Chapter 1

Pronghorn Antelope (*Antilocapra americana*)

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I. <u>INTRODUCTION</u> – Rangelands throughout Wyoming sustain more than half the pronghorn in the world. The species inhabits most non-forested habitats within the State (Fig. 1) and is even found in some alpine locations. The Wyoming Game and Fish Department manages 50 distinct pronghorn herds encompassing more than 100 hunt areas (Fig. 2). Herds are defined based on natural (geographic) or man-made barriers that restrict interchange to less than 10% annually. Hunt areas are established within herd units to achieve harvest objectives and to distribute hunting pressure.

Management and research techniques described in this chapter are commonly applied in Wyoming. Appropriate timeframes for surveys and management activities are depicted in Table 1. For more comprehensive discussions about life history and management of pronghorn, consult Big Game of North America: Ecology and Management (Schmidt and Gilbert 1978).

Table 1. Annual schedule of pronghorn survey and management activities.

	Page No.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Age Composition of Harvest	15			XXXX	XXXX	XXXX	XXXX	XXX					
Distribution Surveys	21						XXXX	XXXX	XXXX	XXXX	XX		
Cementum Annuli Analysis	17						X	XXXX	XXXX	XXXX	XX		
Fawn Trapping	27	XX											XX
Harvest Field Checks	17			xxxX	XXXX	XXXX	xxxx	xxx					
Harvest Questionnaire	15					XX	XXXX	XXXX	XXXX	XX			
Herd Trapping	22					XX	XXXX	XXXX	XXXX	XXX			
Incidental Observations	22	xxxx	xxxx	xxxx	xxxx	xxXX	XXXX	XXXX	XXXX	XXxx	xxxx	xxxx	xxxx
JCR'S	37	XXXX								XX	XXXX	XXXX	XXXX
Line-transect/Trend Counts	9 / 5	XXX											XXXX
Mortality	18	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xXXX	XXXX	XXXX
Pre-season Classifications	3			XXXX	XX								
Season Setting									X	XXXX	XXXX	XX	

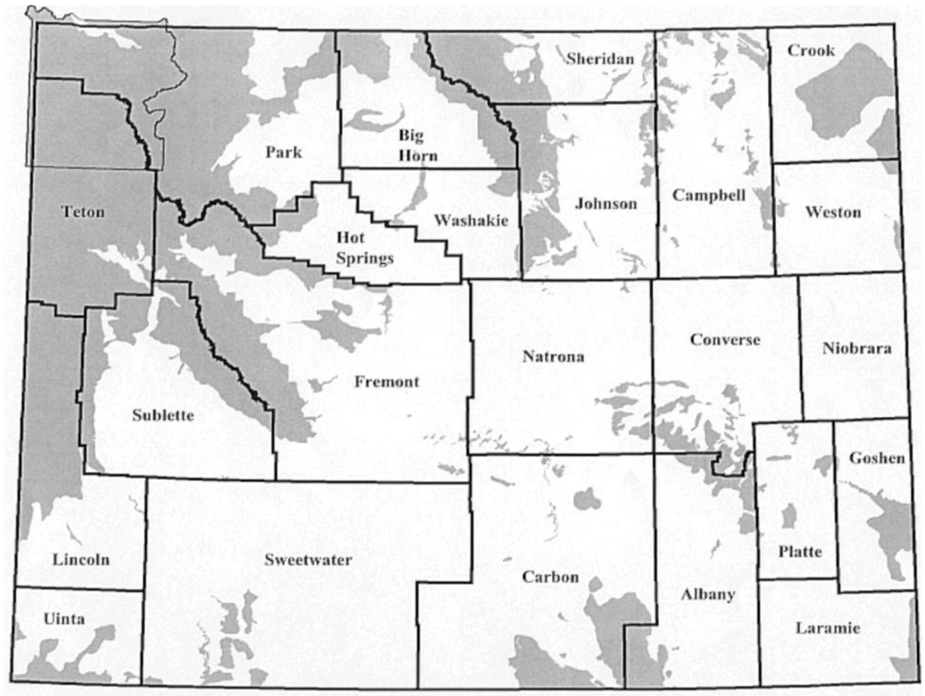


Fig. 1. Distribution of pronghorn in Wyoming (unoccupied habitats are shaded gray).

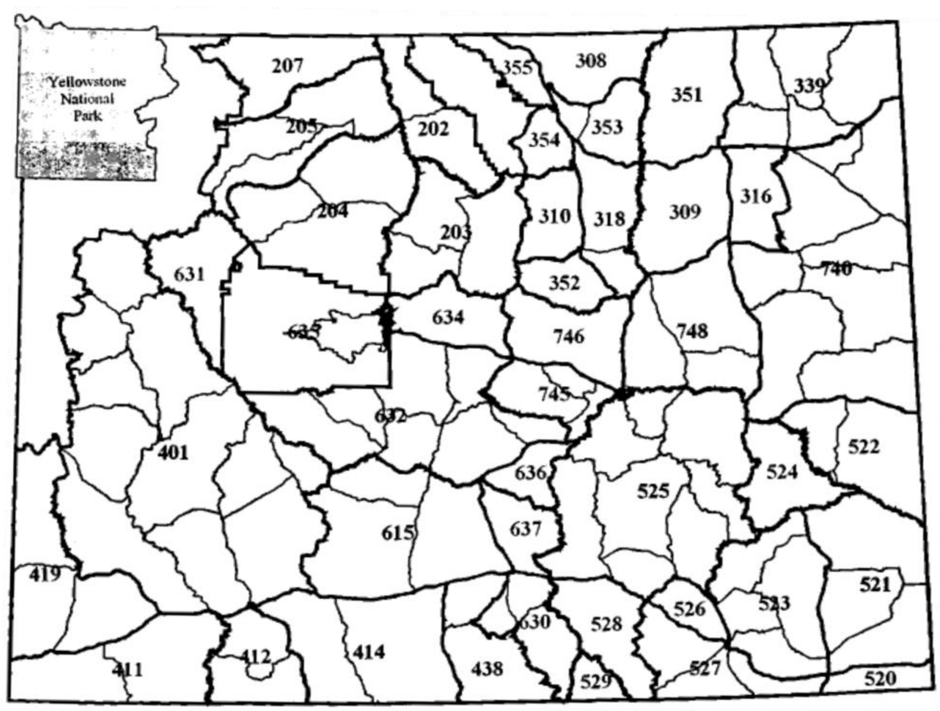


Fig. 2. Boundaries of pronghorn herd units and hunt areas in Wyoming.

II. CENSUS – The following techniques are commonly used in Wyoming to estimate sex and age composition, and size of pronghorn populations.

A. Pre-season Classifications – Pronghorn are classified from fixed wing aircraft and from vehicles on the ground. To assure consistent results, the same observer should conduct classifications each year, using the same method. If aerial and ground surveys are conducted in alternate years, biases associated with each method should be considered when data are interpreted (Woolley and Lindzey 1997). Minimum sample sizes are estimated according to the method described by Czaplewski et al. (1983 – Appendix XII) and achieved for each herd unit. However, it is more important to attain representative coverage of the entire herd unit, than to suspend sampling when the minimum sample size is achieved. If the minimum sample size is consistently exceeded, it may be possible to reduce sampling effort (e.g., by increasing transect spacing) while maintaining representative coverage of the herd unit.

1. Aerial Classifications

a. Rationale – Aerial surveys are more efficient than ground surveys and meet sampling assumptions better because the probability of encountering and classifying each pronghorn in the herd unit is approximately the same. Adequate, representative coverage can be achieved by flying successive transects spaced at regular (1-5 mile) intervals, beginning with a randomly selected transect. Precision of aerial surveys is comparable to that of ground surveys, however, lower fawn:doe and buck:doe ratios may be detected (Woolley and Lindzey 1997).

b. Application – Classifications should be done in late summer (O'Gara and Yoakum 1992), usually 1-31 August. Classifications conducted outside this period can generate biased fawn ratios (O'Gara and Yoakum 1992). Schedule flights the first two to three hours after daylight and the last two or three hours before dark. Bedded animals, especially bucks, are less visible during midday (O'Gara and Yoakum 1992). Aircraft should be designed to fly safely at slower speeds. Suitable aircraft include Piper Supercub, Bellanca Scout, Citabria Explorer, and Maule M-5. Helicopters are also suitable, but cost more to operate and may not improve accuracy of classifications (Woolley 1995). Advise the pilot to avoid stressing animals or running them into fences and other barriers. Dictate data into a small tape recorder. A mechanical counter and a data summary sheet also work well, however these are less efficient when large groups or high densities of pronghorn are encountered. Note essential details such as hunt area, herd unit, time, date, pilot and weather. If locations of pronghorn groups are needed, obtain the coordinates with a GPS receiver. Transcribe pronghorn locations onto Wildlife Observation System (WOS) data forms (Appendix I) after each flight.

c. Analysis of Data – Convert pre-season herd classifications into ratios of fawns, yearling bucks, and adult bucks per 100 does. These data are used to estimate productivity (Gilbert 1978), survival of fawns through summer, and pre-season buck:doe ratios. Ratios of yearling bucks can be highly variable and should be interpreted with caution (Woolley and Lindzey 1997). Ratios derived from aerial classifications are considered accurate provided a statistically valid sampling plan was followed (i.e., the probability of classifying each animal in the population is similar) and provided each animal is classified independently and correctly. However, distinguishing age classes accurately, especially yearling and adult bucks, can be difficult from the air.

The adequate sample size is based on the number of pronghorn in a population and the anticipated proportions of bucks and fawns (Czaplewski et al. 1983). The goal is to attain a 90% confidence interval (C.I.) of $\pm$ 5 animals per 100 does. The resulting buck:doe ratio may be overly precise because sample size is based on the larger ratio in the population, typically the fawn:doe ratio, and this results in a sample larger than necessary to achieve the target C.I. for the buck:doe ratio. Sex and age ratios are useful to monitor general population trends, however, these data should be interpreted in conjunction with other population data to assess population dynamics.

d. Disposition of Data – Record results of aerial classifications on Wildlife Observation Forms. At the end of the classification period, forward data to the biologist responsible for the herd. The biologist will summarize sex and age ratios observed within each herd, then incorporate the information into the Job Completion Reports (JCR) for the applicable herd units.

2. Ground Classifications

a. Rationale – Ground surveys often fail to meet sampling assumptions due in part, to the non-random distribution of road systems and topographic variation. However, reliable composition data can be obtained from ground surveys in areas with adequate vehicular access (Bowden et al. 1984, Woolley and Lindzey 1997). Ground classifications require about 4 times longer than surveys conducted from fixed-wing aircraft, but cost less (Woolley and Lindzey 1997).

b. Application – Plan ground survey routes to intersect all occupied habitats within a herd unit. Sample the entire herd unit. It is not sufficient to sample only high-density locations such as agricultural fields and areas surrounding water sources. Timing is the same as for aerial surveys – the month of August. Mark survey routes on BLM 1:100,000 maps and strictly follow the same routes each year. The same observer should conduct the classifications when possible. Drive at a moderate speed (<25 mph) and stop at regular intervals to observe using binoculars and spotting scopes. Classify every animal in each group of pronghorn encountered. However, classify only from distances at which all age and sex classes can be reliably determined, normally less than 0.5 mile. Bucks are identified more easily at long distances, and this can lead to biased results. Use a GPS receiver or map to determine locations of pronghorn groups. Plot location data using GIS software to compare distributions among years.

c. Analysis of Data – Refer to Section II.A.1.c (Aerial Classifications).

d. Disposition of Data – Refer to Section II.A.1.d (Aerial Classifications).

B. Post-season Classifications – We do not attempt to classify pronghorn after hunting seasons in Wyoming. At that time of year, pronghorn congregate into much larger groups, which are much more difficult to classify. Fawns are also larger and more difficult to distinguish from adults, and bucks may have dropped horn sheaths, making distinction of sex more difficult.

C. Aerial Trend Counts – Trend counts were historically conducted from fixed-wing aircraft to estimate pronghorn abundance throughout Wyoming (Wyoming Game & Fish Department 1982). These counts were generally done between 1 May and 10 June when pronghorn are most visible against green vegetation. Pronghorn populations are currently estimated based on line-transect sampling (Section II.D). The Department no longer recommends trend counts, although they are still conducted within some smaller herds and interstate populations. We do not advocate trend counts during winter because patchy background conditions can substantially reduce observers' abilities to detect animals. In addition, large groups that congregate in winter are difficult to count.

1. Rationale – Aerial trend counts can provide indices to monitor changes in populations, provided the counts are conducted under similar conditions and similar proportions of animals are encountered in each survey. To accomplish this, consistent procedures must be followed. Aerial trend counts have also been used to align modeled simulations of population trends.

