Dr. Reed Noss and George Wuerthner Comments on BLM'sFinal Draft EIS

FINAL COMMENTS ON POWDER RIVER BASIN EIS

Bureau of Land Management
Buffalo Field Office
Buffalo, Wyoming

Dear BLM:

The following comments are from George Wuerthner of the Institute for Wildlife Protection and Reed Noss of Conservation Science Inc. and refer to the Draft EIS for the Powder River Basin Oil and Gas Project. The major focus of our letter is the effect of coal bed methane (CBM) development on wildlife and the conservation of biodiversity in the Powder River Basin (PRB).

We are concerned that the DEIS has not fully disclosed the full impacts of the proposed oil and gas development on biodiversity. The authors claim, perhaps quite correctly that quantitative impacts are difficult to predict due to the variability in timing of development, scope and scale of development, thus only qualitative data are provided. Yet these qualitative data are used to conclude minimum impacts to the region's wildlife. This is simply not acceptable. At the very least the BLM should attempt to provide a "worse case scenario" where maximum acreage of habitat directly and indirectly impacted are estimated, along with estimates of wildlife losses or declines resulting from this scenario. Without such hard numbers, it is far too easy for the BLM to make optimistic predictions about minimum impacts or deny responsibility for quantifying such effects. But if BLM does not have this responsibility, who does? Throughout the document the BLM also asserts that negative impacts can be avoided or minimized through management or a shift in habitat use by affected animals. As we will demonstrate below we believe such assertions fail to acknowledge how changes in habitat and their effects on animal behavior can negatively impact wildlife. We hope our concerns will be addressed more completely in the final EIS and before any further action is taken on the ground.

According to the DEIS this proposal will affect 8 million acres of land, with a total of 51,000 wells drilled over a 10 year period, but with a productive life of up to ten more years. Overall this means potential activity of varying intensity in the PRB for up to 20 years. Some estimates place the number of potential wells higher—at 80,000 or more. And the BLM has suggested that as many as 139,000 wells are possible, yet the analysis is based on the lowest possible number of expected wells. At the very least an analysis of the high well number should be included in one alternative.

In addition to these wells, ancillary facilities needed to support the wells will include pipelines, power lines, compressor sites, and roads. Furthermore, a similar level of development will be occurring on more than 6.5 million acres north of the Wyoming

border in Montana, so the cumulative impact of CBM development on the region will affect more than 14 million acres—or the combined acreage of the states of Vermont, New Hampshire and half of Connecticut! The Wyoming DEIS appears to ignore the fact that on-going development will occur north of the border so that the cumulative impacts will affect a far greater area than acknowledged in this document.

It is also not clear to us from the document whether the BLM considers only development on BLM mineral lease lands or on all lands in the PRB including private lands with full mineral ownership. Because only 10% of the lands in question are under complete federal ownership and control, while about half of the lands in the area are "split estate" it is conceivable that an equal or even greater amount of development could occur on other private lands in the area. Thus all estimates for the degree of habitat fragmentation, effects on wildlife, and other impacts could be much greater than what has been analyzed in the document. As has been shown in other similar situations where mixed ownership exists, such as checkerboard ownership of private timber lands interspersed with Forest Service lands, federal agencies must consider the full effects of all projected development, not just those occurring on federally controlled lands or split estate lands. Without considering these landscape scale effects, the existing document may grossly underestimate the full effects of development on wildlife values.

We predict that this project will result in a significant loss in biodiversity. Before we go further, we believe it's necessary to define biodiversity as we understand it. Preserving biodiversity is not merely about protecting or even increasing the total number of species or species richness. Conservation biologists are concerned with preserving diversity at multiple levels: genetic, population, species and landscape scales, plus maintenance of species at something approaching natural distribution and numbers. So anything that dramatically alters any one of these parameters leads to biological impoverishment or a loss in biodiversity. The proposed PRB development will likely affect biodiversity at all four scales and alter natural distribution and numbers from existing levels.

For instance, we anticipate that full field development will result in significant biological impoverishment. The table 4-94 on page 4-221 notes that development may affect a number of sensitive species whose numbers are already so limited that potential listing under the U.S. Endangered Species Act is contemplated or has been proposed including: white-tailed prairie dog, swift fox, peregrine falcon, trumpeter swan, northern goshawk, yellow-billed cuckoo, burrowing owl, sage thrasher, northern leopard frog, and sturgeon chub. Other, more widespread species are not endangered throughout their range, but may still experience significant population declines in this area, perhaps affecting genetically distinct populations. Finally, habitat fragmentation may affect landscape scale evolutionary processes.

The DEIS appears to agree with our conclusion on page 4-136: "Large contiguous areas of wetland/riparian vegetation would be fragmented by the construction of roads, pipeline corridors, and other linear facilities if such areas must be disturbed. Disturbance followed by reclamation would alter the species composition of reclaimed areas when compared

with undisturbed areas by replacing diverse native communities with communities consisting of a few favored reclamation species." So what will replace the native communities and how will this affect wildlife over the landscape, including ecological processes? The BLM is not explicit in answering such questions.

We disagree, however, with the following statement that attempts to offer assurances by assuming that new wetlands and riparian areas will more than compensate for these losses. " The increase of surface water flows in riparian and wetland areas may also create an increase in biodiversity within and adjacent to disturbed areas because wetland and riparian areas tend to support greater numbers of species than do adjacent uplands." This statement attempts to put a "happy face" on habitat fragmentation and other losses in native biodiversity. It is symptomatic of what is wrong with the analysis throughout the DEIS. What the authors of the DEIS apparently fail to comprehend is that increasing numbers of some species is not a quid pro quo for losses of other species. The goal of biodiversity protection is to preserve native species in something approaching natural distribution and numbers. More duck habitat at the expense of sage grouse habitat is not satisfactory. We do not agree with the statement that increases in wetlands and riparian habitat will have the wildlife benefits stated.

