Outdoor Facts

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COLORADO PRONGHORN COMPATIBILITY AND CONFLICTS WITH AGRICULTURE

INTRODUCTION

The citizens of Colorado place high value on the wildlife resources of this state and, through their elected officials, have given the Colorado Division of Wildlife (CDOW) a mandate to perpetuate the state's wildlife resources and to provide people the opportunity to enjoy them (Colo. Wildl. Comm. 1994). Approximately two-thirds of the land in the state is privately owned; many species of free ranging wildlife inhabit these private lands. Most landowners value and enjoy wildlife on their lands and are strong advocates of wildlife conservation (Fig. 1). For example, at the turn of the century (19th to 20th), landowners across the west were an integral part of the coalition of citizens instrumental in saving pronghorn (*Antilocapra americana*) from extinction. They enforced rigid protection for pronghorn on their land and pressed the State Legislature to pass protective laws (Hoover et al. 1959). By the mid-1940s, pronghorn recovery efforts were successful to the point that the State Legislature legalized harvesting of pronghorn despite "a storm of resentment" by eastern plains landowners still concerned for the species' welfare (Hoover et al. 1959:95).

Pronghorn inhabit open areas with low, sparse vegetation where they can rely on their keen sight and speed to avoid danger. Because of this trait, they are easily observed and are neither secretive nor nocturnal like other large ungulates. Landowners usually know when pronghorn are on their land, which can be either a source of enjoyment or worry, depending on whether or not the pronghorn are perceived to be damaging crops.

Landowner attitudes might be more favorable to wildlife if they saw them as a fiscal asset rather than a liability. The CDOW's Ranching for Wildlife program offers economic incentives for landowners whose lands support wildlife (Hopper 1990), however, the benefits of this program are limited. More creative programs are needed to foster better management of wildlife on private lands. The pronghorn resource is in high demand by sportspersons in Colorado (Pojar 1994) and could provide landowners addi-

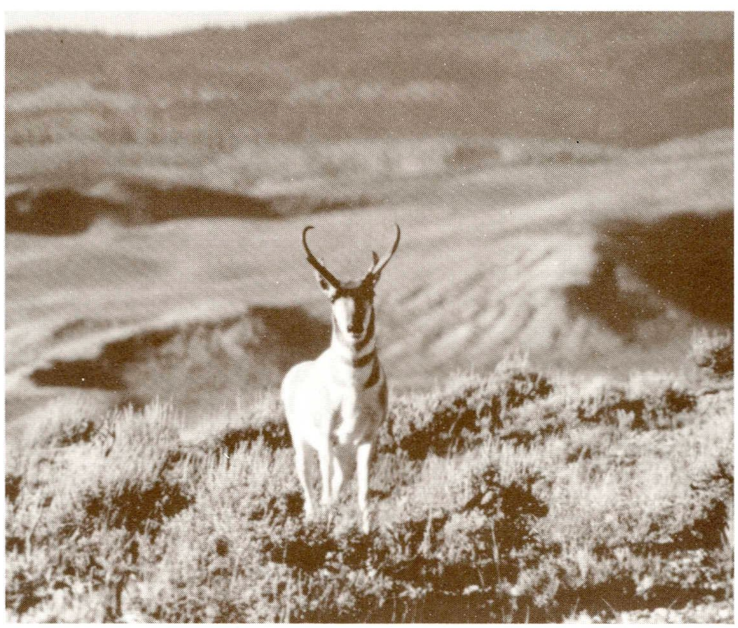

Fig. 1. Pronghorn are valued by the citizens of Colorado. Pronghorn inhabit open range where they depend on their eyesight and speed to avoid danger. (Photo by author)

tional income if managed and marketed as an adjunct product of their agricultural operation (Torbit et al. 1993)

The purpose of this report is to profile the impacts of pronghorn on agricultural lands. The intent is to summarize the role of pronghorn in 3 predominant areas of perceived conflict with agricultural operations: 1) competition with livestock for native vegetation, 2) damage to winter wheat, and 3) the potential to spread noxious weeds.

COMPETITION FOR NATIVE FORAGE

Historically, pronghorn and bison (*Bison bison*) coexisted in approximately equal numbers on native western ranges (Nelson 1925). Because direct competition could be detrimental to both species, dietary divergence (Schwartz et al. 1977) and functional niche separation probably evolved to facilitate sympatric coexistence (Fig. 2). Consequently, there is little dietary overlap by pronghorn and large herbivores (bison/cattle) on native western ranges (Yoakum 1980).