2. Application – Conduct aerial trend counts only in spring (mid-April through mid-June) when vegetation is green. The following procedures are used:
   - Consult records to determine if specific survey instructions, including dates and coverage areas, have been established.
   - If count blocks were defined previously, these should be retained for continuity of data. Count blocks are herd sub regions delimited with clearly identifiable boundaries, such as roads or power lines. Locations where pronghorn congregate, streams for example, are generally not good boundaries unless they are barriers to movement. Each count block should be less than 100 mi^2 so it can be surveyed in one flight. Essentially no animal movement into adjacent count blocks should take place during the survey. Count blocks are designated by Roman numerals.

- The survey crew is usually the pilot and one observer. The observer normally counts only on the side of the plane away from the sun. If 2 observers attempt to count, one is usually facing into the sun, resulting in less reliable counts.
- The pilot must fly the aircraft safely along straight transects at prescribed heights and intervals. The pilot should have previous experience flying low-level wildlife surveys near rugged terrain. Only the observer should count pronghorn. However, the pilot may note pronghorn the observer might not detect directly beneath the plane.
- Aircraft used for trend counts must be light, maneuverable high-winged planes that can be flown safely at low airspeeds ($\leq$ 80 mph = 70 knots). Helicopters are not recommended because they tend to displace pronghorn and rental costs are high. Suitable aircraft include the Bellanca Scout, American Explorer, Piper Supercub, Maule M7, and Cessna 180 and 185. Ideally, a GPS (Global Positioning System) should be on board, enabling the crew to precisely navigate transects. Radar altimeters are desirable to maintain prescribed heights above ground level (AGL).
- The airplane should be flown along parallel transects approximately 1/2 mile apart throughout each count block.
- The observer gauges the outer boundary of the survey strip by sighting across colored marks or streamers fixed to the wing struts. The inner boundary of the survey strip is the flight line vertically beneath the plane. An imaginary triangle is formed by the vertical line between the plane and ground, a horizontal line representing the survey strip width, and the observer's sight line to the outer boundary of the survey strip (Fig. 4). Calibrate the position of wing markers by projecting an identically shaped triangle while the plane is on the ground. Determining where the sight line (hypotenuse) of the miniature triangle crosses the wing strut. Use the following procedure: On the ground or hanger floor, prop up the tail of the plane to its normal flying attitude. Seat the observer in a position and posture normally used for counting pronghorn. Measure the vertical distance from the observer's eye level to the pavement. Calibrate the horizontal distance by multiplying the vertical distance by the ratio of the prescribed survey strip width (e.g., 2,643 ft) to the prescribed height above ground (e.g., 300-400f ft). Measure the horizontal distance from the point on the pavement directly beneath the observer's eye position, perpendicularly to the plane's direction. Using a white chalk or tapeline, mark the pavement at the measured distance, parallel to the plane's direction. While the observer sights across the strut to the line on the pavement, an assistant determines the proper placement of the strut marker. Repeat this procedure for the opposite side of the plane, so surveys can be conducted from either side. This procedure is very sensitive to measurement errors. For the wing strut calibration to accurately delineate transect width, the plane must be flown at the proper height AGL and the observer's eye must be consistently in the same position. Historically, strut markers were not routinely used to define the survey strips during trend counts.
- Count all pronghorn adjacent to the plane and within the outer strut mark. If struts have not been marked, the observer must estimate the outer boundary of

the strip. Surveys are generally flown along north/south transects and the observer counts from the side of the plane facing away from the sun. In some circumstances, an east-west orientation may be necessary, but this can affect accuracy. Fly each transect sequentially farther from the sun to provide the best visibility.

- Carry a map or written coordinates of transects on board. In many cases, transects can be defined by longitudinal headings.
- Conduct trend counts on clear days with unlimited visibility. Complete counts while the sun is between 20° and 60° above the horizon. Begin morning surveys about 30 minutes after sunrise and complete afternoon counts at least 30 minutes before sunset. Plan each flight to provide at least two hours of survey time during suitable light and weather. In rougher terrain, morning shadows can conceal pronghorn so surveys should begin somewhat later.
- Brief the pilot about the survey layout, the pilot's responsibilities, and potential problem areas (e.g., restricted airspace, bomber training areas) or hazards (e.g., power lines, radio towers, areas prone to downdrafts).
- The observer and pilot should be familiar with the Department's flight following procedures (WY. Game and Fish Aircraft Operation Procedures and Safety Policy, 4/27/99).
- Record the following information at the start of each trend count: (1) date, (2) hunt area, (3) herd name, (4) count block number, (5) observer's name, (6) pilot's name, (7) aircraft type, (8) take-off time, and (9) time the survey begins. Also, note weather and habitat conditions (e.g. green vegetation, drought) for comparison with conditions under which previous surveys were flown.
- Record all data on micro-cassette tapes. Tapes are a valuable aid for recording data, but take precautions to minimize equipment failures. Use fresh tapes and batteries and carry extras. Know how to proficiently operate the recorder. While flying out to the count block, check to make sure the recorder is working properly and the tape is understandable. If a recorder and back-up fail, manually record data on a paper form. However, we discourage writing or plotting data by hand, because this distracts the observer from counting.
- Over relatively flat terrain, fly surveys at an average height of 300 ft. AGL. In rougher terrain, increase survey heights (e.g., $\geq$ 400 ft.) for safety and to see over topography. When survey heights are changed, the survey strip-width must be recalculated.
- Fly surveys at a ground speed of not more than 100 mph (90 knots). If strong tailwinds prevent the aircraft from flying at a sufficiently slow speed, suspend the survey. Also suspend the survey when strong crosswinds cause the plane to crab (twist sideways) as it flies along the transect.
- Morning flights are preferable because temperatures are usually comfortable, winds are lighter, and clouds and storms are less prevalent. Late afternoon flights are acceptable when temperatures are less than 85°F, winds are light and little cloud cover has developed.
- Record each transect number, direction of travel, and start and end times.

- Count each cluster (group) of pronghorn within the survey strip. If distribution information is being collected, record the location using a GPS. Record each GPS waypoint with corresponding count data.
- Have the pilot circle larger clusters until an accurate count is obtained.
- When clusters of more than 50 pronghorn are encountered, it can be helpful to photograph them and count animals from prints or slides. Surveys in which photographic methods are used may not be comparable to other surveys done without the aid of photography.
- Record the time you complete each count block (or suspend a survey). Also record the time you land so ferry time can be estimated. These records enable managers to plan and budget future surveys.

3. Analysis of data – Transcribe data from the tape as soon as practical. All observations should be recorded on the Department's Wildlife Observation Forms. Talley the number of pronghorn observed within each count block. Carefully review notes about survey conditions and consult them when interpreting data. Limitations of trend counts include: (1) The proportion of the population not counted is unknown, (2) a measure of reliability is not available, and (3) detection rates may be inconsistent despite attention given to standardizing conditions and procedures.
   - The following procedure is used to estimate population size from trend count data:
     (a) If quantifiable biases can be identified, measure these as time and resources permit, and adjust the final estimate accordingly.
     (b) Estimate each observer's efficiency (usually between 0.4 and 0.8) at detecting pronghorn within each count block. Unfortunately, this is highly subjective.
     (c) Divide the number of pronghorn counted by the efficiency coefficient assumed for each count block.
     (d) Sum the adjusted count block totals to obtain a population estimate. In the past, when trend counts were the primary method used to survey pronghorn, most populations were underestimated because coverage was incomplete or observer efficiency was overestimated.
   - Comparisons of population trends among years are valid only if counts were done during the same seasons and under similar conditions.
   - Always evaluate trend counts in conjunction with other corroborating information such as hunter success and effort, weather and habitat data, and survey conditions.

4. Disposition of data – In cases where trend data are collected, the information is used to update population simulation models and to monitor abundance trends as a basis for regulating harvest. Results should be summarized, distributed to appropriate field personnel, and entered into the Department's Job Completion Report database. Trend data are also interpreted and discussed in Big Game Herd Unit Annual Reports. Distribution information from trend surveys can be plotted on maps,

entered into the Wildlife Observation System, or stored in a GIS database for subsequent analysis.

D. Line-transect Surveys – The principal technique used by the Department to estimate pronghorn populations is density sampling along aerial transects. Called "line-transect sampling," this adaptation of "distance sampling" (Buckland et al. 1993) was developed in Wyoming to estimate pronghorn populations (Johnson and Lindzey 1990; Johnson et al. 1991; Guenzel 1986, 1997). Line-transect sampling has several features in common with aerial trend counts, however it also differs in some fundamental ways (i.e., it's based on a sampling approach and corrects visibility biases). Persons conducting line-transect surveys must obtain specific training prior to implementing the surveys**.** Such training is beyond the scope of this handbook. Consult Appendix II, "Estimating Pronghorn Abundance Using Aerial Line-transect Sampling" (Guenzel 1997). Buckland et al. (1993) provide additional background regarding line-transect sampling.

1. Rationale – Less than 100% of animals are detected during aerial surveys. Two main factors affect detection rates: 1) distance from the observer; and 2) size of groups (clusters). Pronghorn nearer the observer and those in larger groups are easier to detect. Other factors such as light conditions and terrain may further compound visibility bias. Line-transect sampling offers several advantages compared to traditional aerial surveys for estimating pronghorn populations (Guenzel 1994):
   - Visibility adjustments are calculated to account for undetected animals in outer survey bands.
   - confidence intervals are calculated to indicate precision of population. This information is considered when apparent population changes are evaluated.
   - Line-transects are generally less costly and time consuming because the technique is based on sampling rather than total coverage. The approach enables managers to monitor herds more frequently to detect responses to harvest strategies and climatic events such as droughts or severe winter.

   Requirements and limitations of the technique include:
   - Aircraft must be specially equipped. Currently 1 air charter company, Sky Aviation in Worland, WY has flown line-transect surveys with the Department's new system. However, the Department will provide the necessary equipment and training to other air charter services on the Department's contract list.
   - Quality control procedures must be rigorously followed to effectively apply the technique. If sample sizes are low, surveys are poorly designed, or personnel deviate from survey protocols, resulting estimates may be unreliable.
   - Line-transect surveys may not work in all situations.
   - Sampling assumptions for conducting line-transect surveys must be rigorously met. Consult Buckland et al. (1993) for recommendations to deal with problem situations.

2. <u>Application</u> – Biologists should thoroughly review Guenzel (1997) before attempting to design or conduct an aerial line-transect survey. (Refer to Appendix II).

   A fundamental assumption of line-transect sampling is that all animals within the closest strip or band adjoining the flight path are seen. A computer program adjusts counts in outlying strips to correct decreasing rates of detection. Observers are required to carefully watch the line and region near the plane, count pronghorn accurately, and assign locations of observations within correct distance bands. Basic assumptions are: 1) All pronghorn on the line are seen; 2) Pronghorn do not move before they are detected; and 3) Pronghorn locations are placed in the correct distance band. Johnson et al. (1991) demonstrated these assumptions can be reasonably met during aerial line-transect surveys of pronghorn.

   The survey must be designed to maximize the probability all animals within the closest distance band along the transect line are seen. The area directly beneath the plane and approximately 65 m either side of the flight line is the "blind area." Accordingly, the transect line is offset from directly beneath the plane. The airplane is flown at a nominal height of 300 ft. (91.4 m) above ground level (AGL). This elevation is low enough to afford good detection rates, yet is sufficiently high for safety and to avoid displacing animals. Animals that move tend to run parallel to the flight line (Johnson et al. 1991). Transects should be sufficiently spaced to avoid displacing animals into an adjoining transect corridor. Observers record distance intervals or bands (e.g. 25-50 m) in which pronghorn are located rather than estimate actual distances from the line. Visually gauging specific distances or angles from an airplane usually produces inaccurate estimates.

   Pronghorn locations are assigned to parallel distance bands when the plane is perpendicular to the location where the pronghorn were initially seen. The observer projects distance bands onto the ground by sighting across calibrated marks on wing struts or windows of suitable, high-winged aircraft. At the prescribed height AGL, markers define the transect line and perpendicular distance bands to which observed animals are assigned. The placement of strut markers (using dowels) is calculated based on the plane's strut configuration and a fixed eye position. Two strips of tape are placed on the window to assure eye alignment is consistently correct. Before each observation is assigned to a distance interval, the observer must align the window marks with strut markers defining the inner (first) distance band. By design, distance bands are unequal – bands near the transect line beneath the plane are narrower and bands farther out are wider. The number of distance bands is limited so observers do not attempt to survey too much area, thereby missing animals in the closest band. Having fewer bands is also less confusing for observers attempting to assign animals to the correct band. A digital radar altimeter is essential to maintain flight altitude at the prescribed height AGL. In all surveys, circumstances will require some deviation from the planned height AGL. An onboard computer is linked to a GPS to instantaneously record starting and ending points of each transect, locations of observations, and in some cases, flight paths. At the location each observation is recorded, the radar altimeter reading is stored in the computer to later correct observed distances based on the actual height AGL. The stored beginning and end points are used to estimate the actual linear distances surveyed. Transect lines must be laid out randomly with respect to the distribution of pronghorn and should not be manipulated to coincide with any natural pattern of clusters.

