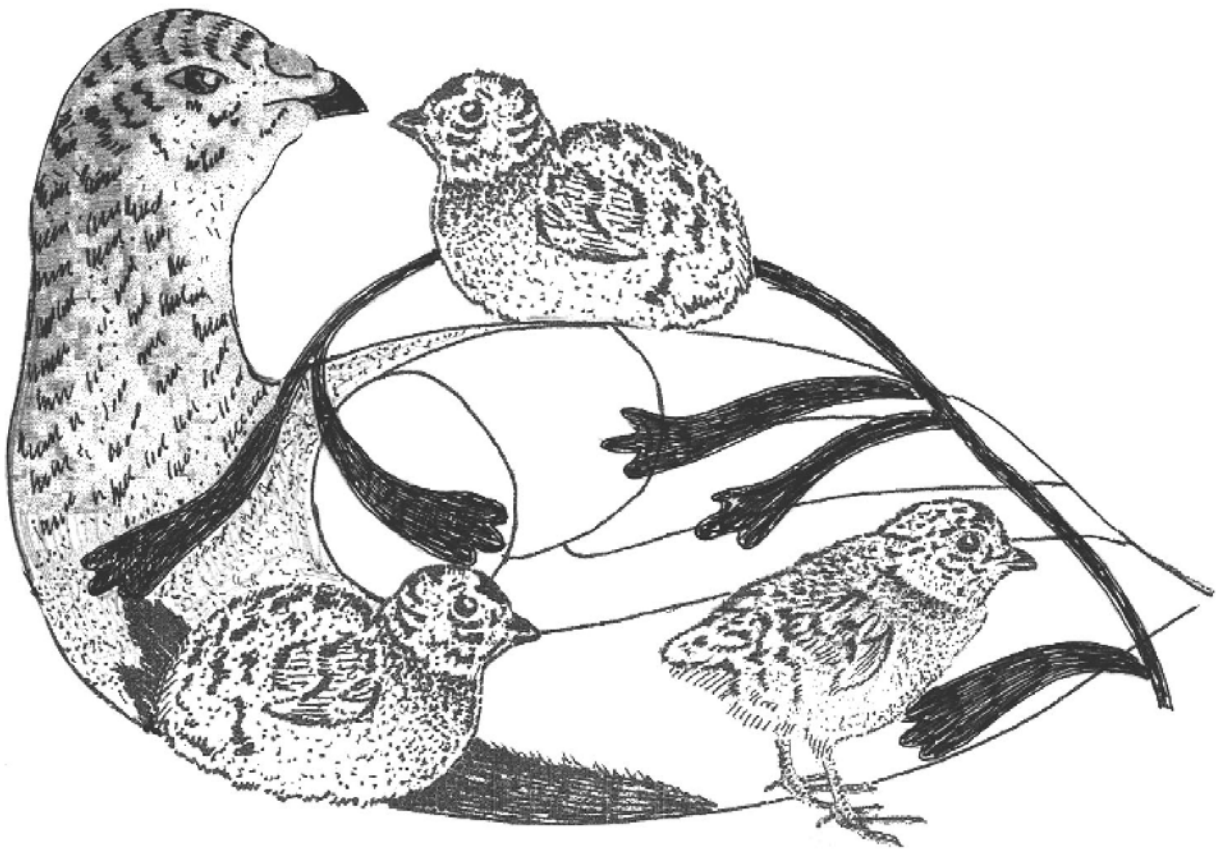
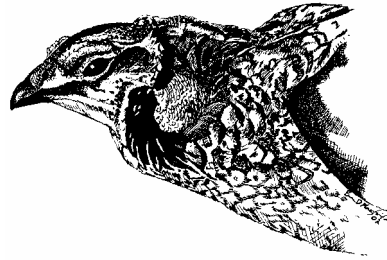


*24<sup>th</sup> Meeting of the  
Western Agencies Sage and Columbian  
Sharp-tailed Grouse Technical Committee*



*Wenatchee, Washington  
June 28 - July 1, 2004*



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## *Program Committee*

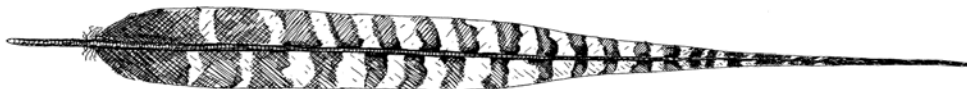
*Michael A. Schroeder, Washington Department of Fish and Wildlife*  
*Matt Berger, Colville Confederated Tribes*  
*Leslie A. Robb, Bridgeport, Washington*

## *Monday Program, 28 June 2004*

<b>2:00 PM</b>	Business meeting – Western Agencies Sage- and Columbian Sharp-tailed Grouse Technical Committee
<b>7:00 PM</b>	Reception – Western Agencies Sage- and Columbian Sharp-tailed Grouse Technical Committee

## *Tuesday Program, 29 June 2004*

<b>8:00 AM</b>	Welcome and opening announcements – Michael A. Schroeder, Washington Department of Fish and Wildlife
<b>Session chair – E. Thomas Rinkes</b>	
<b>8:20 AM</b>	West Nile Virus: an emerging issue in sage-grouse conservation – David E. Naugle, Brett L. Walker, Cameron L. Aldridge, Todd E. Cornish, Brendan J. Moynahan, Matt J. Holloran, Kimberley Brown, Gregory D. Johnson, Edward T. Schmidtman, Richard T. Mayer, Cecilia Y. Kato, Marc R. Matchett, Thomas J. Christiansen, Walter E. Cook, Terry Creekmore, Mark S. Boyce, Roxanne D. Falise, and E. Thomas Rinkes
<b>9:15 AM</b>	Breeding ecology of greater sage-grouse in Mono County, California – Eric J. Kolada, Michael L. Casazza, James S. Sedinger, Melissa A. Farinha, Scott Gardner, and Tim Taylor
<b>9:35 AM</b>	Preliminary results from a translocation of sage-grouse to Strawberry Valley, Utah – Rick Baxter, Jerran T. Flinders, and Dean Mitchell
<b>9:55 AM</b>	<b>BREAK</b>
<b>Session chair – Anthony D. Apa</b>	
<b>10:20 AM</b>	The effects of raven removal on sage grouse nest success – Peter S. Coates and David J. Delehan
<b>10:40 AM</b>	Use of subcutaneous implants for monitoring survival of greater sage-grouse chicks – Michael A. Gregg, Mike R. Dunbar, and John A. Crawford
<b>11:00 AM</b>	Modeling greater sage-grouse chick survival in southeast Idaho – Nathan A. Burkepile, Kerry P. Reese, and John W. Connelly
<b>11:20 AM</b>	Seasonal survival of radio-marked female sage grouse in Mono County, CA: results from the first year of a radio-tracking based study – Melissa A. Farinha, James S. Sedinger, Michael L. Casazza, Christopher A. Nicolai, and Scott Gardner
<b>11:40 AM</b>	Sage-grouse population dynamics and movement in central Nevada – Bradley C. Comstock and James S. Sedinger
<b>12:00 PM</b>	<b>LUNCH</b>
<b>Session chair – Derek Stinson</b>	
<b>1:15 PM</b>	Landscape-Scale Nesting Behavior of Greater Sage-Grouse ( <i>Centrocercus urophasianus</i> ) in north-Central Montana – Brendan J. Moynahan
<b>1:35 PM</b>	Sage grouse “Adopt-A-Lek” program – Jay Gore and Ben Deeble
<b>1:55 PM</b>	Working together to provide a broadscale habitat planning map for greater sage-grouse in Idaho – Michelle L. Commons-Kemner and Signe Sather-Blair
<b>2:15 PM</b>	Conservation Reserve Program: effects of capping enrollment – Lee G. Hemmer
<b>2:35 PM</b>	Oregon greater sage-grouse: a stronghold or barely holding on? – Christian A. Hagen and David A. Budeau
<b>2:55 PM</b>	<b>BREAK</b>
<b>Session chair – Joe Bohne</b>	
<b>3:20 PM</b>	Sage and sharp-tailed grouse in Washington: a conservation overview – Dave Hays, Michael Livingston, Colin Leingang, and Michael A. Schroeder
<b>3:50 PM</b>	Role and activities of Greater Sage-grouse Framework Team – Dwight Bunnell
<b>4:05 PM</b>	Endangered Species Act and the greater sage-grouse – Patricia Diebert
<b>4:20 PM</b>	Development of greater sage-grouse conservation strategy – San J. Stiver
<b>6:00 PM</b>	Business meeting – Western Agencies Sage- and Columbian Sharp-tailed Grouse Technical Committee



