rocky Mountains in the year 1842 and to Oregon and North California in the years 1843-1844. Blair and Rives Printers, Washington, D.C.
Keywords: Sage Grouse.

Fried, S. 1997. Dance fever. Birder's World 11(3):36-40.
Keywords: Sage Grouse.

Frost Spurrier, M., M. Boyce, and B. F. J. Manly. 1994. Lek behaviour in captive Sage Grouse *Centrocercus urophasianus*. Animal Behaviour 47:303-310.
Keywords: Sage Grouse.
Abstract: Lek display and female choice of males was studied in captive sage grouse. Individual males showed significant repeatability in display frequency between years. Variation in female association with males in artificial arenas was largely attributable to variation in the display frequency of individual males and that of males in adjacent positions in the arena. In addition, males were shown to possess "inherent attractiveness" which was correlated with the length of their keel. Females showed significant consistency in their choice of males, and there was no evidence of copying behaviour in their selection of males.

Gabrielson, I. N., and S. G. Jewett. 1940. Birds of Oregon. Oregon State College, Corvallis. 650 pages.
Keywords: Sage Grouse/Oregon.

Garber, C. S., B. D. Mutch, and S. Platt. 1993. Observations of wintering Gyrfalcons (*Falco rusticolus*) hunting Sage Grouse (*Centrocercus urophasianus*) in Wyoming and Montana, USA. Journal of Raptor Research 27:169-171.
Keywords: Sage Grouse/Predation/ARTR/Winter.

Gashwiler, J. S. 1977. Bird populations in four vegetational types in central Oregon. Spec. Sci. Report -- wildlife no. 205. USDA Forest Service.
Keywords: Sage Grouse.

Gates, C., W. T. Marshall, and D. P. Olsen. 1968. Line transect method of estimating grouse population densities. Biometrics 24:135-145.
Keywords: Sage Grouse/Models/Minnesota/ Population density/Techniques-Methods.

Gates, R. J. 1981. Summer use by sage grouse of irrigated agriculture in southeast Idaho. Pages 7-8 *in* Proceedings of the 12th Biennial Western States Sage Grouse Workshop. Bowman, ND.
Keywords: Sage Grouse/Idaho/Agriculture.

Gates, R. J. 1983. Sage Grouse, lagomorph, and pronghorn use of a sagebrush grassland burn site on the Idaho National Engineering Laboratory. M.S. thesis. Montana State University.
Keywords: Sage Grouse/Fire/Idaho/Grasslands/Movement/Diet/Distribution-Mapping/Mortality-Survival.
***Notes*:** Compared use of a 405 ha prescribed burn site (a single burn, so not replicated) and an adjacent control on the INEL site in Idaho. Elevation about 1500 m, cold desert shrub biome. Mainly Wyoming big sagebrush site, but green rabbitbrush also common. Used pellet counts for all 4 species (sage grouse, pygmy rabbits, black-tailed jackrabbits, and pronghorn) to determine relative use of burn vs. control. Measured habitat use 2 years prior and 1 year after the burn. Also studied seasonal diets in unburned habitat, and used radiotelemetry for grouse habitat use in relation to the burn. Prior to the burn, sage grouse use in the burn site and control were not different, but 1 year after the burn use by sage grouse was higher in the burn site ($P < 0.05$). Burn site was used during fall, winter, and spring, but was not "critical winter habitat" for grouse. Summer habitats used were irrigated cropland and lawns at INEL, as heat desiccated forbs and other herbaceous vegetation.

Found a decline in lek counts during the study, probably weather-related. Small burns that produce a mosaic of habitats such as this one could be useful in enhancing forb production. Author concludes that the primary benefit of burning is solely to enhance forb production, but that it should only be done in dense stands of sagebrush, where cover is not limiting.

Gates, R. J. 1985. Observations of the formation of a Sage Grouse lek. Wilson Bulletin 97:219-221.
Keywords: Sage Grouse/Lekking/Cropland/Population trends/Fire/Reproduction/Idaho/Adult/ Behavior/Environmental Requirements.
Abstract: Sage Grouse (*Centrocercus urophasianus*) commonly use disturbed areas as breeding arenas, however, few data are available on the establishment of leks by Sage Grouse. During a study of Sage Grouse use of a prescribed burn site, observations of three wing-tagged male and three radio-collared female grouse on a recently burned area provided some insight into the establishment of an arena.

Gates, R. J., and R. L. Eng. 1984. Sage grouse, pronghorn, and lagomorph use of a sagebrush-grassland burn site on the Idaho National Engineering Laboratory. Pages 220-235 *in* O. D. Markham, editor. Idaho National Engineering Laboratory radio ecology and ecology programs: 1983 progress reports. U.S. Department of Energy, Radiological and Environmental Sciences Laboratory, Idaho Falls, ID. 235 pages.
Keywords: Sage Grouse/Distribution-Mapping/Diet/ARTRWY/Fire/Water/Reproduction/Nesting/Brood rearing/Dispersal/Habitat Use-Selection/Idaho/Agriculture.

Gibson, R., K. E. Semple, and R. K. Wayne. 2001. Seeing half the picture: Behavioral and genetic data from sage grouse leks. 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001. (World Meeting Number 011 0211).

Keywords: Sage Grouse.
***Notes*:** Abstract only.

Gibson, R. M. 1989. Field playback of male display attracts females in lek breeding Sage Grouse. Behavioral Ecology and Sociobiology 24:439-443.
Keywords: Sage Grouse/Lekking/Movement/Nesting/Playback.

Gibson, R. M. 1990. Relationship between blood parasites, mating success and phenotypic cues in male Sage Grouse *Centrocercus urophasianus*. American Zoologist 30:271-278.
Keywords: Sage Grouse/Models/Lekking/Reproduction/Mortality-Survival/Disease-Parasites.
Abstract: In lek breeding Sage Grouse *Centrocercus urophasianus* in eastern California, male mating success is strongly correlated with individual differences in lek attendance, and in the rate and acoustic quality of courtship display, suggesting that these provide cues by which females choose mates. Increased lek attendance and high display rates are also associated with elevated metabolic expenditure. This paper examines the hypothesis that the ability to commit energy to display is related to the incidence of blood parasites. A single hematozoan genus, Haemoproteus , was found in 37.5% of 184 Sage Grouse sampled over a five year period. Parasitism varied across years and increased through the breeding season. However, no measure of display performance or mating success was significantly correlated with decreased parasite load among adult males. Several additional lines of evidence, including numerically low infection intensities, the absence of detectable effects of parasites on hematocrit and erythrocyte production, and the seasonal distribution of parasite incidence all suggested that infections were unlikely to impact male courtship display.

Gibson, R. M. 1992. Lek formation in Sage Grouse: the effect of female choice on male territory settlement. Animal Behaviour 43:443-450.
Keywords: Sage Grouse/Lekking/California/Reproduction/Habitat Use-Selection/Behavior/Nesting.
Abstract: Previous studies of female choice in sage grouse, *Centrocercus urophasianus* , have identified two processes that could drive the local clustering of male territories at leks: (1) fidelity of females to previous mating sites ("temporal spillover" hypothesis), and (2) "spatial spillover" of matings from an attractive male to his immediate neighbours ("hotshot" hypothesis). The effects of each process on male territory settlement were investigated using observations of the resettlement of vacant territories and of individual site fidelity during a 7-year field study. The data support the role of temporal spillover in lek formation and also suggest that territorial males use a "win-stay" rule that should favour the use of established males as cues to settlement by naive individuals. The spatial spillover hypothesis was not supported, perhaps because this process creates conflicts of interest between attractive males and kleptoparasitic neighbours that prevent the formation of stable groups.

Gibson, R. M. 1996. Female choice in Sage Grouse: the roles of attraction and active comparison. Behavioral Ecology and Sociobiology 39:55-59.
Keywords: Sage Grouse/Sexual selection/Passive attraction/Behavior/Models/Lekking.
Abstract: Previous studies of female choice in sage grouse *Centrocercus urophasianus* have implicated both the acoustic quality and repetition rate of the stereo-typed strut display as putative cues for female choice. Stages in the choice process at which specific components of male courtship display influence female decisions were investigated using field observations of female pre-mating behavior. Females visited a subset of territorial males and then actively chose one of these as a mate. The order in which males were visited suggested that females searched until an acceptable mate was found, rather than employing a "best-of-n" tactic. Numbers of females visiting a male were related to differences in an acoustical component of display (inter-pop interval) whereas the probability that a visiting female mated was related to display rate (Table 3), indicating that initial attraction and active choice are influenced by different components of display. In addition, inter-pop interval and display rate tended to covary inversely (Fig. 1), suggesting that attraction and active choice may impose conflicting selection pressures on display performance.

Gibson, R. M. 1996. A re-evaluation of hotspot settlement in lekking Sage Grouse. Animal Behaviour 52:993-1005.
Keywords: Sage Grouse/Nesting/Lekking/Behavior/Dispersal.
Abstract: Recent analyses of avian leks have come to conflicting conclusions concerning the role of male

settlement on female traffic hotspots. This issue was re-examined in the sage grouse, *Centrocercus urophasianus*, using data on pre-nesting movements of radiotagged females and the dispersion of lekking males collected during a 10-year field study. As expected with hotspot settlement, leks were preferentially located in areas through which females traveled between wintering and nesting ranges before mating, In addition, the distribution of males among leks was related proximately to variation in numbers of females visiting each lek during the mating period and ultimately to numbers that nested within a 2-km radius, within which nesting hens were preferentially attracted. The results show both that hotspot settlement can explain certain coarse scale features of male dispersion, and that female behaviour during different stages of the pre-nesting period may influence particular components of male dispersion to differing extents.

Gibson, R. M., and G. C. Bachman. 1992. The costs of female choice in a lekking bird. Behavioral Ecology 3:300-309.
Keywords: Sage Grouse/Behavior.

Gibson, R. M., and J. W. Bradbury. 1985. Sexual selection in lekking Sage Grouse: Phenotypic correlates of male mating success. Behavioral Ecology and Sociobiology 18:117-123.
Keywords: Sage Grouse/Lekking/Reproduction/Anatomy-Morphology.
Abstract: Mate choice cues in sage grouse (*Centrocercus urophasianus*) were reinvestigated by analyzing relationships between male mating success and a range of suggested cues. Display cues were implicated by significant relationships between mating status (whether or not a male mated) and lek attendance, display rate (corrected for effect of female proximity and time of day) and an acoustic component related to temporal and frequency measure of a whistle emitted during the strut display. Although display rate and the acoustic component were intercorrelated, both exerted significant partial effects on mating success in multivariate analyses. These display measures also differed significantly between males. In contrast, mating success was not significantly related to measures of territory characteristics, including size and proximity to the lek center, or to body size. These results resolve discrepancies between previous studies and provide a basis for experimental analysis of the role of female choice in this lek system.

Gibson, R. M., and J. W. Bradbury. 1986. Male and female mating strategies on Sage Grouse leks. Pages 379-398 *in* D. I. Rubenstein and R. W. Wrangham, editors. Ecological aspects of social evolution - birds and mammals.
Keywords: Sage Grouse/Lekking/Dispersal/ Behavior/Habitat Use-Selection/Predation/ Models/Nesting/Movement/Reproduction/Ecology.

Gibson, R. M., and J. W. Bradbury. 1987. Lek organization in Sage Grouse: Variations on a territorial theme. Auk 104:77-84.
Keywords: Sage Grouse/Lekking/Movement/Reproduction/Behavior.
Abstract: During a 5-year study of Sage Grouse (*Centrocercus urophasianus*) in eastern California, displaying males abandoned territoriality throughout one breeding season and did so intermittently in three others. Abandonment followed a severe winter and was correlated with a change from location-dependent to hierarchical dominance relationships between males. Intermittent territorial breakdowns occurred when males left their territories to approach and, in 2 years, to mate with females off the lek. These observations imply that the social mechanisms of sexual selection may vary between leks in this species and suggest a novel function for lek territoriality: territories may act as rendezvous sites with females.

Gibson, R. M., J. W. Bradbury, and S. L. Vehrencamp. 1991. Mate choice in lekking Sage Grouse revisited: the roles of vocal display, female site fidelity, and copying. Behavioral Ecology 2:165-180.
Keywords: Sage Grouse/Lekking/Behavior/Anatomy-Morphology/Habitat Use-Selection/Population trends/Reproduction/California/Yearling/Adult.
Abstract: In lekking sage grouse (*Centrocercus urophasianus*), females exhibit relatively unanimous mate choice for particular males, but a satisfactory explanation for this unanimity has been elusive. We present analyses of mating distributions from two leks over 4 years that provide evidence for female choice based on differences in vocal display performance of males, the locations at which hens mated in the previous year, and the choices of other females (copying). The unanimity of female choice varied markedly among leks and years in correlation with changes in the mean numbers of hens that mated at the same time and hence the opportunity to copy. The results confirm that hens assess phenotypic traits of males directly but

also indicate that the secondary tactics of site fidelity and copying are often important components of female choice.

Giesen, K. M. 1984. Identification of grouse species by hunters in northwestern Colorado: implications for management. Game Info. Leaflet No. 111. Colorado Division of Wildlife .
Keywords: Sage Grouse/Hunting/Colorado/Identification/Anatomy-Morphology.

Giesen, K. M. 1995. Upland bird research: Evaluation of livestock grazing and residual herbaceous cover on Sage Grouse nest success. Final Report. Project number: CO W-167-R/Job 18/Wk.P1. Colorado Division of Wildlife.
Keywords: Sage Grouse/Colorado/Population trends/Nesting/Livestock grazing/Habitat Use-Selection/Distribution-Mapping.

Giesen, K. M., T. J. Schoenberg, and C. E. Braun . 1982. Methods for trapping Sage Grouse in Colorado. Wildlife Society Bulletin 10:224-231.
Keywords: Sage Grouse/Colorado/Trapping/ARTR/Hunting/Juvenile/Dispersal/Habitat Use-Selection/Behavior/Lekking/Spring/Summer/Yearling/Adult/Techniques-Methods.

Giesen, K. M., T. J. Schoenberg, and C. E. Braun. 1982. Methods for trapping Sage Grouse in Colorado: Game bird survey. PROJECT NUMBER: COLORADO W-037-R. Colorado Division of Wildlife.
Keywords: Sage Grouse.

Giezantanner, K. I., and W. H. Clark. 1974. The use of western harvester ant mounds as strutting locations by Sage Grouse. Condor 76:218-219.
Keywords: Sage Grouse/Strutting/ARTR/Fire/Water/Ant Mounds/Spring.

Gill, R. B. 1965. Distribution and abundance of a population of Sage Grouse in North Park, Colorado. M.S. thesis. Colorado State University, Ft. Collins, Colorado.
Keywords: Sage Grouse/Distribution-Mapping/Population trends/ARTR/Brood rearing/Hunting/Strutting/Colorado/Nesting/Weather-Climate/Diet/Movement/Mineral-Oil Development/Sagebrush/ARTRTR/ARTRVA/Other shrubs/Understory-forbs/Understory-grasses/Riparian/Meadow/Cropland/Lekking/Summer/Fall/Winter/Year round/Juvenile/Yearling/Adult/Anatomy-Morphology/Behavior/Habitat Use-Selection/Movement-migration/Herbicides-Pesticides/Shrub removal/Predation/Reproduction/Population trends-Lek counts/Research needs/Scale.
***Notes*:** Study of distribution, movements, and general biology of sage grouse in North Park, Colorado, prior to a spraying program (2,4-D) initiated by BLM in 1965, in which at least 20% of the public lands in the area were to be treated. This area supports many leks (>10), with an estimated population of >2,000 sage grouse.

Gill, R. B. 1965. Game bird surveys: Effects of sagebrush control on distribution and abundance of Sage Grouse. Colorado Division of Wildlife. 203 pages.
Keywords: Sage Grouse.

Gill, R. B. 1966. A literature review on the Sage Grouse. Special report no. 6. Colorado Department of Game, Fish and Parks and Colorado Cooperative Wildlife Research Unit. 39 pages.
Keywords: Sage Grouse/Taxonomy/Distribution-Mapping/Behavior/Nesting/Movement/Diet/Habitat Use-Selection/Brood rearing/Weather-Climate/Hunting/Predation/Management/Disease-Parasites.

Gill, R. B. 1966. Weather and Sage Grouse productivity. Game information leaflet no. 37. Colorado Game, Fish and Parks Department. 4 pages.
Keywords: Sage Grouse.

Gill, R B. 1967. Sex and age determination of Sage Grouse from wing characteristics. Game Info. Leaflet 49.

Colorado Game, Fish and Parks Dep., Denver, CO.
Keywords: Sage Grouse/Anatomy-Morphology/Sex/Age.

Gill, R. B., and F. A. Glover. 1965. Daily and seasonal movements of Sage Grouse. Colorado Cooperative Wildlife Research Unit. Technical Paper 3. 6 pages.
Keywords: Sage Grouse/Movement/Colorado/Diet/Habitat Use-Selection/Herbicides-Pesticides/ARTR/Spring /Summer/Fall/Winter.

Girard, G. L. 1935. Life history, habits, and food of the Sage Grouse, *Centrocercus urophasianus*. M.A. thesis. University of Wyoming, Laramie, Wyoming.
Keywords: Sage Grouse.

Girard, G. L. 1937. Life, history, habits, and food of the sage grouse, *Centrocercus urophasianus* Bonaparte. University of Wyoming Publication 3:1-56.
Keywords: Sage Grouse/Wyoming.

Girard, G. L. 1938. Sage Grouse and the state's conservation program. Pages 66-67 *in* University of Idaho Bulletin 33.
Keywords: Sage Grouse/Distribution-Mapping/Hunting/Diet/Nesting/Habitat Use-Selection/Water.

Goebel, J. 1980. Washakie Basin sage grouse study. Rocky Mountain Energy, Denver, CO. Annual Report.
Keywords: Sage Grouse.

Grandison, J., and M. Welch. 1987. Rich Co., Utah. Sage grouse management: trying to save a desperate situation. Roberson, J., Chairman. Fifteenth Sage Grouse Workshop Transactions, of the Western States Sage Grouse Committee; Western Assoc. of Fish and Game Agencies. Midway, UT, 28-30 July, 1987.
Keywords: Sage Grouse.

Grasse, J. E. 1951. Live-trapping and transplanting in Wyoming. Wyoming Wildlife 15:25-28.
Keywords: Sage Grouse.

Gray, G. M. 1967. An ecological study of Sage Grouse broods with reference to nesting, movements, food habits, and sagebrush strip spraying in the Medicine Lodge Drainage, Clark County, Idaho. M.S. thesis. University of Idaho, Moscow, Idaho. 182 pages.
Keywords: Sage Grouse/Nesting/Brood rearing/Movement/Diet/Herbicides-Pesticides/Idaho.

Grayson, D. K. 1976. A note on the prehistoric avifauna of the lower Klamath Basin. Auk 93:830-833.
Keywords: Sage Grouse/Migration/Avifauna/Weather-Climate/Archaeology/Distribution-Mapping.

Greer, R. 1990. Sage Grouse habitat requirements and development. Habitat Extension Bulletin 31. Wyoming Game and Fish Dep., Cheyenne, WY.
Keywords: Sage Grouse/Lekking/Brood rearing/Winter/Fall/Habitat Use-Selection/Habitat Restoration/Water/Fire/Nesting/Wyoming/Sagebrush/Riparian/Environmental Requirements/Movement-migration/Herbicides-Pesticides/Livestock grazing/Water Development/Shrub removal/Scale.

Gregg, M. A. 1991. Use and selection of nesting habitat by sage grouse in Oregon. M.S. thesis. Oregon State University, Corvallis, Oregon.
Keywords: Sage Grouse/Oregon/Habitat Use-Selection/Nesting/Management/Productivity/Distribution-Mapping/ARAR/ARTR/ARTRTR/ARTRVA/ARTRWY/Other sage/Other shrubs/Grasslands/Understory-forbs/Understory-grasses/Meadow/Pinyon-Juniper/Adult/Reproduction.

Gregg, M. A. 2001. Sage Grouse reproductive ecology and habitat associations: applications to management. Pages 8-12 *in* 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001. (World Meeting Number 011 0211).
Keywords: Sage Grouse.

***Notes*:** This is an expanded abstract.

Gregg, M. A., and J. A. Crawford. 1991. Use and selection of nesting habitat by sage grouse in Oregon. Proceedings of the 17th Western States Sage and Columbian Sharp-tailed Grouse Workshop.
Keywords: Sage Grouse/Oregon/Nesting/Habitat use-selection.

Gregg, M. A., J. A. Crawford, and M. S. Drut. 1993. Summer habitat use and selection by female Sage Grouse (*Centrocercus urophasianus*) in Oregon. Great Basin Naturalist 53:293-298.
Keywords: Sage Grouse/Summer/Habitat Use-Selection/Oregon/Population trends/Brood rearing/ARAR/ARTRVA /ARTRWY/ARTRTR/Hart Mountain.
Abstract: Cover types and vegetative characteristics (e.g., grasses, forbs, shrubs) used by female Sage Grouse (*Centrocercus urophasianus*) during summer were compared with available habitat on two study areas in southeastern Oregon. Broodless hens, which constituted 114 of the 125 (91%) radio-marked hens studied, selected big (*Artemisia tridentata* subspp.) and low sagebrush (*A. arbuscula*) cover types at both study areas. At Hart Mountain, broodless hens did not select specific vegetative characteristics within cover types. However, at Jackass Creek, forb cover was greater (P = .004) at broodless hen sites than at random locations. Differences in habitat use by broodless hens between study areas were associated with differences in forb availability. Broodless hens used a greater diversity of cover types than hens with broods. Broodless hens gathered in flocks and remained separate from but near hens with broods during early summer. By early July broodless hens moved to meadows while hens with broods remained in upland habitats.

Gregg, M. A., J. A. Crawford, M. S. Drut, and A. K. Delong. 1994. Vegetational cover and predation of Sage Grouse nests in Oregon. Journal of Wildlife Management 58:162-166.
Keywords: Sage Grouse/livestock grazing/Predation/Nesting/Habitat Use-Selection/Reproduction/Oregon/ARAR /ARTR/Other shrubs/Understory-forbs/Understory-grasses/Pinyon-Juniper/Juvenile/Adult.
Abstract: Because of long-term declines in sage grouse (*Centrocercus urophasianus*) abundance and productivity in Oregon, we investigated the relationship between vegetational cover and nesting by sage grouse in 2 study areas. Medium height (40-80 cm) shrub cover was greater ($P < 0.001$) at nonpredated (mean = 41%, n = 18) and predated (mean = 29%, n = 106) nests than in areas immediately surrounding nests (mean = 15 and 10%, n = 18 and 106, nonpredated and predated, respectively) or random locations (mean = 8%, n = 499). Tall (>18 cm), residual grass cover was greater ($P < 0.001$) at nonpredated nests (mean = 18%) than in areas surrounding nonpredated nests (mean = 6%) or random locations (mean = 3%). There was no difference ($P > 0.05$) in grass cover among predated nests, nest areas, and random sites. However, nonpredated nests had greater ($P < 0.001$) cover of tall, residual grasses (mean = 18%) and medium height shrubs (mean = 41%) than predated nests (mean = 5 and 29% for grasses and shrubs, respectively). Removal of tall grass cover and medium height shrub cover may negatively influence sage grouse productivity.