Furthermore, how will the addition of new species or population expansion of resident species affect other species in the area? This is not explained or even considered in the DEIS.

Throughout the wildlife section, the DEIS asserts that the effects of roads, habitat fragmentation, and other anticipated impacts are difficult to assess "because these determinant factors are largely unknown at this time" or "the effects of new access roads is difficult to quantify because road densities and lengths are dependent upon specific facility locations, which are undetermined at this time." Such statements are not acceptable. At the very least the DEIS should provide a worst case scenario and estimate those impacts. Shrugging off responsibility for probable impacts because the degree of development is unknown is unacceptable.

HABITAT FRAGMENTATION: The most serious threat to the region's biodiversity comes from the habitat fragmentation created by CBM development. Fragmentation has been documented to cause losses of biodiversity at several levels of organization (Noss and Copperrider 1994 , Ries et al. 2001, Trombulak and Frissell 2000). Fragmentation has been documented to cause losses of biodiversity at several levels of organization. Considering a single species, a small and isolated habitat patch is expected to have a smaller population and less opportunity for demographic or genetic "rescue" from surrounding populations. In metapopulation theory, an unoccupied patch of suitable habitat isolated by fragmentation is less likely to be colonized or recolonized by a target species (Gilpin and Hanski 1991). If enough connections between suitable habitat patches are severed, the metapopulation as a whole is destabilized and less likely to persist. Extinctions of local populations under these circumstances signal bit-by-bit extinction of

the metapopulation or the species as a whole (Harrison 1994).

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Effects of fragmentation at community, ecosystem, and landscape levels are also well documented in the ecological literature (Harris 1984, Wilcove et al. 1986, Saunders et al. 1991, Noss and Csuti 1997, Debinski and Holt 2000). Problems include abiotic and biotic edge effects that reduce the area of secure interior habitat in small habitat patches and often lead to proliferation of weedy and opportunistic species; increased human trespass and disturbance of sensitive habitats and species; and disruption of natural disturbance regimes, hydrology, and other natural processes. The end result of fragmentation is often a landscape that has lost sensitive native species and is dominated by exotics and other weeds. Although species richness at the local or landscape scale is often higher after fragmentation than in the undeveloped condition, many of the added species are organisms that thrive in human-disturbed areas. Higher species richness in human-disturbed landscapes is misleading because it is accompanied by a net loss of sensitive, native species and ultimately by a homogenization of floras and faunas at a broader scale as regions of similar climate begin to converge in species composition (Noss 1983, Mooney 1988).

Most of the habitat fragmentation in the project area is likely to be additive to existing problems. Habitat fragmentation from existing land uses, including livestock production has already negatively impacted such species as sage grouse. For instance, the document notes on page 4-198 that 113,643 acres of land formerly occupied by native vegetation has been altered by agriculture—presumably creation of hay meadows where native riparian vegetation once existed. Since these hay meadows are distributed in a linear fashion along bottomlands their overall effect is much greater than the above acreage figure may indicate.

In any event, the addition of more severe habitat fragmentation on top of the existing habitat loss, degradation, and fragmentation due to other on-going human activities will have an additive effect, in part, because in many instances, the habitat being disturbed by this project has previously been spared. For instance, the DEIS acknowledges that most well-site development and roads will be focused on ridges and out of riparian areas, thus creating new disturbance in landscapes that are today, for the most part, natural.

The DEIS appears to deliberately downplay ecological impacts by focusing on the physical imprint of disturbed surface area, estimated to be 211,992 acres, rather the larger

area that will be affected to varying degrees. The proposed development will affect and make unusable to some species a far greater amount of the landscape through habitat fragmentation, social displacement, and the temporal and spatial pattern of development on the landscape. Just as rural sprawl affects far more of the landscape than the area covered with a house, the proposed CBM development will affect acreage well beyond the lands physically impacted by drill pads, roads, and pipelines. One could make a strong argument that the level of development proposed could negatively impact all 8 million acres to some degree or another.

The more than 5,311 miles of power poles, 17,000 miles of new pipeline, 20,000 miles of roads, and 51,000 wells (39,000 or so well pads) estimated in the DEIS will significantly fragment the PRB. According to the DEIS, wells will be located on an "average" 80 acre spacing. Since this means that some areas will have significantly denser drill pads, some areas will be degraded to the point that they will no longer be useable by many wildlife species.

Throughout the wildlife section of the document, the authors conclude that adverse effects upon wildlife species will be minimal because "disturbance would likely be limited temporally and spatially, and suitable habitats are available elsewhere." We strongly question this assumption. Habitat fragmentation is not so easily mitigated. The effects of fragmentation extend well beyond the land directly impacted, and the effects can persist far beyond the initial disturbance.

Many wildlife species avoid areas for days or weeks after human intrusion. Furthermore, they may be displaced to less suitable habitat (Ingelfinger, F.M. 2001, Lyon 1983, Connelly et al. 2000). Presumably all suitable habitat is already filled with other members of the species, so refugial habitat for deer, antelope, sage grouse, and other species may simply not exist. Increased densities in some areas as others are disturbed will have impacts on reproductive success and survival.

Furthermore, because development and fragmentation will be affecting much of the habitat in the PRB, wildlife moving from disturbed areas will soon development elsewhere, and the available non-disturbed habitat will likely be small. Reduced wildlife numbers are virtually inevitable.

