ENVIRONMENTAL CHARACTERISTICS AND FUNCTIONAL SIGNIFICANCE OF PRONGHORN FAWN BEDDING SITES IN ALBERTA

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Abstract: Reduced recruitment and declining populations of pronghorns (*Antilocapra americana*) in Alberta prompted this study of bed-site selection by neonates. Characteristics of bedding sites of free-ranging fawns were studied on a 9,300-km^2 study area within the grassland range of southeastern Alberta. During 1971–76, 465 bedded fawns, estimated mean age 2.8 days, were located and captured. Fawns commonly bedded on slopes, in native vegetation, in small depressions, on patches of bare gound, or adjacent to clumps of silver sagebrush (*Artemisia cana*), rock, or cow dung. Many appeared to select sites that had characteristics that served as suitable vertical and horizontal sign stimuli, and thus stimulated bedding selection behavior. Sagebrush was sparse on the study area, and 75% of the fawns bedded on grassland ranges that had little or no brush cover. Wind velocity at fawn bedding sites was 59.5% less than readings taken 150 cm above the beds. No evidence of traditional fawning areas was found. The number of marked fawns relocated was used as an index of fawn survival. Estimated survival was higher for animals bedded in native range, and increased with greater cover density and use of depressions; significantly fewer fawns were relocated if they had been initially found bedded on cultivated land. Habitat diversity provided by silver sagebrush, small depressions, and stands of grasses or forbs >25 cm tall constituted important bedding cover, and contributed to above-average survival of fawns on the study area. Managers should recognize the value of these features when making land use decisions for this kind of rangeland.

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Annual systematic surveys for pronghorns in Alberta indicated that in 1969 the population had declined to a 15-year low of 7,000 animals (Wishart 1970:128). Reduced recruitment of young was noted at that time, although Mitchell (1965) had shown that the birth rate of pronghorns in Alberta was high. These factors led to a study in 1971 of the biology of pronghorn fawns.

The occurrence and significance of low fawn recruitment in North America were reviewed by Vriend and Barrett (1978). In recent years, predation has been shown to be a locally important mortality factor for fawns in several areas (Beale and Smith 1973, Barrett 1978, Beale 1978, Bodie 1978, Von Gunten 1978). The characteristics of bedding sites of neonates may be related to fawn survival, although little relevant information is available. In the 1st 3 weeks of life, fawns spend approximately 90% of their time bedded.

Autenrieth and Fichter (1975:38–46) described the behavior of pronghorn fawns that were selecting bedding sites. Some characteristics of fawn bedding sites, particularly as they related to sagebrush-dominated rangelands, have been reported for pronghorns in Montana (Pyrah 1974) and Idaho (Autenrieth 1976). Bromley (1977:79–97) presented data on bedding-site selection by fawns in a small population of pronghorns in Wind Cave National Park, South Dakota. Studies conducted to date have shown important differences in vegetative types selected as bedding sites by pronghorn fawns. Characteristics of fawn bedding sites in grassland communities typical of most of the pronghorn range in Alberta

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have not been reported. Yoakum (1972:176) estimated that the proportion of pronghorns in North America living in grassland communities was 68%, as opposed to 31% living in grassland-brushland communities.

The purposes of my study were to describe bedding sites of pronghorn fawns throughout a predominantly grassland range in southeastern Alberta, and to determine whether fawn survival was related to the characteristics of these bed sites.

