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WILDLIFE HABITATS IN MANAGED RANGELANDS-- THE GREAT BASIN OF SOUTHEASTERN OREGON

PRONGHORNS

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ABSTRACT

The sagebrush steppe of the Great Basin in southeastern Oregon is peripheral habitat for pronghorns, but the quality of the habitat can be improved through rangeland management. The relationship between pronghorns and their habitat components-the availability of water, type of forage, barriers that restrict the movement of herds, and theeffect of grazing by livestock-are discussed. A worksheet is provided that can be used by range managers to rate the quality of a range as pronghorn habitat. Methods of altering habitat to benefit pronghorns are given.

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This publicat ion is part **of the** series **Wildlife Habitats in Managed Rangelands—The Great Basin of Southeastern Oregon.** The urpose of the series is to provide the necessary ıformation on wildlife and its relationship to abitat conditions in managed rangelands in rder that the range manager may make fully ıformed decisions.

The information in this series is specific to the reat Basin of southeastern Oregon and is enerally applicable to the shrub-steppe areas of ıe Western United States. The principles and rocesses described, however, are generally applicable to all managed rangelands. The purpose f the series is to provide specific information for particular area but in doing so to develop a rocess for considering the welfare of wildlife hen range management decisions are made.

The series is composed of 14 separate publicaons designed to form a comprehensive whole. lthough each part will be an independent treatment of a specific subject, when combined in sequence, the individual parts will be as chapters in a book.

Individual parts will be printed as they become available. In this way the information will be more quickly available to potential users. This means, however, that the sequence of printing will not be in the same order as the final organization of the separates into a comprehensive whole.

A list of the publications in the series, their current availability, and their final organization is shown on the inside back cover of this publication.

Wildlife Habitats in Managed Rangelands —The Great Basin of Southeastern Oregon is a cooperative effort of the USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, and United States Department of the Interior, Bureau of Land Management.

Introduction

Grazing by domestic livestock alters rangeland ecosystems in the Great Basin of southeastern Oregon more than any other humanly controlled activity. Such alteration, coupled with increasing human activities, produces changes that affect pronghorns (*Antilocapra americana),* sometimes called pronghorn antelope. Land managers and land use planners find it increasingly necessary to forecast and display the consequences of management activities on pronghorns.

Primary impacts on pronghorn habitat have resulted from livestock management that alters structural conditions and botanical composition of plant communities. These alterations produce distinct habitat components of differing quality.

This chapter shows the relationship between the pronghorn and its habitat in the sagebrush-grasslands of southeastern Oregon; the principles should also apply to other shrub-dominated rangelands used by pronghorns. The information can be used for both short- and long-range land use planning.

Literature review and consultation with wildlife biologists provided data that formed the framework for relating pronghorns to their habitat requirements. Where data were lacking, the best judgment of the authors prevailed.

Assumptions

The management tips provided are based on the following information or assumptions:

1. The sagebrush steppe of the Great Basin is peripheral pronghorn habitat (Yoakum 1968) (fig. 1). From reports of early explorers, we conclude that pronghorns were more abundant on the midcontinent short-grass prairies than in the Great Basin (Burroughs 1961, Fremont 1843, Thwaites 1904). Habitat components that limit populations, however, can be manipulated to benefit pronghorns (Yoakum 1978a, 1978b).

2. Pronghorns evolved to be compatible grazers with other native herbivores, especially bison (*Bison bison*)(Yoakum 3978b). Grazing by these native herbivores changed the composition of the vegetation on grassland ranges of North America to favor pronghorns.

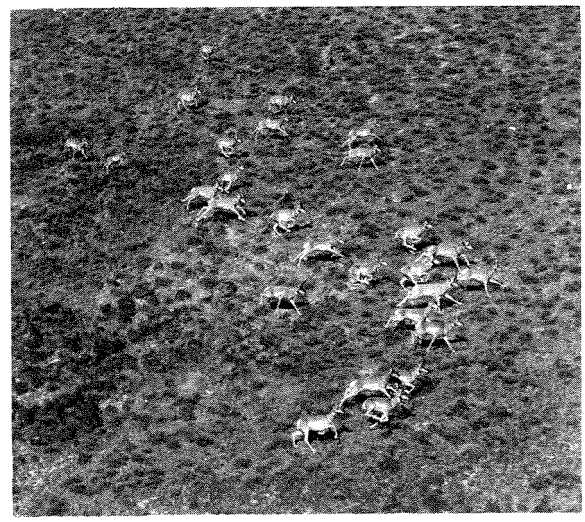


Figure 1.—A pronghorn herd on open sagebrush steppe in Lake County. Oregon. (Photograph by James Yoakum.)

3. Forage and drinking water are the primary components of pronghorn habitat. Forage can be improved on ranges in less-than-optimum condition for pronghorns. Water distribution can be improved on some pronghorn rangelands (Yoakum 1978a).

4. Pronghorn ranges contain a variety of plant communities differing in height, composition, and forage production.

5. Pronghorn densities are influenced primari ly by habitat conditions (Yoakum 1978a).

6. Favored habitats can be identified by comparing pronghorn densities between habitats (Sundstrom and others 1973).

7. Rangelands with a mixture of grasses. forbs, and shrubs of low structure provide the best pronghorn habitat (Yoakum 1972).

8. Agricultural crops other than alfalfa (*Medicago sativa*) are rarely eaten by pronghorns.

9. Fences, especially those of woven wire, frequently form barriers to pronghorn movement (U.S. Department of the Interior, Bureau of Land Management 1974).

10. The welfare of pronghorns can be enhanced by providing for their needs in range management activities (Yoakum 1978a).

Habitat Requirements

Pronghorn densities in the Great Basin aver- e less than 0.4 per square kilometer (1.0 mi^2))akum 1968). Variations in density are related vegetation and water, which are, in turn, ated to precipitation and soils (fig. 2). Yoakum 974) described the following habitat require- :nts for pronghorn on sagebrush-grasslands.