Grensten, J. J. 1987. Locating Sage Grouse leks from color infrared aerial photography. BLM Technical Note No. 377. Denver Service Center, Springfield, VA. 8 pages.
Keywords: Sage Grouse/Lekking/Habitat Use-Selection/Nesting/Brood rearing/Montana/Photography.

Griner, L. A. 1939. A study of the Sage Grouse, *Centrocercus urophasianus*, with special reference to life history, habitat requirements, and numbers and distribution. M.S. thesis. Utah Agricultural College, Logan, Utah. 111 pages.
Keywords: Sage Grouse.

Grossman, E. 2000. Sage Grouse strut their stuff. California Wildlife 53:40-41.
Keywords: Sage Grouse/Season/Behavior/Distribution-Mapping/Habitat/Intraspecies relationships/Lekking/Orientation/Homing/Status/Reproduction/California.
Abstract: Information is presented on the lekking behavior and pair formation of sage grouse in the western United States. Sage grouse were once found in 16 states and three Canadian provinces. Hunted in nine of eleven states where they remain, their numbers have declined by at least a third since 1985, with some populations down by 45 to 80 percent. Reduction of sage grouse habitat due to agricultural use has affected

the species. Despite a recent increase in numbers due to good rainfall, California's sage grouse populations keep declining.

Grover, G. 1944. Disease among sage grouse. Colorado Conservation Comments 7(1):14-15.
Keywords: Sage Grouse/Disease-Parasites.

Gullion, G. W. 1957. Precocial strutting in Sage Grouse. Condor 59:269.
Keywords: Sage Grouse/Strutting/Population trends/Nevada/Behavior/Precocial.

Gullion, G. W. 1966. A viewpoint concerning the significance of studies of game bird food habits. Condor 68:372-376.
Keywords: Sage Grouse/Diet/Water/Hunting/Population trends.

Gullion, G. W., and G. C. Christensen. 1957. A review of the distribution of gallinaceous game birds in Nevada. Project Number: NV W-008-R. Condor 59(2):128-138.
Keywords: Sage Grouse/Distribution-Mapping/Nevada/Agriculture/Meadow/Habitat Use-Selection/ARTR/Pinyon-Juniper/Hunting/ARTR/Other sage.
***Notes*:** Reviews status of all gallinaceous birds in the state, including Sage Grouse. Provides a map of locations of "new records" and published records. Most of these are new. States that the sagebrush habitat type "provides food and cover for Sager Grouse over 29,000 square miles of the northern and eastern parts of the state.".

Guthrey, F. S. 1996. Upland gamebirds. Pages 59-69 *in* P. R. Krausman, editor. Rangeland wildlife. The Society for Range Management.
Keywords: Sage Grouse/Livestock grazing/Habitat management.
***Notes*:** Considers sage grouse a species for which livestock grazing management issues are "contextual," meaing that the impacts can be negative, positive, or neutral, depending on the context in which it occurs.

Hagen, C. A., N. C. Kenkel, D. J. Walker, R. K. Baydack, and C. E. Braun. 2001. Fractal-based spatial analysis of radiotelemetry data. J. J. Millspaugh and J. M. Marzluff, editors. Academic Press, San Diego, CA. 187 pages.
Keywords: Sage Grouse/Scale/Movement/Radiotelemetry/Models.

Hamerstrom, F., and F. Hamerstrom. 1961. Status and problems of North American grouse. Wilson Bulletin 73:284-294.
Keywords: Sage Grouse/Population trends/Mortality-Survival/Hunting/Fire/Diet/Livestock grazing/Agriculture/Management/Water.

Hamerstrom, F., and F. Hamerstrom. 1963. The grouse symposium in review. Journal of Wildlife Management 27(4):869-887.
Keywords: Sage Grouse/Diet/Behavior/Reproduction/Trapping/Movement/Habitat Use-Selection/Population trends/Weather-Climate/Predation/Hunting/Habitat Restoration/Recreation.

Hanf, J. M., P. A. Schmidt, and E. B. Groshens. 1994. Sage Grouse in the high desert of central Oregon: Results of a study, 1988-1993. Bureau of Land Management. 57 pages.
Keywords: Sage Grouse/Reproduction/Nesting/Brood rearing/Summer/Winter/Distribution-Mapping/Weather-Climate/Lekking/Population trends/Habitat Use-Selection/Diet/Oregon.

Hanna, W. C. 1936. Sage hen breeding in California. Condor 38:38.
Keywords: Sage Grouse/Reproduction/California/Nesting/Sagebrush.

Harper, H. T. 1970. Operational management plan for Sage Grouse. California Department of Fish and Game.
Keywords: Sage Grouse/Hunting/Habitat Use-Selection/Population trends/Recreation/Water/Management.

Hartzler, J. E. 1972. Analysis of Sage Grouse lek behavior. Montana Cooperative Wildlife Research Unit. 246 pages.
Keywords: Sage Grouse.

Hartzler, J. E. 1972. An analysis of Sage Grouse lek behavior. Ph.D. dissertation. University of Montana, Missoula, Montana.
Keywords: Sage Grouse/Behavior/Lekking/Yearling/Adult/Montana/ARTR/Grasslands/Anatomy-Morphology/Distribution-Mapping/Movement/Population trends-Lek counts/Scale.
***Notes*:** Three-year study of behavior of male and female sage grouse on a lek in Montana. Quantified many behaviors to test several hypotheses about hen selection of mates and social organization of males. Recorded timing of lek attendance, within a day and across the season. Behavior found to be consistent with classic concept of sexual territoriality. However, did not find evidence of dominance hierarchy among males. Never observed yearlings copulating, and only a few males performed most of the copulations. Concluded that hens selected mates based on level of behavioral activity on the arena. Dissertation includes maps of individual male territories on the arena during the lekking season.

Hartzler, J. E. 1974. Predation and the daily timing of Sage Grouse leks. Auk 91:532-536.
Keywords: Sage Grouse/Predation/Lekking/Montana/Adult/Behavior.

Hartzler, J. E., and D. A. Jenni. 1988. Mate choice by female Sage Grouse. Pages 240-269 *in* A. T. Bergerud and M. W. Gratson, editors. Adaptive strategies and population ecology of northern grouse. Volume I: Population studies. University of Minnesota Press, Minneapolis.
Keywords: Sage Grouse/Behavior/Montana/ARTR/Habitat Use-Selection /Adult/Yearling/Reproduction/Lekking.

Hayden-Wing, L. D., D. B. Costain, J. L. Hull, M. R. Jackson, and T. B. Segerstrom. 1986. Movement patterns and habitat affinities of a Sage Grouse population in northeastern Wyoming. Pages 207-226 *in* R. D. Comer, T. G. Baumann, P. Davis, J. W. Monarch, J. Todd, S. VanGytenbeek, D. Wills, and J. Woodling, editors. Issues and technology in the management of impacted western wildlife: proceedings of a national symposium. Glenwood Springs, Colorado, February 4-6, 1985. Thorne Ecological Institute.
Keywords: Sage Grouse/Movement/Wyoming/Year round/Seasonal/Habitat Use-Selection/Lekking/Nesting/Brood rearing/Reproduction.

Hays, D. W., M. J. Tirhi, and D. W. Stinson. 1998. Washington State status report for the Sage Grouse. Washington Department of Fish and Wildlife , Olympia, WA. 62 pages.
Keywords: Sage Grouse/Distribution-Mapping/Behavior/Diet/Water/Mortality-Survival/Habitat Use-Selection/Reproduction/Spring/Summer/Fall/Winter/Lekking/Nesting/Brood rearing/Predation/Hunting/Weather-Climate/Herbicides-Pesticides/Population trends/Habitat Restoration/Fire/Livestock grazing.

Heath, B. J., R. Straw, S. H. Anderson, and J. Lawson. 1997. Sage Grouse productivity, survival, and seasonal habitat use near Farson, Wyoming. Project Completion Report, Laramie, WY. Wyoming Game and Fish Department.
Keywords: Sage Grouse.

Heath, B. J., R. Straw, S. H. Anderson, J. Lawson, and M. Holloran. 1998. Sage-Grouse productivity, survival, and seasonal habitat use among three ranches with different livestock grazing, predator control, and harvest management practices. Completion Report, Wyoming Game and Fish Department. Rawlins, Wyoming, April 1, 1996 to June 30, 1998. Wyoming Game and Fish Department.
Keywords: Sage Grouse/Predation/Livestock grazing/Wyoming/Reproduction/Mortality-Survival/Habitat Use-Selection/Hunting/Nesting/Brood rearing/Movement.

Hein, D., P. Lehner, R. A. Ryder, J. Bourassa, L. Kolz, C. E. Braun, S. Emmons, H. Funk, K. Giesen, S. McElderry, B. Petersen, S. Porter, T. Schoenberg, and J. Wagner. 1980. Evaluation of the effects of changes in hunting regulations on Sage Grouse populations: evaluation of census of females. Job Completion Report W-37-R-33, WP-3, J-9c. Colorado Division of Wildlife. 203 pages.

Keywords: Sage Grouse/Reproduction/Nesting/Hunting/Movement/Colorado/Distribution-Mapping/ARTRVA/ARCA/Behavior/Lekking.

Hemker, T. P., and C. E. Braun. 2001. Innovative approaches for development of conservation plans for sage grouse: examples from Idaho and Colorado. Transactions of the North American Wildlife and Natural Resources Conference 66:456-463.
Keywords: Sage Grouse.
Abstract: Sage-grouse (*Centrocercus urophasianus, C. minimus*) historically occurred throughout sagebrush (*Artemisia* spp.) dominated rangelands in western North America (Aldrich 1963, Johnsgard 1973). With settlement and continued development of sagebrush-steppe rangelands for cultivated crops, domestic livestock grazing, reservoirs, mining, home sites and other human uses (Patterson 1952, Braun 1998), substantial areas of former habitat can no longer support either the overall distribution or former abundance (Connelly and Braun 1997). Reduction in distribution and abundance has been most pronounced at the periphery of the species' range and sage-grouse no longer occur in Arizona, British Columbia, Kansas, Nebraska, New Mexico or Oklahoma (Johnsgard 1973, Braun 1998). Preparation of conservation plans similar to those developed to benefit sage-grouse in Idaho and Colorado is now underway in most states and provinces where sage-grouse persist. While the process described in this paper is time consuming and, at times, inefficient and frustrating, it is feasible and will produce useful products and understanding. We are convinced that locally produced and supported conservation plans have the best chances for being implemented quickly. Sage-grouse will persist in viable numbers over significant portions of their former range only by obtaining local ownership of the problem, understanding of the issues and timely implementation of conservation actions.

Henshaw, H. W. 1880. Ornithological report from observations and collections made in portions of California, Nevada, and Oregon. Pages 282-335 *in* G. N. Wheeler, editor. Annual Report on the geographical surveys of the United States west of the 100th meridian. U.S. Geological Survey, Washington, D.C.
Keywords: Sage Grouse/Oregon/Nevada/California.

Herman, C. M. 1963. Disease and infection in the Tetraonidae. Journal of Wildlife Management 27(4):850-854.
Keywords: Sage Grouse/Disease-Parasites/Mortality-Survival/Research needs.

Hernandez, E. J. 1987. Fire in the big sagebrush type: Potential impacts on sage grouse. J. Roberson, editor. Proceedings of the 15th Biennial Western States Sage Grouse Workshop. Midway, UT; 28-30 July, 1987.
Keywords: Sage Grouse/Fire.

Hickey, J. J. 1955. Some American population research on gallinaceous birds. Pages 326-396 *in* E. A. Wolfson, editor. Recent studies in avian biology. University of Illinois Press, Urbana.
Keywords: Sage Grouse/Roads/Weather-Climate/Population trends/Mortality-Survival/Hunting/Reproduction/Nesting/Juvenile/Adult/Behavior/Movement/Predation/Diet/Habitat Use-Selection.

Higby, L. W. 1969. Design and use of the bumper mounted cannon net trap as a trapping technique for Sage Grouse. Pages 99-103 *in* 6th Biennial Western States Sage Grouse Committee Proceedings. 6.
Keywords: Sage Grouse/Trapping/Models/Techniques-Methods.

Higby, L. W. 1969. A summary of the Longs Creek sagebrush control project [and effects on sage grouse]. Pages 164-168 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Wyoming/Strutting/ Winter/Meadow/Grasslands/Herbicides-Pesticides.

Higgins, L. A., J. A. Hill, J. R. Young, and R. D. Howard. 1997. Female social behaviour on Sage Grouse *Centrocercus urophasianus* leks in the Gunnison Basin, Colorado, USA. Wildlife Biology 3:275.
Keywords: Sage Grouse/Behavior/Lekking/Movement-Migration/Sexual selection/Gunnison Sage-Grouse.
***Notes*:** Abstract only.

Hjertaas, D. G. 1995. Observations of hybrid sage x sharp-tailed grouse in Saskatchewan. Blue Jay 53:144-147.
Keywords: Sage Grouse/Saskatchewan/Population trends/Lekking/Behavior/Taxonomy.

Hjorth, I. 1970. Reproductive behaviour in Tetraonidae with special reference to males. Viltrevy 7:432-573.
Keywords: Sage Grouse/Reproduction/Behavior/Distribution-Mapping/Habitat Use-Selection/Livestock grazing/Hunting/Population trends/Territoriality/Anatomy-Morphology/Physiology.

Hjorth, I. 1976. The divalent origin and adaptive radiation of grouse songs . Ornis Scandinavica 7:147-157.
Keywords: Sage Grouse/Behavior/Anatomy-Morphology/Songs/Taxonomy/Habitat Use-Selection.

Hoffman, D. M. 1977. Sagebrush and Sage Grouse in Moffat and western Routt Counties. Pages 33-35 *in* Colorado Game Res. Rev.; 1975-1976.
Keywords: Sage Grouse/Distribution-Mapping/Population trends/Habitat Use-Selection/Brood rearing/Hunting/Strutting.

Hoffman, D. M. 1979. Game bird survey: Investigations of the distribution and status of sagebrush and Sage Grouse in the Moffat County area. Pages 95-162 *in* Job Final Report, Project number: COLO. W-037-R-32/WK.PL.03/JOB 10. Colorado Division of Wildlife. 162 pages.
Keywords: Sage Grouse/Colorado/Distribution-Mapping/Winter/ARTR /Nesting/Brood rearing/Herbicides-Pesticides/Hunting/Agriculture/Habitat Use-Selection/Population trends.

Hoffman, D. M. 1979. Investigations of the distribution and status of sagebrush *Artemisia* sp. and sage grouse in the Moffat County area. Pages 97-162 *in* .
Keywords: Sage Grouse/Colorado.

Hoffman, R. W. 1981. Volunteer collection station for use in obtaining grouse wing samples. Wildlife Society Bulletin 9:180-184.
Keywords: Sage grouse/Colorado/Hunting/Wings/Management/Anatomy-Morphology.
Abstract: Volunteer wing collection stations were tested in Middle Park, Colorado during 1975-79 as an alternative means of inexpensively increasing collected grouse wing samples. Of 3,791 blue grouse (*Dendragapus obscurus*) and sage grouse (*Centrocercus urophasianus*) wings collected, 3,213 (84.7%) were deposited in sing stations. Less time, manpower, and expense were required to operate volunteer wing stations for the entire season than for check stations on opening weekend. Besides the basic population data derived from wing analyses, other important management information obtained included identification of major harvest areas, evaluation of hunter success, and assessment of harvest distribution over time.

Hoffman, R. W., and C. E. Braun. 1975. A volunteer wing collection station. Game Information Leaflet No. 101. Colorado Division of Wildlife . 3 pages.
Keywords: Sage Grouse/Hunting/Nesting/Mortality-Survival/Wings.

Hoffman, R. W., and B. S. Cade. 1982. Occurrence of Sage Grouse above treeline. Journal of the Colorado Field Ornithologists 16:22-23.
Keywords: Sage Grouse/Diet/Habitat Use-Selection/Colorado/Treeline/Summer.

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Keywords: Sage Grouse/Washington/Military/Distribution-Mapping/Movement/Habitat Use-Selection/Habitat Restoration/Nesting/ARTR/ Livestock grazing/Fire/Herbicides-Pesticides/Water/Diet/Lekking/Brood rearing/Mortality-Survival.

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Keywords: Sage Grouse.

Holloran, M. J. 1999. Sage Grouse (*Centrocercus urophasianus*) seasonal habitat use near Casper, Wyoming. M.S. thesis. University of Wyoming. 128 pages.
Keywords: Sage Grouse/Habitat Use-Selection/Wyoming/Nesting/Brood

rearing/Radiotelemetry/Predation/Mortality-Survival/Hunting/Livestock grazing/Herbicides-Pesticides/Weather-Climate/Fire.

Homer, C. G., T. C. Edwards, Jr., R. D. Ramsey, and K. P. Price. 1993. Use of remote sensing methods in modeling Sage Grouse winter habitat. Journal of Wildlife Management 57:78-84.
Keywords: Sage Grouse/Models/Habitat Use-Selection/ARTR/ARTRTR /ARTRWY/Weather-Climate/Utah.
Abstract: Populations of Rich County, Utah sage grouse (*Centrocercus urophasianus*) have been declining in recent years. Because loss of winter habitat is a suspected factor, we used Landsat Thematic Mapper data to model structural and compositional attributes of sage grouse winter habitat over a 2548-km super(2) area in Rich County, 1989-90. Of the 7 shrub and 1 no-shrub classes delineated from the Thematic Mapper, sage grouse preferred 3, avoided 3, and demonstrated no preference for the remaining 2. To determine if the model could be extrapolated to other unsampled areas, we tested model validity with 2 independent data sets from the northern and southern ends of the county. Model fit was excellent (P = 0.984). The successful development of this Geographic Information System model demonstrates the future capability of remote sensing/Geographic Information System applications to model structural and compositional attributes of wildlife habitat over large spatial scales.

Honess, R. F. 1942. Sage Grouse coccidiosis not transmissible to chickens. Poultry Science 21:560.
Keywords: Sage Grouse/Coccidia/Wyoming/Taxonomy/Disease-Parasites.

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Keywords: Sage Grouse/Disease-Parasites/Tritrichomonad.

Honess, R. F. 1968. Part 2. Coccidial species infecting the sage grouse. Sage grouse coccidiosis. Pages 23-33 *in* History of an epizootic in sage grouse, Science Monograph 14. University of Wyoming Agricultural Experiment Station, Laramie.
Keywords: Sage Grouse/Eimeria/Disease-Parasites/Physiology.

Honess, R. F., and W. J. Allred. 1942. Sage Grouse studies. Part I. Structure and functions of the neck muscles in inflation and deflation of the esophagus in the Sage Grouse. Pages 5-12 *in* Wyoming Game and Fish Department Bulletin No. 2. Cheyenne, WY.
Keywords: Sage Grouse/Anatomy-Morphology/Physiology/Strutting/Reproduction.

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Keywords: Sage Grouse/Eimeria/Oocysts/Tetraonidae/Disease-Parasites.

Honess, R. F., and G. Post. 1968. History of an epizootic. Part 1: Sage Grouse coccidiosis. Pages 4-22 *in* Science Monograph 14. University of Wyoming Agricultural Experiment Station, Laramie.
Keywords: Sage Grouse/Disease-Parasites/Coccidia/Cropland/Distribution-Mapping/Wyoming/Colorado/Sagebrush/Year-round/Juvenile/Yearling/Adult.

Hornaday, W. T. 1916. Save the sage grouse from extinction, a demand from civilization to the western states. New York Zoological Park Bulletin 5:179-219.
Keywords: Sage Grouse/Roads/Recreation/Hunting/Distribution-Mapping/Mortality-Survival/Extinction/Management.

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Keywords: Sage Grouse/Oregon/Strutting/ Behavior/Water.

Howard, H. 1946. A review of the Pleistocene birds of Fossil Lake, Oregon. Contributions to paleontology. 551:141-195. Carnegie Inst. Washington Pub.

Keywords: Sage Grouse.

Howard, H. 1952. The prehistoric avifauna of Smith Creek Cave, Nevada, with a description of a new gigantic raptor. Bulletin of the Southern California Academy of Science 51(2):50-53.
Keywords: Sage Grouse/Avifauna/Nevada/Predation/Taxonomy.

Howard, H., and A. H. Miller. 1933. Bird remains from cave deposits in New Mexico. Condor 35:15-18.
Keywords: Sage Grouse/New Mexico/Predation/ Archaeology.

Hulet, B. V. 1983. Selected responses of sage grouse to prescribed fire, predation, and grazing by domestic sheep in southeastern Idaho. M.S. thesis. Brigham Young University, Provo, Utah.
Keywords: Sage Grouse/Idaho/Fire/Predation/Livestock grazing/Behavior/Movement/Habitat Use-Selection/Weather-Climate/Nesting/Brood rearing.

Hulet, B. V., J. T. Flinders, J. S. Green, and R. B. Murray. 1986. Seasonal movements and habitat selection of Sage Grouse in southern Idaho. Pages 168-175 *in* E. D. McArthur and B. L. Welch, editors. Proceedings of the symposium on the biology of *Artemisia* and *Chrysothamnus*, 1984 July 9-13; Provo, UT. General Technical Report INT-200. USDA Forest Service, Intermountain Research Station, Ogden, UT.
Keywords: Sage Grouse/Habitat Use-Selection/Idaho/Predation/Weather-Climate/Brood rearing/Nesting/Lekking/Migration/Distribution-Mapping.
Abstract: In 1980 and 1981, 31 sage grouse hens were captured at the U.S. Sheep Experiment Station, Dubois, ID, and fitted with radio transmitters to document movement and selection of habitat. Similarities between habitat by months and areas were determined by discriminate analysis. Data were gathered on the effects of predation and weather on nesting and brood production. The sage grouse were found to be (160.9 air/km) between nesting, summering, and wintering areas, and then in 1981 nested within 82 ft (25 m) of her 1980 nest.

