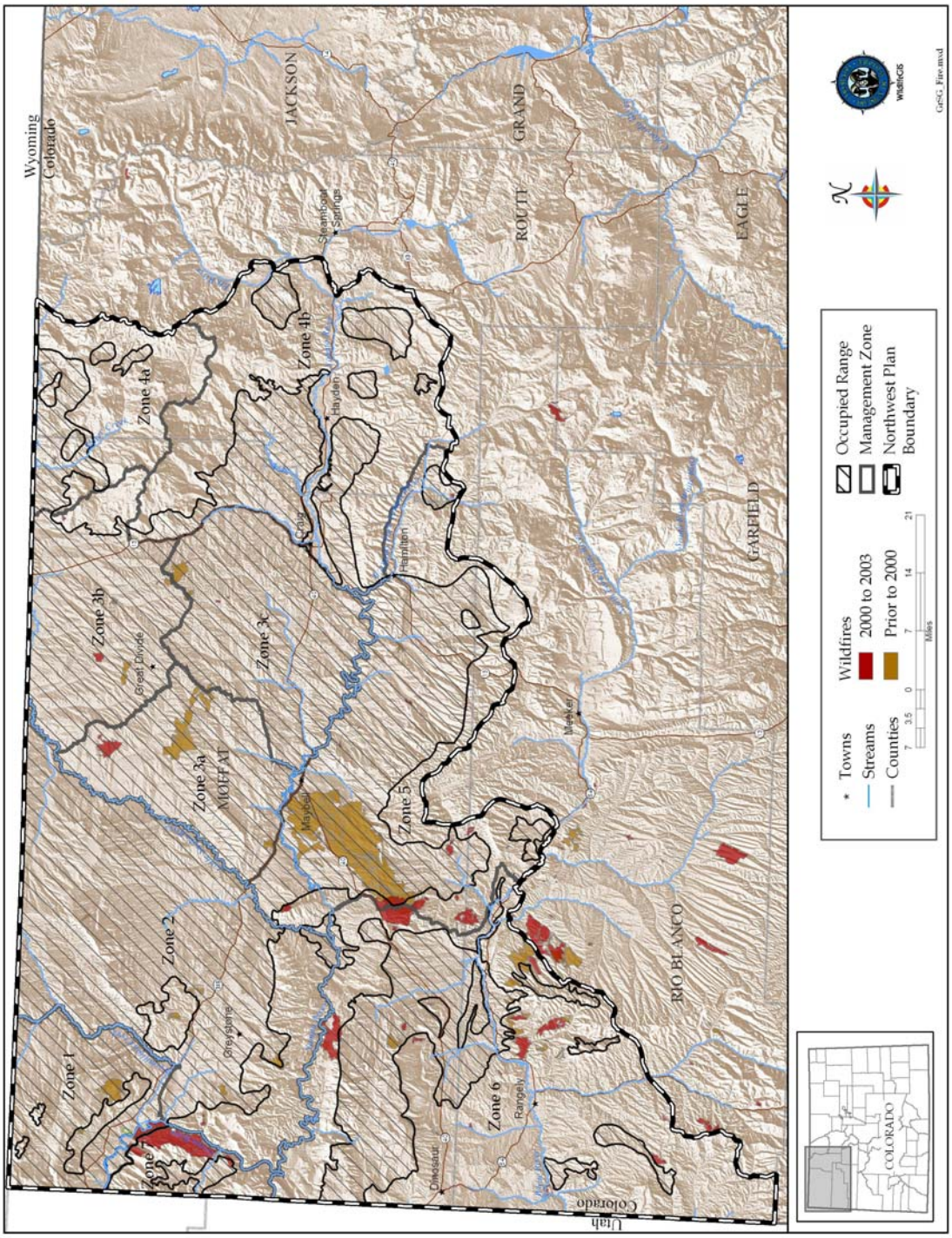
Figure 34. Map of recent wildfires in Northwest Colorado greater sage-grouse habitat