Both pilots and observers must be trained to conduct line-transect surveys and must practice beforehand. Outfitting aircraft for line-transect surveys is a complex, technical undertaking that must be done by experienced personnel. Only approved, properly equipped flight services that have the requisite training should be contracted to do line-transect surveys.

3. Analysis of data – A sophisticated software package, "Distance," is available to analyze line-transect data. Analysis procedures are described in Guenzel (1997). This publication references an MS-DOS version of "Distance," however most users will find the Windows-based programs easier to use. We recommend the Windows 95 release 3.5 or later version for analyzing line-transect data. An overview of steps in the analysis follows:
    - Review the flight reports and summary data. Survey data are generally provided in a Microsoft Excel worksheet or tabular format. Check the flight report for obvious errors or problems such as data that appear out of bounds, unusually large cluster sizes, or survey heights that deviate substantially from 300 feet AGL. Also consider comments or notes recorded during the survey, and conditions that may affect the data.
    - With some manipulation, the Excel worksheet can be reformatted, saved as a tab-delineated text file, and imported into "Distance" 3.5. Adjust cluster distances (distance band midpoints) from the flight line based upon actual height AGL recorded for each observation. Calculate average band distances based upon the recorded survey heights AGL.
    - Import the data file into the "Distance" program and run the analyses.
    - Select optimal analysis from the "Distance" program.
    - Consider survey conditions and data quality when interpreting results.

4. Disposition of data
    - Line-transect surveys are generally flown in late spring; therefore, population estimates derived from these surveys represent end-of-biological-year populations. Results are incorporated into the annual Job Completion Report for the applicable herd unit.
    - Population estimates derived from line-transect surveys are used to align population simulation models.

E. Quadrat Sampling – Quadrat sampling is another aerial survey technique available to estimate pronghorn abundance. As of the 2007 revision to the Handbook of Biological

Techniques, quadrat sampling was not widely used in Wyoming due largely to cost. Helicopters generally are used for quadrat sampling. We do not recommend fixed-wing aircraft for these types of surveys.

Quadrats are sample units distributed within the herd unit, based upon a stratified sampling design. Each quadrat is censused to estimate density. Depending on sampling design, the average densities of pronghorn within sampling strata are extrapolated to develop a population estimate. Quadrat surveys have been used in Colorado and tested in Wyoming (Pojar et al., 1995, Pojar and Guenzel, 1999) to estimate pronghorn abundance. Pojar et al. (1995) concluded quadrat surveys were the least biased technique among those they tested. Another advantage is, pronghorn can be classified as well as counted from a helicopter, and herd composition can be estimated from classifications. However, quadrat surveys cost substantially more than line-transect surveys to achieve the same precision (Pojar and Guenzel, 1999). Ferry time between sample units is generally greater for quadrat surveys than for line-transect surveys and rental costs of helicopters are higher than costs of fixed-wing aircraft.

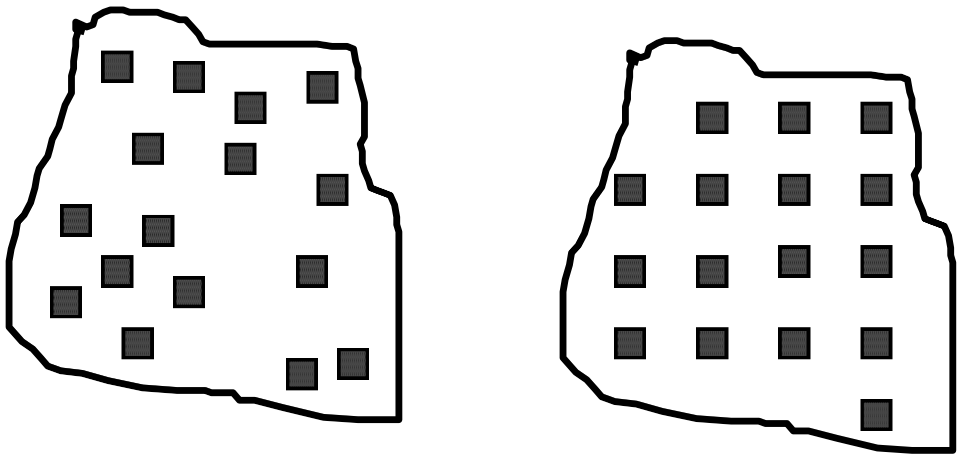
1. Rationale – The fundamental concept underlying quadrat surveys is, all pronghorn can be observed and counted within comparatively small sample units that are searched intensively by helicopter. Because helicopter rental costs are high and availability is limited in Wyoming, quadrat surveys may be most useful for estimating correction factors to improve line-transect estimates (Pojar and Guenzel, 1999). Quadrat surveys may be appropriate in areas that are less suitable for line-transect sampling and when a need for more accurate population estimates justifies the additional expense.

2. Application – Pojar et al. (1995) describe procedures generally followed in designing and conducting quadrat surveys. These procedures have been used in short grass prairie and sagebrush steppe habitats. However quadrat surveys are not a standard census technique in Wyoming.

    a. Planning the Survey
        - In general, sample units are symmetric squares. Other shapes, including rectangular plots, increase sample error (Thompson et al., 1998). Most quadrats are one square mile (Pojar et al., 1995, Pojar and Guenzel, 1999), but smaller units (e.g. 1 km^2) might also be suitable. Quadrats should not exceed an area that can be thoroughly covered. Otherwise, pronghorn may be undercounted. Avoid double-counting animals that flush into other portions of the quadrat. It becomes more difficult to scan longer distances adequately in variable terrain.
        - Estimate an adequate sample size (number of quadrats) and determine if a stratified survey is needed. References cited in the preceding paragraph contain guidance for determining sample size and design. See Cochran (1977) or Zar (1984) for additional background on sampling theory. If a

quadrat survey is used to correct a line-transect estimate, both surveys should have the same basic design (i.e., stratified or non-stratified).

- Select a quadrat configuration (Fig. 3). Random quadrats are most common (e.g., Pojar et al. 1995, Pojar and Guenzel 1999).



A. Random **B. Systematic**

Fig. 3 Alternative Sampling designs for quadrat surveys.

- Determine the UTM coordinates of quadrat corners. Store quadrat coordinates as GPS waypoints prior to the survey. Also carry a written list of coordinates and a topographic map with quadrats plotted.
- Quadrat surveys are normally conducted between late spring (mid-May) and late summer (early September). If quadrat estimates will be used to adjust line-transect estimates, the two surveys must be flown about the same time. However, quadrat surveys during which pronghorn are classified must be flown in late summer to estimate pre-season herd composition.

b. <u>Conducting the Survey</u>

- Normally the survey crew includes the pilot, an observer, and a navigator. Depending on the type of helicopter, two observers may be used in addition to the navigator.
- The observer's sole responsibility is to count pronghorn within each quadrat. Record observations on a cassette tape so pronghorn can be counted continuously.
- The navigator's responsibility is to guide the pilot to the first corner of each quadrat and assure the aircraft remains within quadrat boundaries as the

count is conducted. The navigator must have a proficient skill level using a GPS receiver.

- The pilot should concentrate on flying at the prescribed height and headings given by the navigator. It is best if the pilot does not divert his attention to search for pronghorn.
- Most quadrat surveys are flown between 50 and 100 feet above the ground.
- Survey the ground at a speed of 40-50 mph. Observers must fly slowly enough to navigate within the quadrat, detect pronghorn, and keep tract of pronghorn that are flushed.
- To minimize duplicate counting, note sizes, composition and locations of clusters as they are encountered within the quadrat**.**
- Begin at the first corner of each quadrat, fly the perimeter, then make one or more passes through the interior. To effectively search larger quadrats or rougher terrain, it may be helpful to fly concentric "orbits" inward (Fig. 4).

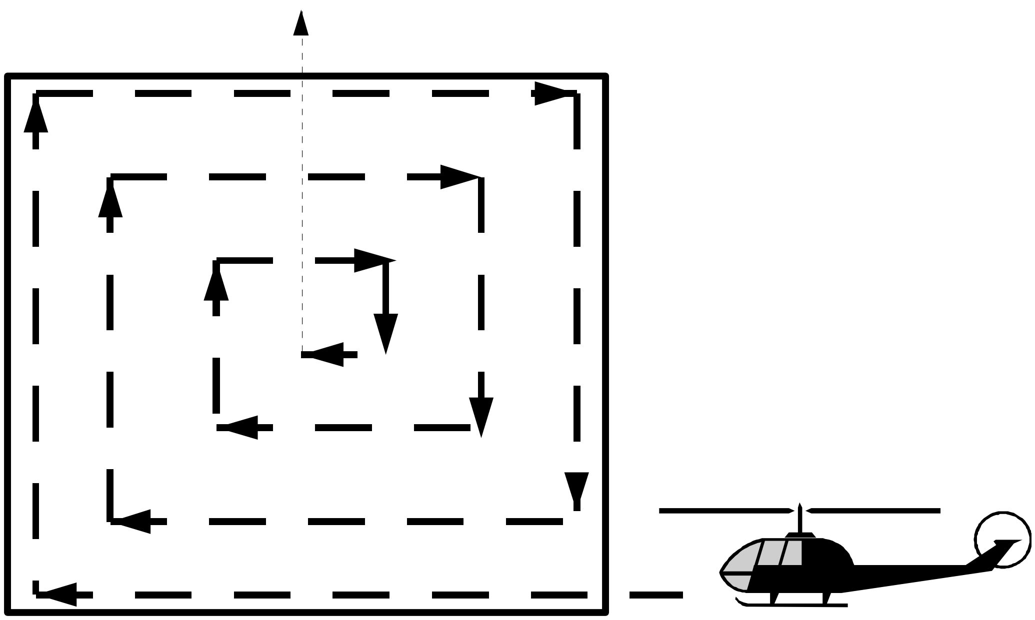


Fig. 4. Concentric search pattern used for quadrat surveys.

3. Analysis of data – Density estimation is straightforward when surveys are not stratified and quadrats are the same size and shape. The density estimate is simply the number of animals counted divided by the total area surveyed. Sample variances, standard errors, and confidence intervals can also be calculated. Version 3.5 of the "Distance" program can correct line-transect estimates by entering calibrating data from other squares, such as quadrat surveys. Distance then adjusts line-transect estimates, based upon this

information. Generally, some double sampling can be useful to routinely improve line-transect estimates.

4. Disposition of data – Data obtained from quadrat surveys are used for the same purposes as data from line-transect surveys. Results should be incorporated and discussed in Annual Big Game Herd Unit Reports. Estimates derived from quadrat surveys can be used to align population simulation models, in addition to calibrating line-transect estimates.

III. HARVEST DATA

A. Harvest Survey

1. Rationale – Managers require estimates of pronghorn harvests to evaluate results of harvest strategies and to adjust license quotas needed to obtain desired harvests. Harvest statistics are incorporated into population models and are also of some limited use for tracking population trends.

2. Application – Pronghorn harvest data are acquired from an annual survey mailed to a stratified sample of license holders. The following parameters are estimated: total harvest, age (adult/fawn) and sex composition of the harvest, hunter success, effort (avg. days expended per animal harvested), and total days of recreation. Harvest parameters are estimated and summarized with respect to each license type, hunt area, herd unit, and statewide. Refer to Appendix III for additional discussion of the Department's harvest survey procedures.

3. Analysis of Data – Harvest data are reviewed each year during the Department's annual season setting process, and are comprehensively evaluated in the JCRs compiled by each region. Changes in hunter statistics such as effort and success are also considered to detect and confirm population trends.

4. Disposition of Data – Statewide estimates of harvest and hunter activity are summarized in the Annual Report of Big Game Harvest published by the Wyoming Game & Fish Department. More detailed summaries of data from hunt areas and herd units are maintained in the annual Job Completion Reports. Herd unit files and databases housed at the headquarters office in Cheyenne serve as repositories for all herd unit information.

B. Age Determination – Information about age structure and age-specific harvest rates can help managers understand the status of a population and predict how it may respond to specific management actions. Detailed age data are obtained from harvested animals. When substantial harvest of females takes place, the age structure of harvested females is presumed to represent the age structure of the female population segment that is older than fawns. However, ages of harvested bucks do not represent the age structure of the male segment because hunters tend to select older bucks.