ABIOTIC FACTORS

pography

Pronghorns are adapted to low rolling topog-)hy with few slopes more than 30 percent in ade. Within such landforms, there are circum- ances to which pronghorns adjust by modify- ; their behavior. Depending on topography, ne herds do not move in response to season; me move relatively short distances with ange of season and then move even longer :tances in response to climatic conditions, :h as increasing snow depth.

tural Barriers

Natural barriers to movement include bodies water, escarpments, mountains, canyons, and :as of tall shrubs or forest, sometimes account- : for isolated, unoccupied habitats that are ierwise suitable (Einarsen 1948).

vation

'ronghorn ranges occur from sea level to 153 meters (11,000 ft) but occurrence at sea el in Mexico and in alpine meadows in Oregon l Wyoming is rare (fig. 3). The largest popula- ns, particularly in the Great Basin, are be- een elevations of 1 220 and 1 830 meters)00-6,000 ft) (Yoakum 1974).

mate

The highest densities, which reflect the best)itats, occur where precipitation averages 38 centimeters (10-16 in) per year. Pronghorn other precipitation zones do reproduce, but y maintain lower densities (Sundstrom and ers 1973, Yoakum 1972).

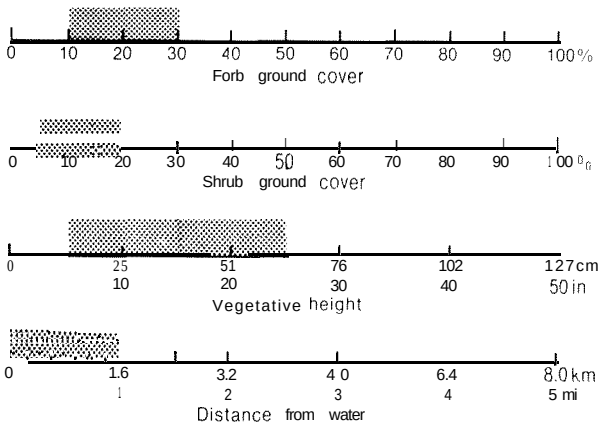


Figure Z.-Components of pronghorn habitat in the sagebrush steppe. Habitat becomes optimum when all components occur together within the bounds marked by bars.

Figure 3.—Distribution range of American pronghorns. the original range denotes only peripheral boundaries because not all areas within it were inhabited. (Adapted from Yoakum 1980).

Whenever Great Basin ranges receive a snow accumulation over 25 to 30 centimeters (10 to 12 in), pronghorns have difficulty obtaining forage. Prolonged periods of such snows are detrimental when one or more of the following occur: low quantity or quality of forage, high winds, and barriers to movement (Bruns 1977, Riddle and Oakley 1973, Sundstrom 1969).

Temperature is usually not a limiting factor. Fawns may die, however, from unseasonable snow or freezing rain (Sundstrom 1968a).

Snow accumulation determines the time and extent of pronghorn movement. The deeper the snow and more rapid the accumulation, the further and faster herds travel toward lower elevations, sometimes traveling as far as 144 kilometers (90 mi) (Mason 1952).

Soil

The best pronghorn habitats in the Great Basin are found on Aridisols and Mollisols which evolved under a regime of 25-38 centimeters (10-16 in) of precipitation per year.

Water

Pronghorns require water throughout the year. Springs, rivers, streams, lakes, reservoirs, catchments, and troughs provide drinking water much of the year; snow provides water during winter.

Rangelands providing optimum habitat have drinking water available at intervals less than 8 kilometers (5 mi) (Sundstrom 1968b). Some animals may be found further than 8 kilometers (5 mi) from water, but Sundstrom (1968b) observed that 95 percent of over 12,000 pronghorns were within 4.8 to 6.4 kilometers (3 to 4 mi) of water.

Water consumption by pronghorns varies inversely with the quality and succulence of available forage. When succulent forage is available, 1 liter (0.25 gal U.S.) of water per animal per day is sufficient. When succulence exceeded 75 percent, animals did not drink (Beale and Smith 1970). During dry summers, 4.2-5.7 liters (1.1-1.5 gal U.S.) per day may be needed (Beale 1966).

Drought can reduce the vitality and fertility of pronghorn (Hailey and others 1966, Jones 1949). Pronghorns have killed themselves trying to get through fences to reach water (Baker 1967).[1]

Water quality-particularly total dissolved solids, alkalinity, and pH—is important for pronghorns. The maximum total dissolved solids suitable for ungulate wildlife is 4,500 ppm (McKee and Wolf 1963). Sundstrom (1971) found little use of water with total dissolved solids in excess of 5,000 ppm, and limited use of a source containing 4,620 ppm. Water with pH over 9.25 was not used. Criteria for water quality suitable for livestock and wildlife are given in the tabulation below; the data are interim, however, and should be used only until more precise data are available."

Criteria	Maximum allowed
Total dissolved solids	[3]10 000 mg/liter
Free chlorine	200 mg/liter
pH	7.0-9.2
Manganese	10 mg/liter
Alkalinity (as $CaCo_2$)	50 mg/liter
Chlorides	1 500 mg/liter
Chromium	5 mg/liter
Hardness	500 mg/liter

BIOTIC FACTORS

Vegetation

Quality and quantity of vegetation are primary influences on pronghorn density. Sagebrush steppe preferred by pronghorns is characterized by Yoakum (1974):

1. Ground cover. Ground cover averages 50 percent living vegetation.
2. Composition. Vegetation averages 40-60 percent grasses, 10-30 percent forbs, and 5-20 percent shrubs.

[1] Baker, Ted C., Federal Aid Coordinator, Wyoming Game and Fish Commission, Cheyenne. Personal communication: 1967.

[2] U.S. Department of Agriculture, Forest Service, Southwestern Region. Water quality interim guidelines. 1968. Unpublished report on file at USDA Forest Service, Albuquerque, NM.

[3] This figure is probably excessive.

/ariety. The number of plant species varies rom 5 to 10 grasses, 20 to 40 forbs, and 5 to 10 hrubs.

Succulence. Succulent plants are preferred orage (Beale and Smith 1970), especially luring spring and in some particularly moist ummers (fig. 4). Pronghorns move from dry ıpland ranges to intermittent lake beds and)layas to graze succulent vegetation (Good 977). They also make disproportionate use of ecently burned rangelands for foraging, es-)ecially in the first growing season after fire. Such areas often provide succulent grass sprouts and an abundance of forbs (Beardahl .nd Sylvester 1976, Stelfox and Vriend 1977).

Range. Open rangelands supporting several)lant communities are preferred over mono- ypic vegetation (Sundstrom and others 1973, Yoakum 1957).