Part II: Identification of Issues Affecting Greater Sage-Grouse in Northwest Colorado

PART II. IDENTIFICATION OF ISSUES AFFECTING GREATER SAGE-GROUSE

This section of the Conservation Plan identifies the issues that members of the GSGWG believe may impact greater sage-grouse populations in Northwest Colorado. The GSGWG extensively surveyed extant scientific literature, Division of Wildlife and other governmental local and state biologists and managers, and the knowledge of local citizens in an attempt to identify the major causes of greater sage-grouse decline in Northwest Colorado. The historic trends identified in **Part I** were also a significant part of this analysis. Some of the results are consistent with findings in other greater sage-grouse ranges. Others may be specific to Northwest Colorado. GSGWG members and members of the public were invited to suggest any and all possible reasons for greater sage-grouse decline. Issues broke into six main categories which may be biological, political, or both. The categories are: habitat quality, habitat loss and fragmentation, predation, hunting, physical disturbance, and disease and genetics. The need for additional planning and outreach was also identified and has been added as a seventh issue. These issues reflect those threats to greater sage-grouse populations or habitat that the GSGWG believed they could do something about. There are other issues that the GSGWG cannot control, including concerns with climatic change, severe winter conditions, drought, or sagebrush die-off on a landscape scale. These unresolvable issues compound and complicate problems with the identified issues that the GSGWG can address.

Each of the selected issues is described below along with the suspected mechanisms by which it may impact greater sage-grouse populations in Northwest Colorado. Opinions as to importance of each factor vary widely among GSGWG members and the impact of individual issues probably varies across the landscape. **These factors are not listed in any order of importance. It should be stressed that impacts are cumulative and one issue cannot be identified as the leading cause of greater sage-grouse population declines across the entire range of greater sage-grouse in Northwest Colorado.**

Habitat Quality

Greater sage-grouse are specialists that use small productive habitats within a large landscape. The availability and arrangement of key pieces of habitat are of importance to sage grouse far beyond the proportion of land area they cover.

Successful breeding is essential to maintain a viable population. The lek system of mating requires the birds to congregate on small areas. Poor quality habitat or disturbance to birds on leks can have significant detrimental effects on the birds' ability to reproduce. Adequate hiding cover provided by sagebrush plant communities adjacent to the display areas is important to minimize predation of birds, both females coming to the lek and males resting during the day after displaying.

Female greater sage-grouse require high quality habitat in the proximity of leks to ensure nest and brood survival. Predation, influenced by poor habitat quality, including the lack of residual herbaceous cover, can be an important factor in low nest success and brood survival.
Hens with broods require habitat that provides high quality forbs and insects for growth of chicks and cover to ensure survival. Hand raised greater sage-grouse chicks survived at higher rates when allowed to feed in high quality forb sites in Northwest Colorado (Huwer 2004). Riparian areas in mid-seral ecological status (herbaceous dominated wet meadows or uplands with relatively thin interspersed sagebrush cover) produce a diversity of food and cover plants for greater sage-grouse. Broods are susceptible to predation during their first few months. Habitat that provides hiding and escape cover as well as quality food enhances the survival of chicks. This ecological condition also provides resources for uses such as livestock grazing and other wildlife needs**.**

The lowest population level during the year generally occurs just prior to breeding and is largely determined by winter survival. Maintaining sufficient winter habitat that is widely dispersed and that provides the food and cover requirements to enhance survival of greater sage-grouse during all winter conditions is paramount to meeting the goal of this Plan.

Evidence of historic plant distribution in the sagebrush steppe region suggests that big sagebrush predates European settlement on most sites where it now occurs. Over the past 150 years, the overall range of sagebrush plant communities in the Great Basin and the Intermountain West has not changed appreciably, although management has influenced the density, distribution, patterns, and age class diversity within that boundary. Several factors, including widespread overgrazing by livestock around the turn of the century and long-term fire suppression, have contributed to changes in the plant communities of this region (Miller et al. 1994). It has been well documented that the abundance of sagebrush (cover and density) has increased in many sagebrush communities since the turn of the century. The density, cover, and diversity of perennial grasses and forbs have decreased over the same period (Piper 1994). Weed infestations have reduced habitat quality in many areas.