1. <u>Tooth Replacement</u>

   a. <u>Rationale</u> – Examination of tooth replacement is a quick and easy field technique to determine the following ages of harvested pronghorn: 0.3 (fawns), 1.3, 2.3, 3.3 years, and older.

   b. <u>Application</u> – Hoover et al. (1959) and Dow and Wright (1962) described aging techniques based upon tooth eruption. Pronghorn have 3 sets of incisors and 1 set of incisor-like (incisiform) canines on the lower jaw. In juveniles (age 4-6 months), all incisors and incisiforms are deciduous; they are much narrower and smaller than permanent, adult incisors. Generally, one set of deciduous incisors is replaced annually, beginning with the central set (called the first incisors). Aging is accomplished by counting the number of larger, permanent incisors and incisiforms present on one side (one-half) of the lower jaw. Juveniles are readily identified by their smaller body size and short rostrum (muzzle). In yearling (16-18 months) pronghorn, the central set of permanent incisors is usually present. These are much larger and broader than adjoining, deciduous teeth. If the permanent incisors have not erupted, the central set of deciduous incisors will appear worn, widely spaced, and may be quite loose. The second set of permanent incisors is present in 2-year old (28-30 months) pronghorn, the third set in 3-year old (40-42 months) pronghorn, and the incisiform canines (fourth set) are generally replaced in 4-year old (52+ months) pronghorn. In some instances, incisiform canines can begin erupting in a 3-year old animal. Because of this, some managers only age pronghorn to 3.3 years. Always test the innermost deciduous teeth for looseness. A loose or missing deciduous tooth indicates the permanent tooth is erupting and the animal should be aged as though the permanent tooth is in place.

      Characteristics of molars and premolars can also be used to age pronghorn. Yearling and older pronghorn have 6 "cheek teeth" visible in the lower jaw. These include 3 pre-molars numbered 2-4 and 3 molars numbered 1-3 front (distal) to back (proximal). The fourth premolar of yearling pronghorn is deciduous and has 3 cusps. The third molar (at the rear of the gum) may still be erupting. In 2-year old pronghorn, the fourth premolar is permanent and has 2 cusps. Cusps on the first molar are sharp. Infundibula (conical recesses) are distinct on all molars, but are becoming worn on the first molar. In 3-year old pronghorn, infundibula are visible on all molars, but only form small pits on the first molar. Infundibula are no longer visible on the first molar of pronghorn when they reach 4 years and older.

   c. <u>Analysis of Data</u>. Information about the age structure of harvested animals is used for the following purposes:
      i. align the age structure of harvests simulated by population models
      ii. assess the effects of various harvest strategies
      iii. estimate age-specific, natural mortality rates within the female segment

iv. assess hunter selectivity for specific age classes, and
v. assess the availability of specific age classes for harvest

d. Disposition of Data – All age data are summarized in the annual JCR for each herd.

2. Tooth Cross-sectioning – Ages of big game animals can be accurately determined based on the number of annular cementum deposits in tooth cross-sections. However, this laboratory technique is expensive and time consuming.

   a. Rationale – Tooth cross-sectioning is recommended when detailed age data are required to determine population age structure and numbers of age classes for modeling purposes.

   b. Application - The first (central) incisors are extracted with roots intact. These are placed inside a tooth envelope on which the following information is recorded: species, sex, date of harvest, hunt area, drainage, and hunter's name and address. Tooth envelopes are forwarded to the Department's lab in Laramie. Aging is accomplished by staining and counting cementum annuli in a cross-section of the tooth root. Refer to Appendix V for a complete description of this technique.

   c. Analysis of Data – Refer to Section III.B.1.c. (tooth replacement)

   d. Disposition of Data – Refer to Section III.B.1.d. (tooth replacement)

C. Field Checks and Check Stations

1. Rationale – Large numbers of harvested animals can be examined efficiently at check stations situated on major roads. Various management data are obtained from hunters and harvested animals.

2. Application – Check stations must be manned, signed, and identified by lighting specified in Wyoming Statute 23-3-308, Chapter 2, Section 9 of the Wyoming Game and Fish Commission Regulations, and the Wildlife Division's "Guidelines for Establishment and Operation of Wildlife Check Stations" (Attachment 1). Always record the following information when each harvested animal is checked: species, sex, age, and hunt area. Depending management needs, additional information such as fat deposition indices, carcass weights, general condition, tissue samples for disease monitoring, and surveys of hunter opinions may be collected. Large samples of sex and age data can also be collected at commercial facilities that process wild game meat.

3. Analysis of Data – Refer to Sections III.A.3 and III.B.1.c. (harvest survey; tooth replacement).

4. Disposition of Data – Refer to Section III.B.1.d. (tooth replacement).

IV. MORTALITY ESTIMATION (non-hunting) – Records of non-hunting mortality are useful documentation to identify sources of significant mortality and to develop corrective actions. Mortality records are also used to assess impacts of development and adjust population models. Non-hunting mortality can result from severe weather, vehicle or train collisions, predation, illegal kills, crippling, starvation, disease, fence entrapment, entanglement, lightning, and poisoning. Severe weather patterns, such as the winters of 1978-79, 1983-84 and 1992-93 and droughts of 1988 and 1994 often lead to significant population declines. Other causes of mortality such as vehicle collisions, disease outbreaks and predation tend to have more localized effects. Several methods are used to document and evaluate non-hunting mortality in Wyoming.

A. Incidental Observations

1. Rationale – Various data, including age and sex composition, are obtained by examining dead pronghorn during and immediately following mortality events. A database of mortality records, maintained over a period of years, can help isolate and document problems such as lethal fences or highway segments. Observations of mortalities can be recorded throughout the year, but are usually more insightful during seasonal migrations. Locations of frequent and recurring mortalities should be depicted on a map that is retained in a permanent file. Such observations should also be reported in the annual JCR. If mortality is chronic, significant and localized, the biologist should investigate causes and corrective measures.

2. Application – When dead pronghorn are encountered, record age, sex, location, and cause of death. If the cause of death is not apparent, arrange to transport the carcass (provided it is in good condition) to the Wildlife Veterinary Laboratory in Laramie for post-mortem examination. Notify the laboratory by telephone so personnel can prepare. Complete a Field History and Necropsy Form to accompany the carcass when it is delivered.

3. Analysis of Data – Mortality records can be sorted and tabulated based on geographic location, season, age, sex, and cause. This information is useful to document and analyze impacts of developments and land uses. It can also assist in identifying and correcting sources of significant wildlife mortality.

4. Disposition of Data – All mortality data, including dates the animals were found, should be recorded on Wildlife Observation Forms. Each biologist is responsible for accuracy of the information collected in his district. The Wildlife Management Coordinator assures the data are entered into the Wildlife Observation System. Non-hunting mortalities should also be summarized and evaluated in the Job Completion Reports.

B. Mortality Transects

1. Rationale – Mortality transects are a systematic survey method used to estimate mortality resulting from severe winters, droughts, disease outbreaks and other causes.

2. Application – Using a 1:24,000 topographic map or aerial photographs, delineate the area in which mortalities have taken place or are suspected. Randomly superimpose a grid of transects onto the map. Transect density depends on sampling intensity and size of the area. Establish enough transects to achieve the desired confidence in the results. If sub-sampling is needed, randomly select transect segments for this purpose. Assign numbers to identify the beginning and end points of permanent transects. Use a GPS unit to locate transects and to navigate along them. Coordinates of transect endpoints should also be listed in the JCR. Transects can be followed on foot or horseback. The observer should record his name, the transect identification number(s), light conditions and ground cover. Determine coordinates of all dead pronghorn encountered within a specified distance from transects (100-500 ft. depending on topography) and record these on a Wildlife Observation Form. Also record the age and sex of each pronghorn. To estimate over-winter mortality, conduct mortality sampling soon after the ground is snow-free, but late enough in the season to assure the possibility of additional winter losses is minimal. Snow should also be melted from draws and other locations where carcasses could be buried under drifts. Conduct sampling on days with good light conditions – clear skies or high, thin clouds. Observers will require the following equipment and materials: map or aerial photo of transects, binoculars, Wildlife Observation Forms, a GPS unit, and a compass (optional). Information from winter mortality transects is recorded on the data form in Attachment 2.

3. Analysis of Data – The density of dead pronghorn is estimated based on the area sampled. If the sample is representative, estimates can be extrapolated to a larger area. Some pronghorn also die during egress from winter ranges. Therefore, to estimate total mortality, it would be necessary to sample spring/fall ranges as well. However, pronghorn dispersal patterns in most cases preclude effective sampling of spring transition habitats.

4. Disposition of Data – The regional biologist compiles results of mortality transect surveys and maintains this information in his files. Findings are also summarized in the annual Job Completion Reports.

C. Weather Severity Indices

1. Rationale – Severe weather patterns can lead to significant mortality and suppressed reproduction and recruitment in populations of pronghorn and other big game (Bartmann 1984, Martinka 1967, Oakley and Riddle 1974, Reeve and Lindsay 1991). The severity of this impact depends on several factors including season,

frequency and duration of weather events, temperature, wind speed, precipitation, and general condition of the animals. By evaluating weather severity data, herd composition (fawn:doe and yearling buck:doe ratios), and condition of animals, managers can, with some consistency, detect and predict elevated mortality rates. This information is used to adjust population estimates and recommend more effective management actions.

2. Application – Climatologic measurements (e.g., temperature, wind speed, precipitation) are recorded at weather stations throughout Wyoming and compiled by the National Weather Service and the Water Resources Center (WRC) at the University of Wyoming. Biologists have developed various criteria and indices to monitor departures from normal weather patterns that can impact big game populations. This information is used to adjust mortality estimates.

2. Analysis of Data – Weather indices are based on data from 4 chronological periods: early summer (SI_1, April-June), late summer (SI_2, July-September), early winter (WI_2, October-December) and late winter (WI_1, January-March). Severity indices are calculated by dividing the current weather index by the long-term (30 year) average weather index for each period, at each station. The following formula is used to calculate winter severity indices during the 2 winter periods:

$$WI = (TPPT/TMAX) \times 100$$

Where TPPT is total precipitation, and TMAX is the mean maximum daily temperature. Summer indices are based on the following formula:

$$SI = TMIN/TPPT$$

Where TMIN is the mean minimum daily temperature.

Reeve and Lindzey (1991), demonstrated fawn:doe ratios of mule deer were inversely correlated with the winter severity indices in south-central Wyoming. Christiansen (1991) modified the winter index based on how much the early summer (SI_1) index deviated from the long-term (30 year) average. His analysis resulted in the following mortality severity index (MSI) adjustments used in the POP-II model:

If the multi-station average SI_1 was 50-99% above the 30 year average,

$$MSI = \frac{WI1 + WI2}{2} + 0.1$$

If the multi-station average SI_1 was $\geq$100% above the 30 year average,

$$MSI = \frac{WI1 + WI2}{2} + 0.2$$

If the multi-station average SI_1 was $\geq$50% below the 30 year average,

$$MSI = \frac{WI1 + WI2}{2} - 0.1$$

4. Disposition of Data – Weather severity data should be compiled and interpreted annually in Job Completion Reports. Each year, the population model should be updated by incorporating the current MSI value to account for realized losses over the winter period.

V. DISTRIBUTION AND MOVEMENT – Pronghorn distribution and movement data are used to identify seasonal ranges, migration corridors, crucial habitats, and herd unit boundaries. Seasonal habitats and boundaries are delineated on herd unit maps maintained in the Cheyenne Headquarters Office. This documentation is essential to support credible analyses of impacts anticipated from development projects and to justify mitigation recommendations. The information is also provided to other resource agencies for use in planning. In addition, the Department may consider animal distributions when setting hunting seasons. Herd unit maps should be reviewed every five years and updated as new information warrants. Refer to Appendix VI for procedures used to update seasonal range maps, keys to range classifications and standard definitions. Distribution and movement data are obtained from observations of marked animals, aerial surveys, and incidental observations.

A. Marked Animals

1. Rational – Detailed information about pronghorn distribution and movements can be obtained from field studies in which animals are fitted with visible markers, radio telemetry, or satellite telemetry transmitters.

2. Application – Depending on objectives of the study, locations of marked animals are recorded during systematic surveys, or incidentally during other field activities. The information is accumulated in geographic databases.

3. Analysis of Data – Data are compiled and interpreted to improve knowledge about distribution, seasonal movements, and herd interchange. The data are interpreted considering time of year, and the influence of geographic features and weather patterns such as snow cover and storm events.

4. Disposition of Data – Observation records and other relevant information are compiled in a regional database and entered in the Wildlife Observation System. Conclusions are discussed in applicable JCRs. Interim and final project reports should be appended to the JCRs.

B. Aerial Surveys

1. Rational – Pronghorn distribution can be documented efficiently over large areas by flying systematic surveys. Flights can be scheduled to determine seasonal distributions or responses to extraordinary events such as severe snowstorms.

2. Application – Plan aerial surveys to make effective use of manpower, funds, and favorable weather conditions. Conduct flights in the early morning or late afternoon on clear days. Record UTM coordinates of all pronghorn observed and enter this data in the Wildlife Observation System.