Hupp, J. W. 1987. Sage Grouse resource exploitation and endogenous reserves in Colorado. Ph.D. dissertation. Colorado State University. 43 pages.
Keywords: Sage Grouse/Winter/Habitat Use-Selection/Colorado/Distribution-Mapping/ARTRVA.
Abstract: Winter habitat use and foraging ecology of sage grouse (*Centrocercus urophasianus*) were studied in the Gunnison Basin, Colorado between 1985 and 1986. Sage grouse foraging activity (N = 157 feeding sites) was not proportionally distributed (P <0.001) among topographic features. Topographic distribution of feeding activity was influenced by physiographic variation in shrub structure of mountain big sagebrush (*Artemisia tridentata vaseyana*) relative to snow depth. Most foraging (45-64% of feeding sites) occurred in drainages and on southwest slopes where sagebrush exposure above snow was maximized. Sage grouse rarely foraged (1-4% of feeding sites) on northeast aspects with slopes >5 degrees because exposed sagebrush was not widely available. Distribution of foraging was not influenced by topographic variation in crude protein or monoterpene concentrations of mountain big sagebrush. Within feeding sites, sage grouse did not selectively forage on plants with high crude protein or low monoterpene concentrations. Sagebrush structural characteristics at 87 winter feeding sites were compared to 100 random locations. Sagebrush structural measures were not useful to identify winter habitat in the mesic terrains where sagebrush removal is most likely to occur. Spring lipid reserves of adult male sage grouse were determined from carcass analysis of 96 individuals collected from 2 Colorado populations between 1983 and 1985. Spring lipid reserves were affected by winter severity. Males depleted lipid reserves during the courtship season. Males in Jackson County mobilized 125 - 130 g of fat during courtship while males in Gunnison County used an average of 66 g. Strutting display of adult males were quantified in Jackson and Gunnison counties in 1986. Slower display rates, lack of evening display, greater variance in male attendance at leks suggest reduced energetic investment in courtship among males in Gunnison County. However, behavioral differences could not be attributed to unequal size of endogenous reserves as lipid deposits (N = 10 adult males/population) during early courtship were similar between populations in 1986. Lipid catabolism likely provides <10% of adult male energetic needs during courtship. Lipids may primarily be mobilized during early courtship when male displays are most vigorous due to the presence of females on leks, and when male reproductive success is determined.

Hupp, J. W. 1987. A test of the relationship between sage grouse lipid reserves and courtship reserves. J.

Roberson, editor. Proceedings of the 15th Biennial Western States Sage Grouse Workshop. Midway, UT; 28-30 July, 1987.
Keywords: Sage Grouse.

Hupp, J. W. 1987. Winter distribution, foraging ecology, and habitat use of sage grouse in the Gunnison Basin, Colorado. J. Roberson, editor. Proceedings of the 15th Biennial Western States Sage Grouse Workshop. Midway, UT; 28-30 July, 1987.
Keywords: Sage Grouse/Gunnison Sage-Grouse/Colorado.

Hupp, J. W. 1988. Avian research: Sage Grouse resource exploitation and endogenous reserves in Colorado. Project number: CO W-152-R (01-03-045)/Work Plan 03/Job 15. Colorado Division of Wildlife. 104 pages.
Keywords: Sage Grouse/Colorado/Winter/ARTRVA/Diet/Habitat Use-Selection/Behavior/Endogenous Reserves/Lekking.

Hupp, J. W., and C. E. Braun. 1984. Spring changes in lipid reserves of adult male Sage Grouse. Journal of the Colorado-Wyoming Academy of Science 16:34.
Keywords: Sage Grouse/Physiology.

Hupp, J. W., and C. E. Braun. 1989. Endogenous reserves of adult male Sage Grouse during courtship. Condor 91:266-271.
Keywords: Sage Grouse/Reproduction/Adult/ Behavior/Physiology.
Abstract: Lipid reserves of 116 adult (> 1 year of age) male Sage Grouse (*Centrocercus urophasianus*) were evaluated in two Colorado populations during lek attendance between 1983 and 1986. Lipid reserves following winters (November-March) with snowfalls < 124 cm were larger than reserves following winters with snowfalls > 160 cm. Lipid reserves during early courtship were larger than reserves during late courtship. Males catabolized lipids during courtship but did not use breast muscle protein. An adaptive advantage to fat deposition before breeding may exist if males primarily mobilize lipids during the peak period of female lek attendance when male reproductive success is determined, or during periods when thermoregulatory costs are high due to low ambient temperatures or wind.

Hupp, J. W., and C. E. Braun. 1989. Topographic distribution of Sage Grouse foraging in winter. Journal of Wildlife Management 53:823-829.
Keywords: Sage Grouse/Distribution-Mapping/ARTRVA/Habitat Use-Selection/Winter/Diet/ARTRWY.
Abstract: We studied sagebrush (Artemisia spp.) exposure above snow and topographic distribution of sage grouse (*Centrocercus urophasianus*) foraging sites in winter (Jan-Mar) in the Gunnison Basin, Colorado. Sage grouse feeding activity (n = 157 foraging sites) was not proportionally distributed among 5 topographic categories ($P < 0.001$). Most (46 and 75% of foraging sites in 1985 and 1986, respectively) feeding activity occurred in drainages and on slopes with south or west aspects. Use of slopes with north or east aspects was less than expected. Distribution of sage grouse feeding activity was influenced by topographic variation in snow depth and mountain big sagebrush (A. tridentata vaseyana) exposure above snow. During a severe winter in 1984, < 10% of the sagebrush vegetation in the Gunnison Basin was exposed above snow and available to sage grouse. During milder winters in 1985 and 1986, exposure of sagebrush was 84 and 79%, respectively. We recommend that sagebrush be maintained in drainages and on slopes with south or west aspects.

Hupp, J. W., and C. E. Braun. 1991. Geographic variation among Sage Grouse in Colorado. Wilson Bulletin 103:255-261.
Keywords: Sage Grouse/Anatomy-Morphology/Population trends/Distribution-Mapping.

Idaho Department of Fish and Game. 1997. Idaho Sage Grouse management plan. Idaho Department of Fish and Game, Boise ID.
Keywords: Sage Grouse/Habitat Use-Selection/Brood rearing/Summer/Winter/Management/Idaho/Lekking/Reproduction/Fire/Herbicides-Pesticides/Agriculture/Seeding forage/Livestock grazing/Population trends/Spring/Hunting/Habitat Restoration.

Idaho Department of Fish and Game. 1998. Sage Grouse: a part of Idaho's high desert heritage. Idaho Dept. of Fish and Game, Upland Game Program, Boise, ID. 6 pages.
Keywords: Sage Grouse/Idaho/Mortality-Survival/Reproduction/Fire/Weather-Climate/Livestock grazing/Predation/Herbicides-Pesticides/Hunting.
***Notes*:** Brief summary of issues and biology of sage grouse in Idaho for the layperson, with colorful graphics and basic text.

Ihli, M., P. Sherbenou, and C. W. Welch. 1973. Wintering sage grouse in the upper Big Lost River. Pages 73-80 *in* Journal of the Idaho Academy of Sciences.

Keywords: Sage Grouse/Livestock grazing/Agriculture/Idaho/Herbicides-Pesticides/Behavior/Diet/ARTR/Other shrubs/Understory-grasses/Cropland/Crested Wheatgrass/Winter/Behavior/Habitat Use-Selection/Shrub removal.

Janson, R. G. 1952. Prairie grouse population trends. South Dakota Conservation Digest 19:2-5.
Keywords: Sage Grouse.

Jarvis, J. M. 1970. Statewide wildlife management surveys and investigations: Sage Grouse research. Utah State Department of Fish and Game. 42 pages.
Keywords: Sage Grouse.

Jarvis, J. M. 1973. The Parker Mountain Sage Grouse study. Pages 345-352 *in* Proceedings of the 53rd Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Population trends/ARTR/Nesting/Mortality-Survival/Winter/Brood rearing/Hunting/Weather-Climate/Utah.

Jarvis, J. M. 1973. Sage Grouse in south central Utah. Pages 47-48 *in* Proceedings of the 8th Biennial Western States Sage Grouse Workshop, Lewistown, MT. 8.
Keywords: Sage Grouse/Utah/Strutting/Mating/Weather-Climate/Juvenile/Nesting/Habitat Use-Selection.

Jenni, D. A. 1982. Sage Grouse. Pages 66-67 *in* D. E. Davis, editor. Handbook of census methods for terrestrial vertebrates.
Keywords: Sage Grouse/Lekking/Dispersal/ Nesting/Brood rearing.

Jenni, D. A., and J. E. Hartzler. 1978. Attendance at a Sage Grouse lek: Implications for spring censuses. Journal of Wildlife Management 42:46-52.
Keywords: Sage Grouse/Lekking/Montana/Attendance/Anatomy-Morphology.

Johnsgard, P. A. 1973. Grouse and quails of North America. University of Nebraska Press, Lincoln, Nebraska. 553 pages.
Keywords: Sage Grouse.

Johnsgard, P. A. 1983. The grouse of the world . University of Nebraska Press, Lincoln, Nebraska.
Keywords: Sage Grouse/Reproduction/Mortality-Survival/Habitat Use-Selection/Hunting/Recreation/Distribution-Mapping/Nesting/Brood rearing/Diet/Movement/Population trends/Sagebrush/ARCA/ARTR/Other sage/Lekking/Winter/Year-round/Juvenile/Yearling/Adult/Anatomy-Morphology/Behavior/Physiology/Environmental Requirements/Movement-migration/Herbicides-Pesticides/Predation/Weather-Climate/Taxonomy.
***Notes*:** This comprehensive book deals with all grouse species of the world. Initial chapters summarize current knowledge (comparative biology) of such topics as behavior, taxonomy, physiology, and population dynamics. References to sage grouse are included in these chapters. There is also a separate species account for sage grouse, which includes a distribution map. Tables and appendices include useful information summarizing data from current literature, such as mortality rates, clutch sizes, estimated recent harvests, and sex and age ratios.

Arena behavior of sage grouse believed to have evolved independently of prairie grouse. Sage grouse

exhibit the most pronounced size dimorphism of any North American grouse, the display areas have a larger average number of participating males, and the central territories tend to be relatively small. The species likely represents the "ultimate stage in evolutionary trends discernible through the entire group." It is ecologically isolated from other grouse species and hybridizes only rarely; thus, its very complex behavior seems to be the result of intraspecific selective pressures.

Species likely originated in western North America, and may be more closely related to blue grouse than adult plumage patterns suggest. Cautions that hunting may play bigger role in population dynamics than believed, especially for "marginal populations." .

Johnsgard, P. A. 2002. Grassland grouse and their conservation. Smithsonian Institution Press, Washington, D. C. 168 pages.
Keywords: Sage Grouse/Sharp-tailed Grouse/Gunnison Sage-Grouse/Conservation/Habitat Loss/Hunting/Lesser Prairie Chicken.
***Notes*:** Book review in Smithsonian catalog states: "Johnsgard argues that habitat loss and excessive hunting are major factors contributing to the decline of each species, particularly the lesser prairie-chicken and the Gunnison sage-grouse, which have been proposed for threatened federal status.".

Johnson, G. D. 1987. Effects of rangeland grasshopper control on Sage Grouse in Wyoming. M.S. thesis. University of Wyoming, Laramie, Wyoming. 65 pages.
Keywords: Sage Grouse/Wyoming/Brood rearing/Juvenile/Diet/Herbicides-pesticides.
***Notes*:** Study had 2 objectives: to evaluate the importance of insects in the diets of captive Sage Grouse chicks, and to evaluate effects of grasshopper control on wild Sage Grouse populations using brood surveys. Although malathion is not very toxic to Sage Grouse and other birds, it is highly toxic to insects, thus may indirectly harm Sage Grouse through the reduced availability of food, especially for juvenile grouse. The introduction includes a thorough review of effects of malathion on birds and insects. Chicks and eggs were collected around 3 leks in Albany Co., WY for the diet study. Brood surveys were conducted in 2 sprayed areas: a 61,000 ha area sprayed near Casper, WY in summer 1985, and 8,400 ha sprayed near Lander, WY in summer 1986. Studies with captive grouse chicks showed high dependence on insects for food, especially during the first 3 weeks of life. Although brood sizes were lower in the sprayed vs. unsprayed area near Casper, the control differed somewhat in habitat, with more sagebrush and less irrigated land. In the site near Lander, there was no observed difference in brood size between sprayed and unsprayed areas, however, there was an influx of broods into the sprayed area after spraying. There were no replicates at either site. Although spraying appeared to reduce brood counts, there is also a problem with grasshoppers removing substantial proportions of the rangeland vegetation during the study. Author's recommendations: 1) use of IPM, with biological controls, as an alternative to malathion; 2) delaying spraying or other forms of grasshopper control as long as possible in the summer, which will allow chicks to develop and thus be less affected by spraying as their diets switch to more vegetation; 3) do not spray in riparian areas; and 4) keep spray areas as small as possible.

Johnson, G. D., and M. S. Boyce. 1990. Feeding trials with insects in the diet of Sage Grouse chicks. Journal of Wildlife Management 54:89-91.
Keywords: Sage Grouse/Diet/Nesting/Mortality-Survival.
Abstract: We evaluated the influence of insect reductions on survival of sage grouse (*Centrocercus urophasianus*) chicks with 148 captive individuals aged 2-45 days when treatment began. Captive sage grouse chicks < 21 days old needed insects for survival and development, whereas birds > 21 days old required insects for optimum development. Quantity of insects in the diet was correlated with sage grouse chick survival and growth.

Johnson, G. D., and M. S. Boyce. 1991. Survival, growth, and reproduction of captive-reared Sage Grouse. Wildlife Society Bulletin 19:88-93.
Keywords: Sage Grouse/Behavior/Diet/Brood rearing/Mortality-Survival/Weather-Climate/ Reproduction.

Johnson, K. H., and C. E. Braun. 1999. Viability and conservation of an exploited Sage Grouse population. Conservation Biology 13:77-84.
Keywords: Sage Grouse/Conservation/Habitat change/Hunting/Management/Population trends/Reproduction/Mortality-Survival.

Abstract: We analyzed the viability of the Sage Grouse (*Centrocercus urophasianus*) population of North Park, Colorado, to evaluate its supposed decline due to hunting pressure and habitat degradation. Demographic data from 23 years of surveys were used to parameterize a post-breeding, female-based projection matrix with three life stages: juveniles, yearlings, and adults. The population was found to be approximately stable or in decline only if immigration and apparent surveying errors were factored from the data set. Adult and juvenile survival and adult and juvenile reproduction, respectively, were identified as the most limiting demographic factors. Empirical evidence from designed experiments with Sage Grouse has shown that these demographic factors respond markedly to habitat manipulations, especially brush manipulation. Several plausible management scenarios were evaluated with 100-year population projections generated through Monte Carlo simulation (1000 iterations), sampling from a normal probability distribution entraining the observed variability in each demographic parameter (95% confidence limits). Habitat manipulations to achieve moderate levels (similar to 15% canopy cover) of sagebrush (Artemisia tridentata) are recommended. Regression analyses with power tests showed correspondence between hunting mortality and total mortality for juveniles and adults. Provided that habitat manipulations improve the survival of juveniles and adults, population viability may be conserved without reducing harvest by hunters.

Johnson, L. L. 1989. Field investigations of the lek mating system in sage grouse. M.S. thesis. University of Wyoming. 41 pages.
Keywords: Sage Grouse.

Johnson, L. L., and M. S. Boyce. 1991. Female choice of males with low parasite loads in Sage Grouse. Pages 377-388 *in* J. E. Loye and M. Zuk, editors. Bird-Parasite interactions: Ecology, evolution, and behaviour. Oxford Ornithological Series 2.
Keywords: Sage Grouse/Behavior/Lekking/Reproduction/Distribution-Mapping/Predation/ Disease-Parasites.

Jones , R. E. 1968. A board to measure cover used by prairie grouse . Journal of Wildlife Management 33(1):28-31.
Keywords: Sage Grouse/Techniques-Methods/Cover.
***Notes*:** Article does not mention sage grouse, only Columbian sharp-tailed grouse. Compares a cover board developed for sharp-tails with other cover board designs.

June, J. W. 1961. Game bird survey: Sage Grouse population trend study. Pages 1-109 *in* Wyoming Game and Fish Commission. 109 pages.
Keywords: Sage Grouse/Population trends/Brood rearing/Hunting/Strutting/Habitat Use-Selection/Recreation/Weather-Climate/Movement/Distribution-Mapping/Herbicides-Pesticides/Wyoming.

June, J. W. 1963. Wyoming Sage Grouse population measurement. Pages 206-211 *in* Proceedings of the 43rd annual conference of the Western Association of State Game and Fish Commissioners. Wyoming Game and Fish Department.
Keywords: Sage Grouse/Population trends/Wyoming/Winter/Distribution-Mapping/Movement/Hunting/Reproduction/Strutting/Brood rearing/Mortality-Survival.

June, J. W. 1969. Man-made waterholes - guzzlers and Sage Grouse use. Pages 125-127 *in* Proc eedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Water/Weather-Climate/Habitat Use-Selection.

Kahn, N. W., C. E. Braun, J. R. Young, S. Wood, D. R. Mata, and T. W. Quinn. 1999. Molecular analysis of genetic variation among large- and small-bodied Sage Grouse using mitochondrial control-region sequences. Auk 116:819-824.
Keywords: Sage Grouse/Genetics/Anatomy-Morphology/Distribution-Mapping.
Abstract: Sage Grouse (*Centrocercus urophasianus*) are lek breeders whose numbers are in serious decline in some areas owing to fragmentation and loss of shrubsteppe habitat. The main goals of this study were to ascertain whether genetic differences exist between the large and small-bodied forms of Sage Grouse and to estimate a crude time frame involved in the morphological and behavioral differences between the forms.

We surveyed the rapidly evolving control region of the mitochondrial DNA (mtDNA) genome because it is likely to be informative for resolving differences between closely related avian populations.

Kahn, N. W., J. St. John, and T. W. Quinn. 1998. Chromosome-specific intron size differences in the avian CHD gene provide an efficient method for sex identification in birds. Auk 115:1074-1078.
Keywords: Sage Grouse/Adult/Juvenile/Genetics/Anatomy-Morphology/Behavior.

Keister, G. P., and M. J. Willis. 1986. Habitat selection and success of Sage Grouse hens while nesting and brooding. Progress Report, W-87-R-2, Subproject 285, Study II. Oregon Department of Fish and Wildlife, Portland, OR.
Keywords: Sage Grouse/Oregon/Nesting/Brood rearing/Habitat Use-Selection.
***Notes*:** Subproject 285 is titled: Coyote and wildlife relations in southeastern Oregon.

Keller, R. J., H. R. Shepard, and R. N. Randall. 1941. Survey of 1941: North Park, Jackson County, Moffat County, including comparative data of previous season. Colorado Game and Fish Comm., Denver. Sage Grouse Surv. 3.
Keywords: Sage Grouse/Colorado.

Kelly, B. 1998. Dancers of the sage. Colorado Outdoors 47(4):25.
Keywords: Sage Grouse.

Kerley, L. 1994. Bird responses to habitat fragmentation caused by sagebrush management in a Wyoming sagebrush steppe ecosystem. Ph.D. dissertation. University of Wyoming. 153 pages.
Keywords: Sage Grouse.
Abstract: This dissertation contains four chapters. In Chapter I, I compared songbird communities among 9year old burned, 22year old herbicide treated
(with 24,D), and untreated sites. The most pronounced differences in songbird species composition, richness, and relative abundance were between sites with the most shrubs (untreated sites) and areas with the fewest shrubs (burns). Songbird diversity (H$\sp\prime$) did not reflect these community differences, but species richness and relative abundance were lower in treated sites and species composition changed between untreated and treated sites to favor groundnesting species.

In Chapter II I compared songbird species occupance among habitat patch types and patch sizes, and species distance to edges. Sixty-seven percent of the songbird species (n = 9) selected the tallest sagebrush stands. However, small remnant shrub patches ($<$1 ha) had fewer shrubnesting species than 2ha remnant or 4ha unfragmented patches. An interior species, the greentailed towhee, was absent from small remnant patches and an edge species, the savannah sparrow, only occurred in remnant patches where burns and tall shrubs were juxtaposed.

In Chapter III I examined seasonal occurrences of sage grouse in untreated, burned, and herbicide treated habitats to determine the impacts
of these preexisting treatments. Nest success was associated with 41% shrub cover and the two nests found in the herbicide treated area with 15% shrub cover were not successful. In winter, sage grouse moved about 7 km south of their summer range to steeper south facing slopes where taller shrubs were exposed above the snow. The concentration of prescribed burns and herbicide applications on similar sagebrush stands on a south facing slope reduced potential winter habitat within the summer range.

Chapter IV contains a summary of my results and management recommendations.

Kerwin, M. L. 1971. The status, behaviour, and ecology of the Sage Grouse in Saskatchewan. M.Sc. thesis. University of Saskatchewan, Regina.
Keywords: Sage Grouse/Disease-Parasites/Reproduction/Diet/Behavior/Movement/Habitat Use-Selection/Diet/Grasslands/Meadow/Understory-grasses/ARCA/ARTR/Saskatchewan/Sagebrush/Other sage/Other shrubs/Understory-forbs/Cropland/Crested Wheatgrass/Lekking/Nesting/Brood rearing/Summer/Juvenile/Yearling/Adult/Mortality-Survival.
***Notes*:** General summary of sage grouse ecology in Saskatchewan, at the northernmost portion of the species' range in North America. Site primarily shortgrass prairie. Leks were further apart (2.2 miles) and had fewer males (26-28) than any other part of the species range. Peak breeding occurred in late April. Males did not appear to occupy territories per se while on the leks, but position was important. Mean brood

size of 193 broods was 4.48 juveniles/brood. During the 2-year study, juvenile mortality was 36.9-50.4%. Infection by tapeworms seemed to be a large factor in juvenile mortality (59% of juveniles examined were infected).

Describes behavior of brooding hens and chicks as well as males on leks. Also looked at movements; mean daily movement of broods was from 86-221 yards. Adults ranged farther, from 383-722 yards. "Total summer movement was less than 4 miles." Measured crown cover of vegetation at brood locations: forb cover ranged from 31-59%; grasses, 49-75%; shrubs from 3-10%. Adult birds used areas with more dense vegetation. Forbs most important diet item in summer for juveniles. Shrubs most important diet item in spring and summer for adult grouse.

Kilpatrick, S. 2000. Using prescribed fire to manage sagebrush communities in occupied Sage Grouse habitats of Wyoming. Available online from www.rangenet.org/projects/grouse/wyoguidelines.htm. (Paper presented at the 22nd Western States Sage and Columbian Sharp-tailed Grouse Symposium in Redmond, Oregon, July 13-14, 2000. 6 pages.

Keywords: Sage Grouse/Wyoming/Fire/ARTRWY/ARTRVA.