Height. Low vegetative structure, averaging 18-61 centimeters (15-24 in) is best. Areas vith vegetation taller than 61 centimeters 24 in) are used less; areas with vegetation nore than 76 centimeters (30 in) tall are eldom used. Such tall vegetation restricts he pronghorn's ability to see and run-attri- butes which combine to form the animal's)rimary defense.

mal

ronghorns historically coexisted in various ts of their extensive range with other ungu- s such as bison, elk (*Cervus elaphus*), mule *(Odocoileus hemionus),* and bighorn sheep *is canadensis)* (Einarsen 1948, Nelson 1925, ara 1978, Yoakum 1978b). The bison, espe- ly, grazed dominant grasses, restricting xth of the grass and enhancing production of forbs and browse favored by pronghorns len 1972).

Coyotes (*Canis latrans*), bobcats (Lynx *rufus*), l golden eagles *(Aquila chrysaetos)* prey on nghorns, especially fawns (Beale and Smith '0, 1973; Compton 1958; Hinman 1961; Udy 3). Bobcat predation on young pronghorns ı depress populations on some ranges under tain circumstances (Beale and Smith 1970, '3). Poor nutrition magnifies the impact of dation (Beale and Smith 1970, Hailey and ers 1966). Generally, where habitat is ade- ıte, predation is not a major limiting factor.

Figure 4.-An adult doe eating succulent forbs from a community of grasses. (Photograph by James Yoakum.)

Human disturbance can be particularly harmful on winter ranges and during fawning. Snowmobiles, motorcycles, and low flying aircraft may cause adverse effects.

Habitat Characteristics

Preferred ranges have shrubs with a mean height of 38 centimeters (15 in) (Yoakum 1974). Low sagebrush *(Artemisia arbuscula)* dominates commonly used summer ranges. The best winter ranges are dominated by shadscale saltbush (*Atriplex confertifolia*), black sagebrush (*Artemisia nova),* and winterfat *(Ceratoides lanata).*

Areas dominated by big sagebrush *(Artemisia tridentata)* are less used, probably becauseof tall growth of the plant. Alteration of big sagebrush communities by fire or by plowing and chaining to control shrubs increases their acceptance to pronghorns (Yoakum 1978a).

Stands of exotic crested wheatgrass (*Agropyron desertorium* and *A. cristatum)* which include succulent forbs such as dryland alfalfa have become accepted habitats when located near occupied ranges and adequately supplied with

water (Heady and Bartolome 1977). When autumn growth of crested wheatgrass and forbs occurs, and the snow cover which follows is light, these rangelands are wintering habitat.

Management Relationships

The pronghorn population in Canada and the United States increased 1,500 percent from 1924 to 1976 (Yoakum 1978b). Control of hunting and large scale transplanting activities reestablished herds on many historic ranges.

Rangeland management (including vegetation alteration, fence construction, water development, and manipulation of livestock use) influences pronghorn habitat. Management planning that considers pronghorn requirements can minimize adverse effects on pronghorn habitat; some habitat improvement may result. If pronghorn's requirements are ignored, however, severe habitat damage can occur (Wagner 1978).

Nearly all rangelands inhabited by pronghorns are also used by domestic livestock-primarily cattle, sheep, and horses. Utilization of forage in 1975 on the Bureau of Land Management's Vale district in southeastern Oregon is shown in the tabulation below (Heady and Bartolome 1977). Pronghorns consumed less than 1 percent of forage, whereas domestic livestock consumed 83 percent:.

Domestic species	Percent forage use
Cattle and horses	82.3
Sheep	0.7
Feral horses	5.8
Total	88.8
Wild species	
Pronghorns	0.9
Mule deer	10.1
Bighorn sheep	0.1
Rocky Mountain elk	0.1
Total	11.2

Insufficient forage for current herbivore populationscreatescompetition for that which is available. Studies of food habits of horses, cattle, domestic sheep, and pronghorns on sagebrush grasslands have shown that horses, cattle, and sheep on sagebrush-grasslands have similar food habits (Olsen and Hansen 1977). Pronghorns do not compete with either horses or cattle when forage and water are abundant. Competition between domestic sheep and pronghorns, however, is more pronounced (Buechner 1950, Hoover and others 1959, Severson and May 1967).

The effect of feral horses on pronghorn habitat is largely conjecture. Meeker (1979) studied interactions between pronghorns and feral horses for one summer in northeastern Nevada and observed no competition at watering sites or interspecific acts of aggression, but evidence of a symbiotic relationship, and a dietary overlap of 12.8 percent.

There have been no analyses of the effects of livestock grazing systems on pronghorns for the Great Basin. Most rangelands in southeastern Oregon no longer support yearlong livestock grazing (Heady and Bartolome 1977). Grazing systems are now based on seasonal needs of livestock while satisfying the physiological requirements of the preferred plant species.

Pronghorns thrive best on ranges with subclimax vegetative composition. These structural and vegetal conditions are created by fire and by the foraging of wild and domestic herbivores. The variety of forbs, grasses, and shrubs is often higher when the species composition and structural conditions of a plant community are typical of midsuccession.

The quality of rangeland for pronghorns in southeastern Oregon is described by combinations of habitat components identified in fig. 5. An example of how to use the form for rating pronghorn habitat as summer and winter range is shown in fig. 6. Where optimum or near optimum vegetative conditions exist, it is best to maintain the plant structure and composition" (Yoakum 1980).

[1] Kindschy, Robert R. The Vale project and wildlife ecology. 1971. Unpublished report on file at the U.S. Department of the interior, Bureau of Land Management. District Office, Vale, OR.

WORK SHEET FOR RATING PRONGHORN HABITAT

(sagebrush steppe)

Step 1. Circle the most appropriate response in side A of each column (complete cols. 1-7 for rating summer range, cols. 2-4 and 6-7 for winter range). Fill in at bottom corresponding percent of optimum from side B.