3. Analysis of Data – Compare distributions of pronghorn observed to seasonal habitats delineated on existing seasonal range maps. Update maps when seasonal distribution data obtained during normal or severe weather patterns indicate refinements are needed. Refer to Appendix VI for a discussion of procedures to update seasonal distribution maps.

4. Disposition of Data – Results of distribution surveys should be evaluated and discussed the annual JCR for the applicable herd unit. Enter location data into the Wildlife Observation System.

C. Incidental Observations

1. Rationale – Knowledge of pronghorn distribution is continually improved as additional data are gathered. Incidental observations are a non-structured source of data for documenting distribution in areas not previously surveyed, and may alert managers to shifts that have taken place in response to development or changing land management practices.

2. Application – Biologists should record incidental observations of pronghorn when the location, time of year or other circumstances contribute further insight about pronghorn distribution patterns. Give particular attention to areas in which changes in land uses are proposed or underway, and to previously unoccupied habitat.

3. Analysis of Data – Refer to Section V.B.3. (Aerial Surveys).

4. Disposition of Data – Records of incidental observations are entered in the Wildlife Observation System. Herd unit maps are revised when distribution data indicate adjustments of boundaries or range delineations are warranted. Discuss all revisions in the applicable JCRs.

VI. CAPTURE METHODS

A. Live Capture – Pronghorn are most often captured for marking, collection of biological samples, or relocation. Capture methods include netting, trapping, chemical immobilization, or hand capture of young fawns. Appropriate capture methods are selected depending on several considerations, for example: number, age, and sex of animals required; density of animals in the trapping area; terrain and proximity to roads; degree of acclimation to fences; wariness of animals; the possibility and acceptability of capture mortalities; and the cost in time and expense per animal captured or marked (Armstrup et al. 1980). The two methods used most commonly in Wyoming are corral traps and hand capture of fawns.

Lee, et. al. (1998) provided an excellent discussion of capture methods. Corral traps are the most efficient devices for capturing large numbers of pronghorn. The surround-net works well to capture small numbers of animals at waterholes. Net gunning from helicopters is also effective for capturing small numbers of animals, especially in remote locations and areas of low pronghorn densities. Chemical immobilization is effective in limited circumstances.

1. <u>Corral Traps</u>

    a. <u>Rationale</u> –The most efficient means of capturing relatively large groups (50 animals) of pronghorn is to drive them into corral traps.

    b. <u>Application</u> – The trap is an oval-shaped corral with two long (0.5km) lead fences or wings that converge at the entrance. The wings of the corral trap form a "v" funneling into the trap entrance. In Wyoming, the distance between these wings is narrowest at the trap, and gradually increases to 1,000-1,300 ft (300-400 m) at the outer end (Fig. 5) (Moody et al. 1982). Wings are constructed of woven wire supported by steel fence posts. Pliable cargo netting is used for the 100-m segment of each wing closest to the trap entrance, to reduce injuries during the final push into the trap. The trap can be set up to incorporate an existing fence as one of the wings. Existing fences are familiar to the animals and their movements around such features are more predictable.

       The corral wall is usually 2-inch, nylon mesh stretched between a cable anchored on the ground and another cable suspended 8 ft above ground by steel support posts. The mesh is covered with a burlap or canvas screen to discourage escape attempts. Before animals are driven into the trap, the screen is rolled to the top of the corral and secured with a quick-release string and cotter pin assembly (Fig. 6). A capture pen is formed by suspending a sliding, canvas curtain across the back of the corral, in front of the exit door. The 8-ft high curtain slides on rings attached to cables stretched tautly across the top and bottom of the corral. Detailed instructions for setting up the trap are provided in Attachment 3.

       A crew of at least 20 personnel is required to conduct this type of trapping operation. One person should supervise the entire operation. Individuals are assigned specific responsibilities that include handling animals, recording data, operating the curtain, etc. The person in charge outlines trapping and handling procedures to ensure the overall operation runs smoothly. The corral and wings should be set up behind a topographic rise to conceal the corral trap from view until pronghorn are well within the wings. The open end must also be oriented downwind so the helicopter flies into the wind as pronghorn are driven between the wings. Other considerations can include taking advantage of known travel lanes of pronghorn, and avoiding steep terrain, tall vegetation, flight hazards, and other manmade or natural barriers.

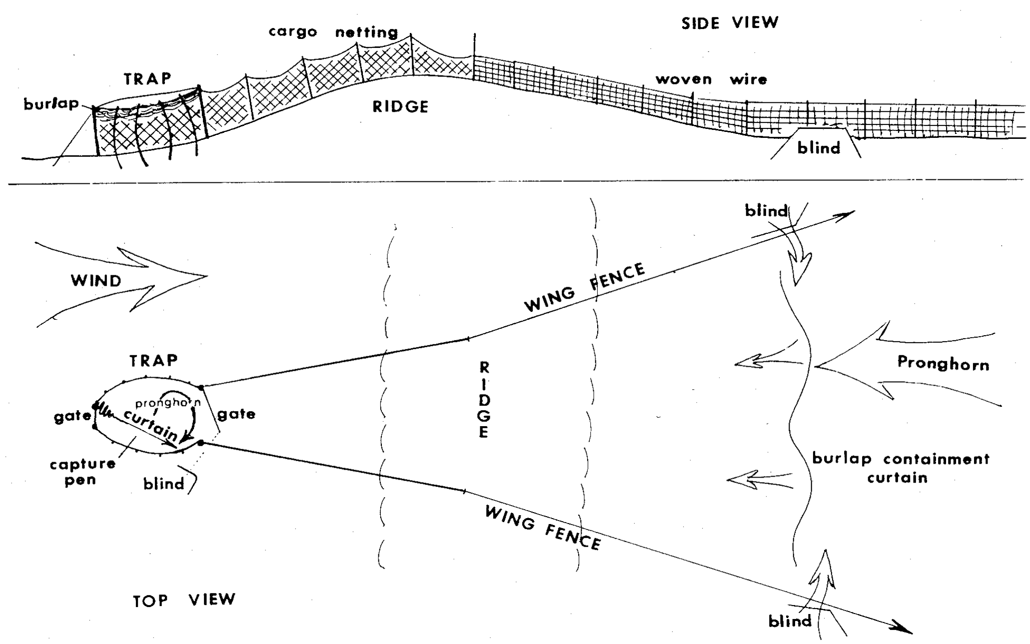


Fig. 5. Basic corral trap design

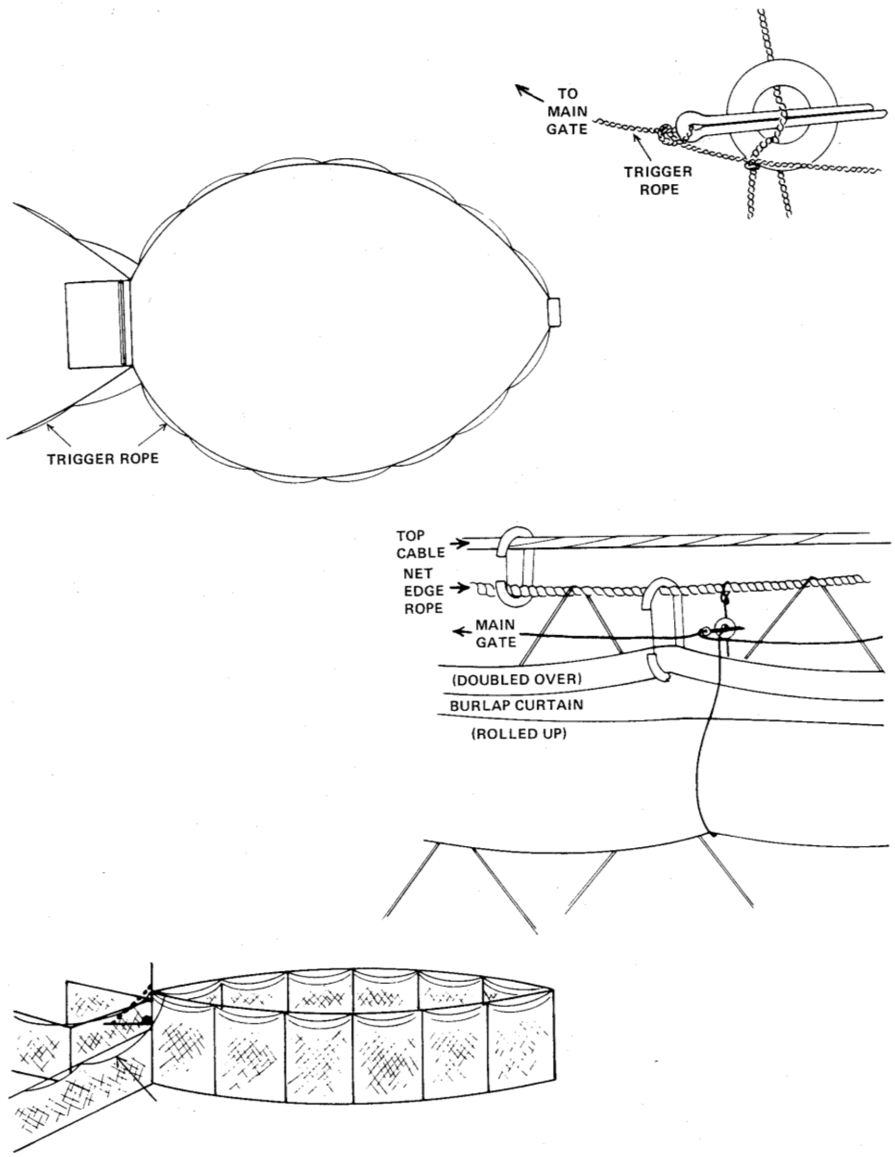


Fig. 6. Curtain (visual screen) and cotter pin assembly.

A helicopter must be used to locate and drive small groups of pronghorn into the trap wings. To minimize stress, do not pursue animals longer than 20 minutes. After a group has been driven well within the lead fence to a point where the wings are approximately 50 m apart, personnel move quickly from blinds located just outside the wings to form a containment line. A burlap curtain is often held along the human line to increase its effectiveness at moving pronghorn toward the trap. Personnel advance toward the corral when the pronghorn move in that direction and stop when the pronghorn stop. The line asserts gentle, but constant pressure until the animals enter the corral and the gate is closed. The curtain suspended above the trap walls is then released to form a visual screen which helps calm the animals. Noise is also kept to a minimum.

To reduce stress and injuries, confine no more than 50 pronghorn in the corral at any time. If a larger number is trapped, release the excess. The Department has had excellent success by marking and releasing animals as quickly as possible (Moody pers. comm.). Subjecting animals to the least possible stress is imperative to reduce mortalities from injuries and capture-induced myopathy.

To begin processing, one person draws the sliding canvas curtain across the corral to form the capture pen in front of the trap exit. Handlers enter the capture pen and stand with backs against the curtain. The end of the curtain is drawn open slightly, allowing 2-6 pronghorn into the capture pen area. Handlers quickly restrain the animals and carry them outside. Depending on the purpose of the capture operation, personnel may collect biological data and samples, and attach visible markers or radio transmitters. Animals are then released or loaded for transport to another release site. In most cases 2 handlers should restrain and move each pronghorn. If pronghorn are being transported but not marked, up to 10 handlers can enter the capture pen each cycle to expedite processing and removal.

Trapping is most effective when pronghorn are concentrated, either on winter range (December-March) or near water in late summer (August-October). Trapping and handling should not take place if air temperature is expected to exceed 70° F. Preferably temperatures should not exceed 50° F.

c. Analysis of Data – Refer to Appendix VII for additional details about analysis of data obtained from marking studies.

d. Disposition of Data – As applicable, compile the following information in a report to the Supervisor of Biological Services: date and location of the trapping/marking operation, identification numbers of ear tags, descriptions of neck bands, radio-collar frequencies, sex and age of all pronghorn captured, trapping related mortalities, release locations, and an evaluation of the trapping operation. Summarize trapping and marking operation and analyze observations of marked pronghorn or tag returns in applicable JCRs.

2. Fawn Capture

   a. Rationale – Fawns are normally caught and marked when managers need specific information about movements between spring and summer ranges or to determine rates and causes of mortality. Handling and marking procedures can, however, affect mortality rates. This should be considered when data obtained from marked fawns are interpreted.

   b. Application – Fawns can be captured by hand when they are very young and relatively insensitive to human disturbance, usually during the last week of May or first week of June. Personnel locate fawns by using a spotting scope to observe does until a fawn is detected nearby. One member of a two-person team acts as a spotter and, using a 2-way radio, directs the other team member to the fawn. When the trapper locates the fawn, he quickly drops a long-handled landing net over it, taking care not to injure the animal. Well-trained dogs, both Labrador Retrievers and German Shepherds, have also been used successfully to locate fawns. After 10 June, fawns are mobile and become difficult to capture by hand.