Pronghorn select for a diet high in protein and low in fiber supplied mostly by forbs and shrubs, whereas large herbivores such as cattle use grasses almost exclusively (Howard et al. 1990, Schwartz et al. 1977). The exception to this general relationship occurs during spring green-up when grasses, during early growth stages, can have protein content of 20% or greater (Schwartz et al. 1977). At this time of year, pronghorn diets may contain up to 20% grasses (Fig. 3) (Hoover et al. 1959). However, on a yearlong basis, grasses comprise only about 6% pronghorn diets compared to 90% for cattle (Hoover et al. 1959). The remainder of the annual pronghorn diet is forbs (43%), shrubs (40%), and "other" species including cacti (*Opuntia* sp.) (11%) (Hoover et al. 1959).

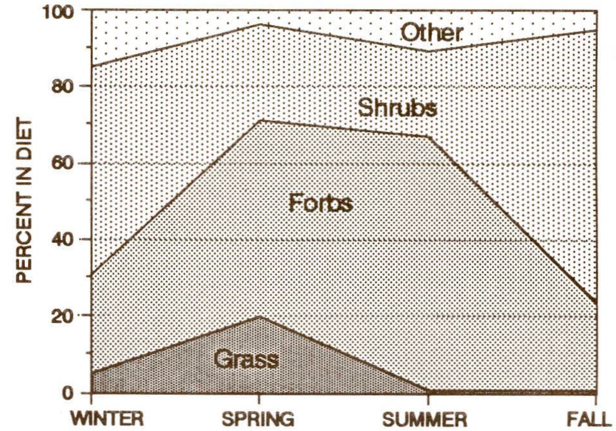

Fig. 3. Pronghorn diets on the grasslands of eastern Colorado consist mostly of forbs (weeds) and shrubs. They feed on grasses only during spring green-up. (From Hoover et al. 1959)

Pronghorn diets can vary widely throughout their range depending on individual animal variation, plant availability and abundance, and plant associations. In northeastern Colorado, pronghorn and cattle had no dietary overlap on light or heavily grazed prairie grasslands (Schwartz and Nagy 1976). Conversely, the diets of domestic sheep and pronghorn include some common forage sources; therefore, dietary overlap does occur between these species, especially during spring (Schwartz and Nagy 1976).

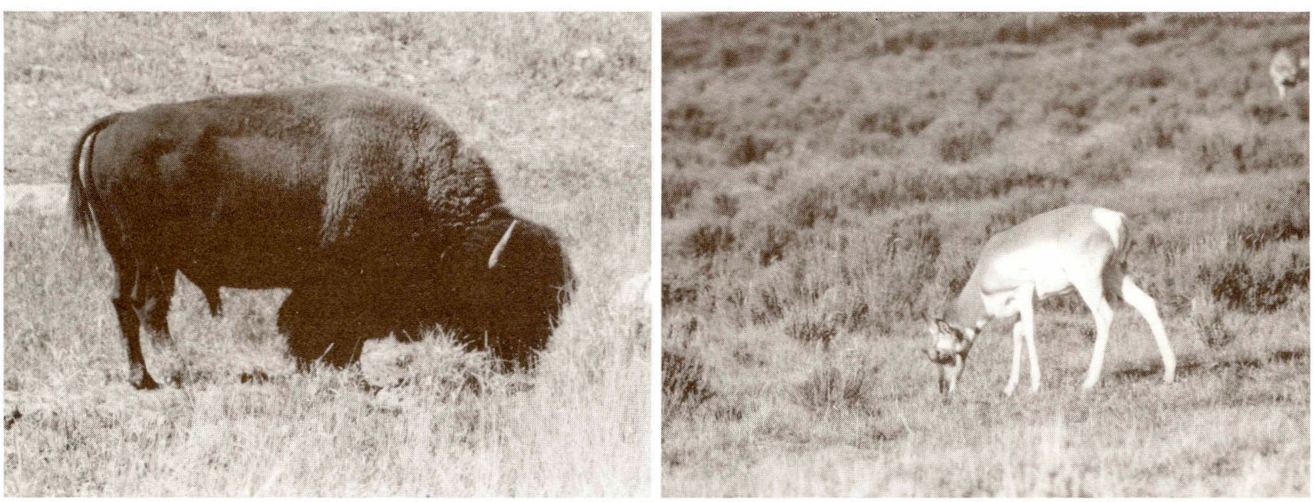

Fig. 2. Bison and pronghorn thrived on the same open prairies for centuries because they fed primarily on different forage plants. Cattle have since replaced bison as the large herbivore on western ranges and also forage mostly on different plants than pronghorn. (Left photo by J. Liewer and right photo by P. Gilbert)