EFFECTS ON ECOLOGICAL PROCESSES: One of the key but often overlooked aspects of biodiversity conservation is maintaining the ecological and evolutionary processes that spawn and sustain species diversity (Noss and Copperrider 1994). In the PRB these processes would include such natural phenomena as drought, floods, wildfire, and predation. Though all of these processes are disrupted to some extent across this landscape already due to livestock production and other human activities, the proposed CBM will further alter their effects on the landscape and its biota. For example, the creation of many new roads will fragment fine fuels, creating fire breaks that will reduce the natural spread of fires. Changes in stream flows created by ground water pumping and the subsequent dumping of water on the surface will alter flow regimes in streams and

rivers. Many species of wildlife are dependent on periodic natural processes to maintain their numbers and meet habitat requirements. Though predicting precisely how habitat fragmentation and development will influence ecological processes is challenging, we would expect some consideration to these problems in the DEIS.

WATER QUALITY AND QUANITY CHANGES: CBM development will result in massive ground water pumping. Pumping will draw down existing local and regional aquifers and reduce important ground and surface water supplies. This could have several effects.

First, loss of flow in springs and the drying out of natural wet meadows could cause livestock to seek out forage in existing, more permanent riparian areas, placing greater impact upon these areas. Livestock production, including the loss of riparian habitat already converted to hay fields, is already the major impact on riparian vegetation in the region, and additional impacts will almost certainly affect many species, including neotropical migrants (Belsky et al. 1997, Chaney et al. 1991, Saab etc. al. 1995, Taylor 1986). But even in areas not affected by livestock, loss of springs and wet meadows could impact many species, including amphibians, mollusks, small rodents, and birds that depend upon these isolated water sources. Sage grouse, for instance, depend on wet meadows later in the summer for foraging Connelly et al. 2000), and loss of these meadows could negatively affect sage grouse whether such meadows are grazed by domestic livestock or not.

Second, flows in major streams could be affected by pumping and aquifer drawdowns. This could create shallower drainages during winter and summer when temperature extremes could negatively affect aquatic life. Fewer fish or other vertebrates such as frogs could mean reduced prey availability for many predators, from herons to kingfishers. Slower water velocity could allow greater ice build-up in winter, eliminating foraging areas for waterfowl, bald eagles, and other water dependent species.

Third, water pumped from aquifers will be substantially different in chemistry and other qualities from existing surface waters. One change will be temperature. Water held in ponds to reduce inflow to streams may increase in temperature due to solar radiation, which could facilitate the spread of non-native species. For instance, bullfrogs are favored by higher temperatures over native frogs, and could find many new breeding sites that will allow them to overwhelm native species.

The new “wetlands” that may be created by increased water flow down streams or in shallow holding ponds could act as population sinks for many species. The toxic chemicals in these ponds may directly harm some groups like amphibians, but more importantly, many of these ponds will be gouged from bare dirt, lack any kind of vegetative hiding cover along their edges, and thus will be of limited use to wildlife (McAuliffe1997). And the wildlife that try to use them may be more vulnerable to predators, thus wasting reproductive effort. For instance, nesting ducks may find little attractive in these settling ponds because the shoreline vegetation that provides the

necessary cover to avoid nest predation will be lacking.

Conversely, release of water pumped from aquifers may lead to increased flows in some major streams, such as the Powder River and Little Powder River, potentially altering natural flow characteristics during the summer. Changes in flow regimes could affect such sensitive fish species as the sturgeon chub and other species such as the interior least tern, which may depend upon bare sandbars for nesting and foraging habitat. Additionally, increased flows down ephemeral streams could lead to greater siltation and sediment flows at times of the year that are unusual—such as late summer or early fall when natural sediment flow is low. Such changes in sediment flow can negatively impact many species, from amphibians to fish (Newcombe and Jensen 1996).

And if there are changes in wildlife numbers, species composition, soils, vegetation due to CBM development, than what will happen once some of these developments like holding ponds are gone? What will occur to the amphibians or waterfowl that may grow dependent on CBM water?

TOXIC CHEMICAL FLOWS: CBM development will involve substantial groundwater pumping that could have many adverse effects on aquifers and above surface stream flows. Water pumped from coal seams tends to contain high levels of salts and other chemicals that are toxic in small quantities. There is not much discussion or even acknowledgment in the DEIS that many of these chemicals will accumulate in soil and water to levels that may be lethal, nor is there any consideration to the effects of bio-accumulation, for instance in invertebrates and fish, and its amplification to detrimental or lethal doses higher up the food chain.

In many cases, it appears, toxic laden waters will be permitted to run down streams into surface waters and could prove lethal to invertebrates including aquatic insects, as well as such vertebrates as fish, frogs, and salamanders. The northern leopard frog, for instance, is known to occur in this area. Frogs, which have more or less porous skins, are especially vulnerable to small quantities of toxins. Water flowing down streams and into larger rivers could negatively impact these animals.

More seriously, even if existing concentrations of toxins were diluted sufficiently by other water flows to reduce toxicity, occasional flushes of toxic waters with higher than normal levels of salts and chemicals can be anticipated. For example, water pumping will occur throughout the year, In winter, much of this water will freeze, then melt in spring with a sudden flush of toxins rushing down small stream channels, where they could harm amphibians and other wildlife.

Another problem with toxic water flows is their effects on riparian habitat. High salt content will affect most vegetative communities, even killing many species. Since much of this flow will be directed down gullies, perennial and non-perennial stream channels, this could negatively affect plant communities in these areas. Since riparian areas are among the most productive areas in this arid region, sometimes accounting for up to 80%

of the annual plant biomass, as well as providing habitat for many wildlife species (Chaney et al. 1991, Belsky 2000), any damage to riparian habitat can have severe implications for the overall biotic carrying capacity. For instance, sage grouse chicks are dependent upon wet meadows for 2-3 weeks in the spring where they find cover and food. A loss in such habitat due to toxic poisoning could negatively impact sage grouse populations. But sage grouse are not the only species that could be significantly affected. Many neotropical songbirds in the area utilize riparian habitat during migration or during the nesting season (Saab et. al 1995). We can expect them to suffer as well.