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STUDY AREA AND METHODS

This study was conducted during 1971–76 in southeastern Alberta, south of 51°N and east of 112°W (Fig. 1). Pronghorn range within the 9,300-km^2 study area is part of the mixed-grass prairie region (Webb et al. 1967). The study area is primarily in the Brown soil zone. The climate is semiarid; mean annual precipitation (1941–70) measured at the Agriculture Canada Research Substation, Manyberries, was 327 mm. Dominant grass species are western wheatgrass (*Agropyron smithii*), needle-and-thread

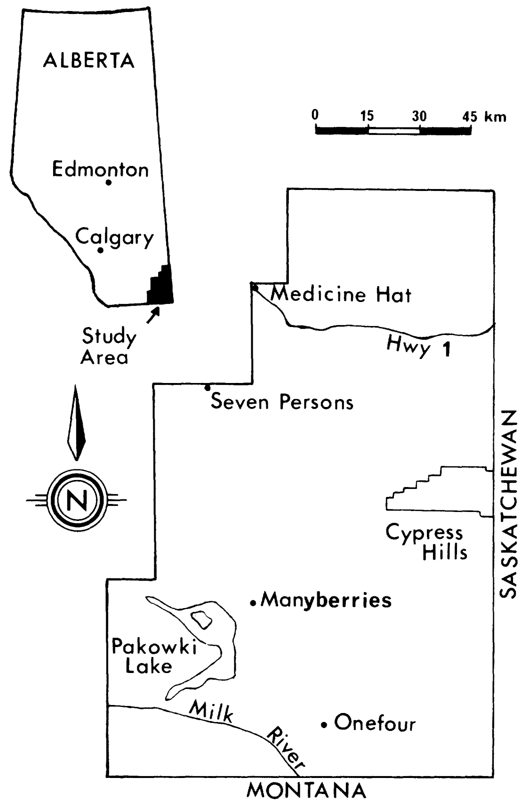

Fig. 1. Location of pronghorn fawn study area in southeastern Alberta.

(*Stipa comata*), and blue grama (*Bouteloua gracilis*). Silver sagebrush is the dominant shrub, although lesser amounts of western snowberry (*Symphoricarpos occidentalis*), rose (*Rosa* spp.), silverberry (*Elaeagnus commutata*), and creeping juniper (*Juniperus horizontalis*) are present. Brush growth was limited to bottomlands and other small areas with favorable moisture regimes. The topography varies from gently rolling plains to hilly, although bottomlands are abundant. Numerous intermittent watercourses transect the study area. More detailed descriptions of the area were presented by Coupland (1950, 1961) and Mitchell and Smoliak (1971). Pronghorns range freely throughout the study area at altitudes generally <1,200 m.

Aerial photographs taken in 1970 showed that 81% of the study area was in native vegetation. Cereal crops and tame pasture occupied the remaining 19%. These proportions have not changed appreciably in the past few years. Nearly all native grasslands are grazed seasonally by domestic livestock. With the exception of the Cypress Hills Park area, which pronghorns use infrequently, no major natural or artificial barriers restrict pronghorn movements or distribution. During the 6 years of investigation, the average fawn:doe index in the study area in midsummer was 50:100; the overall pronghorn density, including fawns, averaged 0.56/km^2 in midsummer. Potential predators of pronghorn fawns included coyotes (*Canis latrans*), bobcats (*Felis rufus*), and golden eagles (*Aquila chrysaetos*).

Locating and Capturing Fawns

Most fawns were located by systematic search around the locations where parental does were seen. These "blind searches" accounted for 78% of all fawns captured. The remaining neonates were observed with the doe, and then allowed to bed before the searches were started. The search and capture methods followed those described by Hoover et al. (1959) and outlined in more detail by Barrett (unpubl. rep., Alberta Dep. Recreation, Parks and Wildl., 1978). When a fawn was located, an extended search for a potential sibling was conducted. Fawns were captured in their bedding sites with an oval-shaped net, measuring 0.6 × 1 m, with a 3-m handle.

Captured fawns were held in a supine position to promote calmness and to measure rectal temperature. The age of each fawn was estimated by its size, behavior, and condition of hair coat and umbilicus. I generally followed the age-class descriptions of fawns outlined by Bromley (1977). The age and sex of each fawn were recorded, and each animal was measured and weighed. Before release, 370 fawns were fitted with color-coded, expandable, 7.5-cm-wide neck collars; radio transmitters were placed on an additional 62 fawns. All were released at their bedding sites.