Abstract: It is estimated that over 94 million acres of the western United States are dominated by various sagebrush species and approximately 58,000 square miles (37 million acres) of Wyoming are covered by thirteen different types of sagebrush. Such sagebrush communities evolved as dynamic landscapes with climatic and edaphic variation driving changes in fire frequencies, and in adaptive development of different sagebrush species. Investigations indicate the historic sagebrush-steppe ecosystem was a mosaic of successional (age) classes created and maintained by fire regimes ranging in frequency from 10-110 years depending on sagebrush species and specific geographic area. The diversity and juxtaposition of sagebrush community type, age class and associated vegetative community types provide habitat for approximately 87 species of mammals, 297 species of birds and 63 species of fish, reptiles and amphibians. Human-induced fire suppression and repetitive livestock herbivory have lead to the successionally advanced or subclimax stages across the landscape. Prescribed fire, wildland fire use, and herbivory management are effective tools available to managers for maintaining and enhancing sagebrush types and associated communities. Treatment prescriptions must be carefully designed and tailored to the species, subspecies and varieties of sagebrush targeted. This paper provides recommendations for landscape-scale management of Wyoming big sagebrush (*Artemisia tridentata wyomingensis),* mountain big sagebrush (*Artemisia tridentata vaseyana pauciflora),* and Vasey big sagebrush (*Artemisia tridentata vaseyana vaseyana)* within occupied sage grouse habitats of Wyoming.

Kimball, J. F. 1969. Sage Grouse management in Utah. Pages 111-117 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY. 6.

Keywords: Sage Grouse/Utah/Habitat Restoration/Distribution-Mapping/Hunting/Population trends/Brood rearing/Strutting/Weather-Climate/Livestock grazing.

Klebenow, D., G. Zunino, M. Stigar, and A. Alstatt. 1990. Statewide wildlife program. The status, trends, and utilization of Nevada's game and furbearer populations and associated habitat: Sage Grouse production and mortality studies. Nevada Department of Wildlife. 26 pages.

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Bitterbrush (Purshia tridentata) was a taller species they sometimes used. No nests were found where shrub cover was greater than 35 percent. Only three of 98 broods were discovered in areas with greater than 31 percent shrubby cover. The most dense stands of sagebrush were not used, probably because few or none of the forbs the young grouse fed upon were present. As the summer progressed, broods moved up in elevation following a gradient of green plant foods. A stepwise discriminant function analysis was made of the data, in an unsuccessful attempt to develop a means of discriminating between nesting vs. nonnesting areas, and brood vs. nonbrood habitat. The analyses only pointed out the most significant variables.

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***Notes*:** Captured 80 sage grouse (20 chicks, 60 adults) in 1998 to determine effects of natural gas development on the Pinedale Mesa (WY) on sage grouse use, productivity, general movements, and habitat use. Birds were captured on 6 leks, 3 of which were classified as "disturbed" and 3 as "undisturbed." Disturbed sites were those with natural gas development within a 3 km buffer of the lek, and also determined by topographic features around the leks. Weekly radiotelemetry locations used to monitor movement and use. Measured vegetation in used and random sites in the study area during 1998-1999.

Found that hens captured on disturbed leks had lower nest initiation rates (10/18 on disturbed, vs. 9/11 on undisturbed) and moved twice as far to nest sites (4116 m vs. 2090 m). 74% of hens captured on disturbed leks moved >3 km from lek to nest, whereas 91% of hens captured on undisturbed leks nested within 3 km of the lek of capture. Hens captured on disturbed leks also selected "higher total shrub canopy cover and live sagebrush canopy cover" than did hens captured on undisturbed leks. Author hypothesized that this may be due to the noise, road traffic, and increased pressure from predation in disturbed areas. Nest success was similar between sites.

Recruitment was low during the study, averaging 61% for both years (early brood rearing success rate), but was much lower if nest initiation and success were accounted for, at 26%. Also found differences between distance between brood rearing sites and roads for hens captured on disturbed leks. Successful hens nested further (mean = 1138 m) from nearest road than did unsuccessful hens (mean = 268 m). Early brood survival appeared to be the "limiting factor in sage grouse population stability on the Pinedale Mesa," based on near total loss of checks during a very early brood rearing season. Late brood rearing did not appear to be a critical time, as only one brood was lost during this period.

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***Notes*:** As of 1996, sage grouse were considered a "sensitive" species in OR, but only for populations in the Blue Mts. province and the Columbia Basin portion of the Columbia Basin/High Lava Plains physiographic province. Includes a current range map for Oregon. Formerly found in all counties east of the Cascade Range but Hood River and Wallowa. The species is now "absent from the entire north portions of its former Oregon range." Now occupies about 50% of its former range in the state, with the major losses occurring in the 1920s and 1930s. Prineville and Vale BLM districts noted as primary land/habitat owners. Reasons for sensitive status in Oregon include: low population numbers and fragmented populations caused by habitat loss from cultivation, sagebrush control programs, livestock grazing, meadow destruction, spring developments for livestock watering, and hot, extensive wildfires. Human disturbance an increasing problem. Suggests sagebrush protection within 1.5 mile radius of leks. Notes extensive research in southeast Oregon to determine factors affecting populations. Research needs include improved inventory procedures, e.g. lek counts and basic inventories in summer and winter sites, esp. where the species is considered "sensitive.".

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***Notes*:** Three-year study (1962-1964) of effects of spraying 2,4-D to control sagebrush in Montana. Used 1,900 acre allotment as study area, of which 1710 acres had been sprayed in 1961. Forb and low shrub cover was reduced in the sprayed strips. Only 4% of the 415 observations of sage grouse on the allotment were on the sprayed strips. Sprayed areas had 97% mortality of big sagebrush plants. Vegetation at sage grouse locations in unsprayed areas outside the allotment and at locations of grouse in the unsprayed strips were similar. Differences in numbers of birds between sprayed and unsprayed areas appeared to be due to differences in vegetation composition. Broods of <= 6 weeks were found in areas with lower densities and crown cover than were older broods and adults. Sagebrush and 3 genera of forbs comprised most of the diet, and were more abundant in the unsprayed areas.

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Abstract: The effects of chemical manipulation of big sagebrush (*Artemisia tridentata*) on sage grouse (*Centrocercus urophasianus*) were studied in Montana during the summers of 1962 through 1964. The principal study was conducted on 1,900 acres, of which 1,710 had been strip-sprayed in 1961 with 2,4-D. Vegetation analyses revealed about 80 percent grasses and 20 percent forbs in the sprayed strip, and 60 percent grasses and 40 percent forbs in the unsprayed strip. Eight and 97 percent of the individual big sagebrush plants were entirely dead in the unsprayed and sprayed strip, respectively. Only 4 percent of 415 sage grouse observations were made on the sprayed strips of the 1,900-acre study area. Canopy coverage of herbaceous vegetation at 137 sage grouse locations consisted of approximately 60 percent grasses and 40 percent forbs. Ninety-two percent of the big sagebrush plants evaluated at grouse locations were living. The similarity of vegetation at grouse locations and in the unsprayed strip led to the conclusion that differences in numbers of sage grouse observed in sprayed and unsprayed strips were related to vegetation

composition. Measurements of big sagebrush at 159 grouse locations showed young broods using areas having a lesser density and lower percent crown coverage than older broods and adults. Analysis of 35 sage grouse crops revealed that sagebrush and three forbs together constituted 94.6 percent of the total volume. Dandelion (*Taraxacum officinale*) and sagebrush had the greatest total frequency of occurrence of all food items. Favored food plants were more abundant in the unsprayed than in the sprayed strip, supporting the conclusion that differences in numbers of sage grouse observed in unsprayed and sprayed strips were related to vegetation composition.

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Keywords: Sage Grouse/Fire/Herbicides-Pesticides/ARTR/Livestock grazing.

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Keywords: Sage Grouse/Translocation/Mortality-Survival/Movement/Habitat Use-Selection/ARTRVA/Dispersal/Reproduction/Nesting.
Abstract: The success of translocations to restore sage grouse (*Centrocercus urophasianus*) populations remains equivocal. Thus, we translocated 196 sage grouse to the Sawtooth Valley, Idaho, during March-April 1986-87 to determine whether translocated birds would survive and reproduce. Movements of 44 radio-tagged birds were extensive during the first 3-6 weeks post-release, and average distances from the release site for 10 females (5.3 plus or minus 0.9 km) were greater ($P < 0.05$) than those for 5 males (3.2 plus or minus 1.0 km). Four of 17 (24%) radio-tagged birds in 1986 and 11 of 27 (41%) in 1987 survived into the summer. Survival was lower ($P < 0.0001$) for 36 radio-marked and 8 patagial-tagged birds during the first 3 weeks post-release than during weeks 4-22 for 1986 and 1987. Five new leks were established by translocated birds. Seven nests of translocated hens averaged 3.6 plus or minus 0.2 km from the release site and 3 produced 14 young. Our data suggest that translocation can be useful in restoring sage grouse

populations to suitable habitat.

Musil, D. D., J. W. Connelly, and K. P. Reese. 1987. Preliminary results of a [sage grouse] translocation effort. J. Roberson, editor. Proceedings of the 15th Biennial Western States Sage Grouse Workshop. Midway, UT; 28-30 July, 1987.
Keywords: Sage Grouse.
***Notes*:** Abstract only .

Musil, D. D., J. W. Connelly, and K. P. Reese. 1993. Movements, survival, and reproduction of Sage Grouse translocated into central Idaho. Journal of Wildlife Management 57:85-91.
Keywords: Sage Grouse/Translocation/Idaho/ Mortality-Survival/Reproduction/ARTRVA/Models/Habitat Use-Selection.
Abstract: The success of translocations to restore sage grouse (*Centrocercus urophasianus*) populations remains equivocal. Thus, we translocated 196 sage grouse to the Sawtooth Valley, Idaho, during March-April 1986-87 to determine whether translocated birds would survive and reproduce. Movements of 44 radio-tagged birds were extensive during the first 3-6 weeks post-release, and average distances from the release site for 10 females (5.3 plus or minus 0.9 km) were greater ($P < 0.05$) than those for 5 males (3.2 plus or minus 1.0 km). Four of 17 (24%) radio-tagged birds in 1986 and 11 of 27 (41%) in 1987 survived into the summer. Survival was lower ($P < 0.0001$) for 36 radio-marked and 8 patagial-tagged birds during the first 3 weeks post-release than during weeks 4-22 for 1986 and 1987. Five new leks were established by translocated birds. Seven nests of translocated hens averaged 3.6 plus or minus 0.2 km from the release site and 3 produced 14 young. Our data suggest that translocation can be useful in restoring sage grouse populations to suitable habitat.

Musil, D. D., K. P. Reese, and J. W. Connelly. 1994. Nesting and summer habitat use by translocated Sage Grouse (*Centrocercus urophasianus*) in central Idaho. Great Basin Naturalist 54:228-233.
Keywords: Sage Grouse/Translocation/Mortality-Survival/Weather-Climate/Habitat Use-Selection/Nesting/Idaho/Sagebrush/ARTRVA/Other shrubs/Understory-forbs/Understory-grasses/Summer/Yearling/Adult/Scale .
Abstract: We translocated 196 Sage Grouse (*Centrocercus urophasianus*) into Sawtooth Valley, Idaho, during March-April 1986-87 to augment a small resident population. Forty-four grouse equipped with radio transmitters were monitored through spring and summer. Nest sites ($n = 6$) had greater ($P = .032$) horizontal cover than did independent random plots ($n = 7$). During summer, grouse used sites ($n = 50$) with taller live and dead shrub heights, greater shrub canopy cover, and more ground litter ($P < .009$) than were found on dependent random plots ($n = 50$) 50-300 m from use sites. Distance to edge and mountain big sagebrush (Artemisia tridentata vaseyana) density best separated use sites from independent random plots in logistic regression analysis and correctly classified 64% of the use sites and 78% of the independent random plots. Sage Grouse used sites that had narrower frequency distributions for many variables than did independent plots ($P < .04$), suggesting selection for uniform habitat.

Myers, O. B. 1992. Sage Grouse habitat enhancement: Effects of sagebrush fertilization. Ph.D. dissertation. Colorado State University. 109 pages.
Keywords: Sage Grouse/Fertilization/Models/ARTR/Anatomy-Morphology/ARTRWY/ARTRVA.
Abstract: I integrated field and laboratory studies to estimate effects of nitrogen fertilization on nutritional quality of big sagebrush (Artemisia
tridentata) for Sage Grouse (*Centrocercus urophasianus*). By manipulating sagebrush chemistry and morphology on 33 10ha plots, I tested whether grouse use of 2 sagebrush subspecies was affected. I also used captive Sage Grouse to experimentally estimate forage preference rankings and nutritional quality.
Nitrogen fertilization had large effects on sagebrush morphology and foliar crude protein. Protein content of foliage increased 3052% following
treatment but declined rapidly. Morphological changes were more persistent. Sage Grouse increased their use of fertilized Wyoming big sagebrush (A. t. wyomingensis, (ATW)) relative to unfertilized ATW but not of fertilized mountain big sagebrush (A. t. vaseyana, (ATV)). Elevated grouse herbivory rates on fertilized ATW were more persistent than foliar chemistry effects and were correlated with effects on plant

morphology.

I allowed captive-reared Sage Grouse to develop feeding preferences for fertilized and unfertilized ATW and ATV without the confounding influences of variable resource availability or predictability common in field studies. I conducted paired comparison preference trials with these birds and used oneway and factorial Bradley Terry models to estimate preference rankings and the effects of experimental treatments on rankings. Captive birds developed strong preferences for ATW over ATV, like wild birds, but also increased their consumption of ATV when it was fertilized.

I used birds captured from a population that specialized on ATW during fall/spring and tested their ability to assimilate nutrients from fertilized and unfertilized ATV and ATW. Assimilation coefficients for dry matter and energy were strongly influenced by the subspecies tested but not by fertilization. Nitrogen balance was not affected by fertilization or subspecies, despite substantial between treatment variation in nitrogen intake. These birds did not fully acclimate to captive conditions and most replications were at submaintenance intakes. Although I used analysis models that are less sensitive to level of intake than traditional approaches, potential problems due to captive birds may have prevented detection of fertilization effects.

Neel, L. A. 1980. Sage Grouse response to grazing management in Nevada. M.S. thesis. University of Nevada, Reno.
Keywords: Sage Grouse/Livestock grazing/Nevada/Habitat Use-Selection/Brood rearing/Movement/Agriculture/Management/ARTRVA/ARAR/ARTRWY.

Nelle, P. J. 1998. The long-term effect of fire on sage grouse nesting and brood-rearing habitats on the Upper Snake River Plain. M.S. thesis. University of Idaho, Moscow, Idaho.
Keywords: Sage Grouse/Fire/Nesting/Brood rearing/Herbicides-Pesticides/Habitat Use-Selection/Reproduction.

Nelle, P. J., K. P. Reese, and J. W. Connelly. 2000. Long-term effects of fire on Sage Grouse habitat. Journal of Range Management 53:586-591.
Keywords: Sage Grouse/Fire/Nesting/Brood rearing/Habitat Use-Selection/ARTRVA/Idaho/Habitat Restoration.

Nelson, O. C. 1955. A field study of the Sage Grouse in southeast Oregon, with special reference to reproduction and survival. M.S. thesis. Oregon State University, Corvallis, Oregon. 113 pages.
Keywords: Sage Grouse/Mortality-Survival/Reproduction/Distribution-Mapping/Strutting/Territoriality/Nesting/Water/Diet/Weather-Climate/Brood rearing/Disease-Parasites/Habitat Use-Selection.

Niemuth, N. D. 1992. Effects of nest predation on breeding ecology of sage grouse (*Centrocercus urophasianus*). M.S. thesis. University of Wyoming.
Keywords: Sage Grouse/Predation/Reproduction/Nesting/Mortality-Survival/Wyoming/Sagebrush/Lekking/Adult/Behavior/Population trends-Lek counts/Models.
***Notes*:** Examined patterns of predation on sage grouse nests in relation to lek location by using 256 simulated (artificial) nests with chicken eggs. Placed nests at 2 densities, high and low. Found higher rate of predation intensity at higher nest densities, indicating a density-dependent mechanism and population regulation. Some evidence also seen for the "male sentinel/decoy hypothesis," in which females nesting near leks may experience lower rates of predation due to predators being attracted to displaying males. Overall predation rate on simulated nests was 31.7%: 11.5% avian predators; 11.9% mammalian, 7.5% ground squirrels, and 0.8% cattle trampling.

Niemuth, N. D., and M. S. Boyce. 1995. Spatial and temporal patterns of predation of simulated Sage Grouse nests at high and low nest densities: an experimental study. Canadian Journal of Zoology 73:819-825.
Keywords: Sage Grouse/Predation/Nesting/Lekking/Behavior.
Abstract: We examined patterns of predation on 252 simulated sage grouse (*Centrocercus urophasianus*) nests placed at two densities around six active leks in southeastern Wyoming, U.S.A. Predation intensity, as measured by the frequency of multiple-nest predation events, was significantly greater at high-density sites, implying enhanced prey capture (functional and (or) numerical response) by predators. Significant spatial

aggregation of nest predation further implies enhanced prey capture by predators at high prey densities. Predation varied significantly among sites, but there were no significant first-order differences in predation between densities. Predation was also significantly affected by year-density and site-year-density interactions. Several factors, including nest cover, prey defense mechanisms, study site location, nest location, year, search methods of predators, number of predators, and random encounter may inhibit or confound density-dependent nest predation. Enhanced prey capture provides a mechanism for density-dependent population regulation.

Nisbet, R. A., S. H. Berwick, and K. L. Reed. 1983. A spatial model of Sage Grouse habitat quality. Pages 267-276 *in* Developments in Environmental Modeling.
Keywords: Sage Grouse/Habitat Use-Selection/Models/Brood rearing/Population trends/Mortality-Survival/Strutting/Distribution-Mapping/Nevada/Utah/ARTR/Other sage/Other shrubs/Crested Wheatgrass/Lekking.

Oakleaf, R. J. 1971. The relationship of Sage Grouse to upland meadows in Nevada. M.S. thesis. University of Nevada, Reno, Nevada.
Keywords: Sage Grouse/Nevada/Meadow.

Oakleaf, R. J. 1971. Statewide game program: A mobile cannon net for capturing Sage Grouse. Nevada Fish and Game Commission. 10 pages.
Keywords: Sage Grouse/Techniques-Methods.

Oakleaf, R. J. 1971. Statewide game program: relationship of Sage Grouse to upland meadows in Nevada. Nevada Fish and Game Commission. 73 pages.
Keywords: Sage Grouse/Nevada/Meadow.

Oakleaf, R. J., and G. C. Christensen. 1971. Statewide game program: Radio telemetry used on Sage Grouse. Nevada Fish and Game Commission. 20 pages.
Keywords: Sage Grouse/Radiotelemetry.

Ogden, A. 1990. A summary of Idaho's wildlife water developments and wildlife use of guzzlers in southeastern Idaho. Pages 141-145 *in* G. K. Tsukamoto, editor. Proceedings of the Wildlife Water Development Symposium.
Keywords: Sage Grouse/Water/Habitat Restoration/Idaho.

Oregon Department of Fish and Wildlife. 1988. Coyote/Sage Grouse research. Plans, specifications, and estimates. Project No. W-87-R-5, Sub-project no. 285. Oregon Dept. of Fish and Wildlife, Portland, OR.
Keywords: Sage Grouse/Oregon.
***Notes*:** Provides estimates of personnel required and costs to initiate the sage grouse research, with 5 separate jobs delineated: project supervision, planning, administration, and coordination; nesting and brood rearing habitat selection; nest success and brood survival; study plan development; and winter distribution and habitat selection.

Oregon Department of Fish and Wildlife. 2002. Sage-grouse lek monitoring, population estimation, and hunting season procedures/guidelines. Unpublished report. Oregon Department of Fish and Wildlife, Upland Game Bird Program, Portland, OR. 11 pages.
Keywords: Sage Grouse/Oregon/Population Trends/Monitoring/Hunting.

Oregon State Game Commission. 1920. Annual Report. Oregon State Game Commission. Portland, OR. 45 pages.
Keywords: Sage Grouse/Oregon.

Oregon State Game Commission. 1954. Biennial Report. Oregon State Game Commission. Portland, OR. 48 pages.
Keywords: Sage Grouse/Oregon.

Ottomeier, A. A., and J. A. Crawford. 1996. Revised measurements of classification of age of Sage Grouse from wings. California Fish and Game 82:61-65.
Keywords: Sage Grouse/Oregon/Nevada/Yearling/Adult/Juvenile/Wings/Anatomy-Morphology.
Abstract: Measurements of primary number 4 (P4) from 294 sage grouse, *Centrocercus urophasianus*, wings from Oregon revealed that P4 was 3-5% shorter than measurements recorded for comparable sex and age groups of sage grouse from Nevada. We recommend revising the key commonly used to classify age of sage grouse by wing measurements to reflect the regional size variation found in this study.

Oyler-McCance, S. J. 1999. Genetic and habitat factors underlying conservation strategies for Gunnison Sage Grouse. Ph.D. dissertation. Colorado State University. 162 pages.
Keywords: Sage Grouse/Genetics/Habitat Use-Selection/Sagebrush/Models/Distribution-Mapping/Statistics/Species Diversity/Gunnison Sage-Grouse.
***Notes*:** Developed a simple habitat-based model to predict occupancy by sage grouse, with three variables: distance to nearest road from the center of the habitat patch, size of the habitat patch (patch area, as a measure of habitat quantity), and percentage of the patch in "habitat" (are in suitable winter, breeding and nesting or summer habitat). The best model had habitat patch size and distance to the nearest road. The genetics work supported the species designation of the Gunnison sage grouse in southwestern Colorado. These populations are extremely isolated and fragmented, as are their habitats. This is reflected in the low numbers of haplotypes in these grouse. They are much less genetically diverse than are more northern grouse, with low heterogeneity and little gene flow evident.

Oyler-McCance, S. J., N. G. Benedict, S. E. Taylor, and T. W. Quinn. 2000. Genetic survey of sage grouse throughout the western portion of their range. Annual Conference of The Wildlife Society, Nashville, TN, 12-16 Sep 2000. (World Meeting Number 003 0833).
Keywords: Sage Grouse/Genetics/Distribution.

Oyler-McCance, S. J., K. P. Burnham, and C. E. Braun. 2001. Influences of changes in sagebrush on Gunnison Sage Grouse in Southwestern Colorado. The Southwestern Naturalist 46(3):323-331.
Keywords: Sage Grouse/Colorado/Gunnison Sage-Grouse.
Abstract: The decline in the abundance of the newly-recognized Gunnison sage grouse (*Centrocercus minimus*) in southwestern Colorado is thought to be linked to loss and fragmentation of its habitat, sagebrush (*Artemisia*) vegetation. We documented changes in sagebrush-dominated areas between the 1950's and 1990's by comparing low-level aerial photographs taken in these time periods. We documented a loss of 20% or 155,673 ha of sagebrush-dominated areas in southwestern Colorado between 1958 and 1993. The amount of sagebrush-dominated area was much higher and loss rates were much lower in the Gunnison Basin. We also found that 37% of plots sampled underwent substantial fragmentation of sagebrush vegetation. If current trends of habitat loss and fragmentation continue, Gunnison sage grouse (and perhaps other sagebrush-steppe obligates) may become extinct. Protecting the remaining habitat from further loss and fragmentation is paramount to the survival of this species.