      Select observation points that afford an unobstructed view for locating fawns. Preferably, conduct operations during mild, dry weather.

   c. Analysis of Data – Refer to Section VI.A.1.c. (Corral Traps).

   d. Disposition of Data – Refer to Section VI.A.1.d. (Corral Traps).

3. Chemical Immobilization

   a. Rationale – Specific animals can be targeted for capture by chemical immobilization, which is the chief advantage of this method (Copeland et al. 1978, O'Gara and Yoakum 1992). However, pronghorn are generally too wary to approach within effective darting range (≤ 50m). Chemical immobilization may be feasible in places where pronghorn are acclimated to humans or vehicles, for example urban settings or golf courses.

   b. Application – Refer to Appendix VIII for detailed information about immobilization techniques. Drugs used to immobilize pronghorn include: succinylcholine (Beale and Smith 1967, Amstrup and Segerstrom 1981), Etorphine (Copeland et. at. 1978, Autenrieth et. al. 1981), and carfentanil (O"Gara 1987). A new opioid anesthetic, A-3080, has been used in trials to immobilize pronghorn at the Sybille Wildlife Research Unit, and was field-tested twice in 2000. In both trials A-3080 was superior to carfentanil with or without xylezine. A-3080 is not currently available for field use, but should be accepted as the preferred anesthetic to immobilize pronghorn in the future.

Until A-3080 is available, the Department recommends a combination of carfentanil and xylazine to immobilize pronghorn. No other drug combination has been proven as safe or effective. The following dosages and equipment are recommended:

Bucks:	2.5 mg carfentanil plus 50 mg xylazine
Does:	2.0 mg carfentanil plus 40 mg xylazine
Fawns:	1.5 mg carfentanil plus 30 mg xylazine
Antagonists:	100 mg naltrexone per mg carfentanil given plus 0.15 mg yohimbine per kg body weight To avoid renarcotization with Carfentanil, give a double dose of antagonist including one dose intravenous and one intramuscular. After administration of the antagonist, expect up to 30 min. of excitation symptoms (rapid pacing, extended tongue, etc.). Do not use xylazine if antagonists will not be administered
.	
Darts:	13-mm (0.50 cal.) Pneu-darts equipped with 25-mm, barbed needles, having 1 or 2 ml capacity.
Dart Rifles:	Preferably, use adjustable $CO2$ powered. (Adjustable 0.22-cal. blank-powered can also be used).

c. Analysis of Data – Refer to Section VI.A.1.c. (Corral Traps).

d. Disposition of Data – Refer to Section VI.A.1.d. (Corral Traps):

B. Relocation

1. Rationale – Pronghorn are captured and relocated for several purposes including: reintroduction to vacant habitat, removal of animals causing damage, and acquisition of subjects for research.

2. Application – A full-size pick-up truck is satisfactory to transport pronghorn. A solid box enclosure with a thick canvas cover is mounted on the bed for this purpose. A horse trailer also works well if it is modified by suspending a canvas sub-roof inside to prevent injury caused by pronghorn jumping and hitting the roof. The vehicle used for hauling should be easy to load and unload, well ventilated, dark, and compartmentalized to segregate animals bearing horns. Approximately 3.2 ft^2 of space are required for each pronghorn. A canvas drape should hang inside the tailgate or trailer door while pronghorn are loaded. This helps prevent

pronghorn inside from bolting toward light and escaping when the tailgate or trailer door is opened to load new pronghorn. A rubber mat on the floor of the pickup or trailer, covered with dirt or wood shavings, will reduce the unnatural feel of the metal floor, provide footing, and aid in keeping the animals calm.

Two people should handle each captured pronghorn when it is moved. One controls the head and chest, the other the hindquarters. Struggling is minimized by lifting the pronghorn off the ground in an upright position with the head well above the level of rumen to prevent aspiration or regurgitation of rumen contents.

3. Analysis of Data – Each relocation project should be evaluated and improvements recommended, as necessary.

4. Disposition of Data – Refer to Section VI.A.1.d. (Corral Traps).

C. Transplant Protocol

1. Rationale – Translocation projects have restored pronghorn to many historic ranges in North America. In some cases, pronghorn are removed from the wild for placement in research facilities or in zoos for education and exhibition. Special handling procedures are needed because of the pronghorn's high-strung nature and susceptibility to injury. Adult animals should not be captured for placement in captive facilities. If captive pronghorn are needed for a legitimate purpose, the project proponents should plan on capturing and hand-rearing newborn fawns.

   The purpose of these guidelines is to provide wildlife managers assistance with planning translocation projects. The four main focuses are: 1) identification of circumstances when relocation of wild pronghorn is justifiable; 2) determination of suitable donor populations; 3) evaluation of potential release sites; and 4) placement of animals in captivity for research or education purposes. Specific techniques for capturing and relocating pronghorn are discussed Section VI.A and B of this chapter. Additional considerations are discussed in the 1998 Pronghorn Management Guides (Lee et al. 1998).

2. Application – The Wyoming Game and Fish Commission has established a policy, "Terrestrial Wildlife Furnished to Others" (July 21, 1998), specifying procedures and conditions under which game animals may be captured and furnished to other agencies or institutions. Pronghorn translocations should be consistent with this policy.

   Pronghorn occupy nearly all areas of suitable habitats in Wyoming. Currently, there is little need to restock or relocate pronghorn within the state, although pronghorn were restored on the Wind River Indian Reservation as recently as 1990. Many interests regard Wyoming as a source for translocations because pronghorn are abundant here compared to other states and provinces. In 2000, newborn pronghorn fawns were captured near Cheyenne and flown to Mexico for use in research to aid recovery of endangered peninsular pronghorn.

a. General Considerations – Proponents of a translocation should evaluate: 1) the objectives of the project; 2) the likelihood of success; 3) the impact of the project on the donor population; and 4) the possible impact of the project on resources in the release area. Before a translocation operation is proposed, proponents should always consider whether another method could achieve the same objectives. Invariably, some mortality will take place when pronghorn are captured, confined, transported, and released into unfamiliar environments. Reasonable precautions are necessary to minimize injuries and mortalities, and to avoid adverse impacts.

   All translocation projects in Wyoming must be conducted according to the following standards:

   - Pronghorn translocations should be considered only when the objectives of the project are consistent with policies of the Wyoming Game and Fish Commission. Commission policy clearly states ownership of wildlife will not be transferred to private individuals. Chapter 10 of the Commission's regulations authorizes the Department to relocate animals for management purposes. Educational and research institutions can also obtain native big game animals for legitimate purposes.
   - Legitimate justifications include:
     - restoration of free-ranging populations;
     - public educational displays; and
     - research to promote conservation and improve knowledge about pronghorn biology.
   - Pronghorn should not be translocated principally to alleviate depredation. Relocating animals causing damage could become a very undesirable precedent for dealing with situations in which a landowner does not allow hunting. However, in certain cases nuisance animals can be acceptable candidates provided their removal serves a legitimate objective such as population restoration.

   Logistics of the capture and translocation project will depend on several practical considerations including:

   - The ultimate goals of the project (establish a free-ranging population, augment an existing herd, establish a captive herd for research, provide animals to other institutions for educational purposes, etc.)
   - Number of animals to be captured and anticipated mortality rates.
   - Desired sex and age composition of the captured cohort.
   - Genetic considerations – should animals be captured from different areas or populations?

b. Selecting Donor Herds – In Wyoming, removing comparatively small numbers of animals has no effect at the population level. A more important consideration is the suitability of animals from the donor herd to meet the objectives of the project. The following considerations will assist in determining where to capture pronghorn for specific translocation projects:

Suitability of the donor population:

- Suitable habitat: Obtain animals from habitats that are similar to the release area if possible. Animals with a history of crop depredation may not be the most desirable to release in certain areas.
- Genetics: Determine if animals are genetically suitable. Is there potential for introgressive hybridization or other undesired effects?
- Animal Health: Determine whether diseases or parasites in the donor population pose a risk to animals in the release area. What is the potential for introducing new pathogens? Will released animals commingle with existing wild populations? Are animals generally in good physical condition? Will translocated animals be exposed to new pathogens within the release area, which may impact their establishment there? It is essential to thoroughly understand pronghorn biology and management.
- Impact on source population: Assess whether the proportion removed could impact the donor population. Will the removal affect availability of adult males for harvest?
- Availability: Determine whether the number and composition of animals desired for the translocation are available and accessible in the donor area. Will additional translocations be required in the future?

Logistical considerations:

- Type of Capture: The capture technique should be suited to the objectives and purpose of the project. Select a technique that can be efficiently implemented within the capture area.
- Availability: Be sure the desired number and composition of animals are readily accessible in the capture area.
- Access: Assure personnel responsible for capture and transport can get to the area where pronghorn will be caught. Obtain the landowners' permission before conducting operations on private lands.
- Time-of-year: Select an appropriate time of year to assure the greatest success (i.e, not too late in the winter to capture adults, not too late in spring to capture fawns).
- Manpower: Secure an adequate number of experienced personnel for all phases of the translocation project.
- Conditions: Monitor weather to be reasonably sure conditions will not pose problems (e.g., too hot, cold or windy; snow too deep; roads closed).
- Health Considerations: Personnel from the Department's Veterinary Services Branch should supervise the care of animals during capture and

transportation. Determine what health certificates, treatments, or conditions will be required to translocate animals, especially across state lines or international boundaries. Will health inspections or quarantines be required prior to reaching the final destination?

- Transportation and Handling Facilities: Arrange to have suitable transportation equipment available for moving animals to the new location as quickly as possible.
- Adequate follow-up: Prepare a written account of the translocation and follow up with progress reports describing procedures, conditions encountered, adjustments made, and results. These reports provide a valuable record of experience gained from each translocation project.

c. Release Sites – A thorough knowledge of pronghorn ecology is essential to effectively plan translocations (Yoakum 1980). Areas pronghorn did not historically inhabit are not generally good candidates for release locations. Such sites typically lack one or more essential components of pronghorn habitat or may not have a suitable climate.

Each potential release site should meet the following conditions:

- Records or other evidence should indicate pronghorn historically occupied the area selected as a release site. Habitat at the release site should be similar to pronghorn habitat in Wyoming. The form developed by Hoover et al. (1959) is recommended to evaluate suitability of grassland release sites. Yoakum (1980) adapted the form for shrub-steppe ecosystems (Table 2). Managers should complete the relevant form before any transplants take place.
- The transplant should serve some legitimate public purpose. Trapping and translocation operations are labor-intensive and costly. Accordingly, they should be done only for justifiable reasons and when there are public benefits. Possible reactions to the transplant should be considered, particularly among private landowners and public land managers. Release sites on public lands receive priority consideration in areas where people will have the opportunity to hunt and observe pronghorn after they become established. Transplants to private lands where the public does not have access are discouraged.
- Obtain written concurrence from affected surface management agencies and private landowners in the release area.
- The major goal of a translocation should be the establishment of a viable herd. Franklin (1980) considered a population viable if it contained at least 50 breeding adults. Franklin also suggested 500 randomly mating individuals is the minimum population size that sustains sufficient genetic variation for adaptation to changes in the environment. Hoover et al. (1959) recommended translocations should contain at least 50 to 100 animals. As a rule, each animal requires at least 1 square mile of native sagebrush/ grassland habitat.