Efforts were made to relocate all marked fawns to test the hypothesis that neonatal survival was influenced by characteristics of their bedding sites. During the 6 years of the study, >1,500 man-days were spent by project personnel in the study area, and >50 days/year were directed toward relocating marked animals. Aircraft were used extensively. Few observations of marked fawns were made before the neonates were active and had integrated with groups of adults. Many sightings were made on their fall and winter ranges in the 1st year following marking. I present information only on whether marked fawns were observed alive 2 weeks or longer after marking. In the context of this paper, relocation information was used as an index of survival of fawns. Fawns not relocated during the study were presumed to have died during the 2 months following their birth, a period during which fawns become integral members of summer herds. No distinction was made between type of collar, year of marking, number of relocations per individual, or other factors for these analyses. Animals were simply classified as relocated or not relocated. Survival of fawns for each habitat type was based on the number of marked individuals relocated from each type.

Data Collected at Capture Site

The general classifications of topography and vegetation best describing the square kilometer surrounding the bedding site were recorded. Topography was classified into 3 categories of increasing relief (flatland, gently rolling, and hilly). Cultivated land within the study area had little relief, and was categorized as flatland. In the last 3 years of the study a more specific category, topographical site, was added. This category contained 5 classes: flatland, depression, and top, middle, and bottom ⅓ of slope. Classification of vegetation of native range reflected numerous associations, but native-grass prairie (NGP) supporting substantial amounts of sagebrush was divided into 4 categories based on the number of sagebrush plants intercepted by a randomly selected 60-m straight-line transect. The 4 categories, NGP-sparse sagebrush, NGP-light sagebrush, NGP-medium sagebrush, and NGP-heavy sagebrush, reflected sagebrush densities of <3, 3–10, 11–25, and >25 plants/transect. Cultivated lands were further subdivided to group the proportions of these lands in tame pasture, seeded cereal crop, stubble, and summer fallow. Additional categories of vegetation accounted for less than 1% of the bedding sites found, and were combined as "others" for tabular presentation; these sites included areas dominated by western snowberry and rose, dried slough bottoms, and cactus (*Opuntia* spp.) flats.

Details concerning substrate and the direction of exposure of bedding sites were recorded in addition to fawn positioning relative to any notable landform. The tendency of fawns to select bedding sites that provided obvious concealment was investigated. Project personnel made an assessment of whether the exact bedding site offered appreciably more concealment to the neonate than would have been the case if it had bedded randomly in the same general habitat. In this context, concealment referred primarily to the use of vegetative matter, but also included other physical features such as rocks and cattle feces where their use was apparent. The distances from fawn bedding sites to the nearest sagebrush plant >3.5 cm in height, to heavy cover, and to water were measured; distances greater than 100 m were estimated. The height of the nearest sagebrush plant was recorded. The heavy-cover classification included NGP-medium and heavy sagebrush, equivalent densities of wild rose, snowberry, and other brush species, and stands of grasses and forbs >25 cm in height.

A hand-held thermometer and an anemometer were used to measure the temperature and wind speed at each bedding site. Temperatures were taken at 3 heights: on the ground in the bed site, 10 cm off the ground immediately above the bed, and 150 cm above the bed. The thermometer was always shaded for the 150-cm reading. The wind speed was recorded at the 10- and 150-cm distances above the ground at the bed sites. The 10-cm readings were selected to approximate the height of a bedded fawn. Precipitation and cloud cover were noted.

Statistical Treatment

Data were processed by an Amdahl 470 V/6 computer using the SPSS statistical package (Nie et al. 1975). For selected variables, differences in relocation success were investigated using chi-square analysis within the program CROSSTABS. Where significant chi-square relationships were found, differences between proportions for component cells for a given variable were investigated by comparing the percentage of fawns relocated for that cell to the overall relocation success for the marked population of fawns, using a binomial distribution analysis.