# Wednesday Fieldtrip, 30 June 2004

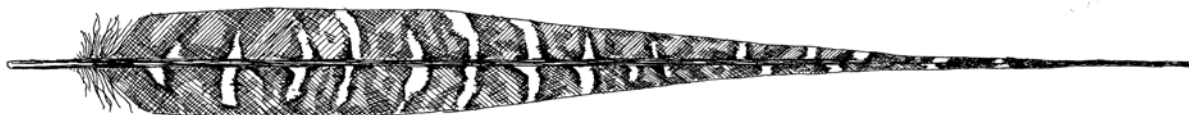
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<b>7:00 AM</b>	Load buses in front of Red Lion Hotel
<b>7:15 AM</b>	Travel to Sagebrush Flat Wildlife Area
<b>8:30 AM</b>	Sagebrush Flat Wildlife Area (Stop 1)
	<b>Habitat</b> – Edd Bracken, Washington Department of Fish and Wildlife
	<b>Management</b> – Dan Peterson, Washington Department of Fish and Wildlife
	<b>Sage-grouse</b> – Michael A. Schroeder, Washington Department of Fish and Wildlife
<b>9:10 AM</b>	Travel to The Nature Conservancy’s Moses Coulee Area
<b>9:30 AM</b>	Moses Coulee Area (Stop 2)
	<b>Geology</b> – Brent Cunderla, Bureau of Land Management
	<b>Habitat</b> – Edd Bracken
	<b>Wildlife</b> – Neal Hedges, Bureau of Land Management
	<b>Shrub-steppe restoration research</b> – Matt Vander Haegen, Washington Department of Fish and Wildlife
	<b>Landscape management</b> – Chuck Warner, The Nature Conservancy
	<b>Sage-grouse</b> – Michael A. Schroeder
<b>10:15 AM</b>	Travel to Douglas County glacial moraine
<b>10:45 AM</b>	Glacial moraine (Stop 3)
	<b>Geology</b> – Brent Cunderla
	<b>Habitat</b> – Jerry Benson, Retired from Washington Department of Fish and Wildlife
	<b>Sage-grouse</b> – Michael Schroeder
<b>11:45 AM</b>	Travel to Mansfield School
<b>12:15 PM</b>	Mansfield School (Stop 4)
	<b>Lunch</b> – Shirley Lester, Mansfield Dollars for Scholars
	<b>Private land and wildlife</b> – Wade Troutman, Landowner
	<b>Douglas County HCP</b> – Britt Dudek
<b>1:30 PM</b>	Travel to Crown Point
<b>2:15 PM</b>	Crown Point overlook (Stop 5)
	<b>Geology</b> – Brent Cunderla
	<b>Sharp-tailed grouse in Washington</b> – Matt Berger and Donovan Antoine, Colville Confederated Tribes
<b>2:45 PM</b>	Travel to Buffalo Lake area (Delay for broken bus)
<b>4:45 PM</b>	Buffalo Lake area (Stop 6)
	<b>Habitat</b> – Edd Bracken
	<b>History and management of sharp-tailed grouse</b> – Matt Berger and Donovan Antoine
<b>5:15 PM</b>	Travel to Colville Agency Convention Grounds
<b>5:30 PM</b>	Colville Agency Convention Grounds (Stop 7)
	<b>Dinner</b> – Colville Confederated Tribes
	<b>Program</b> – Matt Berger and Deb Louie, Colville Confederated Tribes
<b>8:00 PM</b>	Travel to Dry Falls
<b>9:00 PM</b>	Dry Falls overlook (Stop 8)
	<b>Geology</b> – Brent Cunderla
<b>9:15 PM</b>	Travel to Wenatchee
<b>10:45 PM</b>	Red Lion Hotel, Wenatchee

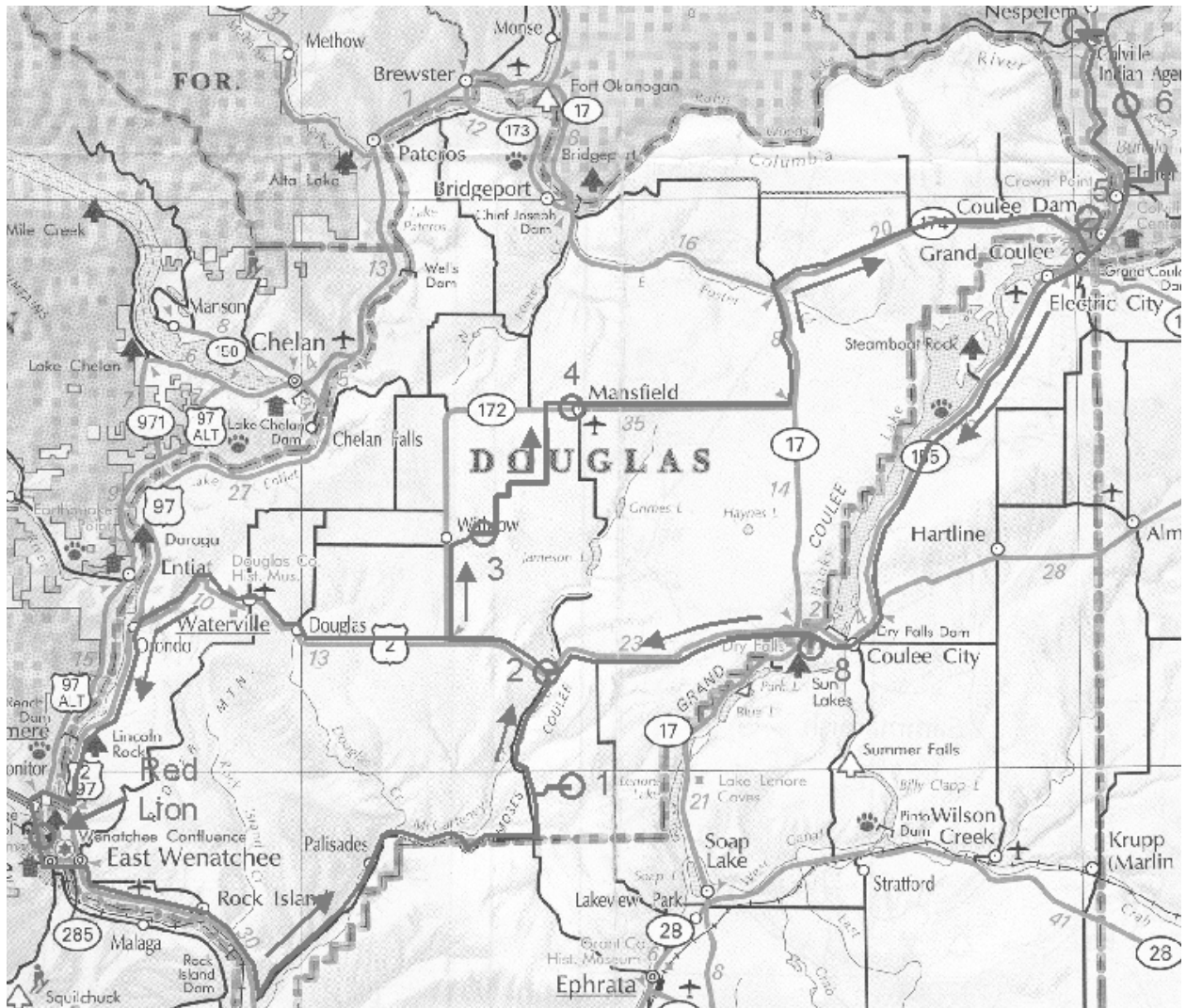
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# Fieldtrip Map

The following map shows the approximate course of the fieldtrip between Wenatchee and the Colville Agency. The numbers in the circles refer to the stops described in the itinerary above. The trip took approximately 2-hours longer than expected due to bus problems between stops 5 and 6.



# Thursday Program, 1 July 2004

<b>Session chair – Ben Deeble</b>	
<b>8:10 AM</b>	Columbian sharp-tailed grouse in British Columbia: status and conservation efforts – Ernest Leupin and Douglas Jury
<b>8:40 AM</b>	Microsatellite DNA phylogeny of sharp-tailed grouse and molecular diversity within the Columbian subspecies ( <i>Tympanuchus phasianellus columbianus</i> ) – Kenneth I. Warheit, Michael A. Schroeder, Allen Spaulding, and Karen Mock
<b>9:00 AM</b>	Assessment of subspecific lineages within the recently derived sharp-tailed grouse ( <i>Tympanuchus phasianellus</i> ): approaching the limits of neutral molecular markers – Allen Spaulding, Karen Mock, Michael A. Schroeder, and Kenneth I. Warheit
<b>9:20 AM</b>	Columbian sharp-tailed grouse: distribution, status, habitat use, and population dynamics in Utah – Ron D. Greer
<b>9:40 AM</b>	Sage-grouse response to natural gas field development in northwestern Wyoming – Matthew J. Holloran and Stanley H. Anderson
<b>10:00 AM BREAK</b>	
<b>Session chair – Kerry Reese</b>	
<b>10:25 AM</b>	Spokane Tribe of Indians Columbian sharp-tailed grouse project – D. J. Wood
<b>10:35 AM</b>	Conservation program of the Columbian sharp-tailed grouse on the Flathead Indian Reservation – Brett Gullett and Don Catanzaro
<b>10:55 AM</b>	Gunnison sage-grouse in San Juan County, Utah: winter ecology, effects of grazing, and insect abundance – Sharon Ward and Terry A. Messmer
<b>11:15 AM</b>	Behavioral and genetic characterization of the Gunnison sage-grouse mating system – Julie R. Stiver and Anthony D. Apa
<b>11:35 AM</b>	Evaluating range-wide population changes in greater sage-grouse – E. O. Garton, J. W. Connelly, M. A. Schroeder, S. T. Knick, and S. J. Stiver
<b>11:55 PM LUNCH</b>	
<b>Session chair – Jerry Kobriger</b>	
<b>1:15 PM</b>	A neglected component of greater sage-grouse brood habitat: nocturnal roost sites – Doris Hausleitner, Kerry P. Reese, Anthony D. Apa, and R. Gerald Wright
<b>1:35 PM</b>	Sage-grouse brood-rearing habitat manipulation, sage-grouse use, and lagomorph herbivory, after two field seasons – David Dahlgren
<b>1:55 PM</b>	Evaluating the importance of forb abundance in brood areas to sage-grouse using human-imprinted chicks – Sherri Huwer, David R. Anderson, Thomas E. Remington, and Gary C. White
<b>2:15 PM</b>	Revisiting greater sage-grouse nest habitat - a work in progress – David D. Musil
<b>2:35 PM</b>	Landscape use by greater sage-grouse: effects of habitat fragmentation – Jay Shepherd, Kerry P. Reese, and John W. Connelly
<b>2:55 PM BREAK</b>	
<b>Session chair – Christian Hagen</b>	
<b>3:20 PM</b>	Modeling greater sage-grouse habitat in Alberta: a multi-scale approach – Cameron L. Aldridge and Mark S. Boyce
<b>3:40 PM</b>	Sage-grouse habitat evaluation on the Yakama Reservation – Brent E. Jamison, Michael F. Livingston, and Margaret Pounds
<b>4:00 PM</b>	Restoration of sagebrush communities following mechanical treatments of pinyon-juniper woodlands – Stephen B. Monsen, Pam Motley, and Bob Welch
<b>4:20 PM</b>	Columbian sharp-tailed grouse management on the Colville Indian Reservation – M. T. Berger, R. Whitney, and D. Antoine
<b>4:40 PM</b>	Effect of plasma protein on renesting by greater sage-grouse – Michael A. Gregg, Mike R. Dunbar, and John A. Crawford
<b>6:00 PM</b>	Reception and Banquet – Guest Speaker, Clait E. Braun, Grouse Inc.

