Survival Costs of Reproduction during the hunting Season Greater Sage Grouse: a Case Study in Central Montana

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Direct investigation of how harvest affects population vital rates and population growth, and the magnitude of harvest effects relative to other sources of mortality, is needed for informed management of harvested species. Greater sage grouse (*Centrocercus urophasianus*) are a species of concern and are still legally harvested in most of their current range,

including Montana. Due to uncertainty about the impact of harvest on vital rates and about the relative importance of harvest compared to other sources of mortality for sage grouse, we implemented a case study to simultaneously compare survival rates between adjacent hunted and nonhunted sites and to evaluate nonhunting factors influencing survival during the hunting season. We monitored the reproductive activity, survival rates, and causes of mortality of females using radio-telemetry in central Montana during 2004 and 2005. We included year, within-season variation, site, female age, and the cost of reproduction as covariates in our survival analysis. Female survival during the hunting season was lower for females with greater reproductive investment, and females on the hunted site had lower survival than females on the nonhunted site. However, lower survival rates on the hunted site could not be attributed to hunter kill, because no radio-marked females were bagged or reported by hunters and no evidence of hunter kill was observed. During this study, harvest appeared to be low in central Montana and appeared to have little impact on the population, especially relative to other mortality causes that were identified. Our results indicated costs of reproduction to survival.