Another unknown is how the chemicals in these waters will affect sediments in streams and ponds. Many of the soils in this area are clay based. Some of these chemicals are known to loosen and mobilize clays, which could result in formation of clay cemented surfaces when water evaporates. How will such cemented surfaces affect runoff (will it be more rapid in subsequent rainfall?), and how would it affect use of the land by such organisms as toads and ground nesting bees? Such issues were not discussed in the DEIS.

LACK OF POPULATION DATA: For countless species that the DEIS acknowledges may be affected by CBM development, there are no base-line data to determine how populations might respond. Yet for the most part the BLM knows where the wells are leased. At the very least specific monitoring and data gathering of both well sites and control areas should be done prior to, during, and after drilling. The overall population size, trends, geographical range, and habitat use in the region are often unknown or poorly understood for most taxa, including even highly visible species like prairie dogs, ferruginous hawks, and burrowing owls, as well as such poorly studied species as leopard frog, various small rodents, aquatic insects, and butterflies. Without base-line data, it's impossible to assess the impacts from development. At the very least, reasonable efforts to gather such data should be made prior to any development

Furthermore, there are apparently few large control areas being created for monitoring. Basically if there is coal methane available, it is leased, without any regard to creating landscape-scale controls where trends can be measured and compared to developed areas. No annual surveys or other methods for scientifically defensible population monitoring will be in effect. Without such base-line information, how can the BLM assert that it knows what kinds of impacts will occur?

ROADS: The proposed development will create thousands of miles of new roads, causing many problems for wildlife. Roads bring in human traffic that disturbs and displaces many wildlife species. Numerous studies show that large ungulates such as elk, mule deer, antelope, and others avoid roads, even under infrequent use wildlife (Cole et al. 1997, Lyon 1983, Ingelfinger 2001, Findlay and Bourdades. 2000, Ries et al. 2001, Trombulak and Frissell 2000). It is not just a matter of numbers—many species' social behavior is changed by the presence of roads and the associated traffic.

According to the DEIS, there will be considerable activity on roads during the development phase. Even during the maintenance phase, most drill pads will be accessed

at least once daily to check the status of each well site.

In the open country that characterizes much of the area, the disturbance effect of roads can be significant. A recent study of sage grouse by Allison Lyons of the University of Wyoming found that birds in Wyoming's Jonas Gas Field by Pinedale were adversely affected and displaced up to 3 miles from roads by as little as one vehicle passage per day. This suggests that an area as wide as 6 miles straddling a road could have greatly reduced habitat potential for some species. Another recent study documented less use of lands near roads by sage grouse and other species. Ingelfinger (2001) found that traffic on roads led to a 50% decrease in sagebrush obligate species, including sage sparrow, vesper sparrow, and Brewer's sparrow, and an increase in horned larks. All these sagebrush obligate species are under increasing duress throughout their range from a host of other problems including livestock production, invasive weeds, and changes in fire frequency. Further erosion of their habitat by CBM development could fragment local populations or create population sinks for these species in this region.

Roads are also barriers for migration of smaller animals. For instance Baur and Baur (1990) found that a primitive road only 3 meters wide was a barrier to the movement of land snails and amphibians (Gibbs 1998). And Swihart and Slade (1984) found that prairie voles were reluctant to cross even tire tracks running through an open field.

Even where no direct effects occur, roads can still be a source of stress, creating elevated energy use that ultimately leads to population decline (Fernandez 1993).

Roads also provide access for non-CBM human uses. Because 90% of development in the PRB will occur on private lands, the federal government will have little control on non-CBM related use. The increasing popularity of ORVs and 4WD vehicles could cause further disturbance to wildlife and facilitate poaching. Lyon (1983) found that elk were displaced from up to 50% of their habitat when road densities exceeded 2 miles of primitive roads per square mile. Similar studies for deer also demonstrate a social displacement and loss of habitat (Rost and Bailey 1979). Even if a road is not driven, it still provides walk-in access. Studies have shown that the mere presence of a road increases human use and disturbance in an area. Thus, even if the vast majority of roads were closed, they would still influence wildlife use of habitat.

Roads, along with well sites, pipelines, and the other developments also will be vectors for the spread of exotic weeds, as we discuss in more detail below.

Besides the effects of roads on wildlife habitat use, there is the problem of increasing traffic and its impacts. This level of development will increase traffic flow on many rural roads well above current levels. This increase in traffic will no doubt result in substantial wildlife losses from vehicle-wildlife collisions. Depending on where and when traffic intersects wildlife movement patterns, this could negatively affect deer, antelope, sage grouse, raptors, songbirds, amphibians, reptiles, and many other species. While vehicle collisions may not be a threat to regional populations, they could effectively limit or even

cause a serious decline in some sub-populations.

Raptors also could be negatively effected by collisions with vehicles. Many birds of prey feed upon dead animals killed by passing vehicles. While this does provide an easy meal, it also means these birds are vulnerable to collisions with traffic. The overall effect could be a decline in raptor numbers. The effects are dismissed in the DEIS with the conclusion that such collisions would be infrequent. Again no evidence for this optimistic conclusion is provided.

Although the DEIS, in one paragraph, acknowledges that vehicle collisions are a potential problem, it again skirts the issue by asserting that "project-related traffic volumes will be greatest during the construction phase and gradually diminish…" with no attempt to quantify how serious this may be.