The reduction, or in some cases loss, of these important facets of greater sage-grouse habitat has reduced the quality of many sites for greater sage-grouse. Some sites are now dominated by "herbaceously challenged" (low vigor) sagebrush communities. Historic wild fires and other range alterations may have removed large contiguous blocks of greater sage-grouse habitat. Localized greater sage-grouse populations may have declined or disappeared for a period of years as a result of these perturbations without significantly affecting greater sage-grouse populations as a whole. The modern world is less tolerant of that kind of landscape scale adjustment over a long time frame. The natural processes that influence vegetation succession have been significantly altered. Sagebrush communities low in grasses and forbs often feature lower greater sage-grouse survival. This is primarily a result of high nest predation due to inadequate herbaceous cover to hide nests, and reduced chick survival due to poor quality food sources resulting from the reduction of forbs and the insects they attract. In addition, mesic

environments important for brood rearing have been reduced in both number and quality due to lowered water tables and changes in vegetation.

Aspects of grazing management can also affect sage grouse survival in Northwest Colorado. While evaluations of grazing impact have generally focused on stocking rate adjustments, the time of range use and the duration of grazing are increasingly viewed as important factors in grazing management which can dramatically affect the amount of residual forage available for sage grouse nesting (Reed et al. 1999). Beck and Mitchell (2000) review the literature identifying effects grazing can have on sage grouse habitat. The GSGWG notes that many sage grouse habitats in Northwest Colorado support large winter ungulate populations in addition to summer livestock grazing, equating to year-around grazing use in some areas.

The GSGWG believes that these factors have influenced greater sage-grouse habitat quality and quantity in Northwest Colorado in varying degrees. These influences have likely varied across Northwest Colorado due to different land uses and climatic and topographic features. It is important to identify and analyze long-term changes in sagebrush habitat that have occurred in Northwest Colorado. Successful implementation of this Conservation Plan includes the application of conservation actions that address these factors.

Habitat Loss and Fragmentation

Habitat loss and/or fragmentation are frequently believed to be the most significant factors in driving wildlife species toward extinction. Knick et al. (2003) identify habitat degradation, fragmentation and loss among the most important threats to sagebrush environments. The general decline in greater sage-grouse numbers is believed to be a result, in part, of vegetation changes and loss of habitat or habitat fragmentation. Habitat fragmentation occurs when large blocks of suitable habitat are broken up, reducing the effectiveness or use of that habitat. Fragmentation and loss of high quality sagebrush habitat over the last century is believed to have increased the sensitivity of Northwest Colorado greater sage-grouse populations to additional habitat loss. Large treatments in sagebrush habitats may affect sage grouse more severely today than they did historically. The cumulative effects of small-scale land treatments, roads, power lines, and cultivation on habitat fragmentation in Northwest Colorado may be as significant in the population decline as large-scale direct habitat loss through cultivation, fire suppression, resource extraction, and housing developments (Braun 1998). In addition, small remnant patches and long, linear strips of suitable habitat that remain in many areas may be virtually ineffective due to their small size and high relative amount of edge. Uncontrolled weeds and long-term juniper encroachment may also lead to habitat loss if unchecked.

Land conversion (highways, dwellings, communities, grain farming, non-reclaimed oil and gas wells, etc.) or inundation from water storage projects can result in permanent habitat loss for greater sage-grouse. Several studies have demonstrated effects of increasing fragmentation on a variety of wildlife species (Knight et al. 1995, Odell and Knight 2001, Maestas et al. 2003). Degradation and some fragmentation of habitats may be temporary but the effects on greater sage-grouse are relatively long-lived (>15-30 years) due to the length of time required for

sagebrush to re-colonize sites in sufficient quantity to support greater sage-grouse. Land conversion is believed to have had significant long-term effects on the number of breeding greater sage-grouse in some areas of Northwest Colorado. The specific rate and amount of habitat alteration and loss in Northwest Colorado is not known. Research efforts to establish these figures are needed.