WINTER WHEAT

Strip farming is practiced in eastern Colorado to conserve soil moisture and reduce wind erosion. Most soils in eastern Colorado are susceptible to wind erosion, and soil moisture for crop production is frequently inadequate. The primary factor for dry land winter wheat grain yield is the amount and timing of precipitation. During times of marginal soil moisture, winter wheat yields are diminished by wind erosion, mortality of seedlings, and retarded development of seed heads.

Pronghorn use wheat fields primarily during winter and spring (Cole and Wilkins 1958, Liewer 1988). Wheat plant material in the rumens of pronghorn collected on or adjacent to wheat fields during November through April in eastern Colorado ranged from 4 to 100% and averaged 74% (Fig. 4) (Hoover et al. 1959). A study in Colorado (Liewer 1988), based on sound statistical design and procedures, quantified the effects on wheat production of pronghorn grazing on wheat fields in the winter. No reduction in yields were found under 3 levels of grazing pressure. One treatment level imposed intense grazing pressure of 430 pronghorn/mi^2 for 172 days (Nov-Apr) and still no reduction in subsequent grain yield was observed.

In Colorado, pronghorn use wheat fields primarily from December through April. Their use of wheat fields begins to diminish in March and they completely abandon wheat for native range by late April before the "jointing" stage of wheat growth begins (Torbit et al. 1993). Grazing of wheat during or after the "jointing" stage has been shown to reduce grain yields (Cole and Wilkins 1958). The forage quality of wheat declines rapidly at about the time (late April) forage quality of new-growth native range is increasing (Schwartz et al. 1977), thus, stimulating the change in pronghorn forage selection.

Fig. 4. Pronghorn graze winter wheat fields during winter and early spring but studies failed to find any reduction in grain yields as the result of pronghorn grazing. (Photo by J. Liewer)

Livestock grazing of winter wheat is often practiced in areas with better soil and moisture conditions than eastern Colorado with no detrimental effects, and possibly some beneficial effects (through stooling), on grain yield (Christiansen 1985) (Fig. 5). Trampling and soil disturbance from cattle grazing did not reduce grain yields in the opinion of wheat farmers in Montana (Cole and Wilkins 1958).

Fig. 5. Livestock grazing of winter wheat is commonly practiced to use available forage and apparently without detrimental effects on grain yield. (Photo by J. A. Liewer)

The potential for up-rooting of sprouted wheat plants is most pronounced when there is sufficient soil moisture to germinate seeds in the fall but insufficient moisture to foster adequate root development (Hoover et al. 1959). The magnitude of this problem is unknown and has not been directly addressed quantitatively. However, (Liewer 1988) reported "few" observations of plants being uprooted through feeding, pawing, or trampling.

With adequate moisture, plants uprooted in a random pattern by a grazing animal may be replaced by tillering of neighboring plants. If, however, an animal systematically uprooted plants in a concentrated area, then a reduction in grain yield relative to the area of uprooted plants would be expected.

Even to the casual observer, wind erosion on the eastern plains of Colorado is a problem (Fig. 6). Soil type, soil moisture, and ground cover are key factors in soil stability. Fallow wheat ground, newly ploughed fields, and sewn wheat fields before adequate plant growth is established, are especially susceptible to wind erosion. Under certain conditions, precipitation will bind soil particles together on the surface to form a "crust." Under light to moderate wind velocities this crust may protect the soil from wind erosion. Quantitative evidence that the crust reduces wind erosion is lacking but empirical evidence suggests that it does.

Pronghorn inhabit wheat fields during winter and spring when high winds are most common in Colorado. During dry years, it is possible that pronghorn contribute to some unknown amount of additional wind erosion by disturbing the crust. The contribution of pronghorn tracks to erosion would be difficult to quantify because of several other factors, the most important of which is tilled, light soil devoid of stabilizing vegetation. Tillage of light, unstable soil will result in wind erosion regardless of the presence or absence of pronghorn.