Col. 1* Availability of water		Col. 2 Vegetative ground cover		Col. 3		Col. 4 Vegetative height		Col. 5* Vegetative succulence		Col. 6 Fences		Col. 7 Slope	
Distance between water in kilometers (miles)	Percent of optimum	Percent shrubs	Percent of optimum	Percent forbs	Percent optimum	Height, in centimeters (inches)	Percent of optimum	Forbs green	Percent optimum	Type	Percent of optimum	Percent grade	Percent of optimum
A	B	A	B	A	B	A	B	A	B	A	B	A	B
1. 3.2 or less (2 or less)	100	1. 5.20	100	1. o-10	32	1. 25 or less (10 or less)	90	1. All summer	100	None	100	1. o-5	100
2. 3.3-6.4 (2.1-4.0)	85	2. 20-30	53	2. 10-30	100	2. 25.50 (10-20)	100	2. To July 15	75	:%-strand barbed wire	90	2. 5-10	75
3. 6.5.9.7 (4.1-6.0)	57	3. 30.40	27	3. 30-50	33	3. 50-76 (21-30)	50	3. To July]	50	4-strand barbed wire with 41+ cm (16+ in.) clearance	80	3. 10.30	50
4. 9.8-12.9 (6.1-8.0)	30	4. 40.50	15	4. 50.70	17	4. 76.102 (31-40)	10	4. To June 15	25	Woven, 81 cm or less (32 in. or less) high	70	4. 30+	25
5. 13.0.16.0 (8.1-10.0)	12	5. 50.70	5	5. 70-90	10	5. 102.127 (41-50)	5	5. To June 1	10	Woven, 81+ cm (32+ in.) high	30		
6. 16.1+ (10+)	0	6. 70+	3	6. 90.100	5	6. 127+ (51+)	0						
Percent of optimum scored:	*					*		*					
	Col. 1		Col. 2		Col. 3		Col. 4		Col. 5		Col. 6		Col. 7

Step 2. Calculate habitat rating. Summer range: (a) Sum of the percents of optimum (step 2. cols. 1-7)÷7 = summer habitat rating.
(b) The column with the lowest percent of optimum shows the habitat component most limiting the quality of pronghorn habitat. The lowest percent = primary habitat limiting factor.

Winter range: (a) Sum of the percents of optimum (step 2, cols. 2-4, 6-7)÷5 = winter habitat rating.
(b) The column with the lowest percent of optimum shows the habitat component most limiting the quality of pronghorn habitat. The lowest percent = primary habitat limiting factor.

* Do not complete when rating winter range.

Figure 5.—Worksheet for rating pronghorn habitat (sagebrush steppe).

WORK SHEET FOR RATING PRONGHORN HABITAT

(sagebrush steppe)

Step 1. Circle the most appropriate response in side A of each column (complete cols. 1.7 for rating summer range, cols. 2-4 and 6.7 for winter range). Fill in at bottom corresponding percent of optimum from side B.

Col. 1* Availability of water		Col. 2 Vegetativeground		Col. 3 cover		Col. 4 Vegetative height		Col. 5* Vegetative succulence		Col. 6 Fences		Col. 7 Slope	
Distance between water in kilometers (miles)	Percent optimum	Percent shrubs	Percent of optimum	Percent forbs	Percent optimum	Height, in centimeters (inches)	Percent of optimum	Forbs green	Percent optimum	Type	Percent of optimum	Percent grade	Percent of optimum
A	B	A	B	A	B	A	B	A	B	A	B	A	B
1. 3.2 or less (2 or less)	100	1. 5.20	100	1. O-IO	32	1. 25 or less (10 or less)	90	1. All summer	100	None	100	1. 0-5	100
2. 3.3-6.4 (2.1-4 0)	85	2. 20-30	53	2. 10-30	100	2. 25-50 (10.20)	100	2. To July 15	75	2. 3-strand barbed wire	90	2. 5-10	75
3. 6.5.9 7 (4.1-6.0)	57	3. 30.40	27	3. 30-50	33	3. 50-76 (21-30)	50	3. To July 1	50	3. 4-strand barbed wire with 41+ cm (16+ in.) clearance	80	3. 10-30	50
4. 9.8-12.9 (6.1-8.0)	30	4. 40-50	15	50.70	17	4. 76-102 (31 40)	10	4. To June 15	25	4. Woven, 81 cm or less (32 in. or less) high	70	4. 30+	25
5. 13 0-16.0 (8 1-10.0)	12	5. 50.70	5	7090	10	5. 102-127 (41-50)	5	5. To June 1	10	5. Woven, 81+ cm (32+ in.) high	30		
6. 16.1+ (10+)	0	6. 70+	3	90-100	5	6. 127+ (51+)	0						
Percent of optimum scored:	* 30		53		100		* 50		* 50		80		100
	Col. 1		Col. 2		Cal 3		Col 4		Col. 5		Col. 6		Col. 7

Step 2. Calculate habitat rating Summer range: (a) Sum of the percents of optimum (step 2, cols. 1-7)÷7 = summer habitat rating.
(b) The column with the lowest percent of optimum shows the habitat component most limiting the quality of pronghorn habitat. The lowest percent = primary habitat limiting factor.

Winter range: (a) Sum of the percents of optimum (step 2, cols. 2 4, 6-7)÷5 = winter habitat rating.
(b) The column with the lowest percent of optimum shows the habitat component most limiting the quality of pronghorn habitat. The lowest percent = primary habitat limiting factor.

. Do not complete when rating winter range.

Summer range:
Total 1→7 = 463 ÷ 7 = 66% of optimum. Water at 30% = primary limiting factor.

Winter range:
Total 2, 3, 4, 6, 7 = 383 ÷ 5 = 77% of optimum. Veg. height at 50% = primary limiting factor.

Figure 6.—Example of completed worksheet.

Rangeland Manipulation

ɔulating vegetation to increase livestock
; intensifying in some areas of the Great
An associated activity is modifying the
:o enhance livestock management and to
more complete rangeland use; fencing
er developments (fig. 7) are examples.

VEGETATIVE CHANGES

Manipulating vegetation can be either beneficial or detrimental to pronghorns, depending on how it is accomplished (Yoakum 1978b, also see footnote 4). Two basic precautions must be taken: other habitat requirements of pronghorns must be met, and all work should follow the

.-Construction of eart hern reservoirs pro-
ıter for pronghorns in water deficient range-
southeastern Oregon. (Photograph by James

principles of range restoration described by Plummer and others (1968):

1. Changes in plant cover must be justified as biologically desirable.
2. Terrain and soils must be suited to the changes.
3. Precipitation must be adequate to assure establishment and survival of seeded plants (Bleak and others 1965).
4. Competition should not prevent establishment of desired species.
5. Only species and strains of adapted plants should be seeded.
6. Mixtures, rather than single species, should be planted.
7. Sufficiently pure and viable seeds should be planted to increase the probability of success.
8. Seed should be sufficiently covered to enhance sprouting (Basile and Holmgren 1957, Plummer 1943).
9. Planting should be done in the correct season to ensure establishment.
10. The planted area should be adequately protected from livestock, insects, fire, off-road vehicles, etc.