Table 1. Vegetation types at pronghorn fawn bedding sites in southeastern Alberta.

Vegetation type	Sagebrush plants/ 60-m transect	Bedding sites found	
		N	%
NGP[a]-sparse sagebrush	<3	162	41.2
NGP-light sagebrush	3–10	129	32.8
NGP-medium sagebrush	11–25	29	7.4
NGP-heavy sagebrush	>25	11	2.8
Stubble field		11	2.8
Summer fallow		18	4.6
Seeded field		22	
Tame pasture		5	1.3
Other[b]		6	1.5
Totals		393	100.0

[a] NGP—native grass prairie.
[b] Includes 4 types of native pasture each of which represents <1% of the cases.

RESULTS

Characteristics of Captured Fawns

During the study, 465 pronghorn fawns were captured. Mean estimated age of neonates was 2.8 days (range 4 hours–10 days), and 95% of the fawns were estimated to be 6 days of age or less. Males constituted 57% of the fawns captured. A twin could not be located for 217 (47%) of the neonates captured. The mean distance between siblings for the 248 fawns that were part of twin groups was 48.0 ± 5.6 (SE) m. Siblings bedded within 5 m of each other 26% of the time, whereas 19% were bedded at sites >80 m apart. Mean weight of fawns captured was 4.2 kg, and no appreciable size difference existed between sexes. Mean rectal temperature of 391 fawns was 39.6 C (range 37.1–42.2 C).

During late May, more than 1,500 mature females were observed during the 6 years of study. Observations on the proportion of pregnant and parental does observed each day and the estimated age of fawns provided information on the chronology of parturition. Little noticeable difference occurred in the synchrony of parturition from year to year, but peak activity appeared to lag by 1 or 2 days in 1972. Generally, in all years, an estimated 75% of does delivered between 23 and 30 May. By 1 June of each year, >90% of the mature does were estimated to have delivered.

Habitat Characteristics of Bedding Sites

Data for 404 fawns indicated that most of them selected bedding sites on slopes or crests of hills. Fawns were located in flat terrain in 31% of the cases. Gently rolling and hilly terrains accounted for 40 and 29% of bedding sites located, respectively. These categories described only the general nature of the topography in the immediate area of bedding sites.

In the last 3 years of the study the location of fawns relative to topographical site was recorded for 167 bedding sites. On 58 occasions, beds were located on flat land having no appreciable relief, and on 29, 27, and 25 occasions bedding sites were located at the top, middle, and bottom ⅓ of slopes, respectively. Additionally, 28 bedding sites were located in depressions that were on either slopes or flat land. These depressions were formed primarily by water and wind erosion or by livestock activity on unstable soils, and were irregularly shaped, and 1–3 m in diameter and 10–30 cm deep. Commonly, these depressions were deep enough to completely conceal a bedded fawn from horizontal view. There was no consistent direction of exposure selected by bedded pronghorns.

In all years, most bedding sites were located on the NGP-sparse and NGP-light sagebrush rangelands that characterized most of the study area (Table 1). NGP-medium and heavy sagebrush types were used only moderately throughout the study, but these vegetation types did not represent a large proportion of the area. Fawn bedding sites were found on cultivated land in 14% of the cases. Bedding sites were found on all major vegetation types available throughout the study area. The estimated mean distance between the bedding sites and the nearest available water for 356 cases was 586 ± 31 (SE) m; the maximum distance was >4 km.