Oyler-McCance, S. J., N. W. Kahn, K. P. Burnham, C. E. Braun, and T. W. Quinn. 1999. A population genetic comparison of large- and small-bodied Sage Grouse in Colorado using microsatellite and mitochondrial DNA markers. Molecular Ecology 8:1457-1465.
Keywords: Sage Grouse/Distribution-Mapping/Genetics/Anatomy-Morphology/Colorado/Connectivity-Fragmentation/Taxonomy.
Abstract: Sage grouse (*Centrocercus urophasianus*) from southwestern Colorado and southeastern Utah (United States) are 33% smaller than all other sage grouse and have obvious plumage and behavioural differences. Because of these differences, they have been tentatively recognized as a separate `small-bodied' species. We collected genetic evidence to further test this proposal, using mitochondrial sequence data and microsatellite markers to determine whether there was gene flow between the two proposed species. Significant differences in the distribution of alleles between the large- and small-bodied birds were found in both data sets. Analysis of molecular variance (AMOVA) revealed that 65% of the variation in mitochondrial DNA (mtDNA) haplotypes could be explained by the large- vs. small-bodied distinction. Genetic distances and neighbour-joining trees based on allelic frequency data showed a distinct separation between the proposed species, although cladistic analysis of the phylogenetic history of the mitochondrial

sequence haplotypes has shown a lack of reciprocal monophyly. These results further support the recognition of the small-bodied sage grouse as a distinct species based on the biological species concept, providing additional genetic evidence to augment the morphological and behavioural data. Furthermore, small-bodied sage grouse had much less genetic variation than large-bodied sage grouse, which may have implications for conservation issues.

Oyler, S. J., C. E. Braun, and K. P. Burnham. 1997. Use of a habitat-based model to predict Sage Grouse *Centrocercus urophasianus* occupancy of patches in southwestern Colorado. Wildlife Biology 3:282.
Keywords: Sage Grouse/Models/Habitat Use-Selection.
***Notes*:** Abstract only.

Parker, R. P., C. B. Phillip, and G. E. Davis. 1932. Tularemia: occurrence in the sage hen, *Centrocercus urophasianus*. U.S. Public Health Report. 47:479-487.
Keywords: Sage Grouse/Disease-Parasites.

Patterson, R. L. 1949. Sage Grouse along the Oregon trail. Wyoming Wildlife 4-15, 34-37.
Keywords: Sage Grouse.

Patterson, R. L. 1950. The 1950 Sage Grouse season. Wyoming Wildlife 14:18-21.
Keywords: Sage Grouse.

Patterson, R. L. 1950. The Sage Grouse in the upper Green River basin. Pages 173-179 *in* Proceedings of the 30th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Wyoming/Population trends/Weather-Climate/Nesting/Brood rearing/Behavior/Reproduction/Mortality-Survival/Movement.

Patterson, R. L. 1950. Sage Grouse populations and land-utilization patterns in the Mountain West. Transactions of the North American Wildlife Conference 15:384-398.
Keywords: Sage Grouse/Population trends/Habitat Use-Selection/Distribution-Mapping/Hunting/Livestock grazing/Strutting/Nesting/Agriculture/Cropland/Movement/Water.
Abstract: The sagebrush-grass and salt-desert shrub range types occur chiefly in the Great Basin and central Rockies. They are typical of dry valleys and basins at elevations between 2,000 and 7,500 feet. These major range types furnish the main habitat for sage grouse and antelope and are largely unappropriated public domain. Ownership and control of range lands in the West is complex. Federal, state, and private agencies establish land-use policies. Some of these policies adversely affect sage grouse and associated wildlife species. Many range practices are definite aids to the management of game populations. The elimination of sagebrush habitat and illegal killing by rural and industrial elements of the population have drastically reduced sage grouse numbers in previous years in certain areas of the West. Within the past few years sage grouse have increased remarkably on the remaining habitat and have been hunted in several states. The Mountain West is the center of the western range livestock and grazing industry. Sage grouse nest desertion occurs in areas heavily utilized by livestock and civilization. Sagebrush is considered of low nutritive value to livestock by some range experts. These factions advocate intensive sagebrush control and eradication programs to improve grazing values. Stockmen and wildlife biologists favor the preservation and maintenance of extensive sagebrush range lands. Sage grouse exhibited distinct seasonal movements between breeding and wintering ranges. These migrations generally involved an altitudinal movement on a major watershed and encompassed several thousand square miles. Sage grouse were solely dependent upon sagebrush and associated plant species for the major part of their habitat requirements during all seasons of the year. Any land-use practice which reduces sagebrush on the western range will reduce the carrying capacity of that range for livestock, big-game and sage grouse populations. Western reclamation is in the high tide of its greatest program. Reclamation areas in this region were formerly sagebrush and grass. Studies conducted on sage grouse in Wyoming disclosed that high populations were present in areas of extensive sagebrush with available water. In areas where large reclamation projects were created, sage grouse and antelope populations were seriously depleted or extirpated, e.g., the Riverton Project. Isolated and small reclamation projects surrounded by extensive sagebrush areas were responsible for local increases in sage grouse numbers, e.g., the Eden Reclamation Project. Full coordination between state and federal agencies has not been attained on river basin wildlife studies. Land-ownership and land-utilization

patterns are constantly changing in semi-arid regions of the West. Land-use policies ultimately set the standards for the abundance and the quality of native wildlife populations. The fate of sage grouse, antelope and associated wildlife species in the Mountain West will depend upon the nature of our land-use programs and the knowledge of our wildlife. The survival of these native wildlife populations will depend largely upon the extent of coordination in our land-use programs and upon the degree of preservation and maintenance of extensive and contiguous areas of native vegetative types.

Patterson, R. L. 1952. Sage Grouse hunting seasons. Wyoming Wildlife 16:10-13.
Keywords: Sage Grouse.

Patterson, R. L. 1952. The Sage Grouse in the Upper Green River Basin of Wyoming. Ph.D. dissertation. University of Michigan, Ann Arbor, Michigan. 474 pages.
Keywords: Sage Grouse.

Patterson, R. L. 1952. The Sage Grouse in Wyoming. Wyoming Game and Fish Commission and Sage Books, Inc., Denver, Colorado. 308 pages.
Keywords: Sage Grouse/Wyoming/Distribution-Mapping/Diet/Habitat Use-Selection/Predation/Water/Weather-Climate/Disease-Parasites/Herbicides-Pesticides/Mortality-Survival/Roads/Strutting/Nesting/Brood rearing/Reproduction/Movement/Livestock grazing/Agriculture/Population trends/Hunting.

Patterson, R. L., and D. Cram. 1949. Sage Grouse--in the West. Wyoming Wildlife 10-13, 37-38.
Keywords: Sage Grouse.

Patterson, R. L., E. F. Putnam, and H. B. Sanderson. 1950. Trapping Sage Grouse in Wyoming. Wyoming Wildlife 4-13.
Keywords: Sage Grouse/Wyoming/Techniques-Methods.

Pennycuick, C. J., M. R. Fuller, J. J. Oar, and S. J. Kirkpatrick. 1994. Falcon versus grouse: Flight adaptations of a predator and its prey. Journal of Avian Biology 25:39-49.
Keywords: Sage Grouse/Predation/Weather-Climate.

Petersen, B. 1980. Game bird survey: Evaluation of the effects of changes in hunting regulations of Sage Grouse populations: evaluation of censuses of females. Pages 115-201 *in* Final report, Federal Aid Project W-37-R-33. Colorado Division of Wildlife. 89 pages.
Keywords: Sage Grouse.

Petersen, B. E. 1979. Game bird survey: Evaluation of the effects of changes in hunting regulations on Sage Grouse populations: Evaluation of censuses of females. Project number: COLO. W-037-R-32/WK.PL.03/JOB 09C. Colorado Division of Wildlife. 28 pages.
Keywords: Sage Grouse/Hunting/Colorado.

Petersen, B. E. 1980. Breeding and nesting ecology of female Sage Grouse in North Park, Colorado. M.S. thesis. Colorado State University, Forth Collins, Colorado.
Keywords: Sage Grouse/Nesting/Reproduction/Colorado/Adult/Yearling/Incubation/Predation/Behavior/Lekking/Movement/Nesting.
***Notes*:** Studied the breeding and nesting ecology of female sage grouse in North Park, Colorado, over 2 years. The author used radiotelemetry to study movements of females and chicks. He captured females on leks and then tracked them to locate nests and broods. Hens were monitored every 1-2 hors for daily activity patterns. Chicks of radiomarked females were also banded and followed. Forty-two hens were captured and followed.

Petersen, B. E., and C. E. Braun. 1980. Patterns of growth rates and weight gain by juvenile Sage Grouse. Journal of the Colorado-Wyoming Academy of Science 12:43.

Keywords: Sage Grouse/Juvenile/Colorado/Growth/Weight/Anatomy-Morphology.
***Notes*:** Published as an abstract only.

Petersen, J. G. 1969. Ecological effects of chemical and mechanical sagebrush control: food habits and summer distribution of juvenile Sage Grouse in central Montana. Montana Fish and Game Department. 39 pages.
Keywords: Sage Grouse.

Peterson, J. 1970. Gone with the sage. Montana Outdoors 5:1-3.
Keywords: Sage Grouse.

Peterson, J. G. 1969. The food habits and summer distribution of juvenile Sage Grouse in central Montana. M.S. thesis. Montana State University, Bozeman, Montana.
Keywords: Sage Grouse/Diet/Summer/Distribution-Mapping/Juvenile/Montana/ARTR/Brood rearing.
Abstract: The food habits of juvenile sage grouse (*Centrocercus urophasianus*) were studied in central Montana during the summers of 1966 and 1968. Forbs averaged 75 percent of the diet of 127 juveniles through 12 weeks of age. The flower buds and leaves of common dandelion (*Taraxacum officinale*) and common salsify (*Tragopogon dubius*) were the most highly preferred and utilized forbs, comprising 25 and 15 percent of the diets, respectively. Other forbs commonly utilized were prairie pepperweed (*Lepidium densiflorum*), prickly lettuce (*Lactuca serriola*), alfalfa (*Medicago sativa*), curlcup gumweed (*Grindelia squarrosa*), and fringed sagewort (*Artemisia frigida*). Big sagebrush (*A. tridentata*) received little use until the birds were 11 weeks old. Insect use declined steadily from a high of 60 percent of the diet in 1-week chicks to 5 percent in 12-week-old juveniles. Observed brood locations, after chicks were 2-3 weeks old, were less frequent on the sagebrush-grassland benches and more frequent on lower areas until, by September, the majority of broods were located on bottomlands. Sagebrush, 6-18 inches high, was most prevalent at brood sites used during morning and evening activity periods. Important components of juvenile sage grouse habitat in this area appear to be an abundance and diversity of forbs and densities of sagebrush ranging from 1-20 percent.

Peterson, J. G. 1970. The food habits and summer distribution of juvenile Sage Grouse in central Montana. Journal of Wildlife Management 34:147-155.
Keywords: Sage Grouse/Diet/Montana/Distribution-Mapping/ARTR/Summer/Sagebrush/ARCA/ARTR/Other sage/Other shrubs/Grasslands/Understory-forbs/Understory-grasses/Cropland/Brood rearing/Juvenile/Adult/Habitat Use-Selection.
Abstract: The food habits of juvenile sage grouse (*Centrocercus urophasianus*) were studied in central Montana during the summers of 1966 and 1968. Forbs averaged 75 percent of the diet of 127 juveniles through 12 weeks of age. The flower buds and leaves of common dandelion (*Taraxacum officinale*) and common salsify (*Tragopogon dubius*) were the most highly preferred and utilized forbs, comprising 25 and 15 percent of the diets, respectively. Other forbs commonly utilized were prairie pepperweed (*Lepidium densiflorum*), prickly lettuce (Lactuca serriola), alfalfa (Medicago sativa), curlcup gumweed (*Grindelia squarrosa*), and fringed sagewort (*Artemisia frigida*). Big sagebrush (*A. tridentata*) received little use until the birds were 11 weeks old. Insect use declined steadily from a high of 60 percent of the diet in 1week chicks to 5 percent in 12-week-old juveniles. Observed brood locations, after chicks were 23 weeks old, were less frequent on the sagebrushgrassland benches and more frequent on lower areas until, by September, the majority of broods were located on bottomlands. Sagebrush, 618 inches high, was most prevalent at brood sites used during morning and evening activity periods. Important components of juvenile sage grouse habitat in this area appear to be an abundance and diversity of forbs and densities of sagebrush ranging from 120 percent.

Petrides, G. A. 1942. Age determination in American gallinaceous birds. Transactions of the North American Wildlife Conference 7:308-328.
Keywords: Sage Grouse/Physiology/Age/Anatomy-Morphology/Gallinaceous.
Abstract: In an effort to overcome a lack of fundamental data in the field of research in game bird productivity, the author has attempted to bring together the known indices to age in gallinaceous birds, to apply them to species other than those for which they were described, and to determine additional criteria enabling identification of young-of-year in all native and naturalized American Galliformes. For the chachalaca (Ortalis vetula), the investigation revealed that young-of-the-year can be recognized until late

winter by the moderately pointed rectrices and sharply pointed outer remiges. All flight feathers of adults are broadly rounded. The outer two juvenile primaries are apparently retained in the young of all American Tetraonidae until their second summer. Normally these are pointed in contrast to the rounded distal wing feathers of adult grouse. Criteria involving the distal primary coverts, rectrices, tarsi, claws, lower mandible and bursa of Fabricius are also given for some species. The Hungarian partridge (Perdix perdix) and the Chukar partridge (Alectoris graeca chukar) can best be identified as young or adult by the shape of the outer primary tips. Color of feet and markings on outer primary coverts and claws act as supplementary indicators of age. The European quail resemble the American grouse in retaining the outer two juvenile primaries and their coverts during the first winter. Young American quail are best recognized by buff or white spotted juvenile primary coverts which are retained, with the outer two pointed primaries, for a year. Adult native quail possess rounded outer remiges and, except the Mearn's quail (Cyrtonyx montezumae mearnsi) plain gray coverts. No reliable plumage criteria for age determination in the ring-necked pheasant (Phasianus colchicus torquatus) were found. A method of external demonstration of the presence of the bursa of Fabricius is described and the use of the weakness of the lower jaw as an indication of youth is suggested. The post-juvenile molt of flight feathers and their coverts is evidently complete in pheasants. Distinctly pointed and gray-tipped distal wing feathers easily separate young turkeys (Meleagris gallopavo) from adults which have round remiges barred with white. Supplementary characters involving the flight feathers, primary coverts, beard, spurs, tarsal scales, claws, and bursa of Fabricius are listed. Several related foreign species were found to possess the criteria for age determination described for native game birds and a number of suggestions for further research in American species are given.

Phillips, J. B. 1990. Lek behaviour in birds: do displaying males reduce nest predation? Animal Behaviour 39:555-565.
Keywords: Sage Grouse/Lekking/Nesting/Predation/Dispersal/Models/Behavior.

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Keywords: Sage Grouse/Oregon.

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***Notes*:** Each of the 2 chapters in the thesis is presented as separate entities. Chapter 1, "Developing criteria for reclamation of sage grouse habitat on a surface coal mine in northeastern Wyoming" was published as Colenso et al., 1980, in the symposium proceedings edited by D. H. Graves (REF # 2180); chapter 2 was prepared as an article for submission to a journal, "Recommendations for sage grouse habitat reclamation on surface mines in northeastern Wyoming," but apparently not published. In the first chapter, 3 data sources were used to make recommendations on mine reclamation, from data gathered prior to coal production at the mine site (3,800 ha): nest site characteristics, radiotelemetry, and dropping counts along fixed transects. Goal was to identify habitat use and critical habitats in the area prior to disturbance. Followed 32 radio-collared grouse during 2 years, counted droppings along 20 transects, and measured nesting habitat around 13 nests. Found that favored nesting habitat consisted of sagebrush with mean ht. of 27 cm, 25% cover. Nest plants should be taller (35-65 cm).

In Chapter 2, identified 3 critical components of habitat: big sagebrush, forb-producing riparian habitat, and habitat patchiness, from previous field work, as well as visual observations (744 individuals over 2 years, but likely same individuals observed >1 time). Ninety relocations total of radiomarked birds. Used chi-square tests for observed vs. expected visual observations, as well as radiolocations, in various vegetation types. Compared distance to various factors and other habitat attributes from telemetry vs. random points. Authors recommended restoration of riparian habitats first, especially with forbs, then sagebrush, in a mosaic pattern. The authors note the difficulty in re-establishing sagebrush across large areas, and provide estimated costs for so doing.

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Abstract: (1) A progress report concerning food habits and nesting studies of the sage grouse in Strawberry Valley, Utah, is presented. (2) An analysis of 61 sage grouse stomachs show that adult grouse and young grouse over two months of age eat approximately 95% plant material during the summer season. Plants of the family Compositae made up the bulk of vegetable material eaten. (3) The diet of young birds less than three months old is 40 to 50 per cent insects, principally ants and beetles. (4) Young grouse eat a greater variety of plants than do the adults. (5) Sage grouse are ground nesting birds and the entire process of nesting and care of the young is accomplished by the females. (6) A study of 161 nests during 1936 and 1937 showed an average clutch of 6.82 eggs. 32.6% of nests contained 7 eggs, 28.5% contained 8 eggs, 24.6% contained 6 eggs, no nest contained over 9 eggs. (7) A direct correlation between vegetative types and degree of nesting success was found. (8) Highest nesting densities were found in dense second growths of sagebrush. 23 nests were found on 160 acres. (9) The presence of grasses and weeds interspersed with the sagebrush made a more successful nesting type than sage of equal density without the understory. (10) 59.70% of nests observed hatched successfully, 26.02% were destroyed by natural enemies, and 14.28% were deserted. The main cause of desertion was believed to be man's activity, a major part of which was due to the study.

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Keywords: Sage Grouse/Livestock grazing/Predation/Water/Fire/Disease-Parasites.
***Notes*:** Only abstract published, no mention of grouse.
Abstract: Because of the controversy about the effects of livestock production on semi-arid and arid ecosystems of the western United States, the impacts of livestock grazing and trampling, predator control, water diversion, conversion of habitat to pasture, fire suppression, and introduction of livestock diseases on special-status wildlife species were reviewed. One or more aspects of livestock production were found to be a primary or significant factor in the decline of 46 wildlife species in the West. Over half of these species were fish. Another 128 species were thought to be negatively impacted by livestock production. This identification of the wildlife species and groups most affected by livestock production can help guide management decisions and be useful in focusing future research priorities so that further impacts on special-status species can be minimized. Copies of this report and a computer disk containing the data base are available from the Audubon Society of Portland.

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Abstract: Sage grouse *Centrocercus urophasianus* have been translocated in at least seven states and one Canadian province, but little published information documents the success of these attempts. Historical and recent efforts at translocations are reviewed, their success evaluated and recommendations for future translocations are provided. Over 7,200 sage grouse have been translocated in at least 56 attempts to augment or reestablish populations since 1933. Only efforts in Colorado, Idaho, and Utah appear successful, however, breeding populations in these areas remain small. Common features of successful sage grouse translocations are: 1) reproductively-active birds were captured on leks at night in March and April, 2) birds were transported rapidly and released the morning following capture, and 3) release sites were isolated, islands of habitat surrounded by inhospitable cover distant from capture areas. Translocation of sage grouse is recommended only after careful evaluation of the release area for year-round habitat, and only if agencies commit resources adequate to monitor birds immediately post-release to assess short-term survival, and to monitor long-term population abundance to assess continued fate of the translocation. Translocations presently should be viewed as experimental and not as a viable strategy to restore extirpated populations of sage grouse.

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Abstract: We measured predation on 120 artificial Sage Grouse (*Centrocercus urophasianus*) nests in montane sagebrush grassland in northern Utah. We examined nests in areas that had been chained and seeded 25 years previously (treated areas) and in areas that were untreated. Predation rates of artificial nests were higher in areas of untreated sagebrush, even though these areas had greater sagebrush cover, taller shrubs, and greater horizontal plant cover. These results differ from those previously hypothesized for treated sagebrush habitat and may reflect a greater abundance of other potential prey species, especially lagomorphs, in untreated areas that attracted greater densities of predators. In addition, over 80% of nests were depredated by mammals, which hunt using olfaction and are less likely than avian predators to be affected by nest cover. We conclude that, after treated sagebrush has recovered to some degree, predation rates of Sage Grouse nests may be lower in treated sagebrush. Consequently, factors other than nest predation (e.g., winter food, thermal cover, insects, perennial forb abundance) may be more important reasons for preserving mature sagebrush stands for Sage Grouse.

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9-13; Provo, UT. General Technical Report INT-200. USDA Forest Service, Intermountain Research Station, Ogden, UT.
Keywords: Sage Grouse/Management/Diet/Nesting/Reproduction/Strutting/Year round/Brood rearing/Habitat Use-Selection/ARTR/ARAR/ARTRWY/ARTRVA/Winter.
Abstract: This paper was written to synthesize and suggest management application of sage grouse-big sagebrush research. Big sagebrush control should not be conducted on sage grouse sites where big sagebrush plants are less than 12 inches (30 to 48 cm) tall with less than 20 percent canopy cover. Also big sagebrush control should not be conducted on big sagebrush plants 7 to 30 inches (17.78 to 76.2 cm) tall with 20 to 40 percent canopy cover within 2 mi (4.8 km) of strutting grounds. Tall, dense, robust clumps of big sagebrush at the head of shallow draws and hollows should be protected for nesting habitat.

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***Notes*:** Study focuses on breeding season ecology, including movements, lek attendance, and nesting. Study site in NE Wyoming is an area that will soon be mined for coal; data gathered in hopes to mitigate impacts of mining on grouse. Study area is grazed by livestock and has 7 active oil wells. Primarily big sagebrush shrubland, but large areas (33% of area) have been treated with herbicide and now "poor" mixed prairie. Some portion (4%) seeded to crested wheat, and 4% riparian. Hypothesized by author that lek location would be correlated with sagebrush cover and height, slope and aspect, and distance of unobstructed visibility. Objectives included determination of inter-lek movements and distribution of birds, male population estimate based on lek attendance, average clutch size and egg characteristics, and vegetation characteristics at nest sites. Only 2 leks on study site, but examined others nearby; peak attendance in 1978 at these 10 leks ranged from 7 to 200 males. Sagebrush cover averaged 22.4% in a 1-km radius around leks, and height averaged 27.6 cm. Most leks were on flat ground, with slope <15%, but no patterns of aspect or terrain observed. High mortality of radioed birds (>30%) believed to be due to predation. Suggests that a 2.5 km buffer from sagebrush destruction be established around leks. Found only 6 nests. Monitored 18 grouse with radiotelemetry. Did not try to look at habitat use/selection. Males

(53 observations total) were clustered around leks, females not as much.