Extensive areas dominated by big sagebrush (where big sagebrush comprises more than 30 percent of the vegetative cover) are marginal pronghorn habitat, especially if the shrubs are taller than 76 centimeters (30 in). Such areas can be treated to decrease the density and height of sagebrush (fig. 8) (Yoakum and others 1980).

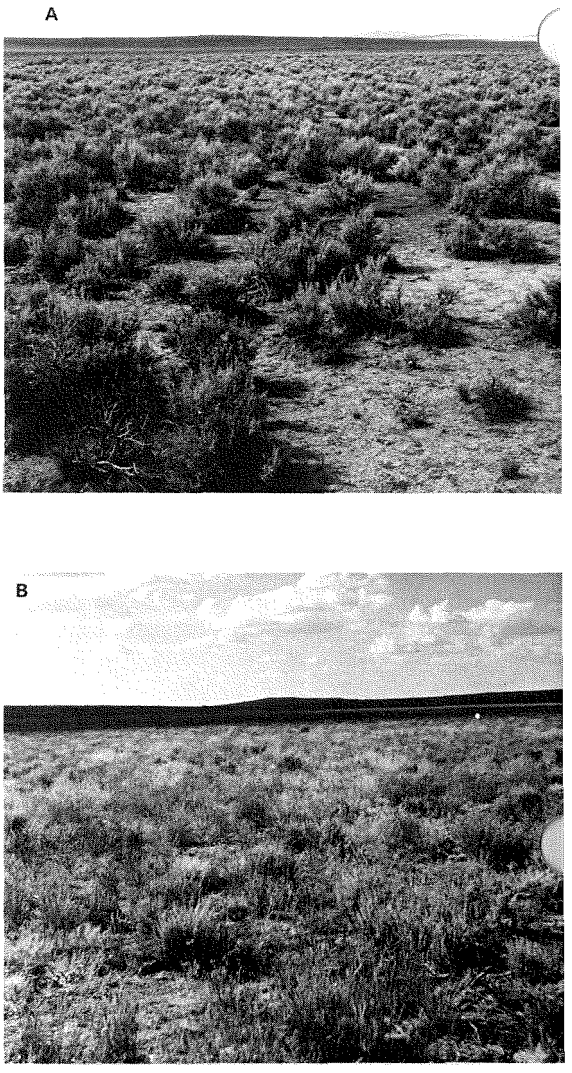


Figure 8.—Results of manipulating vegetation by plowing and seeding: A, vegetation before treatment (photographed July 1963); B, after seeding (photographed June 1969). The vegetative structure shown in B is more favorable to pronghorns. (Photographs by Robert Kindschy.)

If an area is to be treated, it should probably be no larger than 405 hectares (1,000 acres). The size is based on the assumption that (1) the winter range of pronghorn herds residing in the Great Basin averages 1 215 to 3 025 hectares (3,000 to 5,000 acres) and (2) the treated area should encompass no more than one-third of this winter range. About 5- to 20-percent shrub cover should be retained in the treated area. Because sagebrush and native forbs are important food items (Beale and Smith 1970, Mason 1952, Salwasser 1980, Yoakum 1980), the majority of the natural vegetative communities needed for seasonal use, primarily sagebrush-grasslands, should be retained.

Shrubs are often controlled by mechanical means. Plowing and seeding has been done in many areas of the Great Basin. A brushland plow is often used (fig. 9); this is a disk-type plow developed especially for this purpose. Chaining is another technique widely used. A heavy link ship anchor chain is dragged between two crawler tractors. Chaining does not kill many nonwoody plants or the younger, more flexible shrubs.

Aerial application of herbicide has been a common practice for sagebrush control (Heady and Bartolome 1977). Some applications of 2,4-D have killed nearly all shrubs and perennial forbs. This treatment results in standing dead shrubs that retain their tall structure. Pronghorns usually avoid areas containing such structures for several years (fig. 10).

Historically, fire has been an important influence on the structure of plant communities. Controlled or prescribed fire can control shrubs and is used, on a small scale, as a technique for enhancing habitat. Prescribed burning, properly done, can decrease sagebrush density and enhance opportunities for native grasses and forbs (Beardahl and Sylvester 1976, Lovaas 1976, Page 1975). Fire triggers a series of secondary responses, many of which enhance the habitat for pronghorns. Soil fertility is usually increased. With the canopy removed, soils are warmed by solar heating, promoting earlier vegetative growth in the spring. Plant vigor is increased by removal of senescent shoots and foliage. More forage may become available because some plants become more palatable after burning. Long-term

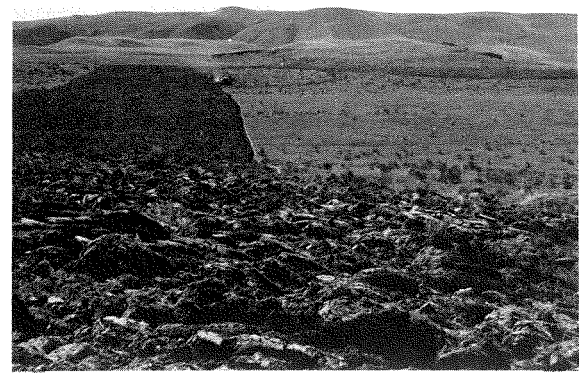


Figure Y.-A brushland plow converts dominated shrublands to communities with comparatively low structure. (Photograph by Robert Kindschy.)