Predation

Issues affecting predation were divided into three main categories: those primarily influenced by habitat quality, those due to increased effectiveness of predators, and those related to increased populations of predators above historic levels. These issues are described in more detail in the greater sage-grouse life history, predator population trend, and habitat quality sections elsewhere in this document.

The impact of predation on Northwest Colorado greater sage-grouse populations has been a contentious issue through the conservation planning process and the subject of considerable discussion. A range of positions has emerged from those discussions that fall somewhere between the following viewpoints:

(1) That predation is one of the major forces driving greater sage-grouse populations downward, given current and expected future greater sage-grouse habitat conditions; or,
(2) that elevated predation rates, if substantiated to be occurring, are the result of poor quality habitat that leaves greater sage-grouse unnaturally exposed to detection and capture by predators; or,
(3) that humankind (due to permanent habitat changes, urban development, etc.) has upset the natural predator/prey balance to such an extent that future greater sage-grouse population goals should take into account the limiting factors imposed by public policy decisions that encourage the expansion of greater sage-grouse predator populations (i.e., eagles) and limit our ability to restore a human-influenced predator/prey balance.

Based on personal observations, many of those leaning toward the first position feel that predator control should be included as a significant part of the Northwest Colorado Greater Sage-Grouse Conservation Plan. Most GSGWG members see a value in treatments to improve greater sage-grouse habitat, however some maintain that greater sage-grouse conservation in Northwest Colorado will be difficult without a predator control component. Adherents of the second position maintain that excessive predation is a symptom of an underlying habitat problem. This viewpoint is based on studies that suggest predation is not an additive mortality factor in greater sage-grouse populations. In addition, data suggest that annual removal of 70% of the population is necessary to effectively reduce coyote populations and must be permanently applied to maintain any effect (Slater 2003). Rushton et al. (2006) found that effective control of red fox populations at landscape scales was neither feasible nor effective unless migration from outside the landscape was low or controlled. Adherents of the third position argue that, whatever the historic impact of predation may have been, habitats have been so altered by man that natural

regulation of the predator/prey relationship for greater sage-grouse has been reduced or eliminated. They note that societal desire to protect predators may be at odds with protection of greater sage-grouse populations and suggest that society needs to choose between predator protection and greater sage-grouse conservation.

Private landowners report having observed increases in predator populations over the last 20 years on their lands. Many of these GSGWG members feel that predation is one of the primary impacts on greater sage-grouse populations in Northwest Colorado. Many GSGWG members have expressed concern that some predators, especially avian species, raccoons and red fox, are either expanding their historic range significantly into greater sage-grouse habitat or are in fact non-native predators in sagebrush rangelands to which greater sage-grouse are not adapted. It has also been suggested that the presence of livestock and the large quantity of carrion and offal remaining after the hunting season may artificially inflate predator numbers to the detriment of greater sage-grouse. The long downturn (1991-1998) in both cottontail rabbits and jackrabbits has also been suggested as a contributing factor in greater sage-grouse decline by forcing some predators to switch from these species to greater sage-grouse to support themselves. In addition, the creation of artificial perches such as fence posts, oil and gas related structures and power lines, might have increased raptor effectiveness. Moffat County and the GSGWG initiated a research project in 2001 to assess relative mammalian and avian predator density between low sage grouse and high sage grouse population areas (Andelt 2003). Preliminary findings indicated that red fox visitation of scent stations was greater in low sage grouse population areas than in high sage grouse areas. Andelt (2003) also found little evidence of sage grouse remains in coyote scat collected, suggesting that coyote may not be a significant predator of sage grouse in Northwest Colorado. He noted that much more detailed information on predator density and sage grouse density would be required to draw definitive conclusions. The GSGWG is very interested in obtaining additional information on the impact of predation on Northwest Colorado greater sage-grouse populations.