Table 2. Form used to evaluate potential sites for pronghorn transplants.
[adapted from Hoover et al. (1959) and Yoakum (1980) for sagebrush-grasslands]

1. LOCATION:
   A. County__________ Nearest town __________
      Nearest ranch __________ Accessibility by road __________
      Township __________ Range__________

2. SIZE (number of square miles of estimated habitat): __________

3. TOPOGRAPHY: __________
   A. Physical Barriers:__________
   B. Constructed Barriers:
      Fences (Location) (Construction Specifications)
      __________ __________
      __________ __________
      __________ __________
      Major highways
      ____
      Other
      ____

4. CLIMATE:__________
   A. Elevation__________ Annual Precipitation__________
   B. Mean depth of snow __________

5. WATER:

	Springs	Reservoirs	Lakes	Streams	Wells	Catchments
A. Number	____	____			____	____
Acres			____			
Miles				____		
B. Production:						
Surface Ac.		____				
Gal./min.	____			____		
Gal/storage						____

   C. Mean distribution of water sources __________
   D. Year-round water?__________

6. VEGETATION:

Major Types	No. Acres	Mean Ht.	Estimated Percent Grass	Forbs	Shrubs
A. ________	____	____	____	____	____
B. ________	____	____	____	____	____
C. ________	____	____	____	____	____

7. LAND OWNERSHIP (number of acres)
   A. Private __________
   B. Public __________
   C. Other __________

8. LAND USE:
   A. Class of livestock__________

B. Stocking rate

____

C. Grazing system____

D. Cultivated crops____

E. Other

____

9. PREDATION:

A. Natural - coyotes________________ eagles_________________ bobcat_____________

B. Human

____

10. TRANSPLANT CONSIDERATIONS:

A. Is the site historic pronghorn range?____

B. Attitude of ranchers

____

Attitude of local Department personnel____

Attitude of local sportsmen's clubs____

____

Attitude of government agencies____

C. Is (are) land manager(s) agreeable to management objectives of State Wildlife Agency?

____

D. Suggested number of pronghorn for transplant____

E. Route of trucks carrying pronghorn and release point____

____

F. Has a "habitat management plan" been developed?____

____

G. Are cooperative agreements completed?

Private land owners____

Public land agencies____

H. Other____

____

Most wild pronghorn appear healthy and comparatively free of debilitating diseases and parasites. However, Cowen (1951) observed, "There are in wild game mammals all shades of departure from the state of perfect health." Disease is always a potential factor that may require examination or observation by a qualified person. Therefore we encourage project managers to have a veterinarian present during capture operations. In addition, drugs are occasionally administered to immobilize animals or for euthanasia. Pronghorn can be transported in full-size pick-up trucks. Refer to Section VI.B. (Relocation) regarding suitable transport equipment. Pronghorn should be monitored a minimum of 3 years following the translocation, and results summarized annually in a report submitted to the Wyoming Game and Fish Department. Monitoring is important to document success and maintain accountability.

d. Placement in Captive Facility – Pronghorn are difficult to maintain in captivity. Therefore, projects involving captive pronghorn should be justified with a legitimate need and purpose for confinement. Such projects should be planned well in advance of the study or educational exhibit. Only persons with prior experience should care for captive pronghorn. Some procedures for maintaining pronghorn in captivity are described by Blunt and Myles (1998). The Department adheres to the following standards when providing pronghorn for retention in captivity:

- Wild-caught adults are not provided for confinement: In general, projects requiring confined pronghorn should be planned sufficiently in advance to capture and hand-raise neonatal fawns. Attempts to confine wild-caught adults have been extremely unsuccessful in the past.
- Legitimate public purpose: The project should serve a legitimate public purpose (research, education, conservation). The separation of fawns from does can become controversial, so the action should be justified.
- Ultimate disposition: All animals and progeny will remain in the public domain. Animals will not be provided for private ownership nor may surplus animals be disposed to game farms or other private interests.
- Transportation: Special provisions should be made to transport fawns as rapidly as possible to the confinement facility. Caretakers should accompany the fawns to the new location. See Blunt and Myles (1998) for additional considerations.
- Adequate facilities: Facilities must provide adequate space, comfort, and isolation. Avoid direct contact with or contamination from other species.
- Follow-up: Recipient agencies and institutions should provide the Department regular reports on the status of pronghorn taken from Wyoming.

3. Analysis of Data – Maintain records of the sex, age and condition of each animal captured and released. Also note method of capture, ambient temperature, duration of transport, types of veterinary inspections, and measures taken to reduce morbidity and mortality. Monitor health, survival and animal response following relocation.

4. Disposition of Data – Capture records, release information and an evaluation of the project will be included in a report to the Supervisor of Biological Services. A Summary of the capture, transport and release information is also included in the appropriate JCR.

VII. DEPREDATION – Consult Buhler et al. (1999).

VIII. MODELING – The Wyoming Game & Fish Department uses a population model (POP-II by Fossil Creek Software) to simulate pronghorn population trends. Refer to Appendix IX for additional details about the modeling process. Herd models are periodically aligned with population estimates derived from line-transect surveys, or with population trends derived from aerial trend counts. Table 2 identifies acceptable ranges and values of parameters used to model pronghorn populations in Wyoming.

Table 2. Parameters used to model pronghorn herds in Wyoming.

Parameter	Recommended range of values
Age Classes:	**12-15** – recommend **12** unless older age classes are documented in the population based on data from tooth cross-sections.
Sex Ratio at Birth:	**50:50**
Fecundity:	For does 2 yrs old and older, reported fecundity rates include 153:100 Beale and Smith 1969), 183:100 (Creek 1967), 185:100 (WGFD Pronghorn Working Group 2000). A standard fecundity rate of **180:100** has been adopted for does $\geq$ 2 years of age, for use in POP-II models in Wyoming. The fecundity rate of adult (2+) females and the pre-season mortality rate of fawns are fixed (standardized) values in the POP-II models. Accordingly, the pre-season mortality severity indices are adjusted to simulate the fawn:doe ratios observed prior to the hunting season.
Pre-season Mortality:	Juveniles: **50%**; based on known fecundity rates and pre-season fawn:doe ratios. Yearlings and adults: **2%**. Based on sex ratios of fawns in harvest data (52.57% females, 47.57% males, n=15,104) and November trapping data (55.77% females, 44.3% males, n=1,405) we have concluded pre-season mortality of male fawns is higher than that of females. A differential mortality rate of up to 1.2x the female ratio may be appropriate for male fawns.

Post-season Mortality:	Juveniles: **30-55%**. Yearling and adults: 3-10% for age classes 2-5 with mortality rates increasing in age class 6 up to 100% in the oldest age class used. Higher mortality rates can be used for males in age class 6 and older.
Wounding Loss:	**10%.**
MSI:	A "1.0" represents average pre-season and post-season mortality rates. Modify the pre-season MSI values as needed to align observed fawn:doe ratios each year. Modify the post-season MSI values using the methodology described by Lutz, et. al. (1996), based on winter (WSI) and summer (SSI) weather severity indices derived from data obtained from weather stations in vicinity of herd unit being modeled.

IX. SUPPLEMENTAL FEEDING – Free-ranging pronghorn are not fed in Wyoming. Because pronghorn are widely distributed and mobile, logistically, it would be very difficult to transport supplemental feed to a stressed population. In addition, no known feed has been found effective for preventing significant mortality of pronghorn during severe winter conditions.

To assure healthy populations are carried through winter, the most effective management includes maintaining winter ranges in good condition, removing barriers to pronghorn movements, and keeping pronghorn numbers within the carrying capacity of the habitat.

X. JOB COMPLETION REPORTS – Pronghorn management information is summarized annually in Big Game Job Completion Reports (JCRs). Each region prepares JCRs for the herds within its jurisdictional boundaries. JCRs include results of line-transect surveys, harvest data, classification data, mortality data, disease assessments, winter severity assessments, population models, management evaluations, applicable research reports, seasonal habitat maps, hunting seasons and justifications, and other pertinent information. Copies of JCRs are available at each regional office and the Cheyenne headquarters.

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ATTACHMENT 1

Revised 5-1-03

GUIDELINES FOR ESTABLISHMENT AND OPERATION

OF

WILDLIFE CHECK STATIONS

PURPOSE: To provide Department personnel with guidance on the establishment and operation of wildlife check stations authorized in W. S. §23-3-308.

OBJECTIVE: The objectives of Wildlife Check Stations are to gather biological data on harvested wildlife while assuring and measuring compliance of laws and regulations; to inform the public of Department operations and objectives; and, to create a deterrent to would be violators.

REGULATORY REQUIREMENTS: Check stations shall be signed and established at a point on a highway or public road clearly visible to the motoring public at a distance of not less than two-hundred (200) yards in either direction from the check station. Check stations shall be at a point where flashing warning lights shall be visible to on-coming traffic for a distance of not less than two-hundred (200) yards in either direction from the check station. Except at permanent check stations, the emergency warning lights on a marked Department law enforcement vehicle or a yellow flashing light on a marked Department non-enforcement vehicle shall be in operation. Except at permanent check stations, at least one (1) person working the check station shall be in Department uniform and at least one (1) vehicle at the check station shall be a marked Department vehicle. At permanent check stations that are specified in Commission Regulations, Chapter 2, General Hunting Regulation, all Department persons working the check station shall be in Department uniform.

A. MAJOR CHECK STATIONS

Major check stations are established on major routes of high motor vehicle traffic, including interstate highways and some State highways. The Regional Wildlife Supervisor shall be responsible for determining if a check station established on a State highway shall be treated as a major check station or a routine check station. Major check stations require the pre-approval of the Wildlife Administration before they are established and operated. These check stations require detailed pre-planning by Department personnel responsible for the establishment and operation of the check station. Department personnel shall adhere to the following guidelines:

1. Before any major check station is recommended to the Wildlife Division Administration, the Regional Wildlife Supervisor and assigned Department employees should review the objective of these guidelines to assure that a need exists to warrant the establishment of a check station. Having identified the need, the Regional Wildlife Supervisor shall submit to the Chief Game Warden or his designee a complete and detailed proposal for the operation of the check station and the expected benefits to the Department. Prior to the approval of the plan by the Chief Game Warden's or his designee, the plan will be submitted to the Assistant Attorney General assigned to the Department for review. The Chief Game Warden or his designee shall select the Department person who shall be in charge of the establishment and operation of the check station. Any non-Department personnel, excluding Peace Officers and Department volunteers, to be utilized to conduct the check station shall require a letter of authorization from the individual's appropriate agency administrator.

2. Public and personal safety is paramount and shall not be compromised under any circumstances. Written pre-approval shall be obtained from the Wyoming Department of Transportation (WYDOT) for any check stations to be operated on interstate highways. The Regional Wildlife Supervisor shall be responsible for deeming if pre-approval from the Department of Transportation is necessary for a check station to be operated on a State highway.

3. All Department persons working the check station shall be in Department uniform.

4. As sportsmen arrive at the check station, a Department person assigned the duty shall identify himself/herself and explain the purpose of the check station. Permission shall be requested from the owner/operator of motor vehicles and trailers to conduct motor vehicle and trailer searches. If permission is not granted, officers may search without a warrant if probable cause exists. Searches shall not be conducted in the absence of sufficient probable cause, without prior consent of the owner/operator. During the search, Department personnel may request assistance from the owner/operator of the motor vehicle and trailer.

5. Ground cloths, plastic sheeting, or some type of ground protection shall be used to assure protection for animal carcasses and items, such as meat, fish, etc., that may be removed from motor vehicles and trailers. Consideration shall be given to the weather, terrain, length expected for the inspection, and motor vehicle and human traffic in the area. Safety of the public and Department personnel shall be the highest priority. Department personnel should assist in returning or re-packing possessions following the completion of the inspection.

6. The use of law enforcement search dogs and handlers shall be in accordance with accepted training standards and such operation procedures as established by the agency that furnished the dog(s) and dog handler(s).

7 Overlapping check stations that could potentially occur on the route of travel by the public shall be minimized to avoid duplication and to prevent inconvenience to the public

8. At check stations where multiple personnel are handling multiple motor vehicles, personnel shall remain at their assigned duty area unless requested to assist at another position.

9. At the conclusion of each inspection, the sportsmen should be thanked for their cooperation and contribution to managing the wildlife resource. Department personnel should, if reasonable, take time to answer questions and address concerns.

B. ROUTINE CHECK STATIONS

These check stations are routinely established by Department personnel along exit routes from specific hunting or fishing areas. Personnel should follow the same guidelines established for major check stations, except prior approval from the Chief Game Warden and Regional Wildlife Supervisor is not required.