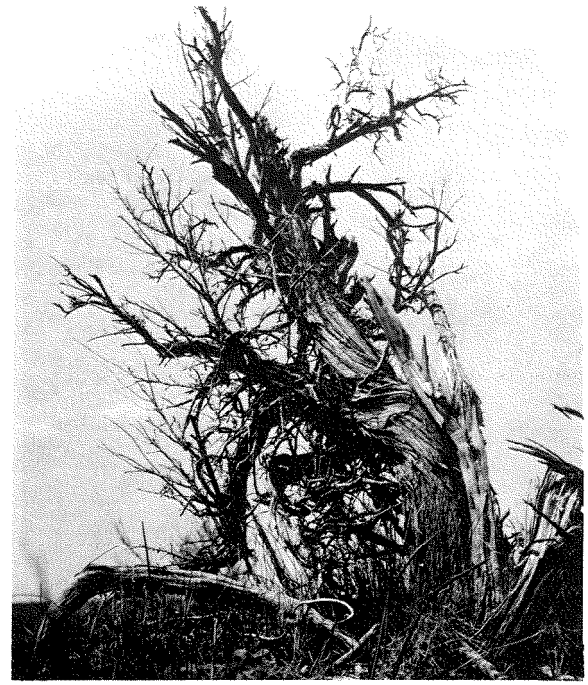


Figure IO.-Big sagebrush killed by chemical application. The skeletons of the sagebrush persist for years and create an unfavorable habitat for pronghorns. (Photograph by Robert Kindschy.)

increases in vegetative growth may be stimulated by timing the burn to favor species with highest yields, by removing competing plants, and by preparing seedbeds for vegetative production.

If a site treated for shrub control has insufficient plants to ensure reproduction, it can be artificially seeded. Such ventures have usually resulted in monocultures of exotic grasses, however, which have limited value to pronghorns other than reducing the height and number of shrubs. Conversely, seeding mixtures have been beneficial to pronghorns, especially when legumes such as dryland alfalfa were included" (fig. **11).** A useful rule of thumb is to include a minimum of six palatable species each of grasses, forbs, and shrubs (Plummer and others 1968).

[5] Kindschy, Robert R. Preliminary report on nomad alfalfa seedings. 1974. Unpublished report on file at the U.S. Department of the Interior, Bureau of Land Management, District Office, Vale, OR.

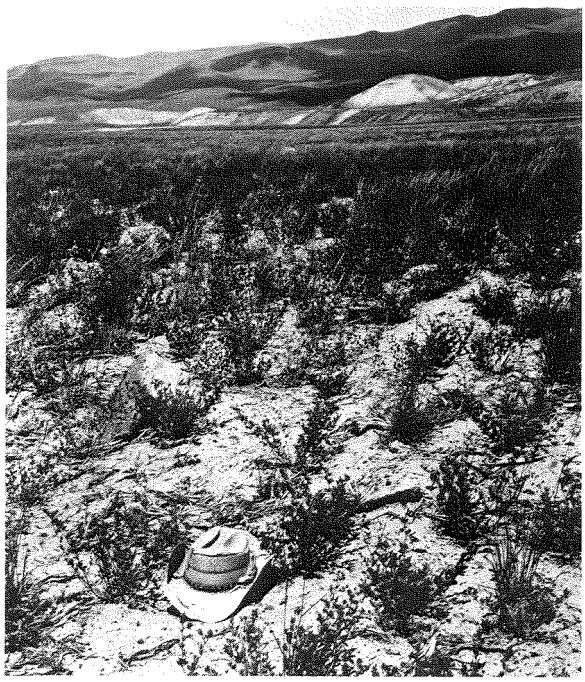


Figure I I.-Using mixtures of forbs and grasses greatly enhances seeded areas as pronghorn habitat. Nomad variety alfalfa and crested wheatgrass were planted in this seeding. (Photograph by Robert Kindschy.)

Pronghorns have used some areas seeded with crested wheatgrass (see footnote 4). Winter use occurs where autumn growth is stimulated by fall rains. Fecal analysis showed that cheatgrass (*Bromus tectorum),* sagebrush, and scarlet globemallow (*Sphaeralcea* sp.) dominated the diet of pronghorns wintering on such areas, crested wheatgrass represented approximately 2 percent."

WATER DEVELOPMENT

Pronghorns drink from many sources of water, including springs, creeks, rivers, lakes and reservoirs, stock water developments, troughs, and devices for catching precipitation or "guzzlers."

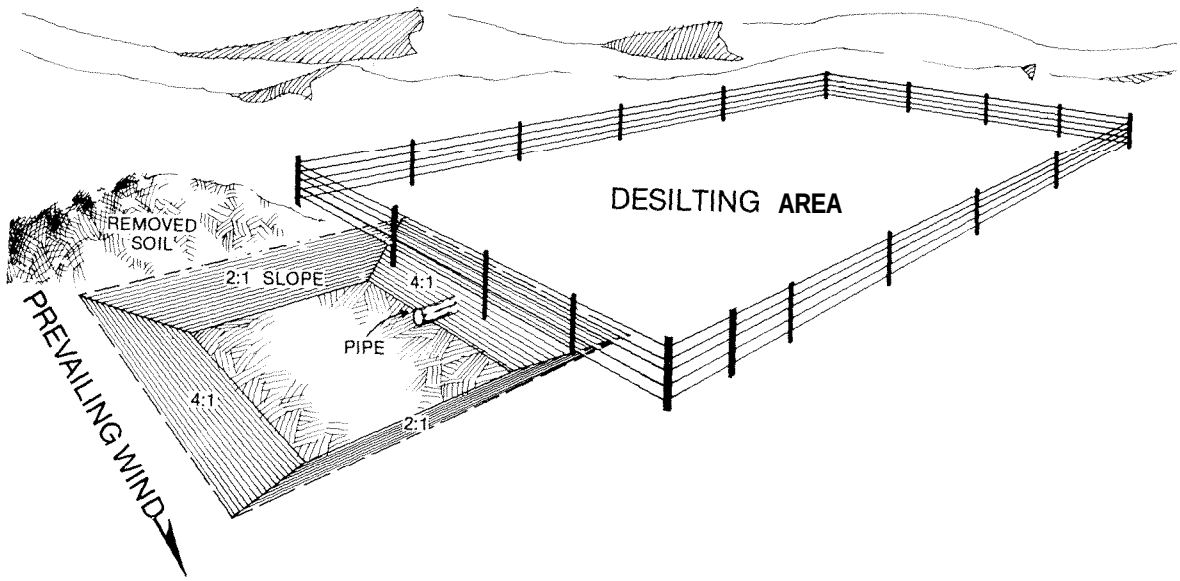
Numerous small reservoirs have been constructed in southeastern Oregon to trap and store precipitation for use by livestock and ungulate wildlife (see fig. 7). Many of these have been constructed on public lands through cooperative funding by State wildlife organizations and Federal land management agencies. In Malheur County, Oregon, 1,037 such reservoirs have been built (Heady and Bartolome 1977).