Fewer than ⅓ of the bedded fawns were on sites where vegetation or other features provided appreciable concealment. Among 297 fawns, 30% were concealed, 3% were partially concealed, and 67% were not concealed. Of the concealed fawns, 55% were bedded in sagebrush, 13% in tall grass or forbs, and 18% in physical depressions. The remaining 15% were bedded adjacent to various features, including rocks, tire ruts, clumps of cactus, cow dung, and other objects. Commonly, fawns bedded with their backs against an obstacle. When siblings were bedded within 5 m of each other, they usually faced in different directions. When bedded on a slope, fawns commonly faced downhill. All habitat types had considerable vegetative and physical diversity that provided some visual camouflage. More than half of the unconcealed fawns, however, were bedded on NGP-sparse or NGP-light sagebrush rangelands (Table 1), and were without appreciable physical cover in the immediate area to hide them. In most cases, cryptic coloration was the prime source of concealment for bedded fawns.

The substrate of fawn bedding sites was predominantly grass species in 62% of cases, whereas bare soil, either disturbed or undisturbed, composed the main bedding-site substrate in 36% of cases examined. In some cases, fawns bedded on a combination of the 2 main types. Many of the bedding sites with predominant grassland vegetation also contained various proportions of the mat-forming ground cover, spikemoss selaginella (*Selaginella densa*).

The mean distance to the nearest sagebrush plant was 102 ± 12 (SE) m (N = 362), and the maximum distance was 1.6 km. The mean height of the nearest sagebrush plant was 26.2 ± 0.9 cm, and the maximum height was 76.2 cm. The mean distance from the bedding sites to the nearest heavy vegetative cover suitable to visually conceal fawns was 325.9 ± 31.5 m (N = 238). In 64% of the cases, the heavy cover consisted of sagebrush. Other main types of heavy cover included native grasses, snowberry, wild rose, and forbs.

Microclimate of Bedding Sites

Mean and maximum temperatures decreased with increasing distances above the ground (Table 2). The mean temperature at ground level was 18.8% higher than the value obtained at 150 cm. Mean wind speed was greatly reduced in bedding sites. Mean and maximum wind speeds at the 10-cm level were reduced 59.5 and 46.7%, respectively, over those at the 150-cm level. Most fawns were bedded in sunny places, although there was no obvious preference for sunshine. Rectal temperature of fawns increased with increasing ambient temperature, as revealed by the correlation $r = 0.43$ ($P < 0.01$) between the rectal temperature of fawns and the ambient temperature measured 10 cm above the ground.

During parturition and shortly thereafter, heavy rainfall, wind, and cold weather occur commonly throughout pronghorn ranges in Alberta. Snowfall in excess of 20 cm is not rare in portions of the ranges in late May. The effect of adverse weather on fawn survival was not measured specifically, but cases were ob-

Table 2. Meteorological data taken at bedding sites of pronghorn fawns in southeastern Alberta.

Measurement	N	$\bar{x}$	SE	Range
Temperature, C				
Ground level[a]	279	20.3	0.4	3.3–47.8
10 cm above ground[a]	243	18.3	0.4	3.3–35.6
150 cm above ground[b]	321	17.1	0.3	3.3–30.6
Wind speed, km/hour				
10 cm above ground	284	6.4	0.3	0–22.5
150 cm above ground	303	15.8	0.5	0–48.3
Cloud cover, %	240	62		0–100

[a] Temperature taken with no unnatural shading.
[b] Thermometer always shaded for this reading.

served in which short-term exposure to moisture reduced the body temperature of fawns. Two cases illustrate the point. In the 1st, a set of twins was located, 1 fawn was captured, and its rectal temperature was 40.7 C. The sibling had run approximately 400 m, bedded, and was caught after being in a 10-minute rain shower. The temperature of this partially dry twin 10–12 minutes after capture and handling was 37.6 C, or 3.1 C lower than that of its sibling before the shower. The 1st twin, which had been released before the shower, was recaptured. Although it was nearly dry by that time, its rectal temperature had fallen 1.9 C, to 38.8 C.

Table 3. Success of relocating pronghorn fawns in relation to topographical characteristics of their bedding sites in southeastern Alberta.