The DEIS is the one opportunity for the public to look at the effects of roads across the basin. Since the BLM knows where most of the wells will be located, putting forth a preliminary road map is possible. At the very least a basin-wide road analysis and assessment should be created and presented in the Final EIS.

EXOTIC WEEDS: Exotic weeds typically colonize disturbed sites, then spread outward from these source locations (Greenburg et al. 1997, Hobbs 2001). The proliferation of new roads, pipelines, well sites, compressor sites, and other disturbances will result in a huge number of newly disturbed sites that will favor the colonization by exotic weeds.

Furthermore, the nearly daily movement of CBM development vehicles from one site to another to monitor wells and pipelines means almost daily opportunity for vehicles to transport weed seeds to these locations. For instance, in one study of a pick up truck driven through a field of spotted knapweed, thousands of seeds were deposited on the undercarriage and wheels of the vehicle. We can anticipate that each new developed site will become a new source for weed colonization of the landscape.

At present the BLM DEIS says that leasees will be required to monitor and control weeds, but there is nothing to indicate how this requirement will be enforced. Furthermore, the most likely means of control will be spraying with toxic herbicides that in many cases will also destroy native vegetation. Even if there is reclamation of the roads and well sites, undoubtedly new weed populations will be established.

The invasion of exotic weeds can have many negative effects on native wildlife. For one, most weedy plants are less palatable and nutritious to wildlife. Wildlife that depend on native grasses or other plants for forage will find some of their favored foods displaced or excluded by exotics, reducing the overall carrying capacity of the site. Also some exotics green up and go dormant at times different from native species, which could affect their availability for native animals. Everything from butterflies that depend on specific host flower species, to rodents that harvest seeds, to antelope that depend on certain native

forbs, could be affected by these changes.

Secondly, invasive plants could affect hiding cover for such species as sharptailed grouse or ground-nesting songbirds, making them more vulnerable to predators, creating population sinks.

Third, such invasive species as cheatgrass can alter fire regimes. In other parts of the West, the invasion of cheatgrass has led to frequent fires that destroy both native sagebrush and native grasslands that can not tolerate such frequent fire intervals.

The long term affects of invasive weeds are downplayed in the DEIS, yet may pose a significant threat to many wildlife species in the area. Yet there is no detailed analysis of which weeds are likely to invade the area, and overall ecological threat that these species create for the region, including an assessment species by species of how effective or ineffective control has been in other places. The BLM has also not provided an assessment of how herbicides used for weed control may impact not only target species, but other vegetation as well as wildlife.

POWER LINES: More than 5,000 miles of power lines will be built, providing new electrocution risks for birds of prey. At the same time, the creation of tens of thousands of new perches for raptors could increase their numbers and effectiveness at predation. Sage grouse, for instance, have been shown to avoid power lines due to increased vulnerability to predators. While these effects are mentioned in the DEIS, there is no attempt to quantify this effect and like many negative impacts mentioned in the document, the mitigation measures are inadequate.

CHANGES IN PREDATORS: The level of development discussed in the DEIS may lead to shifts in predator ratios in the area. The effects of power lines on raptors has already been mentioned, but small mammal predators may increase as a consequence of development. For instance, the increased access created by roads could result in greater shooting of coyotes. Because coyotes prey upon and displace smaller predators such as red fox, the shift in predator populations could affect small prey numbers. Predators like red fox and skunk have been shown to be far more effective predators of ground nesting birds than coyotes. Furthermore, skunks, in particular, are favored by human development, using pipes, culverts, houses, and sheds for hiding and denning. The creation of numerous buildings, culverts, and other developments could lead to an increase in such smaller predators that could adversely affect small prey species.

UNGULATES: The document discusses impacts on large ungulates such as antelope, white-tailed deer, mule deer, and elk. Again the DEIS paints a rosy picture of minimal disturbance of habitat. For instance on page 4-149 of the document, the authors assert that less than 1% of the white-tailed deer year long habitat, or approximately 9,160 acres, would be disturbed. However, it is not clear from the document how this 1% figure was derived. It seems particularly low given the numerous roads, drill pads, human vehicle activity and other habitat fragmentation that will occur. We suspect the authors are merely

referring to the actual physical imprint of development on habitat, rather the broader loss of habitat due to human activity, habitat fragmentation, and other development activities.

Referring again to white-tailed deer, the document concludes that "the loss of suitable white-tailed deer habitats would not likely result in adverse effects to the seasonal habitat use, herd movements or herd condition because of the availability of suitable habitat throughout the project area."

The same assumptions and conclusions are made for all the large ungulates in the PRB. As we have stated elsewhere, such conclusions assume that there is "vacant" habitat to fill with those animals displaced from the developed sites, yet there is no evidence to suggest that such vacant, unoccupied habitat exists. Secondly, the assertions assume that there will be no behavioral changes in herd use of the areas, yet there is abundant scientific evidence that suggests that animals will and do move in response to human activity—particularly those animals that are hunted, as nearly all of these ungulates are.

In the sub-category under Human Disturbance, the authors assert that even if white-tailed deer were displaced and "moved to adjacent suitable habitat," which they presume exist, that this would have no negative effects on the animals. Such assumptions again demonstrate a remarkable failure to consider the year-round needs of animals. Stress during any time of year can cause reduced fitness, with a subsequent decline in population. For instance, nutrition of does in the summer often determines the birth weight of fawns in the following spring. Light birth weight makes fawns more vulnerable to predation, adverse weather and other mortality. While coyotes or spring storms may be the proximate factors in ungulate population declines and will get the blame if populations fall, it is quite possible that widespread disturbance of antelope or deer on summer ranges by human activity is the ultimate factor. These kinds of indirect effects are not given any discussion in the DEIS.