Another water development valuable to pronghorns is the charco pit or dugout (fig. 12). These earthen pits entrap and store precipitation primarily for livestock and wildlife, but they are readily used by pronghorns, especially during hot late summer months when vegetation is desiccated, and the animals' requirement for water increases.

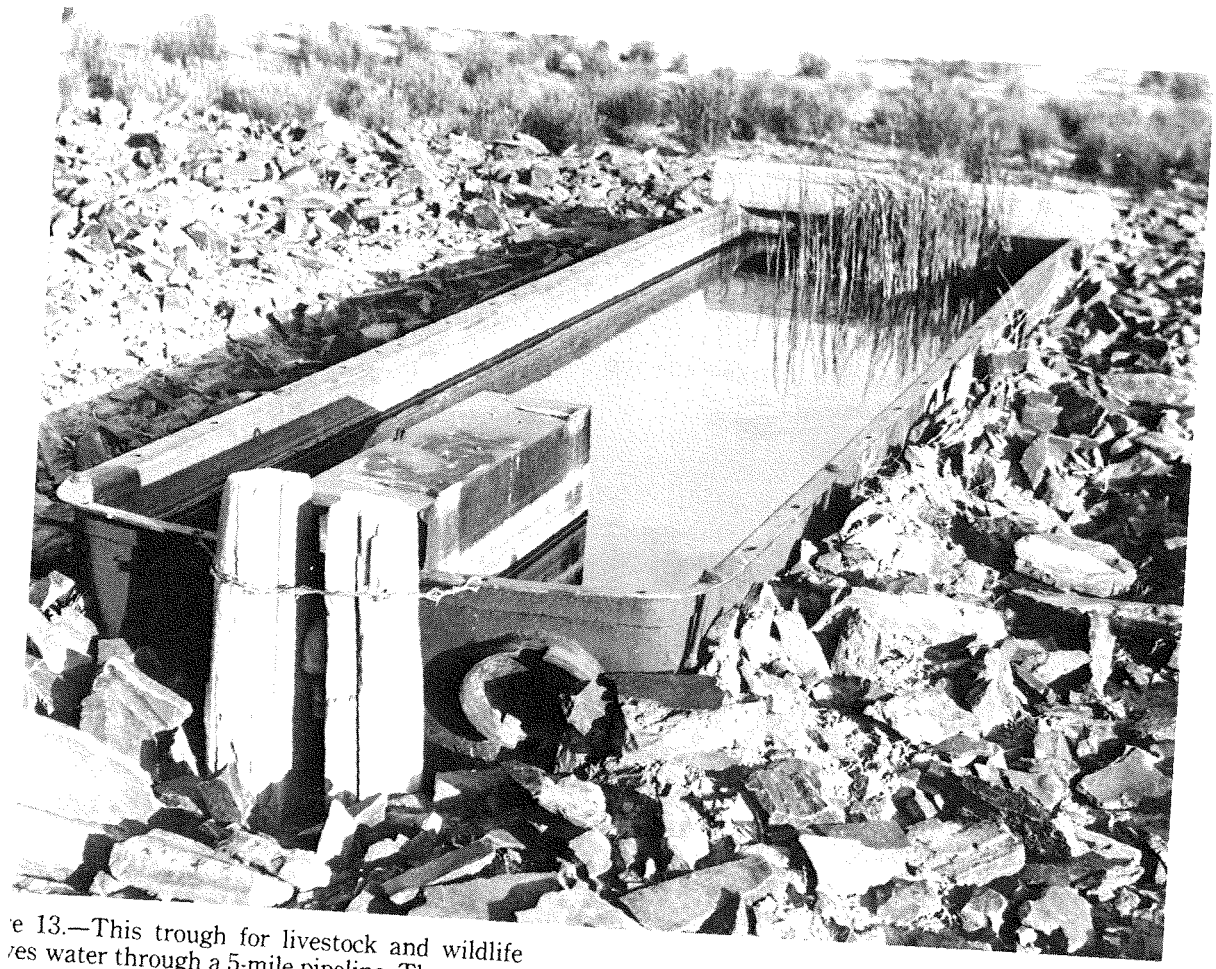
Wildlife use water from natural springs and seeps. These sources of water are often developed for other uses, such as for livestock, fire suppression, and humans. With minor modifications, such as placing troughs low on theground, these developments can benefit pronghorns (fig. 13).

Guzzlers can provide water on ranges otherwise lacking in potential sources (June and Higby 1965, Sundstrom 1968b, U.S. Department of the Interior, Bureau of Land Management 1964).

[6] Spalinger, Don. Notes on the food habits of pronghorn antelope on the Rome seeding, Oregon, during late winter, 1977, with special reference to crested wheatgrass use. 1979. Unpublished report on file at the U.S. Department of the Interior, Bureau of Land Management, Reno, NV



'e 12.—Charco pit. (Adapted from Yoakum 1980.)



'e 13.—This trough for livestock and wildlife /es water through a 5-mile pipeline. The trough nstalled at ground level to facilitate use and was unded by rocks to prevent miring by ungulates. ograph by James Yoakum.)

They require little maintenance, are relatively inexpensive, and serve a variety of wildlife. A three-strand barbed wire fence 81 centimeters (32 in) high with a smooth bottom wire at least 41 centimeters (16 in) above the ground can be constructed to exclude cattle and horses. Such construction still allows pronghorns to use the water, but restricts livestock.

LIVESTOCK FENCING

Fences can restrict the movement of pronghorns, causing changes in herd distribution, deaths, and losses in carrying capacity due to isolation of ranges (Bruns 1977, Hailey and others 1966, Martinka 1967, Oakley 1973, Sundstrom 1970).

The following specifications, resulting from intensive studies, are recommended for fence construction in areas used by pronghorns (Mapston 1972; Spillet and others 1967; U.S. Department of the Interior, Bureau of Land Management 1974, 1975; Zobell 1968):

1. The use of woven or net-wire fences should be minimized.
2. Areas encircled by the types of fences that hinder pronghorn movement should be large enough to include their yearlong habitat needs.
3. Pathways and migration routes of pronghorns should have low fences, lay-down panels, pass structures, or adjustable spacing of the wire (Yoakum 1980).
4. Barbed wire fences with no more than three strands can be negotiated by pronghorns. The bottom wire should be smooth (no barbs) and be at least 41 centimeters (16 in) above the ground. Remaining wires shoud be spaced at 25-centimeter (lo-inch) intervals. The total height of the fence should not exceed 91 centimeters (36 in), and there should be no stays between posts (fig. 14).