Fig. 6. Light soils without vegetative cover are susceptible to wind erosion in Colorado. (Photos by J. A. Liewer)

NOXIOUS WEEDS — BINDWEED

Field bindweed (*Convolvulus arvensis*), considered the "worst weed" in Colorado (Harrington 1964:438), is native to Europe and western Asia and was first discovered in the eastern United States (Virginia) in 1739. Bindweed spread to the western wheat producing states around 1870 in wheat seed imported from the Ukrainian region of Russia (Peterson and Stahlman 1989). Today millions of acres of cultivated lands are infested with this formidable plant (Fig. 7). Control is difficult and eradication nearly impossible because: 1) the seed can remain dormant in the soil for 30 years (Peterson and Stahlman 1989), 2) the root system reaches depths of 20 feet, 3) lateral roots spread to an 18-inch depth and radiate out to 17 feet, and 4) a 2-inch section of root can establish a new plant (Best 1963).

Control of bindweed is an exacting process. Herbicides, such as glyphosate (Roundup), do not kill all the shoot buds on the roots and treated plants can reinfest an area within 3 to 6 weeks (Lauridson 1986). The greatest reduction (79%) in new plant shoots was obtained with a pretreatment application (0.028 kg/ha) of glyphosate followed within 3 days by an application of 2-4-D at 2.24kg/ha (Lauridson 1986:19).

Bindweed is seldom listed among the forage items in pronghorn diets (Ryan et al. 1984). The shortcoming of most food habits studies is that forage availability is not provided and, in most cases, it is not known if bindweed was available for pronghorn to consume. Trace amounts of bindweed were reported in pronghorn rumen samples from Colorado (Hoover et al. 1959) and California (Ferrel and Leach 1950 and 1952). It was listed, along with dandelion (*Taraxacum* sp.) and prickly lettuce (*Lactuca scariola*), as a "frequently used forb" by pronghorn on a winter wheat field in Montana during summer (Cole and Wilkins 1958:15).

In a controlled experiment, viable bindweed seeds were retrieved after passage through a pronghorn digestive system (Ryan et al. 1984). Field ripened seeds, collected after frost to ensure maximum hardness, were used in this experiment. Of the 2,000 seeds fed the experimental animal, 82% were destroyed in the digestive tract. Seeds that passed through the digestive tract germinated at a slightly higher rate than control seeds because of the mechanical and acidic scarification that occurred during the digestive process.

There is no information as to whether or not foraging pronghorn select for bindweed seed pods

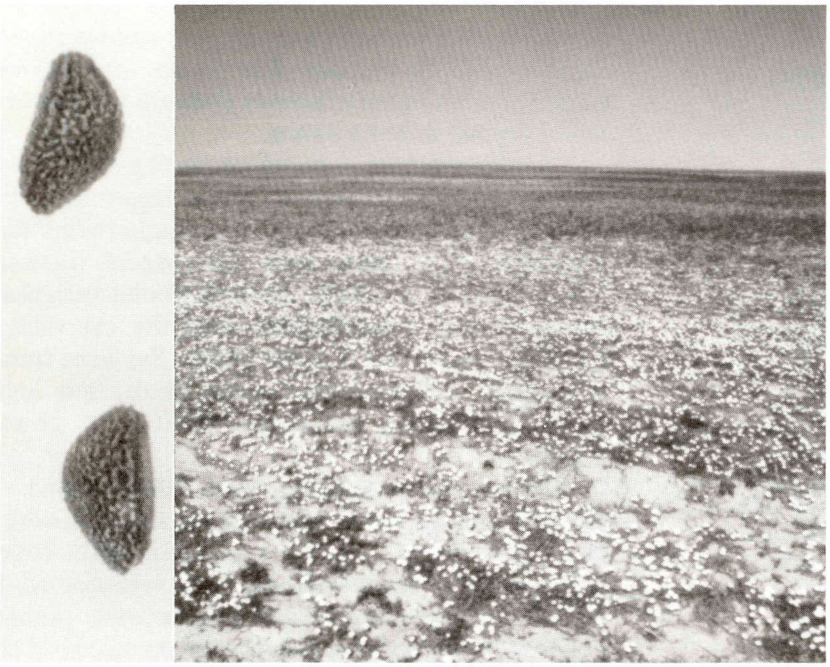

Fig. 7. Ripe bindweed seeds are hard coated and can remain viable for 30 years. Bindweed infestation is detrimental to agricultural crops and can be spread by vegetative parts as well as seeds. (Left photo by C. E. Townsend and right photo by W. D. Snyder)