# Abstracts

## **Modeling greater sage-grouse habitat in Alberta: a multi-scale approach**

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Mark S. Boyce, Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9 Canada

Greater sage-grouse (*Centrocercus urophasianus*) are endangered in Canada and currently exist at the northern fringe of their range in southeastern Alberta and southwestern Saskatchewan. The population has declined by 66-92% over the last 30 years and the factors driving the decline have been poorly understood. We present several local and landscape scale resource selection function models identifying habitat requirements for various life stages (nesting and brood rearing) of the greater sage-grouse in Alberta. Models include both habitat covariates (i.e. sagebrush, litter and forb biomass, range ecosite classification, elevation, slope, aspect, Landsat TM derived variables) and human-use covariates (i.e. road density, oil and gas well site density). We show how these models can be used to identify key habitat requirements for sage-grouse, and develop probability maps to predict sage-grouse occurrence across the landscape. Our models identify important habitats that should be protected to ensure the long-term viability of sage-grouse in Canada. We identify thresholds for human-use activities on the landscape, above which, habitat quality will decline. These models help to highlight specific habitat management needs for the recovery of sage-grouse in Canada and will form the bases of future management initiatives.

## **Preliminary results from a translocation of sage-grouse to Strawberry Valley, Utah**

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Jerran T. Flinders, Brigham Young University, 401 WIDB Provo, UT 84602, [jerran\\_flinders@byu.edu](mailto:jerran_flinders@byu.edu)

Dean Mitchell, Utah Division of Wildlife Resources, 1594 West North Temple Salt Lake City, UT 84114, [deanmitchell@utah.gov](mailto:deanmitchell@utah.gov)

In order to diminish the chance of extirpation in a declining population of greater sage-grouse and in order to study the viability of an experimental translocation, 38 female sage-grouse were translocated from Parker Mtn. in Wayne County, Utah to the Strawberry Valley in Wasatch County, Utah in April of 2003. A radio-collar was placed on each bird in order to track mortality, nest initiation, nest success, movements away from the release site, and seasonal habitat selection. Mortality, the first year following the translocation, totaled 37%. Summer/fall and winter dispersal distances away from the release site averaged 9.13 km and 10.66 km respectively. Twenty-one percent (8 of 38) of translocated females initiated a nest the same year of the translocation. Six of the 8 birds (75%) that initiated a nest, had successful nests, and raised a brood. At least 11 chicks from 5 of the successful nests were recruited to the fall population. Flocking of translocated hens with resident birds became more apparent as winter approached, with 80% of translocated hens being found in flocks with resident birds. Preliminary results in this study appear encouraging, yet caution should give way as "success" of a translocation will only be measured through time.

## **Columbian sharp-tailed grouse management on the Colville Indian Reservation**

M. T. Berger, Colville Confederated Tribes, Fish and Wildlife Dept., Nespelem, WA 99155,  
[matt.berger@colvilletribes.com](mailto:matt.berger@colvilletribes.com)

R. Whitney, Colville Confederated Tribes, Fish and Wildlife Dept., Nespelem, WA 99155

D. Antoine, Colville Confederated Tribes, Fish and Wildlife Dept., Nespelem, WA 99155

Columbian Sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) were once one of the most numerous birds in the Columbia Basin and the Northwest. In addition, they are culturally significant to Indigenous peoples of the region. The design and focus of this three-year Bonneville Power Administration funded project is the protection, restoration, and enhancement of Columbian Sharp-tailed grouse (CSTG) and surrounding habitat on the Colville and Spokane Indian Reservations and lands purchased/managed by the WDFW. This project reviewed past studies, data and expert opinion to formulate a detailed method for restoration and conservation of this species and associated habitats. A team of experts familiar with sharp-tailed grouse biology and habitat requirements coordinate and oversee population and habitat models, etc. for use in future management of this species. Grouse Team members make recommendations for restoration and conservation efforts within the region and assist various agencies and Tribes as requested. Walk-in traps were used to capture, take DNA samples, and attach radio collars to CSTG on different leks. Marked birds were followed and GPS points used to monitor seasonal habitat distribution and use. Currently in year two of the study, data collection and analysis to determine limiting factors restricting population growth and habitat utilization is still underway. Collected information will be used to develop an HSI model for CSTG and management plan for the Colville Reservation.

## **Modeling greater sage-grouse chick survival in southeast Idaho**

Nathan A. Burkepile, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID 83844, [grouse\\_nab@yahoo.com](mailto:grouse_nab@yahoo.com)

Kerry P. Reese, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID 83844

John W. Connelly, Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204

Sage grouse populations have been declining throughout their range. As a result of this decline we initiated a 4-year study to determine what reproductive parameters were limiting greater sage-grouse productivity. During 1999 - 2002, we radio-marked greater sage-grouse hens and monitored nesting activity. After eggs hatched, we radio-marked one-day-old chicks and monitored survival to 10 weeks post-hatch. Nest success ranged between 41 - 51% and did not differ ( $P < 0.001$ ) between years. From 1999 - 2001, chick survival ranged between 20 - 25% and did not differ ( $P < 0.001$ ) between years. However, in 2002 chick survival was higher (35%,  $P > 0.10$ ) than the previous 3 years. In all years, the highest mortality occurred during the first 3 weeks post-hatch. Proportional hazard models indicated that increased May-June precipitation had a positive influence on chick survival. Along with weather, vegetative cover (i.e. grass height, grass and forb cover) also had a positive influence on chick survival. Our results indicate that greater sage-grouse populations are negatively influenced by drought conditions through reduced chick survival, likely mediated through reduced vegetative cover.

## **The effects of raven removal on sage grouse nest success**

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David J. Delehanty, Department of Biological Sciences, Idaho State University, Pocatello, ID 83209,  
[deledavi@isu.edu](mailto:deledavi@isu.edu)

We measured the effects of common raven (*Corvus corax*) removal on the nest success of greater sage grouse (*Centrocercus urophasianus*). One cause of sage grouse population decline is thought to be reduced nest success due to egg depredation by ravens. Ravens are nest predators that have substantially increased in abundance in response to current human land-use practices. In many areas, wildlife managers use egg-baits treated with DRC-1339 to reduce raven numbers in sage grouse habitat. The effects of raven removal on grouse nest success and identification of any compensatory nest predators are largely unknown. During 2002 and 2003, the USDA/WS removed ravens from an experimental area in Nevada, within which we deployed miniature, camouflaged video cameras with time-lapsed recorders at sage grouse nests. Using continuous video monitoring throughout the incubation period, we determined the identity and observed the behavior of sage grouse nest predators. Sage grouse nest success during 2002 and 2003 was 74% (n=19), with no depredations of sage grouse nests or sage grouse nest visitations by ravens. We also observed the behavior of animals that encountered nests, and identified possible biases with estimating raven “take” from the attrition of egg-baits. We found video cameras to be effective devices for identifying predators. These results may be useful in formulating future predator removal activities for sage grouse management.

### **Working together to provide a broadscale habitat planning map for greater sage-grouse in Idaho**

Michelle L. Commons-Kemner, Idaho Department of Fish and Game, 3101 S. Powerline Rd., Nampa, ID 83686, [mcommons@idfg.state.id.us](mailto:mcommons@idfg.state.id.us)

Signe Sather-Blair, U.S. Bureau of Land Management, 1387 S. Vinnell Way, Boise, ID 83709,  
[Signe\\_Sather-Blair@blm.gov](mailto:Signe_Sather-Blair@blm.gov)

For the past 10 years, the greater sage-grouse (*Centrocercus urophasianus*) has become the forefront of conservation planning for both state and federal agencies. Therefore, to better facilitate conservation efforts, we developed a broadscale habitat planning map for sage-grouse in Idaho. The original purpose of the map was to help fire managers develop initial attack plans for fires in sage-grouse habitats dominated by sagebrush. It has since evolved to include habitat restoration potential in areas currently or previously occupied by sage-grouse. State and federal wildlife biologists initially drew polygons of known sage-grouse occurrence on 1:100,000 scale maps. Once the polygons were digitized, they were separated into specific habitat types, key habitat, restoration potential 1 (perennial grassland dominated), restoration potential 2 (annual grassland dominated), and restoration potential 3 (conifer encroachment areas). The population layer was developed incorporating the state’s lek data. The population layer is made up of 2 sub-layers, stronghold (areas with stable sage-grouse populations) and isolated (areas with decreasing sage-grouse populations). The maps are updated on a yearly basis as fires occur, restoration efforts change the classification of a sub-layer, or new information is obtained. The maps are a useful visual tool to help biologists, fire managers, private landowners, ranchers, and others develop appropriate conservation measures for sage-grouse across Idaho.