New fences should have white rag flagging tied to the top wire between each post. Pronghorns will, to some extent, adapt to the fence by the time the flagging deteriorates.

Although pronghorns normally pass under or through fences, some learn to jump fences up to 81 centimeters (32 in) high. Woven wire fences are sometimes considered necessary to control domestic sheep. Of the designs tested, the least detrimental to pronghorn passage were (1) a span of net or woven wire 81 centimeters (32 in) high without single strand(s) of wire above, or (2) a span 66 centimeters (26 in) high with one barbed wire 10 centimeters (4 in) above the net wire (Spillet 1965).

Management Tips

Where pronghorns are selected as a featured species for management and their welfare is an objective of management, the limiting factor(s) for each range should be identified and appropriately altered if habitat is to be improved (see figs. 4 and 5). Following are suggestions, including guidelines from the 1978 pronghorn antelope workshop (Autenrieth 1978):

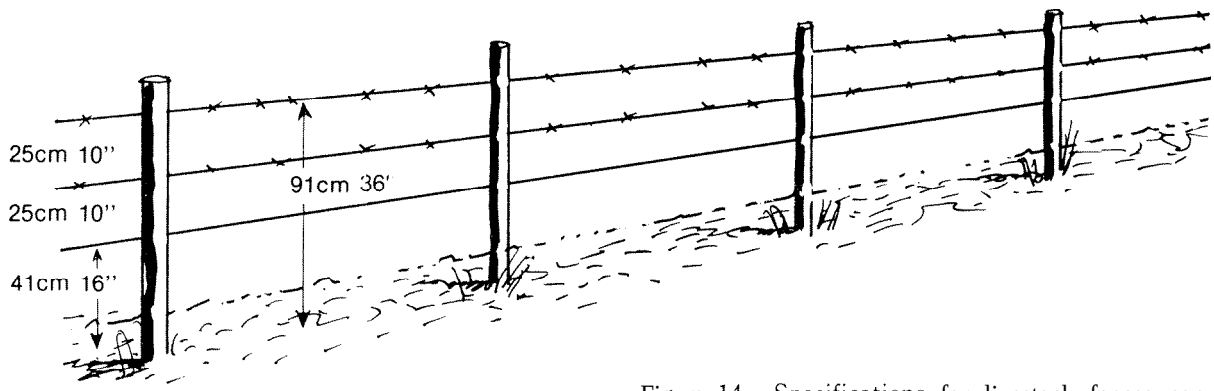


Figure 14.—Specifications for livestock fences constructed of barbed wire on pronghorn ranges (U.S. Department of the Interior, Bureau of Land Management 1975).

HABITAT

1. Where precipitation is less than 15 centimeters (6 in) per year, the vegetation should not be manipulated.

2. The best ranges have at least 50-percent ground cover and the vegetative structure is no taller than 38-61 centimeters (15-24 in).

3. A vegetative composition that averages 50-60 percent grasses, 10-30 percent forbs, and 10-20 percent shrubs is best.

4. High diversity in vegetation is preferable: 5-10 grass species, 20-40 forb species, and 5-10 shrubs.

5. Where plants are seeded, it is important to select species that will ensure succulence into late summer. Dryland alfalfa is an example. Maintenance, improvement, or creation of wet meadows is likewise important.

6. Livestock grazing systems designed to ensure sufficient seasonal forage can also benefit pronghorn. For example, the number of livestock on spring pronghorn ranges can be adjusted to assure growth of vernal forbs, and sheep can be restricted from pronghorn fawning areas for 45 days before and after the peak fawning season (May 15 to June 15). Adequate forage on winter ranges is particularly important; inadequate forage frequently limits the size of pronghorn herds.

7. Pronghorns require 0.9 kilogram (2 lbs) of air-dried, preferred forage per animal per day (Beverson and others 1968). This should be consciously provided through management.

WATER

1. Water sourceson pronghorn summer ranges are most beneficial when no more than 4.8 kilometers (3 mi) apart and when they are designed and managed for pronghorns, even when livestockaremovedtootherpastures.Inaddition,on livestock summer ranges that serve as critical pronghorn winter ranges, some water sources can be restricted from livestock use. The restriction can help prevent overuse of surrounding vegetation by livestock.

2. Availability of water is particularly important on summer ranges from June through October, when each adult pronghorn requires 1 .O liter (1/4 gal U.S.) per day.

3. Water is most palatable to pronghorn when the pH is less than 9.25 and the total dissolved solids are less then 5,000 ppm.

FENCING

1. Pronghorns fare best when fences for controlling livestock movement have no woven wire and are built in such a way to allow pronghorns to pass.

2. Barbed wire fences with smooth bottom wires at least 41-46 centimeters (16-18 in) above the ground, no stays, and a top wire no higher than 81 centimeters (32 in) allow pronghorns to pass.

3. White-topped steel fenceposts will increase the visibility of the fence.

4. White cloth strips tied to the top wire betweenpostsofanewfencewillalsoincreasethe visibility of thefenceand willallow pronghorns to become used to its location.

5. Lay-down panels or “antelope passes” can be constructed at strategic points to allow pronghorns to move between areas. In addition, gates can be left open when livestock are removed from fenced pastures.

HARASSMENT

Human activities disturb pronghorns. Controlling the use of motor vehicles, particularly off-road vehicles, on summer ranges during fawning season (May 15 to June 15) and on winter ranges when herds are concentrated (December 1 to March 15) will minimize disturbance.

GRAZING

Domesticsheepareregenerallymorecompetitive with pronghorns for preferred forage than are cattle and horses. In addition, the net wire fences commonly used to contain sheep often limit the movement of pronghorns. Pronghorns usually fare better when grazing with horses and cattle than when grazing with sheep.

Summary

The old adage that "good" range management is "good" for wildlife was probably never true and is no longer acceptable (Thomas 1979), certainly not for pronghorns. Improvements in pronghorn habitat, to date, have largely been a byproduct of management activities to improve conditions for livestock. But pressure for increased livestock production is accompanied by a growing public concern for wildlife. Pronghorns can benefit from range management activities only if their welfare is planned in advance and their habitat requirements are no longer left to chance.

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