during any phenological stage. In Montana, Cole and Wilkins (1958) found use of the weed during summer, but not during fall when the seeds were ripe and at maximum hardness; their results did not indicate what plant parts were found in the rumen samples. If pronghorn eat only vegetative parts, which could be assumed by summer rather than fall consumption, then their use of the plant would inhibit its development, especially under dry conditions. Consumption of seeds before they reach the hardened stage would likely result in their destruction since over 80% of hardened seeds are destroyed.

Available information suggests the pronghorn plays a minor role in the spread of bindweed and the relative impact of this source for spreading bindweed should be measured against other sources to put it in proper perspective. Harvesting and tillage machinery are probably the most common means of spreading bindweed (Best 1963, Peterson and Stahlman 1989) (Fig. 8). Harvesting equipment that is not **thoroughly** cleaned is a prime source of transport of seeds between fields and between farms (Fig. 9.). Tillage equipment is likely the major source of within field transport because a 2-inch segment of root can start a new plant. Also, feeding livestock contaminated hay or grain, then spreading infested manure, is another source of bindweed infestation (Peterson and Stahlman 1989). Wind and water erosion, feet of animals, wheels of vehicles, road maintenance equipment, birds, rodents, lagomorphs, and other wildlife, including pronghorn, can all contribute to the spread of bindweed. Finally, since bindweed seeds are difficult to remove from harvested cereal grains (Peterson and Stahlman 1989), the original source of bindweed introduction to North America, seed sources of cereal grains are undoubtedly still a factor in establishing bindweed in fields that were once free of the weed.

Pronghorn have not been implicated in the spread of other noxious weeds. If over 80% of the hard-coated seeds of bindweed are destroyed in the pronghorn digestive tract (Ryan et al. 1984), it would seem reasonable to assume that seeds of other noxious weeds without hard seed coats are destroyed. Examples of other noxious weeds eaten in quantity (more than 15% of rumen contents) by pronghorn (Hoover et al. 1959) are: Canada thistle

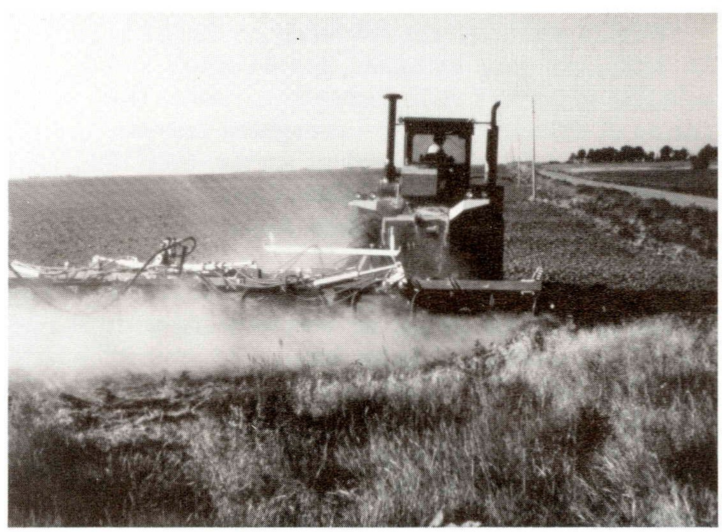

Fig. 8. Tillage equipment can be a major cause of spreading bindweed because a 2-inch segment of root can start a new plant. (Photo by W. D. Snyder)