### **Sage-grouse population dynamics and movement in central Nevada**

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James S. Sedinger, University of Nevada, Reno 1000 Valley rd. Reno, NV 89512,  
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To completely characterize demographic processes in greater sage-grouse (*Centrocercus urophasianus*), we monitored 10 lek sites in a 180 km<sup>2</sup> area in Eureka County, Nevada. We used color banding, lek observations, vegetation sampling and radio telemetry. Sage-grouse were color banded (270 total; 245 male and 25 female) and lek observations were conducted to estimate population demographics and movement probability. We recaptured 30 males after initial marking and used these recaptures and program NOREMARK (White 1996) to estimate a population size of 490 males (95% CI=247-993). 1 individual was recaptured on a lek other than the one on which he was banded. We used radio telemetry to monitor seasonal movement and to locate nesting females. Once located, nests were monitored to determine nest success and nest site vegetation was evaluated for cover characteristics. We used program MARK (White and Burnham 1999) to estimate daily nest survival estimate (.954; 95% CI= .9073-.9728) and nest success (.269; 95% CI =.066-.539). The long-term goal of this 10 year study is to determine if possible increases in avian predators due to transmission lines perch sites have an impact on sage-grouse leks and survival.

### **Sage-grouse brood-rearing habitat manipulation, sage-grouse use, and lagomorph herbivory, after two field seasons**

David Dahlgren, Utah State University, Department of Forestry, Range, and Wildlife Sciences, 5230 Old Main Hill, Logan, UT 84322, [dkd@cc.usu.edu](mailto:dkd@cc.usu.edu)

The greater sage-grouse (*Centrocercus urophasianus*) population on Paker Mountain has seen a downward trend over the last couple of decades. In 1998-1999 the Parker Mountain Adaptive Resource Management (PARM) team funded a study to assess baseline information on sage-grouse. Based on 1998-1999 study, PARM proposed to treat 100-acre plots, containing approximately 40-70% big mountain sagebrush, with two mechanical treatments. In 2000 experimental plots were randomly allocated, with 4 replicates per treatment, of Dixie harrow, Lawson aerator, and control plots. Pre- and post-treatment data was taken using a variation of the point-intercept and line intercept methods. In October 2001 treatments were completed. In 2002 and 2003 post-treatment data was collected. In 2003 bird dog flush counts and sage-grouse pellet counts were conducted to assess use within treatment plots. In addition to sage-grouse research, we became interested in the effect of lagomorph herbivory on treatment response. In 2001 ungulate exclosures were erected due to grazing concerns. Researchers observed increased rabbit use within ungulate exclosures during late summer. In spring 2002 we constructed rabbit exclosures in each treatment type to determine the impact of lagomorph herbivory on the grass/forb component. In 2002 and 2003 data was collected using a daubenmire frame within exclosures. Data will continue to be collected through the 2004 field season.

### **Seasonal survival of radio-marked female sage grouse in Mono County, CA: results from the first year of a radio-tracking based study**

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Michael L. Casazza, United States Geological Survey, Western Ecological Research Center, Dixon, CA 95620

Christopher A. Nicolai, University of Nevada, Reno, Department of Environmental and Resource Sciences, Reno, NV 89512

Scott Gardner, California Department of Fish and Game, Wildlife Programs Branch, Sacramento, CA 95814

Several petitions have been filed under the Endangered Species Act to list the greater sage grouse (*Centrocercus urophasianus*), with one of these petitions specifically for the population in the Mono basin in Mono County, California. Mono County is located at the western edge of the sage grouse range adjacent to the Sierra Nevada Mountains. We studied five subpopulations of greater sage grouse within Mono County. One of the objectives was to determine annual and seasonal survival rates for the entire subpopulation. Comparisons of survival rates across seasons would allow us to examine possible subadult and adult population limiting factors. We trapped and radio marked adult and subadult greater sage grouse during spring and fall of 2003 and spring of 2004. Radios were equipped with mortality sensors. Individual locations were determined at a minimum of once per week throughout the year. The intensive tracking schedule allowed us to determine when a transmitter was on mortality signal within a few days. Seasons were separated as follows: spring; March-May, summer; June-August, fall; September-November, and winter; December-February. We used program Mark to create a model to determine whether variation existed between survival rates among seasons and between subadults and adults. We created a model that allowed subadults to “graduate” into adult age classes in their second winter of life. In general, survival rates showed a cyclic pattern throughout the year with peak survival occurring during the fall and winter. Juvenile survival rates were generally 10-12% lower than those of adults and followed the same patterns.

### **Evaluating range-wide population changes in greater sage-grouse**

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Greater sage-grouse (*Centrocercus urophaisanus*) populations have declined >50% during the last 4 decades throughout their much of their original range that included parts of 14 states and 3 provinces. We performed a comprehensive analysis of changes in their populations throughout this historical range by accumulating and analyzing all available male counts at more than 5,600 sage- grouse leks identified since agencies began routine monitoring of this species. Range-wide declines were reflected to varying degrees in all regions with 3 states and 1 province apparently experiencing complete extirpation of the species. Three different but related methods to assess population trend (changes in males per lek, lek class size (small <20 to large 50+), rate of change index) all indicated widespread declines. Eighty three percent of populations showed declines in males per lek with statistically significant declines in 69% of the populations. Six of seven regions showed statistically significant declines. In all regions the percent of small leks grew while the percentage of large leks declined. Sage-grouse populations overall declined at a rate of 2.0% per year from 1965 to 2003. This annual rate of decline was much higher during the first 2 decades (3.5% in 1965-86) compared to the last 2 decades (0.37% in 1986-2003). Applying density-independent models of population growth to the overall population indicates a low probability of persistence if the population continues to decline but a more realistic density- dependent model suggests a higher probability of persistence.

## **Sage grouse “Adopt-A-Lek” program**

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Trained citizens have been used for the past 5 years to gather population data on sage-grouse leks in Montana, Wyoming and Nevada in a program named "Adopt-A-Lek" launched by the National Wildlife Federation. Citizens volunteer their time for training and field work overseen by NWF and agency staff. They are trained to use appropriate sage-grouse survey protocols for the respective state using GPS units, data forms, topographic maps and other equipment.

Most regions do not possess the capacity to obtain replicate counts on a majority of their known sage-grouse leks. The objectives of Adopt-A-Lek are to efficiently supplement population and baseline habitat data for agencies to assist in determining grouse distribution and populations, to collect baseline habitat information. In some cases this project allows agencies to task their professional staff with more technical aspects of grouse research and management.

During 2003 sixty-five citizens gathered data at 132 active and historic leks in Montana, Wyoming, and Nevada. They searched for leks in additional areas using trained bird dogs, and detected 12 new leks. In 2004 ninety volunteers were fielded, for which results have not yet been tabulated.

Major funding for the project has come from the National Fish and Wildlife Foundation, and NWF has partnered with over 25 other businesses, agencies, foundations and individuals. Volunteers have been recruited from retired agency ranks, academia, landowners, and the hunting community. Associated benefits from the program are that volunteers become knowledgeable and effective advocates for sage-grouse and sagebrush steppe habitats, which is particularly critical in communities where harvest-based advocacy is declining.

## **Use of subcutaneous implants for monitoring survival of greater sage-grouse chicks**

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Declines in greater sage-grouse (*Centrocercus urophasianus*) abundance may be attributed to low juvenile survival. However, little information is available about factors influencing sage-grouse chick survival. We developed a method for radio-marking sage-grouse chicks to estimate survival, determine cause of mortality and evaluate habitat use. We modified subcutaneous implants for use on newly hatched greater sage-grouse chicks. Miniature transmitters weighing 0.83 to 1.1 g with a battery life of 28 days, were implanted subcutaneously just anterior of the scapulars. We monitored radio-marked chicks daily for 28 days following capture and unmarked chicks at 28 days post-hatch to evaluate capture and transmitter effects on survival. We used Akaike's Information Criterion to select the best model among a set of 20 a priori candidate models of capture and transmitter effects on chick survival. Five hundred sixty-one chicks (288 marked and 273 unmarked) were monitored during spring and summers of 2002-3. Predation was the primary mortality factor for radio-marked chicks. Inflammation or infection at the transmitter implant site was not evident in any chicks and did not contribute to any chick deaths. Seven chicks (2% of total captured) apparently died from effects related to capture or transmitter implantations. Results of model selection indicated that unobserved capture and transmitter effects did not bias 28 day

survival rates for greater sage-grouse chicks. Subcutaneous implants are an effective method for attaching transmitters to newly hatched greater sage-grouse chicks to estimate survival rates and will facilitate research investigating habitat use and factors effecting chick survival.