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Keywords: Sage Grouse/Taxonomy/Anatomy-Morphology/Physiology/Behavior/Movement/Distribution-Mapping/Diet /Hunting/Predation/Management/Productivity/Disease-Parasites/Herbicides-Pesticides/Bibliography.

Saab, V. A., and T. D. Rich. 1997. Large-scale conservation assessment for neotropical migratory land birds in the Interior Columbia River Basin. General Technical Report PNW-399. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 56 pages.
Keywords: Sage Grouse/Population trends/Riparian/Habitat Use-Selection/Pinyon-Juniper/Migration/Management.

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Keywords: Sage Grouse/Disease-Parasites/Sarcocystis rileyi/Alberta/Juvenile/Adult.

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Keywords: Sage Grouse/Population trends.

Savage, D. E. 1968. The relationship of Sage Grouse to upland meadows in Nevada. M.S. thesis. University of Nevada, Reno, Nevada. 127 pages.
Keywords: Sage Grouse/Meadow/Nevada.

Savage, D. E. 1969. The relationship of Sage Grouse to upland meadows in Nevada. Transactions of the 16th Annual Meeting of the California-Nevada Section of the Wildlife Society. 16(3):8-17.
Keywords: Sage Grouse.

Savage, D. E. 1969. The relationship of Sage Grouse to upland meadows in Nevada. Pages 134-141 *in* 6th Biennial Western States Sage Grouse Committee Proceedings.
Keywords: Sage Grouse/Nevada/Meadow/Movement/Weather-Climate/Water/Diet/ARAR/ARTR.

Savage, D. E., G. C. Christensen, and R. E. Eckert. 1969. Statewide research and investigations: Relationship of Sage Grouse to upland meadows in Nevada. Nevada Fish and Game Commission. 110 pages.
Keywords: Sage Grouse/Meadow/Nevada.

Schladweiler, P. 1968. Ecological effects of chemical and mechanical sagebrush control: Effects of chemical and mechanical sagebrush control on Sage Grouse (breeding season movements and habitat use of male Sage Grouse). Pages 18-24 *in* Montana Fish and Game Department.
Keywords: Sage Grouse.

Schladweiler, P. 1973. Breeding season movements and habitat use of male Sage Grouse in central Montana. Pages 37-38 *in* Proceedings of the 8th Biennial Western States Sage Grouse Workshop, Lewistown, MT.
Keywords: Sage Grouse/Montana/Habitat Use-Selection/Movement/Strutting/Nesting.

Schlatterer, E. F. 1960. Productivity and movements of a population of Sage Grouse in southeastern Idaho. M.S. thesis. University of Idaho, Moscow, Idaho.
Keywords: Sage Grouse/Productivity/Movement/Population trends/Idaho/Brood rearing/Reproduction/Strutting/Fire/Weather-Climate/Nesting.

Schlatterer, E. F., and D. B. Pyrah. 1970. Ecological effects of chemical and mechanical sagebrush control: Effects of chemical and mechanical sagebrush control on Sage Grouse. Montana Department of Fish, Wildlife, and Parks. 13 pages.
Keywords: Sage Grouse.

Schmidt, P. A., J. A. Hanf, and E. B. Groshens. 1994. Relationship between precipitation and number of males on leks in central Oregon: A model to predict number of sage grouse. Proceedings of the 19th Western States Sage and Columbian Sharp-tailed Grouse Workshop, Reno, NV, July 1994.
Keywords: Sage Grouse/Oregon/Model.

Schneegas, E. R. 1967. Sage Grouse and sagebrush control. Transactions of the North American Wildlife and Natural Resources Conference 32:270-274.
Keywords: Sage Grouse/Habitat Use-Selection/Weather-Climate/ARTR/Livestock grazing/Fire/Herbicides-Pesticides/Habitat Restoration/Population trends/Diet/Nesting/Mortality-Survival/California/Sagebrush/ARCA/Grasslands/Meadow/Shrub removal.

Schoenberg, T. J. 1982. Game bird survey: Potential impacts of strip mining on Sage Grouse movements and habitat use. Project Number: COLO. W-037-R-35/WK.PL.03/JOB 12/FIN. Colorado Division of Wildlife. 147 pages.
Keywords: Sage Grouse/Movement/Habitat Use-Selection/Predation/Winter/Dispersal/Nesting/Reproduction/Brood rearing/ARTR.
***Notes*:** The report appears to contain a copy of Schoenberg's master's thesis. This work involved gathering preliminary data on habitat use and movements of sage grouse in an area proposed for strip mining in North Park, Colorado.

Schoenberg, T. J. 1982. Sage grouse movements and habitat selection in North Park, Colorado. M.S. thesis. Colorado State University, Fort Collins, Colorado. 83 pages.
Keywords: Sage Grouse/Movement/Habitat Use-Selection/Colorado.

Schoenberg, T. J., and C. E. Braun. 1980. Spring habitat use by male and female Sage Grouse. Journal of the Colorado-Wyoming Academy of Science 12:43-44.
Keywords: Sage Grouse.
***Notes*:** Published as an abstract only.

Schroeder, M. A. 1993. Movement and habitat use of Sage Grouse in a fragmented landscape. Pages 22 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse.

Schroeder, M. A. 1994. Dispersal in relation to habitat fragmentation and population isolation. Proceedings of the 19th Western States Sage and Columbian Sharp-tailed Grouse Workshop, Reno, NV, July 1994.
Keywords: Sage Grouse/Movement-Dispersal/Fragmentation/Connectivity-Fragmentation/Washington.
***Notes*:** Abstract only.

Schroeder, M. A. 1994. Movement and habitat use of Sage Grouse in a fragmented landscape. Northwest Science 68:149.

Keywords: Sage Grouse/Habitat Use-Selection/Connectivity-Fragmentation/Agriculture/Nesting/Lekking.
***Notes*:** (Published as abstract only).

Schroeder, M. A. 1995. Productivity and habitat use of sage grouse in north-central Washington. Job Progress Report W-96-R. Washington Department of Fish and Wildlife, Olympia, WA.
Keywords: Sage Grouse/Washington.

Schroeder, M. A. 1997. Do Sage Grouse *Centrocercus urophasianus* exhibit metapopulations in northcentral Washington, USA? Wildlife Biology 3:269.
Keywords: Sage Grouse/Management/Metapopulation/Genetics/Lekking/Habitat Use-Selection/Washington.

Schroeder, M. A. 1997. Unusually high reproductive effort by Sage Grouse in a fragmented habitat in north-central Washington. Condor 99:933-941.
Keywords: Sage Grouse/Nesting/Behavior/Productivity/Reproduction /Predation/Connectivity-Fragmentation/Mortality-Survival/Washington.
Abstract: Productivity of Sage Grouse (*Centrocercus urophasianus*) was studied in north-central Washington during 1992-1996. Nest timing and success, clutch size, probability of nesting and renesting, and variation associated with age and year were examined for 84 females monitored with the aid of radio telemetry. Although date of nest initiation varied annually, yearling females (hatched in previous year) consistently nested later than adults; mean date of initiation of incubation was 22 April overall. The average nest contained 9.1 eggs and was incubated for 27 days. Clutch size was smaller for renests than for first nests; clutch size also varied annually. Although the overall rate of nest success was only 36.7%, all females apparently nested at least once, and at least 87.0% of females renested following predation of their first nests. As a result of renesting, annual breeding success was estimated as 61.3%. Percent of all females that produced a brood at least 50 days old was 49.5%; at least 33.4% of 515 chicks survived greater than or equal to 50 days following hatch. Although the rates of nesting and renesting appear to have been underestimated in other studied populations, Sage Grouse in north-central Washington display more reproductive effort overall; they lay more eggs and are more likely to nest and renest.

Schroeder, M. A. 1999. Sage and sharp-tailed grouse research in Washington.
Keywords: Sage Grouse/Washington.

Schroeder, M. A. 2000. Population dynamics of greater and Gunnison sage-grouse: a review. Job Progress Report, Washington Department of Fish and Wildlife, Upland Bird Research.
Keywords: Sage Grouse/Population Trends/Viability/Mortality-Survival/Washington/Gunnison Sage-Grouse.
***Notes*:** Includes tables with life-stage parameters summarized from literature reporting on studies across the range of both greater and Gunnison sage-grouse. These tables included the citations/sources for each life stage parameter estimate.

Schroeder, M. A. 2001. Population dynamics of northern and Gunnison Sage Grouse. Pages 3-6 *in* 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001. (World Meeting Number 011 0211).
Keywords: Sage Grouse/Population trends/Hunting/Management/Nesting/Reproduction/Mortality-Survival/Dispersal/Genetics/Gunnison Sage-Grouse.
***Notes*:** This is an expanded abstract.

Schroeder, M. A., and R. K. Baydack. 2001. Predation and the management of prairie grouse. Wildlife Society Bulletin 29(1):24-32.
Keywords: Sage Grouse/Predation/Management/Nesting/Juvenile/Mortality-Survival/Adult/Connectivity-Fragmentation/Yearling/Brood rearing/Environmental Requirements/Reproduction.
Abstract: This paper examines the importance of predation in the life cycles of sage grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Tympanuchus phasianellus*), greater prairie-chicken (*T. cupido*), and lesser prairie-chicken (*T. pallidicinctus*). Most individual prairie grouse eventually succumb to predation, with substantial effects on nest success, juvenile survival, and adult survival. Predator control has

occasionally been used as a management tool with the belief that reducing predator numbers can enhance viability of game populations in general and prairie grouse in particular. Although some experimental research has shown that direct reduction of predator numbers can increase grouse recruitment, most current management plans recommend indirect management of the grouse-predator relationship by manipulating habitats. However, as habitats become more fragmented and altered and populations of prairie grouse become more threatened and endangered, it is important to reconsider predator control as a management option and to evaluate its viability through experimentation.

Schroeder, M. A., D. W. Hays, M. F. Livingston, L. E. Stream, J. E. Jacobson, and D. J. Pierce. 2000. Changes in the distribution and abundance of Sage Grouse in Washington. Northwestern Naturalist 81:104-112.
Keywords: Sage Grouse/Mapping-Distribution/Fragmentation/Washington/Population Trends/Lekking/Habitat Use-Selection.

Schroeder, M. A., and L. A. Robb. 1993. Is nesting success of Sage Grouse related to characteristics of habitat in Northcentral Washington? Page 24 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado. C. E. Braun, compiler.
Keywords: Sage Grouse/Washington.

Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage Grouse (*Centrocercus urophasianus*). A. Poole and F. Gill, editors. The birds of North America, No. 425. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, D.C. 28 pages.
Keywords: Sage Grouse/Behavior/Distribution-Mapping/Anatomy-Morphology/Species identification/Taxonomy/Movement-migration/Habitat Use-Selection/Physiology/Diet/Predation/Reproduction/Nesting/Mortality-Survival/Population trends.

Scott, J. W. 1941. Behavior of the Sage Grouse during the mating cycle. Bulletin of the Ecological Society of America 22(4):38 .
Keywords: Sage Grouse/Behavior/Mating/Strutting.
***Notes*:** (Abstract only). Presents numbers of matings observed, % by dominant cocks, and general observations of behavior on the lek.

Scott, J. W. 1942. Mating behavior of the Sage Grouse. Auk 59:477-498.
Keywords: Sage Grouse/Strutting/Behavior/Mating/Anatomy-Morphology /Mortality-Survival.

Scott, J. W. 1944. A study of the comparative behavior of three species of grouse. Journal of the Colorado-Wyoming Academy of Science 4:58-59.
Keywords: Sage Grouse/Behavior/Taxonomy/Anatomy-Morphology.

Scott, J. W. 1950. Additional observations on the Sage Grouse. Anatomical Record (Philadelphia) 108:552.
Keywords: Sage Grouse/Behavior/Strutting/ Mating/Weather-Climate/Predation.

Scott, J. W. 1950. A study of the phylogenetic or comparative behavior of three species of grouse. Annals of the New York Academy of Sciences 51:1062-1073.
Keywords: Sage Grouse/Behavior/Genetics/Anatomy-Morphology/Reproduction/Habitat Use-Selection.

Scott, J. W., and R. F. Honess. 1933. On a serious outbreak of Coccidia among sage chickens. Journal of the Colorado-Wyoming Academy of Science 1(5):87-88.
Keywords: Sage Grouse/Disease-Parasites.

Scott, J. W., and R. F. Honess. 1937. A further investigation of Coccidia in the sage hen. Journal of the Colorado-Wyoming Academy of Science 2(2):48.
Keywords: Sage Grouse/Disease-Parasites.

Scott, M. D., and G. M. Zimmerman. 1984. Wildlife management at surface coal mines in the northwest. Wildlife

Society Bulletin 12:364-370.
Keywords: Sage Grouse/Mining/Hunting.
***Notes*:** Surveyed 56 large surface coal mines, using a mailed questionnaire, about land administration, wildlife inventory practices, and other topics. Includes a table of key game species, including sage grouse, and what baseline information the mining companies collect about these species. For sage grouse, which occurred on 53% of the mines surveyed, information was collected at most mines (>70%) on food habits, density, movements, and habitat use.

Sealy, S. G. 1963. Sage grouse distribution. Wildlife Investigations Progress Report. Alberta Department of Lands and Forests, Edmonton.
Keywords: Sage Grouse.

Semple, K. E., R. K. Wayne, and R. M. Gibson. 2001. Microsatellite analysis of female mating behavior in lek-breeding sage grouse. Molecular Ecology 10:2043-2048.
Keywords: Sage Grouse/Genetics/Behavior.

Sexton, V. L. 1936. Oregon's Wildlife Resource. Oregon State Planning Board Report. 102 pages.
Keywords: Sage Grouse/Oregon.

Seymour, J. 1998. Spectacular Sage Grouse is a real avicultural challenge. Game Bird and Conservationists Gazette 45:40-41.
Keywords: Sage Grouse.

Sherfy, M. H. 1992. The influence of season, temperature, and wind speed on Sage Grouse metabolism. M.S. thesis. University of New Hampshire, Durham, NH. 65 pages.
Keywords: Sage Grouse/Metabolism/Winter/Summer/Spring/Wind/Behavior/ARTR/Diet.

Sherfy, M. H., and P. J. Pekins. 1994. The influence of season, temperature, and absorptive state on Sage Grouse metabolism. Canadian Journal of Zoology 72:898-903.
Keywords: Sage Grouse/Weather-Climate/ARTR/
Diet/Behavior/Physiology/Spring/Summer/Winter/Adult/Environmental Requirements/Models.
Abstract: We used indirect respiration calorimetry to measure the metabolism of six adult sage grouse (*Centrocercus urophasianus*) during winter, spring, and summer. During winter the metabolic rate of fed birds was higher ($P < 0.05$) than that of fasted birds. The standard metabolic rate (SMR) of females (0.692 mL O2•g^-1•h^-1) was higher than of males (0.583 mL O2•g^-1•h^-1) in winter; in both sexes SMR was higher in winter than in summer. Females' SMR was lower ($P = 0.0001$) in spring than in winter. Lower critical temperatures of both males and females were substantially lower in winter (-0.6°C, -4.8°C) than in summer (14.9°C, 14.8°C). Although seasonally elevated, the SMR of sage grouse in winter is low in comparison with that of other galliforms with northern distributions. Thermoregulation during a winter night at -10°C would result in minimal (<5%) expenditure of endogenous reserves by either sex. Thermoregulation and SMR in winter are more energetically costly to female sage grouse than to males, and may necessitate increased behavioral thermoregulation by females. Seasonal change in SMR differs between the sexes, and is probably influenced by the energetic demands of the breeding season.

Sherfy, M. H., and P. J. Pekins. 1995. Influence of wind speed on Sage Grouse metabolism. Canadian Journal of Zoology 73:749-754.
Keywords: Sage Grouse/Weather-Climate/Behavior/Wind/Sagebrush/Adult/Physiology/Environmental Requirements.
Abstract: We measured the effect of wind speed on the metabolic rate of six adult sage grouse (*Centrocercus urophasianus*) with indirect respiration calorimetry at ambient temperatures above, near, and below the lower critical temperature. There was a significant effect (P is less than 0.05) of temperature on metabolic rate at all wind speeds, and a significant effect (P is less than 0.05) of wind speed on metabolic rate for temperatures less than or equal to 0 degrees C. Wind speed had a more pronounced effect on metabolism at temperatures below the lower critical temperature for sage grouse. Metabolic rates measured at wind speeds of greater than or equal to 1.5 m/s were significantly higher than those measured at wind speeds less than 1.5 m/s. Multiple regression analysis of wind speed (u; m/s) and temperature (Ta; degrees

C) on metabolism (MR; mL O2 times g^-1 times h^-1) yielded the equation MR = 0.0837 (u) - 0.0248 (Ta) + 0.5444. The predicted cost of thermoregulation at conditions of -5 degrees C and u = 1.5 m/s was about 1.5 times standard metabolic rate; half the increase was due to wind. Measurements of wind speed in sagebrush (Artemisia spp.) stands indicate that such habitat effectively reduces wind speeds to less than 1.5 m/s. Microhabitat value should be recognized in the management of sagebrush stands.

Short, L. L., Jr. 1967. A review of the genera of grouse (Aves, Tetraoninae). American Museum Novitates, Number 2289. 39 pages.
Keywords: Sage Grouse/Anatomy-Morphology/Genetics/Behavior/Distribution-Mapping/Predation/Habitat Use-Selection/Taxonomy.

Shufeldt, R. W. 1913. Review of the fossil fauna of the desert region of Oregon, with a description of additional material collected there. Bull. Am. Mus. Nat. Hist. 32:123-178.
Keywords: Sage Grouse/Oregon/Fossils.

Sime, C. A. 1991. Sage Grouse use of burned, non-burned, and seeded vegetation communities on the Idaho National Engineering Laboratory, Idaho. M.S. thesis. Montana State University, Bozeman, MT. 55 pages.
Keywords: Sage Grouse/Idaho/Lekking/Nesting/Brood rearing/ARTRTR/ARTRWY/Movement/Adult/Habitat use-Selection/Exotic vegetation/Fire/Seeding forage /Montana/Sagebrush/Other shrubs/Grasslands/Understory-forbs/Understory-grasses/Crested Wheatgrass/Summer/Yearling/Scale/Seeded/Other exotics.
***Notes*:** Study objectives were to examine sage grouse movement patterns in different vegetation types within a "fire scar complex;" to compare relative seasonal use of burned, non-burned, and seeded areas, and to characterize vegetation types within the complex. Selected 2 fire scar areas as study sites: Arco Highway, which burned <1 square kilometer in 1974; and Tractor Flats, which burned in about 1910, and in 1956 was reseeded (11 sq km) to crested wheatgrass. (The remainder of the Tractor Flats site revegetated naturally to perennial grasses and shrubs). Both sites were grazed by livestock at the time of the study, conducted in 1988-89. Author concluded that changing the sagebrush community did not appear to "discourage sage grouse use" because of the complex of vegetation types available and the streams in the study area. For management implications, author states the prescribed fire may be used, but only under special circumstances and with care (e.g., adequate moisture, lack of exotics), and that crested wheat seedings not be used, but native seed mixes.

Simon, F. 1937. A new cestode, *Raillietina centrocerci*, from the sage grouse, *Centrocercus urophasianus*. American Microscop. Society 56:340-343 .

Keywords: Sage Grouse/Disease-Parasites.

Simon, F. 1939. Cheilospirura centrocerci, a new nematode from the Sage Grouse, *Centrocercus urophasianus*. American Microscop. Society 58:78-80.
Keywords: Sage Grouse/Anatomy-Morphology/Nematode/Disease-Parasites.

Simon, F. 1939. Eimeria centrocerci n. sp. du *Centrocercus urophasianus* (coq de Bruyere). Ann. Parasitol. 17:137-138.
Keywords: Sage Grouse/Disease-Parasites.

Simon, F. 1940. The parasites of the Sage Grouse. Pages 77-100 *in* University of Wyoming Publication, 7(5).
Keywords: Sage Grouse/Disease-Parasites/Diet/Mortality-Survival/Reproduction/Anatomy-Morphology.

Simon, J. R. 1940. Mating performance of the Sage Grouse. Auk 57:467-471.
Keywords: Sage Grouse/Behavior/Mating/Strutting/Reproduction.

Slosson, J. R., and L. A. McKibben. 1970. Upland game investigations: Operational management plan for Sage Grouse. California Department of Fish and Game. 72 pages.
Keywords: Sage Grouse.

Spurrier, M. F. 1989. Courtship behavior in *Centrocercus urophasianus*. M.S. thesis. University of Wyoming. 70 pages.
Keywords: Sage Grouse.

Spurrier, M. F., M. S. Boyce, and B. F. Manly. 1994. Lek behaviour in captive Sage Grouse *Centrocercus urophasianus*. Animal Behaviour 47:303-310.
Keywords: Sage Grouse/Behavior/Lekking/Reproduction/Adult/Yearling/Models.

Spurrier, M. F., M. S. Boyce, and B. F. J. Manly . 1991. Effects of parasites on mate choice by captive Sage Grouse. Pages 389-398 *in* J. E. Loye and M. Zuk, editors. Bird-Parasite Interactions: Ecology, evolution, and behaviour. Oxford Ornithological Series 2.
Keywords: Sage Grouse/Lekking/Disease-Parasites/Models/Wyoming/Juvenile/Adult/Behavior.

Stabler, R. M., C. E. Braun, and T. D. I. Beck. 1977. Hematozoa in Sage Grouse from Colorado. Journal of Wildlife Diseases 13:414-417 .
Keywords: Sage Grouse/Colorado/Hematozoa/ Disease-Parasites.

Stabler, R. M., P. A. Holt, and N. J. Kitzmiller . 1966. Trypanosoma avium in the blood and bone marrow from 677 Colorado birds. Journal of Parasitology 52:1141-1144.
Keywords: Sage Grouse/Disease-Parasites/Habitat Use-Selection/Colorado.

Stabler, R. M., N. J. Kitzmiller, and C. E. Braun. 1981. Redescription of *Eimeria centrocerci* from Sage Grouse (C*entrocercus urophasianus*). Transactions of the American Microscopical Society 100:86-89.
Keywords: Sage Grouse/Eimeria/Wyoming/Movement/Sporulation/Disease-Parasites/Colorado.
Abstract: *E. centrocerci* was found in the droppings from two of 153 sage grouse, *Centrocercus urophasianus* , from Moffat County, Colorado. Because Simon's (1939, 1940) figures are not clear and the description is ambiguous, a redescription of *E. centrocerci* from the sage grouse is presented.

Stanton, D. C. 1958. A study of breeding and reproduction in a Sage Grouse population in southeastern Idaho. M.S. thesis. University of Idaho, Moscow, Idaho.
Keywords: Sage Grouse/Reproduction/Idaho/ ARTR/ARAR/Strutting/Brood rearing/Nesting/Population trends.

Stevens, R. 1987. Field identification characteristics of eight sagebrush taxa and grasses, forbs, and shrubs adapted to areas inhabited by each. Pages 5 *in* 15th Sage Grouse Workshop Transactions, July 28-30, 1987, Midway, UT.
Keywords: Sage Grouse.