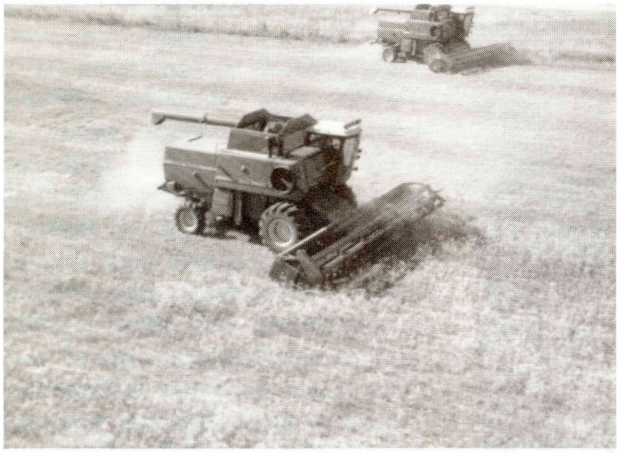

Fig. 9. Bindweed seeds are difficult to separate from cereal grain. Western wheat-producing states were originally infested with bindweed-contaminated seed sources from Russia. Contaminated seed is still a major factor in the spread of bindweed. (Photo by author)

(*Cirsium arvense*), cacti, and broom snakeweed (*Gutierrezia sarothrae*). Plants that are poisonous to some classes of livestock are dominant in pronghorn diets during certain times of the year. Such plants include: vetches (*Astragalus* sp.), globemallow (*Sphaeralcea coccinea*), and larkspur (*Delphinium* sp.). Hoover et al. (1959) suggested that because pronghorn consume poisonous and noxious plants and other plants that compete with grasses, they are beneficial on most livestock ranges.

SUMMARY

Wildlife resources are intimately connected to the social, political, economic, technological, and ecological status of a state (Schenborn 1985). The citizens of Colorado value the pronghorn resource and, according to an independent survey, 6 of 10 Coloradans prefer that the number of pronghorn in the state be increased (Standage Accureach, Inc. 1991:22).

Pronghorn populations primarily occur on private agricultural lands, so compatibility with agricultural production is an issue. At current pronghorn population levels, verifiable damage is not significant. Annual damage claims paid by the CDOW from 1978-90, averaged $3,331, representing 1.3% of total statewide damage payments for all wildlife species (Pojar 1991). In spite of relatively low damage payments, damage complaints by landowners are numerous, indicating that real damage by pronghorn is either minor or is difficult to verify. The numerous complaints and perceived damage may be partially due to the conspicuous presence of pronghorn because they are not nocturnal or cryptic in their habits.

Pronghorn do feed on wheat plant parts during winter and spring, but even under experimentally forced high grazing pressure (430 pronghorn/mi^2 for 172 days) grain yields were not reduced (Liewer 1988, Torbit et al. 1993). Environmental variables (most notably, precipitation) were the overriding factors in grain yield (Liewer 1988). Evidence from this study indicates that grain production and pronghorn grazing are compatible (Torbit et al. 1993).

Numerous pronghorn food habits studies conclude that pronghorn do not compete with cattle on native range. Niche separation with large herbivores was established during coevolution with bison. The ecological relationship between pronghorn and large herbivores may even be described as a form of mutualism - a situation where each species benefits from the presence of the other. Pronghorn eat forage that is not used by cattle and, in fact, some of the plants eaten by pronghorn are poisonous to cattle (Hoover et al. 1959). Reduction of plant biomass not used by cattle releases moisture and nutrients for use by grasses. Likewise, cattle grazing and trampling fosters forb and shrub growth, which is beneficial to pronghorn. It would seem that the evolutionary compatibility of pronghorn and large herbivores has not been changed with the substitution of cattle for bison on western rangeland.

The most successful means of reducing wind erosion has been through the taxpayer funded Conservation Reserve Program (CRP), which has reduced overall erosion by an estimated 22% and saved 350 million tons of top soil from wind erosion (Senft 1994). It is of concern to taxpayers that after an investment of $19.2 billion in this program the CRP contracts will terminate. An estimated 90% of the land in eastern Colorado will be re-ploughed for grain production (Senft 1994) and exposed to wind erosion. Tillage of highly erodible land will result in wind erosion and the contribution of pronghorn to this erosion is unknown. It would seem that pronghorn influence would be minor in relation to the other contributing factors such as soil type, soil moisture, vegetative cover, and, most importantly, wind velocity.

Crop damage by pronghorn is usually circumstantial and difficult to measure and document. This indicates that they may be compatible with the majority of agricultural operations. Pronghorn may be viewed as a potential revenue-producing part of the operation. Collaboration between landowners and the CDOW could result in ways of exploiting Colorado pronghorn herds to benefit the species, landowners, and the citizenry of Colorado.