What is almost laughable is the attempt to suggest that if development and human activities rise to the level where they displace ungulates on private lands, then the animals will be moved to public lands—where presumably they will be easier to hunt, as if that is the only concern of wildlife conservation.

WATERFOWL: The DEIS attempts to downplay the potential impacts on waterfowl by asserting that the hundreds, if not thousands of settlement ponds provided when ground water is pumped to the surface during CBM operations will be left to gradually evaporate or percolate back into the ground, hence creating new waterfowl feeding and nesting habitat. But most of these ponds will have little vegetation along their shores, providing almost no effective cover for nesting birds. In addition, the high toxicity of the ponds could pose a threat to the birds' survival, as acknowledged in the DEIS on page 4-168. The document further acknowledges that evaporation of pond water could lead to toxic conditions. Yet, as with other parts of the document, there is no attempt to quantify how this might affect waterfowl. It is quite likely that these "new" habitats created by settlement ponds will become population sinks that will attract birds but ultimately cause

population declines, rather than increases. In particular we don't know what the long term effects might be on birds that merely stop and feed in these toxic soaps, that may die hundreds of miles away from ingestion of heavy metal or toxins like selenium.

PRAIRIE DOGS: The document briefly discusses prairie dogs under its terrestrial wildlife species section on page 3-122. Both white-tailed and black-tailed prairie dogs are known to occur in the area. The white-tailed prairie dog (WTPD) is a Wyoming BLM sensitive species. The black-tailed prairie dog (BTPD) is a candidate species under the ESA. The BTPD is considered a keystone species since many other wildlife including black-footed ferret, burrowing owl, mountain plover, swift fox, ferruginous hawk, and more than 100 other species have been known to utilize or depend upon BTPD colonies to meet at least part of their habitat needs (Agnew et al. 1986, Reading et al. 1989, Wuerthner 1997).. Similar associations are recorded for WTPD colonies as well. Both WTPD and BTPD are declining throughout their range due to a host of factors including plague, poisoning campaigns by the livestock industry, habitat fragmentation from roads, housing tracts, and agriculture. As a result, BTPD are thought to occupy less than 1% of their former habitat, and this was one factor prompting the petition for listing (Wuerthner 1997).

CBM development is likely to further jeopardize the WTPD and BTPD populations in this area by direct disturbance of habitat and as a result of other environmental changes that occur. For instance, greater road access may lead to an increase in human caused mortality from "varmint hunting." Again, since much of the development will occur on private lands, state control over hunting impacts will be limited. Although roads can facilitate movement of WTPD and BTPD to colonize new habitat, they can also allow the spread of plague easily from colony to colony, which would negatively affect prairie dog population viability. Additionally, crushing by vehicles on heavily traveled roads could become a significant source of mortality if these roads are close to a major prairie dog colony.

The presence of new telephone poles and other structures that serve as perches may increase raptor predation success and could limit colony size and populations in areas where poles are located close to WTPD and BTPD colonies.

Even if current development schemes do not cause a further downward trend in PRB prairie dog populations, they may well reduce or limit their future expansion by creating many barriers to new colonization, changes in predator relationships, and changes in human access. Maintaining stable populations should not be the objective or goal for prairie dogs, particularly on public lands. Expansion is absolutely necessary if WTPD and BTPD populations and their associated species are to increase beyond mere survival levels and recover to ecologically effective population sizes.

Though the document acknowledges that WTPD and BTPD are found in the area, the numbers, population trends, and geographical occurrence for either species are not known. Furthermore, we could find no discussion of prairie dogs in section 4 of the DEIS

on environmental consequences. Given the importance of prairie dogs to so many other species, the absence of detailed discussion is surprising. At a minimum the DEIS should include an analysis of all large prairie dog colonies and sites where potential for expansion of prairie dog colonies may be possible so they can be protected, not precluded from future colony expansion.

LONG-BILLED CURLEW: Long-billed curlews are listed as sensitive by a number of agencies. They nest on shortgrass prairie and are uncommon breeding residents of the area. Other than noting their occurrence in the project area, no further discussion of how CBM development may affect curlews occurs in the document.

YELLOW-BILLED CUCKOO: The yellow-billed cuckoo is another sensitive species that inhabits the area. Its range has been dramatically reduced, in part due to its dependency upon healthy riparian habitat. The effect of toxic run-off on riparian habitat is downplayed, as discussed earlier, but could be significant in some areas. Thus potential impacts upon this species exist, yet no discussion of this was found in chapter 4.

SAGEBRUSH OBLIGATE SONGBIRDS: A number of sensitive sagebrush obligate songbird species exist in the project area, including sage sparrow, Brewer's sparrow, and sage thrasher. Again, the document acknowledges in chapter 3 (affected environment) the presence of these species, but provides no further discussion of potential effects of CBM development. Yet as recent studies conducted near Pinedale demonstrate, the vehicle traffic on roads can reduce habitat use by these species, thus potentially impacting them.

MOUNTAIN PLOVER: The mountain plover is another ESA candidate species. It is associated with prairie dog complexes and is known to exist in the project area. The document acknowledges the dependency on prairie dogs, but goes no further in analyzing the effects of development on BTPD or directly on mountain plovers themselves. How, for instance, could plovers be impacted if the main large predators shift from coyotes to foxes? Are plovers vulnerable to raptors? And if so, will the construction of numerous new telephone poles create death zones for plovers? We could find no discussion of plovers in chapter 4.