### **Columbian sharp-tailed grouse: distribution, status, habitat use, and population dynamics in Utah**

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With the decline of Columbian sharp-tailed grouse (CSTG) populations in the western states, the information needed to make good management decisions was not readily available to managers in northern Utah. This project will attempt to garner information about the population distribution, the habitat uses in different seasons, with high interest being placed on nesting, brood rearing and wintering uses. To accomplish this, CSTG were trapped on dancing grounds and fitted with a necklace style radio transmitting collar. The collared birds were then located weekly and a vegetation analysis using a Robel pole and a Daubenmire frame was done on flush points and a randomly selected paired point. The importance of different types of habitat, including CRP, is being investigated, along with mortality rates. Identification of seasonal habitat is a prime concern, and by locating birds in all seasons, habitat usage by season is being determined. By locating collared hens during nesting season and monitoring them during brood rearing, suitable habitat will be identified. Defining population trends and identifying previously unknown populations in historic ranges is being done. Habitat improvement projects are being implemented and monitored. The data collected in the first year is still being analyzed, with results and conclusions forthcoming.

### **Effect of plasma protein on renesting by greater sage-grouse**

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Greater sage-grouse (*Centrocercus urophasianus*) population declines have been attributed to reduced productivity. Renesting by sage-grouse can contribute significantly to annual productivity during some years. Because of lack of information on this aspect of sage-grouse reproductive ecology, we investigated the effect of dietary protein, age of hen, and time of nest initiation and loss of first nests on occurrence of renesting. We captured, determined age, collected blood, and radio-marked pre-laying female sage-grouse on 3 study areas during 1999-2003. Radio-marked females (n = 168) were monitored during the reproductive period to determine date of nest initiation and nest loss, and renesting activity. We used Akaike's Information Criterion adjusted for small samples sizes (AICc) and Akaike weights (wi) to determine the best approximating model from a group of 8 candidate models based on hypothesized importance of our variables to renesting by sage-grouse. Our results indicated that probability of renesting varied by age, nest initiation period, nest loss period, and level of total plasma protein. The odds of renesting decreased 1.77 times (95% CI: 1.18 to 2.36) for each unit increase in nest initiation period, increased 7.88 times (95% CI: 6.89 to 8.88) for hens that had nests depredated during the first 2 weeks of incubation, and increased 16.54 times (95% CI: 14.18 to 18.90) for each unit of increase in total plasma protein. During our study, the greatest renesting effort was for adult females that initiated nests early during the nesting season and had nests depredated during the first 2 weeks of incubation. Total plasma protein was greater for renesting hens regardless of age, nest initiation period, or nest loss period.



Because sage-grouse obtain nutrients required for reproduction immediately prior to breeding from the available food supply, management that promotes high quality pre-laying hen habitat could potentially effect sage-grouse reneesting rates.

### **Conservation program of the Columbian sharp-tailed grouse on the Flathead Indian Reservation**

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This conservation program is a multi-phase effort by the Confederated Salish and Kootenai Tribes to reintroduce Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*). The Columbian sharp-tailed grouse is an important species to the Salish, Pend O'reille and Kootenai people that has suffered tremendous declines over the past century with 1978 being the last documented recording on tribal lands. The conservation program will consist of four phases: habitat assessment, reintroduction plan, public awareness and implementation of plan. Presently, we are undergoing habitat assessment of Ferry Basin using several remote sensing platform. Riparian draws will be delineated using high resolution 1m/4m multi-spectral spring IKONOS imagery. Grasslands systems will be delineated using multi-temporal (spring, summer, fall, and winter) 15m ASTER imagery. The fused product will then be used as inputs into existing Habitat Suitability Index models to determine the amount and quality of habitat that is available on Flathead Indian Reservation. An understanding of the quantity and quality of Columbian sharp-tailed grouse habitat on tribal lands is critical in order to increase the probability of successful reintroduction of this species. Information regarding spatial extent and quality of that habitat will be fed directly into a comprehensive reintroduction plan. The reintroduction plan will organize, prioritize, and guide the reintroduction process, establish objective criteria by which to measure progress, and detail specific actions needed prior to reintroduction.

### **Oregon greater sage-grouse: a stronghold or barely holding on?**

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Previous assessments of Oregon greater sage-grouse (*Centrocercus urophasianus*) indicated significant and negative long-term trends in spring population sizes and production indices with little hope of recovery. Despite these reports, Oregon greater sage-grouse populations have remained relatively stable over the last 30 years. The purpose of this paper is to discuss the current status of greater sage-grouse in Oregon, and some of the limitations to previous assessments of the population. We used lek count data, rates of population change from lek counts, and chick:hen ratios from brood surveys and wing-bees to evaluate population status. Spring breeding populations have fluctuated throughout assessment period, but the overall trend was not significantly different from zero. The rates of change data indicated significant declines during the early period, but populations have stabilized since the mid 1970s. Production data from harvest has been collected with consistent protocols from 1993-2003, and shows a steady increase in chick:hen ratios. Production ratios from brood survey were positively correlated with the wing-data during this same period, but the relationship was less clear over the long-term. Our results were contrary to previous assessments, and conclude that populations generally have stabilized since the declines of the early period (pre 1970s). We discuss the need to identify relevant and realistic periods for population objectives.

### **A neglected component of greater sage-grouse brood habitat: nocturnal roost sites**

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Declines in greater sage-grouse abundance may be associated with habitat degradation. Despite extensive research into the habitat requirements of the species, summer nocturnal habitat has received no attention. We investigated the vegetation characteristics of nocturnal roosts used by radio-marked female greater sage-grouse and compared diurnal and nocturnal habitat use during the brood-rearing period. Nocturnal roosts (n=58) had less visual obstruction and bare ground, and greater percent forb cover than at random sites (n=92). Mean shrub height and shrub cover at nocturnal roosts was shorter (31 vs. 58 cm) and less dense (9% vs. 22%) than at diurnal sites used by broods (n=92). Females with broods moved a median of 397 m from the last diurnal location to nocturnal roost sites. This suggests that females with broods were required to move 3 times their median daily movement in order to find suitable nocturnal brood habitat. Literature estimates of daily and seasonal movements of females with broods may be biased low. Guidelines for the management of brood-rearing habitats address only diurnal habitat needs and should be modified to include the requirements of nocturnal habitat.

### **Sage and sharp-tailed grouse in Washington: a conservation overview**

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Greater sage-grouse (*Centrocercus urophasianus*) and Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) have declined dramatically in Washington State over the past 100 years and are state listed as threatened species. Currently, sage-grouse occur in two distinct populations, one due east of Wenatchee in Douglas and northern Grant counties, and one to the south, located on the U. S. Army's Yakima Training Center. Sharp-tailed grouse occur in eight small subpopulations, each separated from the nearest population by distances of at least 20 kilometers. Statewide management plans for sage and sharp-tailed grouse were written in 1995 and a state sage-grouse recovery plan was completed in 2004. Significant recent conservation actions for the southern sage-grouse population include development and implementation of a management plan at the Yakima Training Center and a 2004 genetic augmentation with 25 birds from Nevada. Additionally the Yakima Indian Nation has conducted extensive habitat evaluation and developed plans for reintroduction southwest of the Yakima Training Center. A large number of enrollees in the federal Conservation Reserve Program as well as land acquisition by the Bureau of Land Management and The Nature Conservancy have played important roles in conservation of the northern sage-grouse population. Washington Department of Fish and Wildlife initiated management programs for sharp-tailed grouse during the 1990's with state land acquisition funds and mitigation funds from Bonneville Power Administration. Approximately 40,000 acres have been

acquired and managed by Washington Department of Fish and Wildlife for sharp-tailed grouse alone. Sharp-tailed grouse translocations to Scotch Creek in the late 1990's reversed declines, and the subpopulation is now increasing. Future conservation needs include augmentation of other sharp-tailed grouse subpopulations, continued involvement in federal farm-bill programs, and continued habitat recovery and improvement of land managed for sage and sharp-tailed grouse.

### **Conservation Reserve Program: effects of capping enrollment**

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Lands enrolled in the federal Conservation Reserve Program (CRP) support numerous species of birds, mammals, and reptiles. The relationship with CRP for sage grouse (*Centrocercus urophasianus*) and sharp-tailed grouse (*Tympanuchus phasianellus*) appears to be particularly dramatic. Most leks and nests in north-central Washington are located in CRP or in areas dominated by CRP. The CRP also has numerous benefits to landowners. Many of these shared benefits will be at risk if current rules for enrollment are not modified. One of the key rules in question caps CRP enrollment to 25% of the total cropland in a county.

### **Sage-grouse response to natural gas field development in northwestern Wyoming**

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Natural gas development across western North America has been increasing since the 1930s. According to the American Gas Association, natural gas consumption in the U.S. is expected to increase at least 40% by 2015. The paucity of information relating to the possible effects of natural gas development on greater sage-grouse populations combined with the recent discovery and development of natural gas reserves in northwestern Wyoming led to the following objective(s): determine the influence of (1) spring drilling activity at variable distances from active sage-grouse leks, and (2) road-related disturbance relatively close to active sage-grouse leks on male strutting behavior and survival, and female demographic parameters. Between 1998-2004, lek counts were used to estimate male lek attendance, and radio-marked birds were used to estimate male and female seasonal survival and female nesting demographics. Mean annual declines in the maximum number of males attending leks impacted by a drilling rig within 3.2km or a road within 500m were 32 and 19%, respectively, compared to 2% average annual declines for leks >6.5km from gas field disturbance (controls). Annual declines on road-disturbed leks were positively correlated with traffic volume (Pearson's correlation 0.607). Although lek attendance, male and female survival, and female demographics varied depending on lek-to-drilling rig and nest-to-drilling rig distances, the data suggests that the presence of a drilling rig within 5.5km directly and indirectly influenced sage-grouse. However, changes in female demographic parameters relative to controls did not explain the substantial lek attendance declines associated with natural gas disturbance.