Alternatively, other GSGWG members believe that prey species abundance generally drives predator abundance if habitat is present in sufficient quantity and quality to support the prey species, in this case greater sage-grouse. These members point to the decline in habitat quantity and quality, and increased habitat fragmentation as the primary causes of poor greater sage-grouse survival. Habitat fragmentation, and the resulting decrease in patch size and increase in edge between vegetation types, has been implicated in many studies as a chief cause of increased nest predation (Yahner and Scott 1988, Yahner et al. 1989, Burger et al. 1994). These studies have looked at artificial nest predation in forested regions as well as in prairie environments. It has been suggested that greater sage-grouse numbers could increase in Northwest Colorado, regardless of local predation levels, if adequate quantity and quality of habitat was available.

The disagreement about the role of predation is not whether greater sage-grouse are eaten by predators. GSGWG members agree that most greater sage-grouse in Northwest Colorado die of predation. The disagreement is whether existing predation rates are abnormally high and whether those rates have caused or contributed to the recent decline in greater sage-grouse

populations. Questions about the effect of human-induced fragmentation and degradation of greater sage-grouse habitat on predation rates are also unresolved.

Hunting

The maintenance of current hunting seasons and the continuation of hunting seasons for greater sage-grouse into the future have generated lengthy discussion within the GSGWG. This discussion has revolved around questions of the value of continuing to hunt greater sage-grouse, the impression that continuing to hunt declining greater sage-grouse populations leaves with land users, and the impact that greater sage-grouse hunting has on populations in Northwest Colorado.

GSGWG members opposed to the continued hunting of greater sage-grouse in Northwest Colorado maintain that hunting seasons should be curtailed or discontinued to avoid any intentional take of individual greater sage-grouse through hunting mortality. They argue that greater sage-grouse harvest has a direct negative effect on grouse populations by killing birds that would otherwise remain in the population and that it is inconsistent to voice concerns about greater sage-grouse declines while continuing to hunt and kill the birds. Many GSGWG members stated that they were concerned about discussing habitat maintenance and development, particularly if it affected landowner operations, unless hunting mortality of greater sage-grouse was reduced or eliminated. Particular concern was raised about the impact of hunting on small, isolated greater sage-grouse populations.

GSGWG members that support continued hunting of greater sage-grouse in Northwest Colorado also expressed concern that greater sage-grouse seasons be designed to avoid serious impacts to greater sage-grouse populations. They argue that, while hunting does remove individual greater sage-grouse from Northwest Colorado populations, those populations are not significantly reduced because hunting mortality of game birds is largely compensatory, meaning that greater sage-grouse taken by hunters replace birds that would otherwise have died as a result of habitat limitations, predation or other natural factors during the year. They also argue that historic Colorado greater sage-grouse harvest information indicates that annual harvest has seldom exceeded 10% of the birds in a population, even with much higher historic hunting pressure (Colorado Division of Wildlife, unpublished data). GSGWG members supportive of continued greater sage-grouse hunting also hold that continued recreational hunting is a valid activity on public lands. Maintenance of existing uses while enhancing greater sage-grouse populations is a principal objective of the Northwest Colorado Greater Sage-Grouse Conservation Plan. In addition, there are numerous historic examples of sportsmen taking concerted action and donating considerable manpower and funding to recover species that were being hunted. There are few non-hunted species that have benefited from the same interest and dedication. Also, all nesting success and chick survival data currently collected by the Colorado Division of Wildlife outside of major research efforts come from wings of harvested birds submitted by hunters. While this data could be collected from live birds, it would require handling of many individual birds and would only come at great cost in labor and funds. These GSGWG members stress the importance of maintaining the wing data source as long as it can be done without jeopardizing the population. Connelly et al. (2004) strongly encourage the continuation of greater sage-

grouse wing collections for the purpose of obtaining this additional information on greater sage-grouse demographic parameters