ACID RAINFALL: CBM development releases large quantities of air pollutants, including sulfides that contribute to acid precipitation. Though the prevailing wind direction is west to east, the northern Great Plains, particularly along the base of the Big Horn Mountains, experiences numerous spring and summer storm patterns that come from the south, moving northwest, and could carry air pollutants into the higher elevations of the Big Horn Mountains or even further west into the Wind River and Beartooth Mountains. All of these high mountains have granitic cores that have poor buffering capacity and may suffer from acidification affecting fish populations, invertebrates, amphibians, and other species. We found no mention of this potential impact in the document.

RECLAMATION: Under the reclamation section of the DEIS on page 4-117, the authors

acknowledge that reclamation of native vegetation will be difficult, noting that native shrublands and grasslands will remain in a "low diversity state for an extended period of time." Typically reclamation involves the use of non-native grass species. At the very least, all reclamation should require the use of native species with seed sources endemic to the area. Genetic variation in sagebrush, grasses, and other plants varies widely across the West, and sagebrush seed from Oregon, for example, would not be appropriate for use in eastern Wyoming. The DEIS acknowledges that, due to invasion of exotic weeds, full restoration of native plant communities may be impossible, so in effect, we are talking about a huge reduction in native plant and wildlife habitat that may be permanent. Yet the document, without any documentation asserts that impacts on landscape would be insignificant.

Such conclusions are based on a number of flawed assumptions. One is that the many areas affected by high salt and toxic chemical flows are apparently NOT included in the acreage figures.

Two, it is not clear what is included in the total acreage of disturbed habitat. Does this include only drill pads or are the roads, pipelines, compressor pads, etc., all part of the figure?

Third, the general assumption is that ecological impacts are limited to lands directly impacted by disturbance. Ignored is the potential ability of each disturbance to affect many adjacent acres—for instance by acting as a weed invasion source, with propagules spreading outwards from each disturbance site like ripples in a pond when a stone is tossed. The cumulative effects of disturbance can be far greater than the acreage physically impacted by development. The document acknowledges this potential, but again cites the lack of ability to quantify these effects as an excuse not to include them in any figures presented. This unwillingness to apply the precautionary principle is one of the fundamental flaws of the DEIS.

GROUND WATER PUMPING: Though many of the aquifers that will be tapped for CBM development are deep and thus not directly tied to existing surface waters, in some instances ground water depletion may affect or disrupt surface flows from existing springs and wetlands. These existing wetlands can not simply be "replaced" by creation of new water sources such as settlement ponds. Loss of these springs may affect species with limited mobility including native amphibians and mollusks.

MITIGATING RESTRICTIONS: In many cases the mitigating restrictions on CBM development are inadequate and do not reflect the best available science. For example, in chapter 5-10, controlled surface use is proposed for ¼ mile from all sage grouse leks. Yet recent research suggests that disturbance can affect female habitat use up to 3 miles from the source of disturbance such as a road.

Or in the case of power lines and their effects on sage grouse by providing perches for raptors, no set backs for power lines in relation to nests are mentioned in the mitigation

section. Furthermore, it would be difficult to locate nests to even determine such effects.

Under Chapter 5-7 the BLM does acknowledge that it "may" require survey to assure that no sensitive or threatened species are present. But surveys appear to be discretionary, not a requirement. And for other species, "waivers" to all stipulations can be issued if the species under consideration has "moved" out of the area.

SECONDARY IMPACTS: As acknowledged in the DEIS, livestock production is the dominant existing land use. Livestock has many well known impacts upon wildlife and biodiversity (Fleischner 1994, Hobbs 2001), thus any shift in habitat utilization or intensity of use by livestock as a result of CBM development has the potential to lead to negative impacts on wildlife not directly the result of CBM development.

For instance, creation of new stock ponds by ground-water pumping and subsequent creation of settlement ponds could open up many new areas to intensive livestock use. This could create problems for native species from neotropical songbirds (Saab et al. 1995) to large ungulates such as mule deer (Kie et. al. 1991, Loft et al. 1991, Loomis 1991) Sage grouse are particularly vulnerable to new grazing influences, because greater use by livestock of uplands dominated by sagebrush may negatively impact grouse populations (Beck and Mitchell 2000). Grazing by livestock can also alter fire regimes and invasion of woody species such as juniper (Belsky Blumenthal 1997).

Previous mention was made of the role of CBM development in the spread of weeds. Livestock are also a major source of habitat fragmentation and weed invasion (Hobbs 2001). So the cumulative effects of CBM along with changes in livestock production practices could greatly alter the existing landscape with synergetic effects upon wildlife and biodiversity.

CONCLUSIONS: The DEIS is short on specific analysis and long on speculation, and generally paints a rosy future implying compatibility of CBM development with the long term maintenance of biodiversity in the PRB. Few firm numbers are given for projected impacts upon wildlife. In many cases, particularly with respect to sensitive species, no discussion of CBM development impacts is attempted at all. In other instances, a glaring lack of baseline information on populations, geographic distribution, and specific habitat use makes projections of potential future impacts impossible. Though the document acknowledges there will be impacts, the magnitude of impacts is usually downplayed, and the burden of proof is incorrectly placed on those concerned about biodiversity. In summary, the DEIS fails to accurately and responsibly portray the likely cumulative effects of full field development on wildlife.

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REFERENCES:

Agnew, W., D.W. Ureak, and R.M. Hansen. 1986. Flora and fauna associated with prairie dog colonies and adjacent ungrazed mixed grass prairie in western South Dakota. Journal of Range Management. 39:135-139.

Baur. A. and B. Baur. 1990. Are roads barriers to dispersal in the land snail Arianta arbustorum? Canadian Journal of Zoology 68:613-617.

Beck, J.L. and D.L. Mitchell. 2000. Influences of livestock grazing on sage grouse habitat. Wildlife Society Bulletin. 28(4)993-1002.