## **Evaluating the importance of forb abundance in brood areas to sage-grouse using human-imprinted chicks**

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In order to effectively manage sage-grouse brood areas for the conservation of the species, information is needed on chick resource requirements. Forb abundance has been identified by several studies as an indicator of brood habitat quality, but no studies have quantified the direct effects of forb abundance on sage-grouse chicks. A promising method for conducting such studies uses human-imprinted sage-grouse chicks in field experiments. In 2002 and 2003, I conducted field experiments in Middle Park and Moffat County, Colorado, respectively. The objectives of these studies were (1) to develop and evaluate methods for acquiring human-imprinted sage-grouse chicks and using them in field experiments; and (2) to quantify the effects of 3 levels of forb abundance (i.e., < 10%, 10 – 20%, and >20%) in brood habitat on the growth of these chicks. These studies demonstrated that human-imprinted sage-grouse can be successfully used in field experiments and that this is, potentially, an informative approach to investigating a variety of grouse-habitat relationships. In 2002, there was no evidence that forb abundance in the exposure areas had an effect on the rate of mass gain or feather growth. However, in 2003, the mass gain and feather growth rate of chicks increased with increasing forb abundance. This result, in combination with results from previous studies that have shown a correlation between chick mass and long-term survival, suggests that management actions that increase forb abundance in brood areas with < 20% forb abundance may lead to increased chick survival and sage-grouse productivity.

## **Sage-grouse habitat evaluation on the Yakama Reservation**

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Greater sage-grouse (sage-grouse) have been absent from the Yakama Reservation for over 30 years. In line with efforts to recover sage-grouse populations in the state of Washington, we assessed vegetation characteristics in 180,000 acres of shrub steppe as habitat for sage-grouse to evaluate the area's potential to support a reintroduced population. Detailed vegetation cover type maps were produced using aerial photographs, topographic maps, and field assessments to identify polygons of unique vegetation associations. Vegetation characteristics (e.g., height of grasses, shrub coverage, etc.) were measured along transects in each of the major cover types. The vegetation cover type map was digitized and divided into 1-ha cells within a GIS. Vegetation attributes were estimated for each cell based on the cell's cover type and vegetation transect data using geostatistical techniques. Estimated vegetation attributes resulting from geostatistical analysis were used to calculate Habitat Suitability Indices for each cell for nesting, brood-rearing, and winter habitat. Using the seasonal HSIs, a "fitness index" model hypothesized to predict the rate of population growth was used to rank habitat suitability. The results of these efforts

indicated that 34,860 ha (~86,150 ac) of the assessment area should provide suitable habitat for sage-grouse. Current efforts focus on verifying the results of the vegetation modeling, developing a comprehensive sage-grouse recovery and management plan for the Reservation, and conducting habitat restoration work.

### **Breeding ecology of greater sage-grouse in Mono County, California**

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Greater sage-grouse (*Centrocercus urophasianus*) populations have declined range-wide, including California. The population of greater sage-grouse in Mono County, California was petitioned (unsuccessfully) for listing under the endangered species act as a distinct population segment, based on recent genetic information suggesting that they are relatively unique. Little published information is available about their breeding ecology in this region, which is in the southwestern most portion of the species' range. We initiated a study to gain a more comprehensive ecological understanding for the species in this region. We radio-marked 35 female sage grouse in spring of 2003, 19 females in the fall of 2003, and 15 females in the spring of 2004, and monitored these birds through the nesting season. We recorded nest initiation dates, re-nesting effort, clutch size, and predation events. We also recorded detailed vegetation measurements at nest sites, and random locations within the study area. For 2003, 70% of the hens initiated a nest. Of nests initiated, we found Mayfield estimates for nest success to be 34% using Program Mark. Fledging success was found to be 33% (% of hens that initiated a nest that produced > 1 chick > 50 days old). Of successful nests, 64% of the hens fledged chicks to > 50 days old. We observed an average brood size at time of hatching to be 6 with 53% surviving to at least 50 days old (n=45 chicks hatched). Data from the 2004 nesting season will be incorporated as it becomes available. The larger sample size in 2004 will enable us to compare nesting variables across seasons as well and link them to habitat characteristics recorded at nest sites.

### **Columbian sharp-tailed grouse in British Columbia: status and conservation efforts**

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Columbian sharp-tailed grouse, once the most abundant upland game bird in the Pacific Northwest has seen dramatic declines over much of its range. The primary factors responsible for their decline in British Columbia have been attributed to the loss and degradation of native climax grasslands. In British Columbia, Columbian sharp-tailed grouse inhabit both climax grasslands in the southern interior as well as large burns and cutblock habitats associated with sedge-meadow complexes to the north. These large

cutblocks were created over the last two decades to help curtail the spread of the mountain pine beetle. Grassland populations have seen the most severe declines in British Columbia and have been extirpated from the Okanagan Basin and the East Kootenay Trench. In areas where they still occur, grassland populations appear to have stabilized, albeit at significantly lower numbers than observed historically. While our knowledge of grassland populations is adequate, little is known regarding population status and distribution of birds in sedge meadow/cutover habitats. Preliminary inventory work in the spring of 2004 in the cutover habitats suggests that these populations may be abundant and widespread. The Ministry of Environment, Lands, and Parks launched a landowner stewardship program in 2002 to help restore and enhance grassland sharp-tailed grouse habitats and populations.

### **Restoration of sagebrush communities following mechanical treatments of pinyon-juniper woodlands**

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Pinyon-juniper have invaded and occupied extensive areas throughout the West as a result of a decrease in understory from grazing, changes in fire frequency, and associated management practices. Extensive loss of wildlife habitat has subsequently occurred, creating a decline in sage grouse and mule deer. Removal of tress and seeding introduced perennial grasses was a common practice beginning in the early 1960's. Numerous sites in Colorado were treated by anchor chaining and seeding as a means to enhance wildlife habitats and livestock grazing. Chaining practices have been questioned, but careful evaluation of the effects on wildlife habitat and plant community development has not been reported. This study was developed to evaluate the species composition, including the recovery of black sagebrush and Wyoming big sagebrush through natural recruitment approximately 40 years after treatment. Studies were located on old chainings and grass seedings of the Uncompahgre Plateau, Colorado. Chaining effectively reduced tree competition and allowed seeded species to successfully establish. In addition, natural recruitment of native herbs and shrubs has occurred to fully occupy the sites. Seeded grasses remain a part of the composition, but do not dominate in most situations. A full compliment of native broadleaf herbs and perennial grasses now occur as the principal species. Black sagebrush and Wyoming big sagebrush have regained dominance on soils and sites they are naturally adapted. Shrub density, age class composition, distribution, and presence of understory herbs appear adequate to sustain sage grouse and mule deer populations. Tree re-encroachment has been restricted by the presence of understory species.

### **Landscape-Scale Nesting Behavior of Greater Sage-Grouse (*Centrocercus urophasianus*) in north-Central Montana**

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The long-term decline of Greater Sage-Grouse (*Centrocercus urophasianus*, hereafter "sage grouse") over much of their historic range is a concern of managers of sagebrush (*Artemisia* spp.) habitats. Because sage grouse range widely across expanses of sagebrush habitats, and due to the extent of public land holdings in north-central Montana, conservation or recovery efforts for sage grouse are likely to be applied at the landscape scale (rather than the scale of the nest-site, for example). Much of current management focuses on the land around leks because leks appear to be the center of year-round activity. In order to assess the efficacy of this approach, it is important to understand where sage grouse nest and rear their broods in relation to leks.

As part of a larger doctoral research project, 247 female sage grouse were radio-marked in the springs of 2001-2003 to allow estimation of estimate reproductive parameters. With the resultant wealth of locations on sage grouse nests, the spatial relationship between nests and leks can be quantified. In general, sage grouse in this study nested further away from leks than expected, though distances varied among 4 study sites. Renesting attempts within a year were generally close to the first nest location (within several hundred meters). Finally, individuals tracked in successive years typically nested within several hundred meters of the previous year's nest location. Though habitat conservation and enhancement efforts must target more land than first expected, individual birds exhibit some degree of nest-area fidelity. Focusing on particular geographic areas centered on leks may be an effective strategy.

### **Revisiting greater sage-grouse nest habitat - a work in progress**

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My objective is to sample greater sage-grouse nest habitat in a variety of habitat types to fine-tune the WAFWA management guidelines for use in Idaho. In past research, sampling was conducted after nests hatched to avoid disturbing incubating hens. Grass can grow significantly during the 27 day incubation period and measuring grass height after hatch may misrepresent the grass cover initially selected by the hens. During the last 2 years, grass height has been measured during the early stages of incubation at 30-50 meters from nests and then again after hatching at both near the nests and 1, 3, and 5 meters from the nests. A model of grass growth will be constructed to predict grass height at the onset of incubation. I am also estimating horizontal cover in a unique way by using a Robel pole measured from the perspective of the incubating hens. Traditional methods are being used to estimate 1) canopy cover of shrubs with Canfield's line intercept, 2) ground cover of grass and forbs with Daubenmire frames, and 3) horizontal cover at the nest bowl with a Jones cover board. Landscape information of the nest sites is also being obtained such as grazing strategies and fire/rehabilitation history. Logistic regression will be used to determine which habitat variables best predict the fate of nests. A total of over 155 nests in 11 study areas have been sampled since the study was started in 2002.