ATTACHMENT 2

DATA FORM FOR WINTER MORTALITY TRANSECTS

WINTER MORTALITY TRANSECT FORM

Date: ________________ General Area: ________________________________ Transect No. ______________________

Starting Point (Describe) T____ R _____ ¼ _______ ¼ _______ Sec._______ Course of Transect Line: ______________________

Length of Transect: ________________________________ Habitat Type(s): ______________________________________

Exposure: ______________________ Elevation: ____________________ Observers: ______________________________

Snow Cover? _______ Yes _______ No If "Yes" _______ %

Live Animals Seen in Area. Number: ___________ Species:____

	Spc.	Sex	Age	Dist. From Base Line (ft.)	Right (R) Left (L)	Dist. From Last Carcass		Spc.	Sex	Age	Dist. From Base Line (ft.)	Right (R) Left (L)	Dist. From Last Carcass
N_1							N_{31}						
N_2							N_{32}						
N_3							N_{33}						
N_4							N_{34}						
N_5							N_{35}						
N_6							N_{36}						
N_7							N_{37}						
N_8							N_{38}						
N_9							N_{39}						
N_{10}							N_{40}						
N_{11}							N_{41}						
N_{12}							N_{42}						
N_{13}							N_{43}						
N_{14}							N_{44}						
N_{15}							N_{45}						
N_{16}							N_{46}						
N_{17}							N_{47}						
N_{18}							N_{48}						
N_{19}							N_{49}						
N_{20}							N_{50}						
N_{21}							N_{51}						
N_{22}							N_{52}						
N_{23}							N_{53}						
N_{24}							N_{54}						
N_{25}							N_{55}						
N_{26}							N_{56}						
N_{27}							N_{57}						
N_{28}							N_{58}						
N_{29}							N_{59}						
N							N						

ATTACHMENT 3

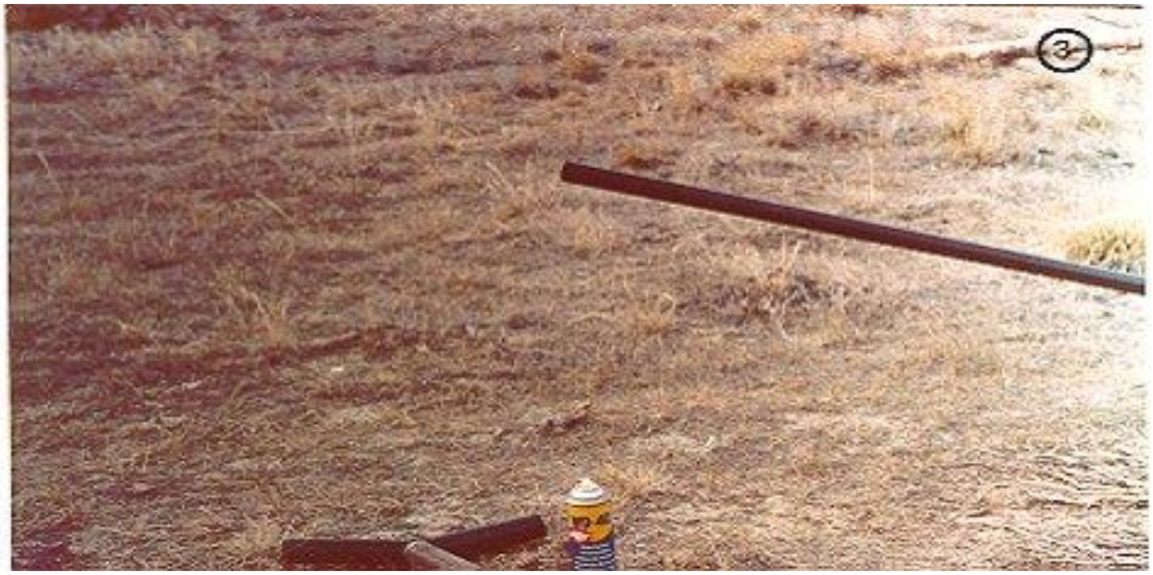
PRONGHORN

TRAP

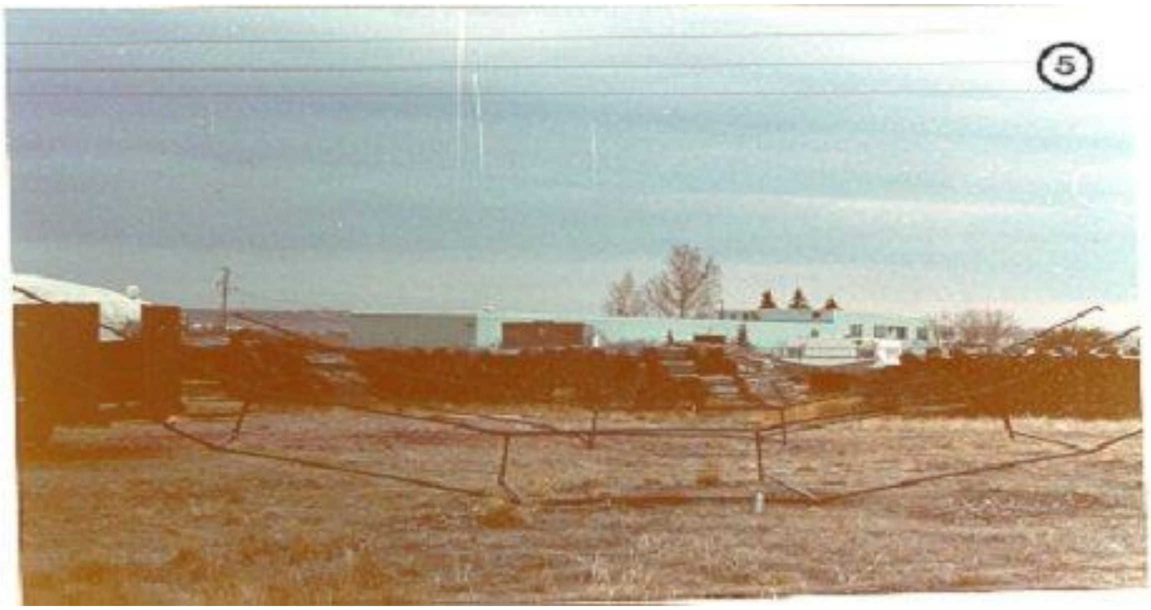
INSTRUCTIONS

Begin by unloading pipes and joints and arrange them in a circle (picture #1). The main gate should be located where the trailer is in this picture. The joints are numbered 1-8 with numbers welded on each bottom joint (picture #2). Joints painted brown go at point #1 and at the hinge for the front gate. Brown pipes are the uprights and black pipes are the laterals.

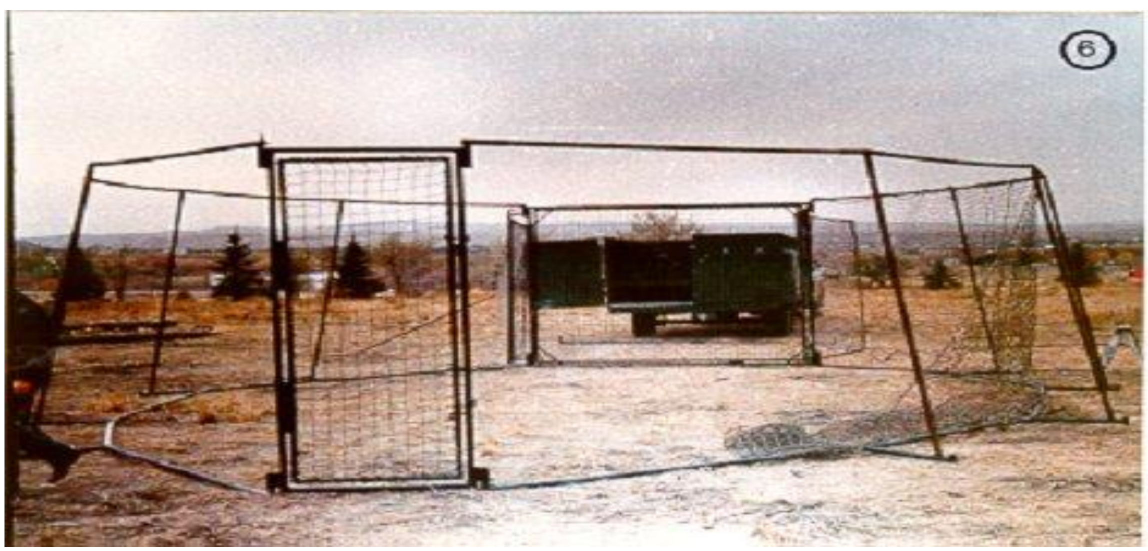
Spray joints with WD-40 before assembly (picture #3). Pipes should fit into each joint up to the welded bead (picture #4). Do not beat pipes and joints with steel hammers; use soft mallets. Build the two sides flat on the ground rather than in position (picture #5).

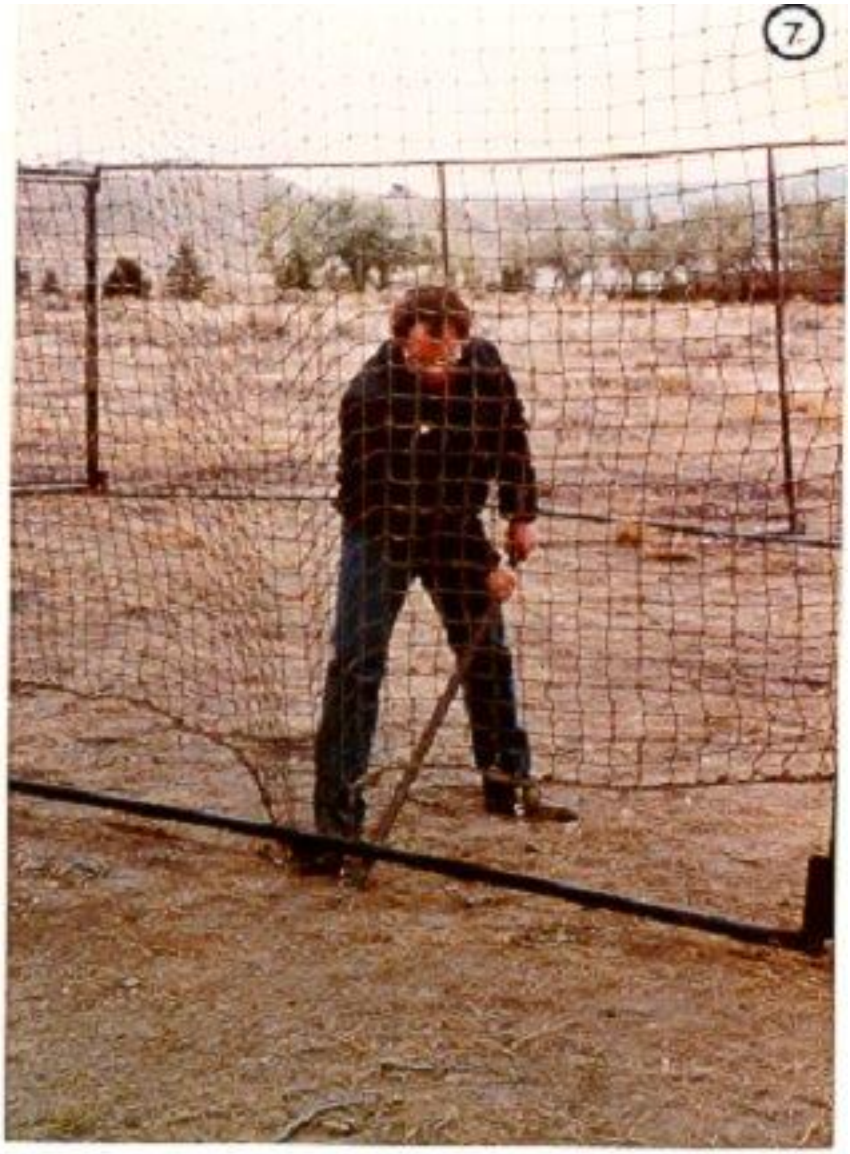

3


4



With one person at each joint, raise one side at a time (picture #6). Align so that the front gate is directly centered across from the main gate. Place the main gate first, the front gate second, and the two wing gates last. Hang the net from the top pipes first, then with people standing on the netting to stretch it, attach the nets to the bottom pipes. You may have to use a pry bar to raise the bottom pipes enough to slide the snap hooks through (picture #7).





Stake the trap down once the netting is all in place (picture #8). Pin wing panels to the wing gate and then to each other (picture #9). When laying out the wing panel, be sure they are all facing the same direction otherwise you will have to move them again.


6

Stake and pin wing panel supports as you go (picture #10). **Safety Point: Do not put up or take down the wing panels without supports in place or it may fall over and hurt someone.** The main gate is pinned to a support bar, which is then pinned to the first two wing panels (Picture #11).


10


11

Side curtains are hung by snap hooks, rolled up, and pinned (pictures #12 and #13).


13

The inside curtain is attached to a cable running from the front gate to joint #1 and staked outside the trap (picture #14). The cable is held by a come-a-long.

TOOLS/SUPPLIES TO BE KEPT WITH ANTELOPE TRAP

	ITEM	**USE**	**QUANTITY**
1.	WD-40	LUBE FITTINGS	2 CANS
2.	HAMMERS, MALLETS	FITTING PIPES	3 EACH
3.	SLEDGE HAMMERS	STAKES	2 EACH
4.	COME-ALONGS	INSIDE CURTAIN	2 (1 SPARE)
5.	LADDERS	NETTTING, CURTAINS	3 EACH
6.	END WRENCHES	CLAMPS, BOLTS	1 SET
7.	PRY BARS	NETTING	2 EACH
8.	PARACHUTE CORD	REPAIRS	1 SPOOL
9.	POST PULLER	WING FENCE	1 EACH
10.	HANDYMAN JACK W/CHAIN	PULLING STAKES	1 EACH
11.	SOFT WIRE	REPAIRS	1 SPOOL
12.	FENCING PLIERS	WING FENCES	2 PAIR
13.	HYDRAULIC JACK	CHANGE TRAILER TIRES	1 EACH
14.	4 WAY WRENCH	CHANGE TRAILER TIRES	1 EACH

ALL OF THE ABOVE ITEMS WILL BE SUPPLIES WITH TRAP AND TRAILER FROM THE CASPER REGION INVENTORY. ALL ITEMS WILL REMAIN WITH TRAP AND TRAILER, OR WILL BE REPLACED WHEN RETURNED TO CASPER AT THE EXPENSE OF DISTRICT USING TRAP.