	Fawns relocated[a]		Fawns not relocated[a]	
Topographical site	N	%	N	%
Flatland	18	26	50	74
Top ⅓ of slope	8	28	21	72
Middle ⅓ of slope	2	7[b]	25	93
Bottom ⅓ of slope	7	28	18	72
Small depression	13	46[c]	15	54

[a] Chi-square probability of obtaining the relationships in the column by chance is <0.01.
[b] Relocation rate was less ($P < 0.05$) than that of the entire marked population.
[c] Relocation rate was greater ($P < 0.01$) than that of the entire marked population.

In the 2nd case, a set of twins was located, and during netting of the 1st animal, its sibling fled approximately 200 m and ran into a 30- to 35-cm-deep slough and stood there for nearly 5 minutes before it was captured. Six minutes after the fawn was retrieved from the water its rectal temperature was 37.2 C. The temperature of the dry fawn was 41.2 C. The previously wet fawn was recaptured the following day, was dry, and had a temperature of 40.9 C.

Bedding-Site Characteristics and Fawn Survival

Excluding sightings made during the 1st 14 days following markings, 127 fawns were relocated and identified at least once. There was no significant chi-square relationship between the success in relocating fawns and general topography, exposure, or bed substrate of their capture sites. Data for concealed and partially concealed fawns were combined for analysis, and revealed that these fawns were relocated 33.3% of the time, compared to 19.3% for unconcealed fawns; these differences were significant ($P < 0.03$). Other significant relationships existed between the success in relocating fawns and topographical site (Table 3) and vegetation type (Table 4)

Table 4. Success of relocating marked pronghorn fawns in relation to vegetation characteristics of their bedding sites in southeastern Alberta.

Vegetation type	Sagebrush plants/60-m transect	Fawns relocated[a]		Fawns not relocated[a]	
		N	%	*N*	%
NGP[b]-sparse sagebrush	<3	42	26	120	74
NGP-light sagebrush	3–10	41	32	89	68
Heavy native vegetation[c]	>10	14	33	29	67
Cultivated land		7[d]	12	50	88

[a] Chi-square probability of obtaining the relationships in the column is <0.05.
[b] NGP—native grass prairie.
[c] Includes equivalent densities of other shrub species and stands of grasses and forbs >25 cm tall.
[d] Relocation rate was lower ($P < 0.008$) than that of the entire marked population.

noted at the bedding sites where they were first located.

With respect to vegetation type, the proportion of fawns relocated was 2.36 times greater if the initial capture sites were on native rangeland as opposed to cultivated land (Table 4). The proportion of fawns relocated was highest for native range with heavier cover. The success rates in relocating fawns that were concealed or partially concealed and those that were located on NGP-light sagebrush or heavy native vegetation were similar, and suggested comparability of these types in relation to fawn survival.

The distribution of does and fawns during the 6 years of my study did not provide substantive evidence for the existence of traditional fawning areas for local populations. Certain topographical and vegetative features appeared to be preferred as parturition sites, but these were widely distributed throughout the study area. Preferred parturition areas were not typified, however, by predictable annual increases in pronghorn densities in local areas. In the study area, the mean group size during the parturition period, excluding fawns, of all groups having at least 1 parental female was 1.7 ($N = 413$ groups). The distribution of mature does during late May of each year was not consistent. Variations in distribution of does during May were believed to reflect availability of succulent vegetation in a given year and severity of the previous winter, which often caused major shifts in the distribution of pronghorns during that period.

DISCUSSION

The high proportion of fawn bedding sites located in NGP-sparse and NGP-light sagebrush rangeland (Table 1) contrasted sharply with findings in Montana (Pyrah 1974) and Idaho (Autenrieth 1976). Additional evidence on the lack of dependence on sagebrush as bedding cover in Alberta was the mean distance of 102 m between bedded fawns and the nearest sagebrush plant. Pyrah (1974:113) measured 85 fawn bedding sites and reported a mean canopy coverage of 21.2% big sagebrush (*Artemisia tridentata*), 32.0% grass, and 13.5% forbs. He reported that all bedding sites selected by pronghorn fawns were in vegetative types containing big sagebrush. Autenrieth (1976:130) analyzed 131 bedding sites in Idaho, and reported that 73% were located in big sagebrush and the remainder in low sagebrush (*A. arbuscula*). In that study, pronghorn fawns reportedly selected bedding sites with greater-than-average brush canopy cover, total vegetation cover, and brush height.