Belsky, A.J. and D.M. Blumenthal. 1997. Effects of Livestock grazing on stand dynamics and soils in upland forests of the Interior West. Conservation Biology 11:315-327.

Belsky A.J. , A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems of the Western United States.. Joournal of Soil and Water Conservation. First Quarter.

Chaney, E., W. Elmore, and W.S. Platts. 1990. Livestock grazing on western riparian areas. Environmental Protection Agency, Washington, D.C.

Cole, E.K., M.D. Pope, and R.G. Anthony. 1997. Effects of road management on movement and survival of Roosevelt elk. Journal of Wildlife Management. 61:1115-1126.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin. 28(4) 967-985.

Debinski, D.M., and R.H. Holt. 2000. A survey and overview of habitat fragmentation experiments. Conservation Biology 14:342-355.

Fernandez, C. 1993. The choice of nesting cliffs by golden eagles Aquila chrysaetos: the influence of accessibility and disturbance by humans. Alauda 61:105-110.

Findlay, S.C. and J. Bourdades. 2000. Response of wetland biodiversity to road construction on adjacent lands. Conservation Biology 14: 86-94.

Fleischner. T. L. 1994. Ecological costs of livestock grazing in western North America. Conservation Biology 8: 629-44.

Gibbs. J.P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. Journal of Wildlife Management. 62(2).

Gilpin, M.E., and I. Hanski, editors. 1991. Metapopulation dynamics: empirical and theoretical investigations. Linnaean Society of London and Academic Press, London.

Greenberg, C.H., S.H. Crownover, and D.R. Gordon. 1997. Roadside soil: a corridor for invasion of xeric shrub by nonindigenous plants. Natural Areas Journal 17:99-109.

Harris, L.D. 1984. The fragmented forest: island biogeography theory and the preservation of biotic diversity. University of Chicago Press, Chicago, IL.

Harrison, S. 1994. Metapopulations and conservation. Pages 111-128 in P.J. Edwards, R.M. May, and N.R. Webb, eds. Large-scale ecology and conservation biology. Blackwell Science, Oxford, UK.

Hobbs, R.J. 2001. Synergisms among habitat fragmentation, livestock grazing, and biotic invasions in Southwestern Australia. Conservation Biology 15:

Ingelfinger, F.M. 2001. The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming. MS thesis, Dept. of Zoology. U of Wyoming, Laramie, Wyoming.

Kie, J. G., C. J. Evans, E. R. Loft, and J. W. Menke. 1991. Foraging behavior by mule deer: the influence of cattle grazing. Journal of Wildlife Management. 55(1): 665-674.

Loft, E. R., J. W. Menke, and J. G. Kie. 1991. Habitat shifts by mule deer: the influence of cattle grazing. Journal of Wildlife Management. 55(1):16-26.

Loomis, J.B., E. R. Loft, and D. R Updike, and J. G. Kie. 1991. Cattle-deer interactions in the Sierra Nevada: a bioeconomic approach. Journal of Range Management. 44(4): 395-399.

Lyon. L.J. 1983. Road density models describing habitat effectiveness for elk. Journal of Forestry. 81:592-596.

McAuliffe, J.R. 1997. Rangeland water developments: conservation solution or illusion? Symposium on Environmental, Economic, and Legal Issues Related to Rangeland Water Developments, November 13-15, 1997. Arizona State University College of Law, Tempe, AZ.

Mooney, H.A. 1988. Lessons from Mediterranean-climate regions. Pages 157-165 in E.O.

Wilson, ed. Biodiversity. National Academy Press, Washington, D.C.

Newcombe, C.P. and J.O.T. Jenson. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk. North American Journal of Fisheries Management. 16:693-727.

Noss, R.F. 1983. A regional landscape approach to maintain diversity. BioScience 33:700-706.

Noss R. and A. Cooperrider. 1994. Saving nature's legacy: protecting and restoring biodiversity. 416 pgs. Island Press. Covelo, CA.

Noss, R.F., and B. Csuti. 1997. Habitat fragmentation. Pages 269-304 in G.K. Meffe and R.C. Carroll, editors. Principles of conservation biology. 2nd edition. Sinauer Associates, Sunderland, MA.

Reading, R.P. , J.J. Grensten, and T.W. Clark. 1989. Attributes of black-tailed prairie dog colonies in north central Montana, with management recommendations for the conservation of biodiversity. In: The prairie dog ecosystem: managing for biodiversity. Tim W. Clark , Dan K. Hinckley and Terrell Rich, eds. Montana BLM Wildlife Technical Bulletin. #2. Billings, Montana.

Ries, L., Debinski, D. M., M.L. Wieland. 2001 Conservation value of roadside prairie restoration to butterfly communities. Conservation Biology 15:

Rost, G.R. and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. Journal of Wildlife Management 43:634-641.

Saab, V.A., C.E. Bock, T.D. Rich, D.S. Dobkin. 1995. Livestock grazing effects in western North America. In: Martian, Thomas E. Fish, Deborah M. Eds. Ecology and management of neotropical migratory birds. New York: Orford University Press. Pgs. 311-3353.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5:18-32.

Swihart, R.K. and N.A. Slade. 1984. Road crossing in Sigmodon hispidus and Microtus ochrogaster. Journal of Mammalogy. 65:357-360.

Taylor, D. M. 1986. Effects of cattle grazing on passerine birds nesting in riparian habitat. Journal of Range Management 39(3): 254-258.

Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14:18-30.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pages 237-256 in M.E. Soulé, ed. Conservation biology: the science of scarcity and diversity. Sinauer, Sunderland, MA.

Wuerthner, George. 1997. Viewpoint—The Blacktailed prairie dog—headed for extinction? Journal of Range Management 50(5)