Stiehm, H. A. 1946. Sage Grouse trapping. Colorado Conservation Comments. 9(4):15.
Keywords: Sage Grouse/Techniques-Methods.

Stigar, M. S. 1989. Hunting low-density Sage Grouse populations. M.S. thesis. University of Nevada, Reno.
Keywords: Sage Grouse/Predation/Juvenile/Adult/Hunting/Reproduction/Brood rearing/ARTR/Lekking/Nevada/Sagebrush/ARAR/ARTRTR/ARTRWY/Other shrubs/Riparian/Meadow/Nesting/Summer/Fall/ Juvenile/Yearling/Population trends-Lek counts.
***Notes*:** Study had 3 objectives: continue research on effects of harvest, develop helicopter techniques for surveying sage grouse, and conduct a dummy nest predation study. Hunting did not seem to be the primary factor in low sage grouse populations. Populations on both study areas increased during the study, despite declining annual recruitment in both areas. Predation may be a major factor, given the results of the nest predation study. Disturbance by researchers during trapping caused changes in habitat use by sage grouse. Helicopter techniques are promising, but need to obtain estimates of birds missed.
Abstract: Sage grouse (*Centrocercus urophasianus*) densities, production, and harvest rates were monitored on two study areas in northwestern Nevada for four years. Lek numbers increased 100% on a non-hunted area, and 85% on a hunted area where hunting pressure in birds harvested doubled over a four-year period. Late-summer density surveys for sage grouse by helicopter increased from 3.6 to 4.9 birds/sq km on the non-hunted Hart Camp from 1985 through 1987, while on the hunted Grassy Meadows, surveys indicated

5.4 birds/sq km during 1985 dropped to 4.1 in 1986, then increased to 7.7 birds/sq km in 1987. The Grassy Meadows population increased 41% over a three year period while Hart Camp increased 32%. Production estimates from harvest information decreased during the last three years from 1.8 to 1.0 juveniles/hen. During 1987, a dummy nest predation study on both areas experienced a 100% mortality with all 1,400 eggs in 200 simulated sage grouse nests destroyed in a two-week period.

Stiver, S., and C. E. Braun. 1995. Sage grouse distribution and abundance. Western States Sage Grouse Technical Committee. 61 pages.
Keywords: Sage Grouse.

Strickland, D. 1999. Petroleum development versus wildlife in the overthrust. Transactions of the North American Wildlife and Natural Resources Conference 64:28-35.
Keywords: Sage Grouse/Mineral-Oil development.
Abstract: The magnitude of petroleum development in southwestern Wyoming, particularly for natural gas, has resulted in controversy over potential impacts on wildlife, especially big game and sage grouse. In general, wildlife interests claim petroleum development is having a significant negative impact on wildlife, whereas industry supporters claim impacts are minor, if they exist at all. The resolution of this controversy, if possible, could have implications for the management of natural resources on all public lands.

Sveum, C. M. 1995. Habitat selection by Sage Grouse hens during the breeding season in south-central Washington. M.S. thesis. Oregon State University, Corvallis, Oregon.
Keywords: Sage Grouse/Habitat Use-Selection/Reproduction/Washington/Nesting/Brood rearing/ARTR/Management/Population trends/Livestock grazing/Agriculture/Distribution-Mapping/Hunting.

Sveum, C. M., J. A. Crawford, and W. D. Edge. 1998. Use and selection of brood-rearing habitat by Sage Grouse in south central Washington. Great Basin Naturalist 58:344-351.
Keywords: Sage Grouse/Habitat use-selection/Washington/Brood rearing.

Sveum, C. M., J. A. Crawford, W. D. Edge, and L. L. Cadwell. 1993. Sage Grouse nesting habitats in southcentral Washington. Pages 16 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse.

Sveum, C. M., W. D. Edge, and J. A. Crawford. 1998. Nesting habitat selection by Sage Grouse in south-central Washington. Journal of Range Management 51:265-269.
Keywords: Sage Grouse/Predation/Reproduction/Habitat Use-Selection/Nesting/Habitat Restoration/Washington/ARTR/Other shrubs/Grasslands/Riparian/Nesting/Adult/Habitat Use-Selection/Reproduction/Other sage.

Swanson, S., D. Franzen, and M. Manning. 1987. Rodero Creek: Rising water on the high desert. Journal of Soil and Water Conservation 42:405-407.
Keywords: Sage Grouse/Livestock grazing/Water/Grasslands/Rodero Creek/Nevada.
***Notes*:** Describes restoration efforts along a perennial stream at Sheldon National Wildlife Refuge. The stream abuts wet meadows that were previously important habitat for sage-grouse broods during summer. The initial restoration appeared effective (e.g., dam construction to halt gulllying), but long-term effects were unknown.

Sweeney, C. 1996. In this 'wasteland,' a diversity of wildlife. Idaho Wildlife 16:13.
Keywords: Sage Grouse.

Swenson, J. E. 1986. Differential survival by sex in juvenile Sage Grouse and Gray Partiridge. Ornis Scandinavica 17:14-17.
Keywords: Sage Grouse/Gray Partridge/Juvenile/Mortality-Survival/Brood rearing/Montana/Reproduction.

Swenson, J. E., C. A. Simmons, and C. D. Eustace . 1987. Decrease of Sage Grouse *Centrocercus urophasianus*

after ploughing of sagebrush steppe. Biological Conservation 41:125-132.
Keywords: Sage Grouse/Shrub Removal/Montana/Winter/Cropland/ARTR/Understory-forbs/Understory-grasses/Yearling/Adult/Herbicides-pesticides/Agriculture/Population trends-Lek counts.
Abstract: The effects wildlife of ploughing sagebrush *Artemisia* spp. steppe have been little studied. From 1973 to 1984, numbers of lekking male sage grouse *Centrocerus urophasianus* declined by 73% in a study area of south central Montana, 16% of which was ploughed by 1984. The proportion of ploughed wintering areas increased from 10% in 1975 to 30% in 1984. In contrast, numbers of lekking male sage grouse on a nearby unploughed control area showed no clear long-term trend. Ploughing even small areas of sagebrush steppe to produce cereal grains appears more detrimental to sage grouse than chemical control of sagebrush.

Swope, H. M. 1969. Guidelines for range type-conversion projects in Sage Grouse range. Game information leaflet No. 74. Colorado Department of Natural Resources, Division of Game, Fish and Parks.
Keywords: Sage Grouse/Habitat Restoration/Diet/Strutting/Nesting/Brood rearing/Colorado/Sagebrush/Environmental Requirements/Herbicides-Pesticides/Shrub Removal/Scale.

Tate, J., Jr., M. S. Boyce, and T. R. Smith. 1979. Response of Sage Grouse to artificially created display ground. Pages 459-463 *in* General Technical Report RM-65. The mitigation symposium: A national workshop on mitigation losses of fish and wildlife habitat. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.
Keywords: Sage Grouse/Distribution-Mapping/Roads/Disturbance/Reproduction/Lekking.

Thompson, W. K. 1946. Live-trapping and transplanting ringnecked pheasants and Sage Grouse. Pages 133-137 *in* Proceedings of the 26th Annual Conference of the Western Association of State Game and Fish Commissioners.
Keywords: Sage Grouse/Translocation/Montana/Distribution-Mapping/Trapping/Predation/Cropland/Techniques-Methods.

Thorne, T. 1969. Diseases in Wyoming Sage Grouse. Pages 192-198 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Disease-Parasites/Wyoming/Water.

Thorvilson, R. C. 1969. An appraisal of endocrine activity in strutting sage grouse. M.S. thesis. Montana State University, Bozeman. 15 pages.
Keywords: Sage Grouse/Endocrine/Reproduction/Behavior/Physiology /Montana/Lekking/Yearling/Adult/Anatomy-Morphology.

Toepfer, J. E., R. L. Eng, and R. K. Anderson. 1990. Translocating prairie grouse: what have we learned? Transactions of the North American Wildlife and Natural Resources Conference. 55:569-579.
Keywords: Sage Grouse/Translocation/Movement/Nesting/Brood rearing/Mortality-Survival/Physiology/Reproduction/Disease-Parasites.
Abstract: The release of wild-trapped or pen-reared game birds to establish populations in unoccupied habitat is a common wildlife management practice. Of the upland game birds of North America, the prairie grouse--prairie-chickens (*Tympanuchus cupido pinnatus, T. c. attwateri, T. pallidicinctus*), sharp-tailed grouse (*T. phasianellus*) and sage grouse (*Centrocercus urophasianus*)--have the poorest record when it comes to establishing populations. It is no coincidence that relatively sedentary species such as wild turkeys (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), ring-necked pheasants (*Phasianus colchicus*) and gray partridge (*Perdix perdix*) have been the easiest to establish. In contrast, prairie grouse are mobile and make extensive seasonal movements, primarily by flying. This mobility makes it difficult to keep these birds in the vicinity of the release site. Lewis (1961) indicated that minimal movement away from release sites is the key to a successful translocation. Attempts to establish prairie grouse have been numerous but not well documented, and few results have been published. This paper summarizes information from the literature, unpublished progress reports and discussions with individuals involved with prairie grouse translocations.

Toepfer, J. E., J. A. Newell, and J. Monarch. 1988. A method for trapping prairie grouse hens on display grounds. Pages 21-23 *in* Prairie chickens on the Sheyenne National Grasslands. U.S. Forest Service General Technical Report RM-159. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
Keywords: Sage Grouse/Trapping/Fence/Techniques-Methods/Lekking.
***Notes*:** Although the trap design described in this paper could be used to capture sage grouse, as mentioned in the last paragraph of the article, the paper is about methods for trapping prairie grouse, primarily Greater Prairie Chickens, on leks.

Torell, L. A., J. A. Tanaka, N. Rimbey, T. Darden, L. Van Tassell, and A. Harp. 2002. Ranch-level impacts of changing grazing policies on BLM land to protect the Greater Sage-Grouse: evidence from Idaho, Nevada, and Oregon. PACWPL Policy Paper SG-01-02. Policy Analysis Center for Western Public Lands, Caldwell, ID. 20 pages.
Keywords: Sage Grouse/Idaho/Oregon/Nevada/Livestock grazing/Sensitivity Analysis/Economics.
Abstract: PDF available at: http://pacwpl.nmsu.edu/Projects.htm.

Townsend, J. 1969. Policy of BLM as it specifically relates to wildlife habitat, and effects on habitat of chemical control of sagebrush. Pages 131-134 *in* Proceedings of the 6th Biennial Western States Sage Grouse Workshop. Rock Springs, WY.
Keywords: Sage Grouse/Habitat Restoration/Movement/Diet/Water/Migration/Herbicides-Pesticides/Livestock grazing/Management.

Trueblood, R. W. 1952. Sage grouse, grass reseeding studies. Utah Fish and Game Bulletin 9(8):1,7.
Keywords: Sage Grouse/Habitat Restoration.

Trueblood, R. W. 1954. The effect of grass reseeding in sagebrush lands on Sage Grouse populations. M.S. thesis. Utah State University, Logan, Utah.
Keywords: Sage Grouse.

Tweit, S. J. 2000. The [next] spotted owl. Audubon 102(6):64-70.
Keywords: Sage Grouse/Grasslands/Migration/ Idaho/Behavior/Connectivity-Fragmentation/Habitat Use-Selection/Habitat Restoration/Predation/Cheatgrass/Livestock grazing.

U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants; animal candidate review for listing as endangered or threatened species, proposed rule. Federal Register. 56:58804-58812.
Keywords: Sage Grouse/Endangered species/Taxa.

U.S. Fish and Wildlife Service. 1994. Final EIS for the Hart Nat. Antelope Refuge, Comp. mgt. plan. USFWS, reg. 1, Portland, OR. 2.
Keywords: Sage Grouse.

USDI Bureau of Land Management. 1975. Effects of livestock grazing on wildlife, watershed, recreation, and other resource values in Nevada. USDI-BLM. 96 pages.
Keywords: Sage Grouse/Livestock grazing/Nevada/Recreation/Weather-Climate/Riparian/Crested wheatgrass/Herbicides-Pesticides/Meadow/Predation/Movement/Pinyon-Juniper/Management/Roads.

USDI Bureau of Land Management. 2000. Management guidelines for Sage Grouse and sagebrush ecosystems in Nevada . Nevada BLM. Not paginated pages.
Keywords: Sage Grouse/Nevada/Reproduction/Nesting/Reproduction/Movement/Mortality-Survival/Brood rearing/Habitat Use-Selection/Winter/Fire /Livestock grazing/Pinyon-Juniper/Recreation/Mineral-Oil development.

USDI Bureau of Land Management, U. S. Fish and Wildlife Service U. S. Forest Service Oregon Department of Fish and Wildlife and Oregon Department of State Lands. 2000. Greater Sage-Grouse and the sagebrush-steppe ecosystem: management guidelines. Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Oregon Department of Fish and Wildlife, and Oregon Department of State Lands. 27

pages.
Keywords: Sage Grouse.
***Notes*:** Guidelines primarily developed for management of BLM lands in Oregon and Washington.

Vale, T. R. 1974. Sagebrush conversion projects: An element of contemporary environmental change in the western United States. Biological Conservation 6:274-284.
Keywords: Sage Grouse.

Vehrencamp, S. L., J. W. Bradbury, and R. M. Gibson. 1989. The energetic cost of display in male Sage Grouse. Animal Behaviour 38:885-896.
Keywords: Sage Grouse/Models/Behavior/Lekking/Weather-Climate/Physiology.
Abstract: The energetic expenditure of displaying male sage grouse, *Centrocercus urophasianus* , was measured for 18 individuals in the field using the doubly labelled water technique. Daily energy expenditure increased significantly with increased display rate, increased time spent on the lek, and decreased ambient temperature. Daily energy expenditure for the most vigorously displaying males was two times higher than for a non-displaying male and four times higher than basal metabolic rate. Estimates of the instantaneous rate of energy expenditure during display ranged from 13 multiplied by 9 to 17 multiplied by 4 times basal metabolic rate. The effort devoted to display differed markedly among males and was correlated with certain other male characteristics. Males that attended leks were in better condition (higher body weight relative to size) than non-attenders, but among lek attenders condition was negatively correlated with increased display effort.

Versaw, A. 1997. CFO field trip report: Gunnison Sage Grouse/shorebirds April 26-27, 1997. Colorado Field Ornithologists Journal 31:124-126.
Keywords: Sage Grouse/Gunnison Sage-Grouse.

Wakkinen, W. L. 1990. Nest site characteristics and spring-summer movements of migratory Sage Grouse in southeastern Idaho. M.S. thesis. University of Idaho. 55 pages.
Keywords: Sage Grouse/ARTRWY/Nesting/Habitat Use-Selection/Migration/Idaho/Predation/Distribution-Mapping.

Wakkinen, W. L., K. P. Reese, and J. W. Connelly. 1987. Sage Grouse and fire: an update on an Idaho research project . J. Chairman Roberson, editor. 15th Sage Grouse Workshop Transactions of the Western States Sage Grouse Committee; Western Assoc. of Fish and Game Agencies; Midway, UT; 28-30 July, 1987.
Keywords: Sage Grouse/Fire/Idaho.

Wakkinen, W. L., K. P. Reese, and J. W. Connelly. 1992. Sage Grouse nest locations in relation to leks. Journal of Wildlife Management 56:381-383.
Keywords: Sage Grouse/Nesting/Lekking/Habitat Use-Selection/Predation/Weather-Climate/ Idaho/ARTRWY/Other shrubs/Understory-grasses/Crested Wheatgrass/Adult/Movement.
Abstract: We tested 2 predictions about the locations of nests of lek-forming species to evaluate a guideline developed to protect sage grouse (*Centrocercus urophasianus*) nesting habitat. Sage grouse (n = 37) in southeastern Idaho did not attempt to nest midway between leks, as 1 hypothesis suggests. Neither was there evidence indicating that areas surrounding a lek are important for nesting, as a second hypothesis suggests. Because distribution of sage grouse nests was random with respect to lek location, nesting habitat protection based on either hypothesis affords no special protection for nests.

Wakkinen, W. L., K. P. Reese, Connelly J. W., and R. A. Fischer. 1992. An improved spotlighting technique for capturing Sage Grouse. Wildlife Society Bulletin 20:425-426.
Keywords: Sage Grouse/Reproduction/Idaho/ Lekking/ARTR.

Wallestad, R. 1973. Fall and winter requirements of sage grouse in relation to sagebrush control. Pages 23-24 *in* Ecological effects of chemical and mechanical sagebrush control. Montana Fish and Game Dept. Job Progress Report, Project No. W-105-R-77 and 8. 131 pages.
Keywords: Sage Grouse.

Wallestad, R. 1975. Life history and habitat requirements of Sage Grouse in central Montana. Montana Department of Fish and Game. 65 pages.
Keywords: Sage Grouse/Montana.

Wallestad, R. 1975. Male Sage Grouse responses to sagebrush treatments. Journal of Wildlife Management 39:482-484.
Keywords: Sage Grouse/Herbicides-Pesticides/ARTR/Montana/Strutting/Nesting/Population trends.

Wallestad, R., J. G. Peterson, and R. L. Eng. 1975. Foods of adult Sage Grouse in central Montana. Journal of Wildlife Management 39:628-630.
Keywords: Sage Grouse/Diet/Montana/Year round/ARTR/Cropland.

Wallestad, R., and D. Pyrah. 1974. Movement and nesting of Sage Grouse hens in central Montana. Journal of Wildlife Management 38:630-633.
Keywords: Sage Grouse/Montana/Movement/Nesting/Agriculture/Distribution-Mapping/Winter/ARTR/Other shrubs/Adult/Reproduction.
Abstract: Movements and nesting cover of sage grouse (*Centrocercus urophasianus*) hens were studied in central Montana during the springs of 1969, 1970, 1971, and 1972. Thirty-one sage grouse hens were radio-equipped resulting in 22 nests being located. Nineteen additional nests were located during nest searches and work incidental to telemetry. Adults laid larger clutches than yearling hens and also were more successful in bringing off a brood. Sixty-eight percent of the 22 nests of radio-equipped hens occurred within 1.5 miles (2.5 km) of the strutting ground where the hens were captured. Sagebrush (Artemisia tridentata) formed the nesting cover over all of the nests located. Successful nests were located in sagebrush stands with a higher average canopy coverage than those of unsuccessful nests, and had significantly greater sagebrush cover within 24 inches (60 cm) of nest and within a 100-square foot (9-m^2) plot around nest. Consideration of the ecological requirements of animals affected by publicly funded programs is important. This is especially true of sage grouse since extensive areas of sagebrush have already been eliminated or modified by such programs with little apparent regard for the welfare of this unique game bird.

Wallestad, R., and P. Schladweiler. 1974. Breeding season movements and habitat selection of male Sage Grouse. Journal of Wildlife Management 38:634-637.
Keywords: Sage Grouse/Movement/Habitat Use-Selection/Montana/Recreation/Behavior/Nesting/Winter/Strutting/ARTR/Other shrubs/Lekking/Yearling/Adult.
Abstract: Movements and habitat requirements of sage grouse (*Centrocercus urophasianus*) cocks were studied in central Montana during the breeding seasons of 1968 and 1972. Fifteen sage grouse cocks were captured and radio-equipped. Movements of up to 0.8 mile (1.3 km) from the strutting grounds were common, with 82 percent of the locations falling beyond 0.2 miles (0.3 km). Sagebrush (Artemisia tridentata) with a canopy coverage of 20-50 percent occurred at 80 percent of the 100 locations measured. Average sagebrush canopy coverage at these sites was 32 percent. Strutting grounds are key activity areas within wintering-nesting complexes which can be readily identified and delimited, and should be given complete protection from sagebrush removal projects. Results of this and previous studies in this area indicate that this protection should extend to a radius of no less than 1.5 miles (2.4 km) from strutting grounds.

Wallestad, R. O. 1970. Summer movements and habitat use by Sage Grouse broods in central Montana. M.S. thesis. Montana State University, Bozeman, Montana.
Keywords: Sage Grouse/Habitat Use-Selection/Brood-rearing/Montana/Movement/Cropland/Distribution-Mapping/Sagebrush/ARTR/Other sage/Other shrubs/Grasslands/Understory-forbs/Riparian/Juvenile/Yearling/Adult/Environmental Requirements/Movement/Scale.
***Notes*:** Studied movements and habitat use of sage grouse hens with broods during 2 summers (1968-69) in central Montana. Had 580 locations on 18 radio-telemetered grouse. Height of sagebrush at brood sites averaged 6-18 inches, and canopy cover of sagebrush used most by grouse with broods was scattered (0-10%) or "common" (10-25%). "Rare" sagebrush (0-1% canopy) was primarily agricultural land, and was used most in late summer. Canopy cover of sagebrush at brood locations varied during the brood-rearing

season; means were : June - 14%; July - 12%; August - 10%; and September - 21%. Forb cover at brood locations averaged 27% one summer and 17% the next. Grass canopy cover means were 51% and 47% in the 2 years. Sizes of areas used by broods varied, depending on season and what habitat type occupied (e.g., sagebrush vs. alfalfa fields). Food availability seems to determine what habitat types are used during different parts of the summer season.

Yearling hens moved more on a daily basis than did adults (749 yards average, vs. 645). Broods usually in sagebrush-grassland in early summer, shifting to more mesic bottomlands later, with a shift in the diet to more succulent forbs (vs. the insects eaten early in life). Daily activity was also reduced with this shift. Increased daily movements in August may correspond to shifts back to sagebrush grasslands.

Wallestad, R. O. 1971. Summer movements and habitat use by Sage Grouse Broods in central Montana. Journal of Wildlife Management 35:129-136.
Keywords: Sage Grouse/Summer/Movement/Habitat Use-Selection/Brood rearing/Montana/Weather-Climate.
Abstract: The habitat use and movements of sage grouse (*Centrocercus urophasianus*) broods were studied with the aid of radiotelemetry in central Montana during the summer of 1968 and 1969. Five hundred and eleven locations were obtained on 13 radiomarked sage grouse broods. In both summers big sagebrush (Artemisia tridentata) in scattered (110 percent) and common (1025 percent) densities received the greatest utilization by broods. Sagebrush heights at brood sites ranged mainly between 6 and 18 inches. For the 2 years combined, sagebrush canopy coverage averaged 14 percent for June, 12 percent for July, 10 percent for August, and 21 percent for September. Broods utilized sagebrush grassland benches early in the summer (June and July) and shifted to greasewood (*Sarcobatus vermiculatus*) bottoms and/or alfalfa (*Medicago sativa*) fields as the forbs on the higher elevations became desiccated. Broods remained in these bottom types until late August and early September and then shifted back into sagebrush. Sizes of areas used by broods averaged 213 acres in sagebrush in early summer (June and July), 144 acres in alfalfa fields (July and August), 91 acres in greasewood bottoms (July and August), and 128 acres in sagebrush in late summer (August and September). Availability of food appeared to be the factor that determined the vegetational types utilized by broods during different periods of the summer.