### **West Nile Virus: an emerging issue in sage-grouse conservation**

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Since its introduction to New York in 1999, West Nile virus (WNV) has rapidly spread west across North America, infecting and killing wild and domestic birds, horses, humans, and other animals. Although >208 species of birds are known to be susceptible, the impact of WNV on native, wild bird populations is virtually unknown. In 2003, we documented pronounced declines in late-summer survival in adult female greater sage-grouse (*Centrocercus urophasianus*) caused by infection with WNV across the eastern edge of their range. Mortality caused by WNV infection was among radio-marked female sage-grouse from four study sites in Alberta, Montana, and Wyoming between 1 July and 31 August 2003. Data from locations that monitored sage-grouse both before WNV (1998-2002) and in 2003 indicate that survival declined an average of 25%, whereas survival did not decline in the Upper Green River Basin in Wyoming, a site where WNV was not detected in sage-grouse. Overall, individuals in populations exposed to the virus were 3.3 times more likely to die during the two-month WNV period than birds in uninfected populations. Declines occurred in late summer when survival typically is high. Thus, the 25% decline in survival during the two-month WNV period approaches annual rates of female mortality. Of immediate concern are the potentially devastating consequences of WNV for small populations of Gunnison sage-grouse (*C. minimus*) in Colorado and Utah and greater sage-grouse in California, Utah, Washington, Alberta, and Saskatchewan. Knowing whether sage-grouse survive WNV infection is crucial to anticipating possible long-term effects on populations. We have found no evidence that sage-grouse are able to survive WNV infection and develop immunity. In a survey of 111 birds from Alberta, Montana, and Wyoming in fall 2003 from areas with confirmed WNV deaths in sage-grouse, we found no live sage-grouse seropositive for neutralizing antibodies against WNV. Man-made water sources that attract sage-grouse also expose them to insects that vector WNV. Vector surveillance near coal-bed methane ponds in the Northern Powder River Basin in August and September 2003 indicated that the mosquito *Culex tarsalis*, a highly competent vector of WNV that breeds in surface waters of western North America, was infected with WNV. The emergence of WNV further complicates conservation sage-grouse in western North America. Predominant human activities that create water sources in arid western landscapes are agricultural irrigation, cattle grazing, and oil and gas activities, namely coal-bed methane development. Efficacy of mosquito control with pesticides over vast areas of sage-grouse range remains untested, and the suggestion of land use change only fuels conflict over water management in the west.

### **Landscape use by greater sage-grouse: effects of habitat fragmentation**

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Probable causes of greater sage-grouse (*Centrocercus urophasianus*) declines include various forms of habitat degradation, reduction, and fragmentation. Prescribed fire and wildfire, mechanical or chemical treatments, or complete conversion to agricultural use has resulted in fragmentation of shrubsteppe. Many studies have attempted to understand local or microhabitat level habitat use by sage grouse. At larger scales, habitat use and fragmentation have been studied much less and using limited methods. Our objectives are to quantify greater sage-grouse habitat use and the levels of habitat heterogeneity within the landscape. We used remotely sensed vegetation data, measures of habitat composition, and landscape metrics designed to measure habitat heterogeneity. There is an increased need for the development of methods using remotely sensed data at the landscape level to understand larger scale habitat issues in an efficient manner. We used linear regression to explain habitat use variables such as size of core use area and mean daily movement with habitat composition and landscape metrics at several scales. Variables were obtained at several scales, including 150 and 450 meter buffered points, and core areas of use. Combinations of landscape metrics, cover types, and scales produced 30 landscape vegetation variables, and with the use of gender produced 31 independent variables for use in explaining landscape use measurements. Using non-correlated variables, we explain relative measures of fitness such as mean daily distance moved and size of core use area with landscape level metrics of habitat composition and heterogeneity.

#### **Assessment of subspecific lineages within the recently derived Sharp-tailed Grouse (*Tympanuchus phasianellus*): approaching the limits of neutral molecular markers**

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The Continental Divide has served as a tacit delineation between the Columbian (*T. p. columbianus*) and Plains (*T. p. jamesi*) subspecies of sharp-tailed grouse, since the description of the latter taxon in 1917. We examined neutral molecular markers for evidence of evolutionary lineages corresponding to this delineation. Amplified-fragment length polymorphism (AFLP) of nuclear DNA, and sequence data of mitochondrial DNA, were collected from sharp-tailed grouse in 18 localities. We used the Alaskan (*T. p. caurus*) and prairie (*T. p. campestris*) subspecies, as well as greater prairie-chicken (*Tympanuchus cupido*) as outgroups. Shallow divergences, and the sharing of mitotypes between sharp-tailed grouse and greater prairie-chicken, strongly suggested that mitochondrial lineages have not sorted between these species. A mutational network of mitotypes was consistent with a recent, contiguous range expansion and a peripatric expansion across the Continental Divide. Patterns of AFLP variation were consistent with the mitochondrial results. As expected for a recently expanded range, small among-locality divergence and non-significant isolation-by-distance indicated that migration-drift equilibrium has not occurred. With the exception of Colorado, localities west of the Continental Divide were grouped by both neighbor-joining and Bayesian structure analysis of AFLP data. A molecular clock calibration suggested these events took place during the late Pleistocene. The inference of lineages within a recently derived lineage, such as the Sharp-tailed Grouse, approaches the limit of resolution of neutral, molecular markers. In these cases, multiple genetic marker systems should be employed. Additionally, morphological and ecological data should be used.

## **Behavioral and genetic characterization of the Gunnison sage-grouse mating system**

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Factors affecting the loss of genetic diversity include fluctuating population size and variation in male and female reproductive success. The lack of genetic diversity observed in Gunnison sage-grouse (*Centrocercus minimus*) compared to greater sage-grouse (*C. urophasianus*) is of concern to the agencies responsible for conserving the species. Specially, biologists are concerned that the highly skewed male reproductive success characteristic of the sage-grouse mating system may lead to the loss of genetic diversity more quickly from declining populations of Gunnison sage-grouse than in a species of comparable population size but with a less skewed mating system. The goals of our research are to estimate the size of the Dry Creek/Miramonte Gunnison sage-grouse population using mark-recapture methodology and to estimate the variation in male and female reproductive success using behavioral and genetic measures. The 2003 population estimate was 53 males (95% CI 36-80) and 115 females (95% CI 60-222). In 2003, approximately 29% of males successfully copulated and 3 of 29 (10.3%) females successfully nested. Preliminary data from 2004 will also be presented. Ultimately, results from this study will be incorporated into a Rangewide Conservation Plan for Gunnison sage-grouse.

## **Gunnison sage-grouse in San Juan County, Utah: winter ecology, effects of grazing, and insect abundance**

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Gunnison sage-grouse (*Centrocercus minimus*) were recently reclassified as a separate species from Greater sage-grouse (*Centrocercus urophasianus*). Given their current limited range, and declining populations they have been identified by the U.S. Fish and Wildlife Service as a candidate species for listing on the federal Endangered Species Act. Currently, the only known populations are found in southwestern Colorado (Gunnison Basin) and southeastern Utah in San Juan County. A combined population estimate is 3,500-4,000 birds. Less than 10% of the population occurs in Utah. In 1996, a local organization, called The San Juan County Gunnison Sage-grouse Working Group (SWOG) was formed to coordinate conservation efforts in the county. The group consists of private landowners and natural resource conservation agencies. To guide the conservation efforts, SWOG initiated a local research project to learn more about the species' habitat requirements. In response to severe drought conditions in 2002 in San Juan County, a number of landowners were given permission to graze agricultural lands enrolled in the Conservation Reserve Program (CRP). Many of these CRP fields are important Gunnison Sage-grouse habitat. This study is part of a larger collaborative effort involving the local community, private landowners, and government agencies to collect additional information necessary for preserving this species. The objectives of my research are to: 1) determine winter habitat use patterns for Gunnison sage-grouse, 2) determine nesting, brood-rearing, and reproductive success of Gunnison sage-grouse, 3) determine Gunnison sage-grouse use of grazed and ungrazed CRP fields; compare vegetation structure and percent canopy cover, and 4) compare insect abundance and diversity in brood locations to adjacent areas within the study site.

## **Microsatellite DNA phylogeny of sharp-tailed grouse and molecular diversity within the Columbian subspecies (*Tympanuchus phasianellus columbianus*)**

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We obtained 558 Sharp-tailed Grouse (STGR) samples from 22 loosely defined populations throughout North America, and 43 samples of Greater Prairie Chicken from three populations. Ten microsatellite loci developed in other galliform species were used to assess the phylogeographic relationships of these grouse populations, without *a priori* delineation of subspecies boundaries. The microsatellite loci were also used to measure molecular diversity within the Columbian STGR, the boundaries of which we defined based on phylogeographic analysis. We calculated the phylogeographic relationships among populations using pairwise genetic distances and a neighbor-joining tree (prairie-chicken used as the outgroup). Confidence in the branching structure of the tree was determined using a bootstrap analysis (1000 iterations). The resulting tree and associated bootstrap values support monophyly of STGR, with respect to Greater Prairie-chicken, and monophyly of Columbian STGR *sensu stricto* (limited to populations west of Rocky Mountains). The analysis does not support the monophyly of the Plains subspecies; the structure of the tree indicates that Plains STGR maybe paraphyletic with respect to the Columbian subspecies. No population within the Columbian range showed depressed molecular diversity, despite the fact that many of these populations have depressed populations sizes. There is significant geographic structure among the Columbian populations, although a test for isolation by distance was not significant. We hypothesize that prior to the population declines during the past century or so, the Columbian STGR effective populations were extremely large with high molecular diversity. The isolated populations that exist today still show the signal of this near-panmictic structure because these populations are not at equilibrium; there has not be sufficient time for the population genetic structure today to reflect their isolation and diminished size.