The sharp contrast between habitat types in southeastern Alberta and the fawn study areas of Pyrah (1974) and Autenrieth (1976) is evident from the work of Mitchell and Smoliak (1971). In a 2,496-km^2 portion of my study area, Mitchell and Smoliak (1971:241) reported a mean canopy coverage on native range of 2.3, 10.0, and 87.7% shrubs, forbs, and grasses and sedges, respectively. In contrast to the situation in Alberta, fawns in the Montana and Idaho study areas apparently rarely bedded in rangeland with such limited brush cover (Pyrah 1974, Autenrieth 1976).

The use of small depressions as bedding sites by some fawns in Alberta differs from findings of Autenrieth and Fichter (1975). Walther (1968:110) reported that gazelle fawns (*Gazella* spp.) selected bedding sites characterized by a vertical object plus a small hollow place; Autenrieth and Fichter (1975:40) rejected Walther's observation as being generally applicable to pronghorn fawns on their study area. The tendency of some neonates in Alberta to bed in hollows, on patches of bare ground, in wheel ruts, or adjacent to rocks, cow dung, or small clumps of vegetation, however, suggested that Walther's (1968) criteria for bedding sites of gazelles were met commonly by bedded pronghorn fawns in Alberta. The same conclusion was reached by Bromley (1977:95), who observed that pronghorn fawns in Wind Cave National Park selected bedding sites that satisfied both horizontal and vertical criteria. Fawns on Bromley's (1977:91–93) study area preferentially selected patches of bare ground as bedding sites, and such areas, in his view, satisfied the criterion of a small hollow area.

In Alberta and Wind Cave National Park, and presumably elsewhere where brush cover available to fawns is limited, the tendency to select bedding sites using other features to satisfy both vertical and horizontal sign stimuli may be more apparent. Rangelands with abundant diversity and that readily provide preferred fawn bedding sites, in keeping with the general requirements of pronghorns, should provide greater security for resident pronghorns.

Low density of pronghorns and wide variation in distribution during the parturition period supported the conclusion that traditional fawning areas were not present in southeastern Alberta. Similarly, Autenrieth (1976:129) observed major shifts in the distributions of parturient does between years, and strongly questioned the existence of traditional fawning grounds on his Idaho study areas. Other authors have supported or described the existence of traditional fawning areas (Einarsen 1948, Ingold 1969). Mace (1954:4) described open basins containing sagebrush as preferred fawning grounds. Furthermore, the 1962 guidelines for antelope management listed "kidding grounds" as one of the key areas of antelope range that a management agency should identify (Griffith 1962:106). The definition of what constitutes a traditional fawning area has not been well established. It is probable that where such areas exist, increased pronghorn densities during the parturition period may reflect a limited availability of seasonally preferred forage and terrain. Annual variation in climatic conditions and vegetation growth would be expected to cause corresponding shifts in the distribution of pronghorns during this period. The presence or absence of traditional fawning grounds throughout the pronghorn range may be an additional facet of the regional biology of this species that shows great variation between areas. A suggested hypothesis for the lack of traditional fawning grounds in Alberta is the abundance of habitat areas commonly selected by parturient females in relation to the generally low density of pronghorns.

Bromley (1978) discussed the behavioral characteristics of pronghorn fawns in relation to the ecological pressures of climate, availability of food, predation, and habitat structure. He believed that behavioral patterns at the birth site were adaptive responses to climate and predation. Bromley had no measurements of weather to support his hypothesis. Meteorologic data from my study indicated that fawn bedding sites had reduced wind and higher ambient temperatures than were recorded 150 cm directly above the bedding sites. Regrettably, meteorological values for areas not selected as bedding sites were not obtained for comparative purposes during my study. Similarly, comparative weather data for other pronghorn ranges beyond Alberta are not published.