Physical Disturbance

Greater sage-grouse activities and habitat use is believed to be diminished by a variety of natural and human-caused disturbances. These disturbances may take many forms and can arise from many different causes. Key disturbances believed to occur in Northwest Colorado include interference with breeding activities around lek sites, either through flushing birds or causing them to damping lek activities or through noise generation which interferes with breeding vocalizations on the lek, physical destruction of nests through trampling or other ground disturbing activities, abandonment of nests through repeated flushing of hens, and the scattering of broods and wintering flocks. Much of the concern expressed about this issue is intuitive. There has been comparatively little rigorous research conducted on disturbance of greater sage-grouse. Some recent studies concerned with sage grouse in oil or gas development areas imply that physical or noise disturbance is operating but do not identify the primary cause or mechanism (e.g. Naugle et al. 2006a, Holloran 2005, Lyon and Anderson 2003). Holloran (2005) is a PhD dissertation and Naugle et al. (2006a) is an interim report. Although the Naugle (2006a) and Holloran (2005) papers have not been peer reviewed as of this writing, portions of the Naugle et al. (2006a) interim report have since been published in Walker et al. (2007) and Doherty et al. (2008). An additional study on the specific effects of noise on sage grouse was initiated this year through the University of California and may begin to bring some certainty to this issue once completed in a few years. In the meantime, we can observe greater sage-grouse react to disturbances in a non-research setting and predict their response to other disturbances or infer a response based on what is known about the reactions of other types of wildlife.

Excessive disturbance to birds during the breeding season can increase mortality or cause some hens not to mate. Holloran (2005) and Naugle et al. (2006a) have observed abandonment of leks over time as disturbances increased. Holloran also documented a substantial increase in greater sage-grouse mortality in high disturbance environments. Lyon and Anderson (2003) found that fewer greater sage grouse nested in disturbance areas. Greater sage-grouse breeding activities can be sensitive to disturbance by human presence, wildlife and livestock behavior and loud, persistent noises around lek sites. Many of these events are transitory and not of significant long term concern. Chronic events may have more serious consequences for greater sage-grouse. Human activities around lek sites should be minimized during the breeding period. Large structures should not be built within view of lek sites and human activities within 0.5 miles of active leks should be minimized while strutting and breeding activities are in progress. Loud noise, especially chronic noise like that from pipeline compressors, may depress greater sage-grouse lek activity when noises occur close to leks during the breeding season. Regular visits to leks by the public for viewing and by biologists for scientific activities can also disturb breeding. Increased travel of roads due to energy development or other uses in greater sage-grouse breeding habitat during the spring appears to disturb sage grouse on leks near roads, causing greater movements to nests and nest initiation rates to fall by 28% (Lyon and Anderson 2003). Cross country travel while antler collecting is becoming a significant recreational use of sage

grouse habitat in Northwest Colorado and is also a potential source of disturbance to breeding and nesting sage grouse. Wildlife and domestic ungulate management should encourage these activities to not excessively or unnecessarily disturb breeding or nesting greater sage-grouse.

Excessive disturbance to birds can cause hens to abandon nests or increase the mortality to hens or broods. Nesting greater sage-grouse can be disturbed and nests destroyed or abandoned through a variety of human and animal actions. Ground clearing or disturbing activities in greater sage-grouse nesting activities can physically destroy nests. Repeated flushing of birds from nests by casual or intentional disturbance can also cause greater sage-grouse hens to abandon otherwise successful nests. Avoiding this type of abandonment is always a primary consideration in designing greater sage-grouse research projects. Tight herding of livestock and dense migrating herds of big game wildlife may also cause loss of nests through trampling. Broods may be subject to the same types of disturbances during both early and late brood-rearing periods. Broods that are broken up repeatedly by disturbance factors may experience greater chick predation and lower chick survival.