Wallestad, R. O. 1973. Movements and nesting requirements of Sage Grouse hens in central Montana. Pages 54 *in* Proceedings of the 8th Biennial Western States Sage Grouse Workshop, Lewistown, MT.
Keywords: Sage Grouse/Movement/Nesting/Montana/ARTR.

Wallestad, R. O., and R. C. Watts. 1972. Small game research: Factors effecting annual Sage Grouse productivity in central Montana. Montana Department of Fish and Game. 24 pages.
Keywords: Sage Grouse/Montana/Productivity.

Wambolt, C. L., A. J. Harp, B. L. Welch, N. Shaw, J. W. Connelly, K. P. Reese, C. E. Braun, D. A. Klebenow, E. D. McArthur, J. G. Thompson, L. A. Torell, and J. A. Tanaka. 2002. Conservation of Greater Sage-Grouse on public lands in the western U.S.: implications of recovery and management policies. PACWPL Policy Paper SG-02-02. Policy Analysis Center for Western Public Lands, Caldwell, ID. 41 pages.
Keywords: Sage Grouse/Habitat management/Livestock grazing/Hunting/Fire/Predation/Translocation/Weather-Climate/Inventory/Monitoring/Economics.
Abstract: PDF available at: http://pacwpl.nmsu.edu/Projects.htm.

Ward, J. C. 1944. Rodent poison and bird life. Wyoming Wildlife 7(4):15, 20.
Keywords: Sage Grouse/Herbicides-Pesticides.

Ward, J. C., M. Malcolm, and W. Allred. 1942. The susceptibility of Sage Grouse to strychnine. Journal of Wildlife Management 6:55-57.
Keywords: Sage Grouse/Strychnine/Cropland/Mortality-Survival.

Ware, L. 1951. Curtain falls on Utah's greatest hunt . Utah's Fish and Game Bulletin . 8(12):1-2.
Keywords: Sage Grouse/Hunting/Utah/Migration.

Washington Department of Fish and Wildlife . 1994. Washington State management plan for sage grouse.

Keywords: Sage Grouse/Washington/Management.

Washington Department of Fish and Wildlife. 1995. Washington state management plan for Sage Grouse. Washington Department of Fish and Wildlife, Wildlife Management Program, Olympia, WA. 101 pages.
Keywords: Sage Grouse/Taxonomy/Behavior/Diet/Mortality-Survival/Reproduction/Distribution-Mapping/Population trends/Habitat Use-Selection/Recreation/Lekking/Herbicides-Pesticides/Cropland/Washington.

Watters, M. E., T. L. McLash, C. L. Aldridge, and R. M. Brigham. 2002. The effect of vegetation structure on the fate of artificial Greater Sage-Grouse nests. Ecoscience 9(2):In Press.
Keywords: Sage Grouse/Nesting/Predation.

Watts, C. R. 1973. Factors affecting annual Sage Grouse productivity in central Montana. Pages 49 *in* Proceedings of the 8th Biennial Western States Sage Grouse Workshop, Lewistown, MT. 8.
Keywords: Sage Grouse/Montana/Productivity/Reproduction/Yearling/Weather-Climate.

Webb, D. R. 1993. Sage Grouse nest site characteristics and microclimates on grazed lands in Wyoming. Pages 25 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and 18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse.
***Notes*:** Abstract only.

Webb, R. 2001. Status review of the Mono Basin distinct population segment of the Greater Sage Grouse (*Centrocercus urophasianus phaios).* Institute for Wildlife Protection, Eugene, OR. Publ. No. 361-01. 195 pages.
Keywords: Sage Grouse/California/Distribution-Mapping/Endangered species.
***Notes*:** This document was submitted to the USFWS as supporting evidence by the Institute for Wildlife Protection in their petition of December 28, 2001 for a rule to list the Mono Basin sage grouse under the Endangered Species Act. The two primary threats to sage grouse listed in the abstract are cheatgrass invasion and the spread of juniper.

Wehr, E. E. 1931. A new species of nematode worm from the sage grouse. Proceedings of the U.S. National Museum. 79(3):1-3.
Keywords: Sage Grouse/Disease-Parasites.

Weidensaul, S. 2001. Sage grouse strut their stuff. Smithsonian 33(3):56-63.
Keywords: Sage Grouse/Strutting/Habitat Use-Selection/Lekking/Livestock grazing/Agriculture/Predation/Habitat Restoration/Mortality-Survival.

Welch, B. L., C. L. Cox, and T. K. Sales. 1995. Strutting grounds and strutting: posturing of two Utah Sage Grouse populations. Res. Pap. INT-485. USDA Forest Service, Intermountain Research Station, Ogden, UT. 9 pages.
Keywords: Sage Grouse/Utah/Population trends/Behavior/ARTRVA/Connectivity-Fragmentation.

Welch, B. L., J. C. Pederson, and R. L. Rodriguez. 1988. Selection of big sagebrush by Sage Grouse. Great Basin Naturalist 48:274-279.
Keywords: Sage Grouse/ARTRTR/ARTRVA/ARTRWY/Winter/Utah/Behavior/Diet.
Abstract: Feeding sites of wintering sage grouse (*Centrocercus urophasianus*) were located, one each in stands of three subspecies of big sagebrush (*Artemisia tridentata* : ssp. t*ridentata* , basin; spp. *vaseyana* , mountain; and ssp. *wyomingensis* , Wyoming). Evidences of differential use of plants within subspecies were observed. Whole leaves from fed-on and nonfed-on big sagebrush plants were examined for intrasubspecies chemical comparisons of crude protein, phosphorus, in vitro digestibility, and monoterpenoids. No significant differences were detected except for in vitro digestibility of Wyoming fed-on and nonfed-on big sagebrush and monoterpenoid content of basin big sagebrush. Nutritive content of all three subspecies was high, which may in part help to explain wintering sage grouse weight gains.

Welch, B. L., J. C. Pederson, and R. L. Rodriguez. 1989. Monoterpenoid content of Sage Grouse ingesta. Journal of Chemical Ecology 15:961-969.
Keywords: Sage Grouse/ARTR/Diet/ARTRWY/ARTRVA.
Abstract: The authors tested the hypothesis that the monoterpenoid levels in the ingesta from various digestive organs of sage grouse are less than that expected from the big sagebrush leaves ingested. Results supported the hypothesis. Dramatic reductions occurred between the gizzard and duodenum. Monoterpenoid levels in the ceca were nil; thus adverse effects of monoterpenoids on ceca microbes would also be nil.

Welch, B. L., F. J. Wagstaff, and J. A. Roberson . 1991. Preference of wintering Sage Grouse for big sagebrush. Journal of Range Management 44:462-465.
Keywords: Sage Grouse/ARTR/ARTRVA/ARTRWY/ARTRTR/Utah/Winter/Diet.

Welch, B. L., F. J. Wagstaff, and R. L. Williams . 1990. Sage Grouse status and recovery plan for Strawberry Valley, Utah. Research Paper INT-430. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 10 pages.
Keywords: Sage Grouse/Utah/ARTR/Diet/Nesting/Brood rearing/Movement/Spring/Fall/Summer/Winter/Habitat Use-Selection/Distribution-Mapping`.

West, N. E. 2001. Landscape issues in Sage Grouse management. Pages 25-26 *in* 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001.
Keywords: Sage Grouse/Habitat Use-Selection.
***Notes*:** This is an expanded abstract.

Western States Sage Grouse Committee. 1974. Guidelines for habitat protection in sage grouse range.
Keywords: Sage Grouse.

Whitson, T. D., and R. A. Olson. 2001. A comparison of changes in plant species with applications of 2,4-D and tebuthiuron. Pages 22-24 *in* 54th Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, 17-23 Feb 2001.
Keywords: Sage Grouse/ARTR/Livestock grazing/Herbicides-Pesticides.
***Notes*:** This is an expanded abstract.

Widemo, F., and I. P. F. Owens. 2000. Size and stability of vertebrate leks. Animal Behaviour 58(6):1217-1221.
Keywords: Sage Grouse/Lekking/Models/Behavior/Reproduction.

Wiley, R. H. 1969. Social structure of Sage Grouse strutting grounds. 6th Biennial Western States Sage Grouse Committee Proceedings. 6:188-192.
Keywords: Sage Grouse/Strutting/Behavior/Reproduction/Anatomy-Morphology.

Wiley, R. H. 1973. The strut display of male Sage Grouse: A "fixed" action pattern. Behaviour 47:129-152.
Keywords: Sage Grouse/Behavior/Strutting/ Mating.

Wiley, R. H. 1973. Territoriality and non-random mating in Sage Grouse, *Centrocercus urophasianus*. Animal Behavior Monographs 6:87-169.
Keywords: Sage Grouse/Territoriality/Mating/Behavior/Distribution-Mapping/Lekking/Strutting/Nesting.

Wiley, R. H. 1974. Evolution of social organization and life-history patterns among grouse. Quarterly Review of Biology 49:201-227.
Keywords: Sage Grouse/Reproduction/Anatomy-Morphology/Lekking/Dispersal/Winter/Behavior/Habitat Use-Selection/Mortality-Survival/Diet/Polygyny.

Wiley, R. H., Jr. 1970. Territoriality and non-random mating in Sage Grouse *Centrocercus urophasianus*. Ph.D.

dissertation. The Rockefeller University, New York, New York.
Keywords: Sage Grouse/Territoriality/Behavior/Mating/Reproduction /Genetics/Lekking/Strutting.

Wiley, R. H., Jr. 1978. The lek mating system of the Sage Grouse. Scientific American 238:114-125.
Keywords: Sage Grouse/Lekking/Reproduction/Behavior/Mortality-Survival/Rocky Mountains.

Willett, G. 1906. Eggs of the sage grouse. Condor 6:75.
Keywords: Sage Grouse.

Willis, M. J. 1988. Coyote ecology and removal. Oregon Department of Fish and Wildlife, Progress Report, Fed. Aid in Wildl. Restoration W-87-R-7. 7 pages.
Keywords: Sage Grouse/Oregon/Predation.

Willis, M. J. 1989. Sage Grouse research. Progress report, Study Number III, Project Number W-87-R-5, Oregon Department of Fish and Wildlife, Portland, OR.
Keywords: Sage Grouse/Reproduction/Oregon/Habitat Use-Selection/Winter/Nesting/Brood rearing/Mortality-Survival.

Willis, M. J. 1990. Sage Grouse habitat use and survival. Progress report, Study Number II, Project Number W-87-R-6, Oregon Department of Fish and Wildlife, Portland, OR. 7 + appendices pages.
Keywords: Sage Grouse/Habitat Use-Selection/Oregon/Crested Wheatgrass/Winter/Mortality-Survival.
***Notes*:** Study objective is to "determine reasons for the declining productivity of sage grouse." One sub-objective was to develop a comprehensive research plan for sage grouse in Oregon, and a final study plan was completed as part of this project. This progress report also includes a more developed study plan for job 5 on "winter distribution and habitat selection." The research study plan appended is dated 30 August 1989 by M. J. Willis and is entitled, "Influence of crested wheatgrass on wintering sage grouse in southeast Oregon."

Willis, M. J. 1991. Sage Grouse habitat use and survival. Progress Report. Fed. Aid Wildlife Restoration Project Number W-87-R-7, Sub-project 285, Study III. Oregon Department of Fish and Wildlife, Portland, OR. 9 pages.
Keywords: Sage Grouse/Oregon.
***Notes*:** Short progress report on each of the 4 remaining jobs of the ODFW sage grouse study. Most of the data presented are for job #5, the winter habitat use and selection study.

Willis, M. J. 1992. Sage Grouse habitat use and survival. Progress report, Study Number III, Project Number W-87-R-8, Oregon Department of Fish and Wildlife.
Keywords: Sage Grouse/Habitat Use-Selection/Mortality-Survival/Nesting/Brood rearing/Winter.

Willis, M. J., and G. P. Keister, Jr. 1984. Sage grouse ecology (research plan - 1984). Oregon Dept. of Fish and Wildlife, Wildlife Research. Unpublished file report.
Keywords: Sage Grouse/Oregon.

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Keywords: Sage Grouse/Oregon/Habitat Use-Selection/Predation/Water/Livestock grazing/Hunting.

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Keywords: Sage Grouse/Mortality-Survival/Reproduction/Diet/Fire/Habitat Restoration/Seeding forage/Oregon/Habitat Use-Selection.

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***Notes*:** Volume 2 contains "group level" results, with summaries of habitat amount and changes from historical to current amounts across the Basin, as well as management implications for the species in the group. Sage-grouse are in Group 33 (p. 347-355), along with other sagebrush associated species such as Brewer's Sparrow, Sage Sparrow, and Pygmy Rabbit.

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Keywords: Sage Grouse/Reproduction/Mortality-Survival/Hunting/Models/Diet/Habitat Use-Selection/Nesting/Behavior.

Wooley, D. J. 1946. Estimated sage grouse kill. Colorado Conservation Comments 1(9):19.
Keywords: Sage Grouse/Hunting.

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Wrobleski, D. W. 1999. Effects of prescribed fire on Wyoming big sagebrush communities: implications for ecological restoration of Sage Grouse habitat. M.S. thesis. Oregon State University, Corvallis, Oregon. 76 pages.
Keywords: Sage Grouse/Fire/Habitat Restoration/ARTRWY/Nesting/Anatomy-Morphology/Diet.

Wyoming Game and Fish Department. 2002. Wyoming Greater Sage-Grouse conservation plan. Draft plan. Wyoming Game and Fish Department, Cheyenne, WY. 72 pages.
Keywords: Sage Grouse/Wyoming.
***Notes*:** No author or publisher appears on the pdf version of this plan. It is a draft, dated July 10, 2002, and was retrieved from the WGFD web site.

Yocom, C. F. 1956. The sage hen in Washington State. Auk 73:540-550.
Keywords: Sage Grouse/Washington/Habitat Use-Selection/Livestock grazing/Fire/Water/Population trends/Hunting/Migration.
Abstract: The purpose of this report is to get on record what is known about some of the history of the Sage Hen in the State of Washington so that it will be available for future workers in game management. The distributional information presented here is only fragmentary. It is hoped that others that have pertinent information on this species will record it. Management and population studies should be made on the remaining areas in Washington that are suitable for this species so that the Sage Hen will remain one of our harvestable game birds for many years to come on managed lands.

Young, J. R. 1992. Influence of secondary sexual traits on male mating success in an isolated population of sage grouse. Fourth International Behavioral Ecology Congress, Princeton, NJ, 17-22 Aug 1992. (World Meeting Number 923 5022).
Keywords: Sage Grouse.

Young, J. R. 1993. Reproductive behavior of Gunnison Sage Grouse: Do mating barriers exist? Pages 21 *in* Proceedings of the 1st Joint Meeting: 20th Prairie Grouse Technical Council Meeting and18th Western States Sage/Columbian Sharp-Tailed Grouse Workshop, Fort Collins, Colorado.
Keywords: Sage Grouse/Behavior/Gunnison Sage-Grouse.

Young, J. R. 1994. The influence of sexual selection on phenotypic and genetic divergence among Sage Grouse populations. Ph.D. dissertation. Purdue University, West Lafayette, IN. 123 pages.
Keywords: Sage Grouse/Population trends/Nesting/Habitat Use-Selection/Brood rearing/Summer/Behavior/Genetics/Lekking/Distribution-Mapping/Gunnison Sage-Grouse.
Abstract: I studied the mating behavior, ecology, and genetics of an isolated population of sage grouse (*Centrocercus urophasianus*) in the Gunnison Basin, Colorado. Sage grouse have a lek mating system in which only a small percentage of males mate. Sexual selection in such a mating system can lead to rapid evolution of sexual dimorphism in size, plumage characteristics and mating behavior as well as associated female preferences for such male traits. As a result, I predicted that sexual selection could increase population divergence as well as reduce population persistence. Field observations indicated that traits important to male mating success, such as mating vocalizations, had diverged in the Gunnison population relative to other sage grouse populations. To determine the effect of this divergence in male mating vocalizations on female behavior, I conducted reciprocal field playback experiments at two leks, one in Gunnison and the other in a nearby, but allopatric, northern Colorado population. Females in each population avoided male vocalizations from the other population, suggesting the existence of a premating barrier. While female mating behavior differed between populations, my investigation of female nesting ecology and summer habitat use showed that Gunnison females are ecologically similar to females in other sage grouse populations. Females in Gunnison (a) chose nest sites with more sagebrush density and structure than random sites, (b) had higher nesting success in areas with greater shrub density and forb and grass cover, and (c) used flat, mesic areas with extensive grass and forb components when rearing broods. Genetic analyses of four sage grouse populations revealed moderately higher bandsharing and F_{st} values compared to nonlekking bird species. In addition, some genetic differentiation exists among the four populations and between leks in Gunnison. My results demonstrate the Gunnison population is distinct in secondary sexual traits, but not female ecology. These results are consistent with the view that sexual selection can have a direct role in the initial stages of population divergence leading to speciation. My results also suggest that lek mating species may have reduced genetic variation relative to nonlekking species and subsequently are more vulnerable to environmental changes.

Young, J. R. 1994. Male vocalizations act as mating barriers between sage grouse populations: The effect of playbacks on female mating behavior . 1994 Midwest Animal Behavior Conference, Carbondale, IL, 8-10 Apr 1994. (World Meeting Number 942 5508).
Keywords: Sage Grouse/Behavior.

Young, J. R., C. E. Braun, S. J. Oyler-McCance, J. W. Hupp, and T. W. Quinn. 2000. A new species of Sage Grouse (Phasianidae: *Centrocercus*) from southwestern Colorado. Wilson Bulletin 112: 445-453.
Keywords: Sage Grouse/Gunnison Sage-Grouse/Dispersion/Habitat/Reproduction/Behavior/Taxonomy/Colorado/Utah/Lekking/Yearling/Adult/Connectivity-Fragmentation/Anatomy-Morphology/Behavior/Distribution-Mapping/Genetics.
Abstract: The Gunnison Sage-Grouse (*Centrocercus minimus*) is described as a new species from southwestern Colorado and contrasted with the Sage-Grouse (*Centrocercus urophasianus*) from northern Colorado and western North America. Gunnison Sage-Grouse differ from all other described sage-grouse (C. u. urophasianus, C. u. phaios) in morphological measurements, plumage, courtship display, and genetics. The species currently is limited to 8 isolated populations in southwestern Colorado and adjacent San Juan County, Utah. Total estimated spring breeding population is fewer than 5000 individuals with the largest population (<3000) in the Gunnison Basin (Gunnison and Saguache counties), Colorado.

Young, J. R., J. W. Hupp, J. W. Bradbury, and C. E. Braun. 1994. Phenotypic divergence of secondary sexual traits among Sage Grouse, *Centrocercus urophasianus*, populations. Animal Behaviour 47:1353-1362.
Keywords: Sage Grouse/Population trends/Behavior/Reproduction/Models/Distribution-Mapping/Gunnison Sage-Grouse.
Abstract: Sage grouse, *Centrocercus urophasianus*, in an isolated montane basin near Gunnison, Colorado

differ in several morphological and behavioural traits from conspecifics studied in other areas of the species' range. Both sexes in Gunnison are smaller than sage grouse elsewhere, and males possess differences in feather morphology as well. The mating behaviour of male sage grouse in three populations was examined to determine whether male strut displays of Gunnison sage grouse were behaviourally distinct. Behavioural analyses revealed Gunnison males perform strut displays at a slower rate than males in the two other sage grouse populations sampled. In addition, Gunnison males' strut displays contain unique visual and acoustical aspects. The most distinguishing attributes of Gunnison sage grouse were male secondary sexual characteristics including traits that correlate with mating success in other populations. Thus, phenotypic differences observed in the Gunnison population represent a divergence in expression of traits that are likely to be influenced by sexual selection. Recent models of speciation suggest that species characterized by intense sexual selection, such as those with lek mating systems, have the potential for rapid inter-populational divergence in male traits and female preferences leading to speciation.

Young, J. R., and D. J. Minchella. 1997. The role of genetics and behaviour in Sage Grouse *Centrocercus urophasianus* management and conservation. Wildlife Biology 3:276.
Keywords: Sage Grouse/Behavior/Genetics/Lekking/Distribution-Mapping.

Zablan, M. A. 1993. Evaluation of Sage Grouse banding programs in North Park, Colorado. M.S. thesis. Colorado State University. 7 pages.
Keywords: Sage Grouse/Weather-Climate/Mortality-Survival/Colorado/Models/Hunting/Colorado/ARCA/ARTR/ARTRVA /ARTRWY/Other shrubs/Spring/Winter/Juvenile/Adult/Techniques-Methods.
***Notes*:** Estimated annual survival rates of sage grouse in North Park, CO, using 15 years of leg band recovery data. Survival differed between the sexes. For females, there were no annual differences, nor were subadults different from adults. Estimated survival for females was 54.7%. For males, differences were found among years and between age classes: mean survival for males banded as adults was 38.4%, and 51.7% for males banded as subadults. Author also examined effects of weather on survival rates. Found no effect of any of the weather variables examined (spring and winter precipitation and spring and winter temperatures) on survival of males. However, statistical power was low. Need 600 banded birds/year in each sex and age class to obtain CVs of 20% for annual survival, to detect a difference of 0.4 in annual survival. Also examined effects of aggregated recoveries on estimates. Assessed accuracy, precision, and bias of recovery and survival rate estimates by comparing known and simulated recovery and survival rates. Did not determine extent of recovery aggregation, but results suggested that even with low levels of aggregation, effects of this on precision of estimates of survival and recovery could be great.

Zablan, M. A. 1993. Upland bird research: Survival estimates of Sage Grouse in North Park, Colorado. Colorado Division of Wildlife. 48 pages.
Keywords: Sage Grouse.

Zunino, G. W. 1987. Harvest effect on Sage Grouse densities in northwest Nevada. M.S. thesis. University of Nevada, Reno, Nevada. 41 pages.
Keywords: Sage Grouse/Hunting/Nevada/Lekking/Brood rearing/Population trends/Weather-Climate/Distribution-Mapping.
Abstract: Sage grouse (*Centrocercus urophasianus*) densities, production, and harvest rates were monitored on two study areas in northern Washoe County, Nevada for two years. Late summer estimated grouse densities increased from 0.4 birds/km2 in 1984 to 3.6 birds/km2 in 1985 on the control (nonhunted) study area. Grouse densities increased from 1.9 birds/km2 in 1984 to 5.4 birds/km2 in 1985 on the experimental (hunted) study area. The percent increase in grouse density on the nonhunted area was 4 times greater than the percent increase on the hunted area. Recruitment into each grouse population was low throughout the study period. Production was not significantly different between or within the study areas in 1984 or 1985. Hunter harvest rates appeared to be high each year ranging from 63% of the observed density in 1984 to 25% of the estimated density in 1985.