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LITERATURE CITED

Best, K. F. 1963. Note on the extent of lateral spread of field bindweed. Can. J. Plant Sci. 43:230-232.

Christiansen, S. 1985. Grazing of wheat in the vegetative stage: shoots. Proc. Natl. Wheat Pas. Sym. Oklahoma State University. Pp. 244-255.

Cole, G. F., and B. T. Wilkins. 1958. The pronghorn antelope its range use and food habits in central Montana with special reference to wheat. Montana Game and Fish Dep., Tech. Bull. 2. 39 pp.

Colorado Wildlife Commission. 1994. Long range plan. Colo. Div. Wildl., Denver. 32 pp.

Ferrel, C. M., and H. R. Leach. 1950. Food habits of the pronghorn antelope of California. Calif. Fish and Game 36:21-26.

_____, and _____. 1952. The pronghorn antelope of California with special reference to food habits. Calif. Fish and Game 38:285-293.

Harrington, H. D. 1964. Manual of the plants of Colorado. Sage Press, Chicago. 666 pp.

Hoover, R. L., C. E. Till, and S. Ogilvie. 1959. The antelope of Colorado. A research and management study. Colo. Dep. Game and Fish. Tech. Bull. 4. 110 pp.

Hopper, R. M. 1990. Evaluation, issues, and challenges of the wildlife ranching program in Colorado. Pronghorn Antelope Workshop 14:84-101.

Howard, V. W., Jr., J. L. Holechek, R. D. Pieper, K. Green-Hammond, M. Cardenas, and S. L. Beasom. 1990. Habitat requirements for pronghorn on rangeland impacted by livestock and net wire in east-central New Mexico. N. Mex. State Univ. Agric. Exp. Sta. Bull. 750. 48 pp.

Lauridson, T. C. 1986. Effect of foliar treatments on distribution of ^{14}C-Glyphosate in *Convolvulus arvensis L.* PhD. Diss., Colo. State Univ., Ft. Collins. 85 pp.

Liewer, J. A. 1988. Pronghorn grazing impacts on winter wheat. M.S. Thesis, Colo. State Univ., Ft. Collins. 32 pp.

Nelson, E. W. 1925. Status of the pronghorned antelope, 1922-1924. U.S. Dep. of Ag. Bull. 1346. 64 pp.

Peterson, D., and P. W. Stahlman. 1989. Field bindweed control in field crops and fallow. Coop. Ext. Serv., Manhattan, Kansas. Publ. MF-913. 6 pp.

Pojar, T. M. 1991. Pronghorn management analysis guide, 1992-1994. Colo. Div. Wildl., Research Center, Ft. Collins. 17 pp.

_____, T. M. 1994. Colorado pronghorn status report - 1994. Pronghorn Antelope Workshop (In Press).

Ryan, L. A., T. M. Pojar, and C. E. Townsend. 1984. Viability of bindweed seeds after passage through a pronghorn digestive system. Pronghorn Antelope Workshop 11:225-232.

Schenborn, D. A. 1985. Environmental scanning: The difference between strategic success and failure. Trans. N. Amer. Wildl. Nat. Res. Conf. 50:304-312.

Senft, D. 1994. Bringing idled land back into production. Agricultural Research. U.S. Dep. of Ag., Ag. Res. Serv. August, pp 10-11.

Standage Accureach, Inc. 1991. Colorado Division of Wildlife big game survey. Standage Accureach, Inc., Denver. 116 pp.

Swartz, C. C. 1977. Pronghorn grazing strategies on the shortgrass prairie, Colorado. PhD. Diss., Colo. State Univ., Ft. Collins. 113 pp.

_____, and J. G. Nagy. 1976. Pronghorn diets relative to forage availability in northeastern Colorado. J. Wildl. Manage. 40:469-478.

_____, _____, and R. W. Rice. 1977. Pronghorn dietary quality relative to forage availability and other ruminants in Colorado. J. Wildl. Manage. 41:161-168.

Torbit, S. C., R. B. Gill, A. W. Alldredge, and J. C. Liewer. 1993. Impact of pronghorn grazing on winter wheat in Colorado. J. Wildl. Manage. 57:173-181.

Yoakum, J. 1980. Habitat management guides for the American Pronghorn Antelope. U.S. Dep. Int., Bur. Land Manage. Tech. Note 347. 77 pp.

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