Disturbance of greater sage-grouse on winter ranges may also cause decreased survival of birds. Repeated flushing of birds through human activity, ground disturbance, or livestock and big game herding patterns may be detrimental to survival of greater sage-grouse on winter ranges by exposing birds to predation and increased metabolic demands.

Disease and Genetics

Greater sage-grouse, like other gallinaceous birds, harbor a wide variety of internal and external parasites and several disease causing organisms. There are occasional references in the literature to greater sage-grouse population declines resulting from disease outbreaks. The most notable outbreak occurred in Wyoming in the 1940's. Rogers (1964) reported that outbreaks of coccidiosis had been reported in Moffat County in the 1940s. Scott (1940) suggested that drought conditions concentrated grouse at water sources and acted to increase the transmission rate of the disease. This was disputed by other authors (Honess 1947). Disease outbreaks were not believed to be an issue affecting greater sage-grouse until West Nile Virus was discovered in greater sage-grouse in Wyoming in 2003.

West Nile Virus was discovered in greater sage-grouse in the Powder River Basin in Wyoming in 2003 (Naugle et al. 2004). It rapidly moved through a group of radio-telemetered greater sage-grouse that summer, and has shown up there and in surrounding areas since. The mosquito-borne disease was documented in the Eagle-South Routt population in Colorado in 2004. Several dead greater sage-grouse found in Axial Basin and on Cold Spring Mountain in 2006 also tested positive for the disease (A.D. Apa unpublished data). Initial reports are that sage grouse are quite susceptible to the disease. All captive greater sage-grouse exposed to the disease in a laboratory test died of the disease. The disease has had substantial impact on populations in Montana and Wyoming (Naugle et al. 2004), but has yet to make a major entry into Colorado greater sage-grouse.

The loss of genetic variability has been suggested in Gunnison sage-grouse and isolated populations of greater sage-grouse. Loss of genetic variability or genetic depression can reduce the ecological fitness of a species and cause it to decline, generally by decreasing successful breeding, survival and/or recruitment. Northwest Colorado greater sage-grouse populations occur over large ranges. Several separate sub-populations of grouse are suspected to exist in Northwest Colorado. Substantial exchange of birds between populations and breeding complexes occurs in many greater sage-grouse areas. Similar exchange is believed to occur in Northwest Colorado. Little radio-telemetry work had been conducted on greater sage-grouse in Northwest Colorado prior to 2001. Telemetry data collected on greater sage-grouse since 2001 in the Axial Basin/Danforth Hills, north-central Moffat County, and Cold Spring Mountain areas indicate that some interchange occurs between the populations studied (A.D. Apa, unpublished data). Additional information is needed on other populations to fully understand the interconnectedness of greater sage-grouse populations in Northwest Colorado. The large, contiguous range, multiple populations and suspected interchange between populations in Northwest Colorado are believed to minimize the concern that genetic depression is likely to occur.

Planning and Outreach

Greater sage-grouse populations have historically fluctuated within Moffat County for years with little or no data to support trends. However, during the past decade, greater sage grouse populations have increased in Northwest Colorado. Also during this time, significant data has been compiled concerning habitats and populations and through that research, conservation efforts can be realized.

Planning needs include the effective collection and distribution of greater sage-grouse population and habitat data to those concerned with greater sage-grouse conservation and coordinated management of greater sage-grouse populations and habitat. Development and implementation of effective conservation measures for greater sage-grouse across Northwest Colorado will depend on a coordinated approach. Preparation of this Conservation Plan is an important first step, but planning efforts must continue in the future for greater sage-grouse conservation to progress.

Many residents of Northwest Colorado and non-residents involved in industrial or recreational activities in Northwest Colorado remain unaware of historical greater sage-grouse population declines, greater sage-grouse needs, and plans for conservation efforts. The GSGWG has identified the need to promote public interest in and concern for greater sage-grouse conservation and increase the awareness of greater sage-grouse issues, needs, and conservation opportunities, both within Northwest Colorado and elsewhere in the state.