The contribution of cold, wet weather to pronghorn fawn mortality has not been well documented. Hepworth (1965:2) reported that disease, in combination with inclement weather, was believed primarily responsible for low fawn:doe ratios in Wyoming. Beale (1978:446) reported that some fawns on his Utah study area died from pneumonia and adverse weather; data on the number of fawns affected were not presented. Bodie (1978:425) stated that several dead fawns were found after spring snowstorms in Idaho. Similar weather-related mortality of pronghorn fawns is probable in Alberta during periods of adverse conditions, but confirmation is lacking.

The proportion of fawns relocated following marking and release was highest if their bedding sites had been in small depressions or on native rangeland, particularly in areas with heavy vegetative cover (Tables 3, 4). Undisturbed fawns usually bed in a head-up posture, and depressions or heavy cover may be particularly effective in reducing their visibility to predators. The relocation statistic was used as an index of survival, and indicated that a minimum of 29.4% of the marked fawns survived at least 2 weeks, and most of these much longer. This is in general agreement with the estimated 41.3% survival to 2 months of age for all fawns in southeastern Alberta during the same time period (Barrett 1978:439). A few of the marked fawns were probably rejected by their dams, whereas other marked survivors were probably not relocated. These factors, however, should have occurred independently of bedding-site characteristics. The highest incidence of predation in Alberta occurred when fawns were 11–20 days old (Barrett 1978:436), a period during which the characteristics of fawn bedding sites should play an important role in survival. The hypothesis was that the probability of being relocated, i.e., fawn survival, was unaffected by the characteristics of fawn bedding sites. Based on available data, this hypothesis was rejected. In a preliminary conclusion, Bodie (1978:426) also reported contrasting mortality rates for pronghorn fawns that used 2 distinct vegetation types on his study area in Idaho.

Characteristics of bedding sites are important because of the assumption that fawns continue to select bedding sites with biotic and abiotic features similar to those in which they are born. Observations on the habitat characteristics of 15 birth sites in my study showed them to be similar to the bedding sites reported herein. Similarly, Autenrieth (1976:130–131) reported that his initial data supported the argument for habitat imprinting between birth site and subsequent fawn bedding sites. More conclusively, Bromley (1977:92–93) showed that the characteristics of bedding sites of fawns in Wind Cave National Park did not change significantly with increasing age of fawns during their 1st month of life.

My study contrasted the effectiveness of different habitats in providing protection for the fawn. In the 3-week interval following parturition, fawns are bedded apart from their dams approximately 90% of the time (Autenrieth and Fichter 1975). Bromley (1978:461) hypothesized that bedding-site selection was essentially a response to predation. Predation has been shown to be a major cause of fawn mortality in southeastern Alberta (Barrett 1978) and elsewhere (Compton 1958, Beale and Smith 1973, Beale 1978, Bodie 1978, Von Gunten 1978). Considering present knowledge, additional research on characteristics of bedding sites of pronghorn fawns, and in particular on mortality rates of pronghorn fawns using different vegetation communities, appears warranted throughout most of the pronghorn range.

Based on my findings, several management recommendations are made. Sagebrush rangeland, although limited on the study area, contributed to the highest survival of fawns, and should be retained wherever possible. Large cultivated tracts on important pronghorn ranges should be avoided. Habitat diversity provided by small depressions, stands of grasses or forbs >25 cm tall, and small areas of bare ground all constituted important fawn bedding cover, and should be retained and incorporated into any habitat development or mitigation programs designed to improve pronghorn range. Preferred fawning grounds should be evaluated on the basis of habitat characteristics and not solely by geographical areas.

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