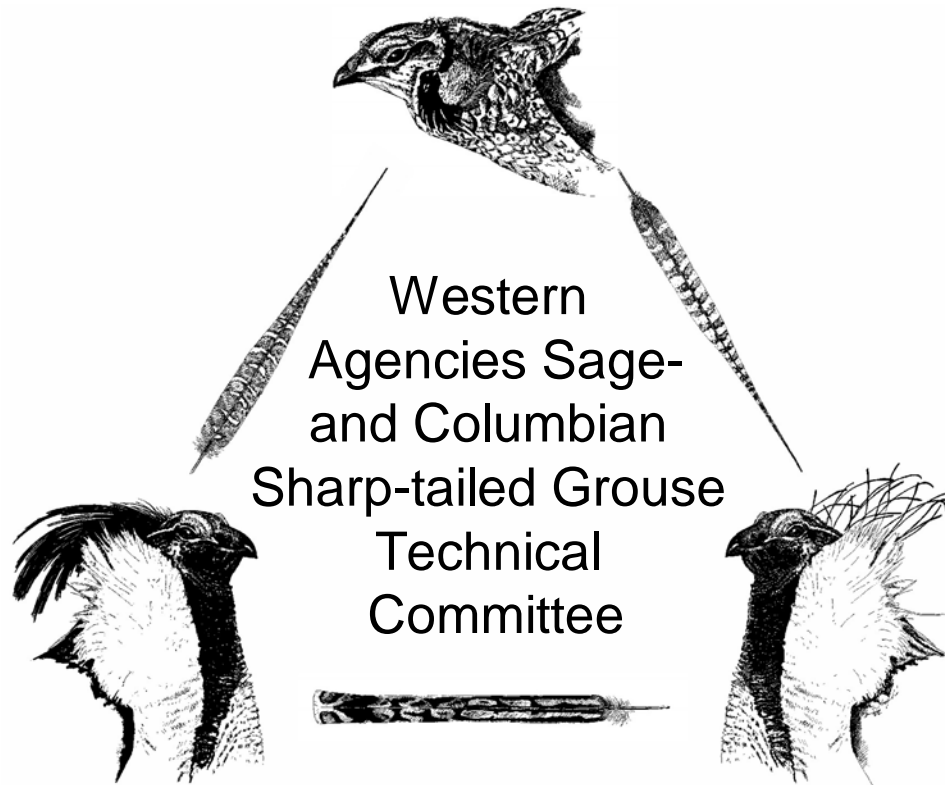
## **Spokane Tribe of Indians Columbian sharp-tailed grouse project**

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The Spokane Tribe's Wildlife Program is planning habitat enhancements to shrub-steppe habitat on the Spokane Indian Reservation with the intentions of one day re-introducing Columbian Sharp-tailed Grouse. Habitat surveys have concluded that enhancements are necessary to increase the probability of a successful re-introduction. Habitat enhancements are planned for approximately 240 acres over the next three years. Enhancements will consist of native grass seeding to increase hiding cover. Shrubs will be planted to increase value for wintering habitat. Noxious weed control is also planned to address knapweed, cheat grass and toadflax which are all present and increasing in abundance. The entire project area has been set aside for protection through Tribal Resolution to prevent further development.



## *History of the Technical Committee*



The first known discussion about the need for a sage-grouse committee was held at the Western Association of Fish and Wildlife Agencies (WAFWA) conference in Las Vegas, Nevada in 1954. After additional informal meetings and discussions, the first official “Western States Sage Grouse Workshop” was held in 1959 in Farson, WY. This workshop has subsequently been held every two years with a slight 1-year adjustment in schedule to coordinate with the Prairie Grouse Technical Council. WAFWA has expanded the group to include the Columbian sharp-tailed grouse as well as Canadian provinces (hence, the name change).

1	1959	Farson, WY	13	1983	Ontario, OR
2	1961	Elko, NV	14	1985	Alturas, CA
3	1963	Lima, MT	15	1987	Midway, UT
4	1965	Walden CO	16	1989	Moses Lake, WA
5	1967	Boise, ID	17	1991	Pocatello, ID
6	1969	Rock Springs, WY	18	1993	Fort Collins, CO
7	1971	Salt Lake City, UT	19	1994	Reno, NV
8	1973	Lewistown, MT	20	1996	Gillette, WY
9	1975	Reno, NV	21	1998	Billings, MT
10	1977	Grand Junction, CO	22	2000	Redmond, OR
11	1979	Twin Falls, ID	23	2002	Bicknell, UT
12	1981	Bowman, ND	24	2004	Wenatchee, WA

# *Portraits of a Community*

## *Washington Department of Fish and Wildlife*

The Washington Department of Fish and Wildlife (WDFW) manages several wildlife areas within the distributions of greater sage-grouse and Columbian sharp-tailed grouse. Their management activities include the restoration of native grass, forb, and shrub communities and the translocation of grouse. The WDFW focuses substantial attention on research and on the development of management and recovery plans. These plans have been applied in numerous areas including support of agricultural programs such as the Conservation Reserve Program and multi-species management efforts.



*Washington  
Department of*  
**FISH and  
WILDLIFE**

## *Bureau of Land Management*

The Bureau of Land Management (BLM) regularly provides both financial and intellectual support for grouse research and management activities in the state of Washington. Because their land often includes or borders areas critical for grouse, the BLM's involvement and support has been a crucial component in the development of successful management and recovery strategies.



## *Colville Confederated Tribes*

The Colville Confederated Tribes (CCT) have acquired land, restored habitat, and conducted research to address the specific needs of Columbian sharp-tailed grouse. They are an enthusiastic partner with other organizations and individuals in the development and implementation of regional management strategies. The CCT support the largest remaining population of sharp-tailed grouse in the state of Washington.



## *The Nature Conservancy*

The Nature Conservancy (TNC) has earned substantial respect in eastern Washington as an excellent steward of the environment and a good neighbor. This respect has resulted from their efforts to control noxious weeds and their willingness to integrate agency and private land-use interests in the development of regional management strategies. TNC owns and manages a substantial portion of the Moses Coulee area in central Douglas County, Washington in the heart of the remaining sage-grouse range.

## *Mansfield Dollars for Scholars*

Mansfield Dollars for Scholars is a non-profit community-based scholarship foundation with a mission to encourage educational pursuits. Not only does the group award its own scholarships, but it administers scholarships for the local Lion's Club, Grange, and Teacher's Association. The group awarded \$17,950 in scholarships to Mansfield graduates in 2003 and maintains an endowment fund of \$20,000. Creating a successful organization is difficult, especially in a tiny community with K-12 enrollment of 100-110. Nevertheless, the small and motivated group won the "Golden Tassel Award" in 2002 for the best new Dollars for Scholars' chapter in the nation.

## *U.S. Fish and Wildlife Service*

The U.S. Fish and Wildlife Service manages shrub-steppe dominated areas in Washington for many species, including greater sage-grouse. They are participating in regional projects including the development of a multi-species habitat conservation plan in Douglas County.

## *Bonneville Power Administration*

The Bonneville Power Administration (BPA) has provided substantial money to acquire and manage habitat for the mitigation of impacts associated with energy generation. The BPA currently is supporting research on Columbian sharp-tailed grouse on land managed by the Colville Confederated Tribes, a project with numerous regional ramifications.

## *Douglas County Landowners*

Most landowners in Douglas County care a great deal for wildlife. They also are extremely involved in local, regional, and national issues that pertain to wildlife, water, and agriculture. They are participating in working groups and in the development of a multi-species habitat conservation plan.

## *Foster Creek Conservation District*

The Foster Creek Conservation District (FCCD) encourages positive conservation practices among landowners with the use of education, outreach, and incentives. The FCCD in Douglas County, Washington is nationally recognized as one of the leading conservation districts. They are currently in the process of bringing together numerous federal and state agencies, non-governmental organizations, and private landowners to develop a habitat conservation plan in Douglas County encompassing many species of wildlife dependent on shrub-steppe habitat.

## *North American Grouse Partnership*

The North American Grouse Partnership (NAGP) is a citizen-based advocacy group for grouse. It began in the year 2000 following a meeting of biologists, ranchers, attorneys, educators, doctors, veterinarians, and others who met to discuss their common concern over the decline of various grouse species throughout North America. NAGP is now pursuing grouse conservation and management on a national stage with the development of a North American Grouse Management Plan.

## *Other Cooperators and Contributors*

*Coeur D'Alene Tribe  
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Washington Audubon Society  
Washington Department of Natural Resources  
Spokane Tribe Wildlife Program  
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### *Artwork*

*Philip Lee, Bridgeport, Washington (front and back cover)  
Lisa Alcazar-Hagen, Hines, Oregon (banquet)  
Brian Maxfield, Utah Department of Natural Resources (all other artwork)*

## Banquet Speaker

*Clait E. Braun, Grouse Inc.*

Clait received degrees from Kansas State University, University of Montana, and Colorado State University. He studied and managed sage-grouse and white-tailed ptarmigan for about 30 years in the state of Colorado, and was the avian research program manager for the Colorado Division of Wildlife at the time of his retirement in 1999. Clait actively promoted the Western Agencies Sage and Columbian Sharp-tailed Grouse Technical Committee during his career.

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