TRANSLOCATION PROGRAM

Introduction

The decline of bighorn sheep around the turn of the 19th century and the reasons for those declines has been well documented (Buechner 1960). Rocky Mountain bighorn sheep in Montana were no exception, yet remnant groups of bighorns persisted over time, leaving an estimated 1,200 bighorns in Montana in 1950. It was around this time that the Montana Fish and Game Department (as it was known in those days) began trapping bighorns from the few viable populations remaining and transplanting them into areas of formerly occupied habitat. For a detailed discussion on translocation efforts, see Trapping and Transplanting in Chapter 1.

Through the winter of 2008-09 a total of 2,598 bighorn sheep have been trapped in Montana with 2,067 of those released in a total of 55 different locations within the state. A total of 465 bighorns went out of state to establish new populations or augment existing populations. States receiving bighorns from Montana included Oregon, Idaho, Washington, Nebraska, Utah, Wyoming, Colorado, and North Dakota.

The 1986 "Montana Department of Fish, Wildlife and Parks Bighorn Sheep Transplant Guidelines" and the 1995 "Final Policy for Bighorn Sheep Transplant For Newly Established Herds" provided needed direction for Montana's bighorn sheep program for many years. Since those documents were produced, however, some new laws and policies have been created. It is the intent in this section to revise and combine the original documents to reflect those changes.

Also, other elements of a successful translocation program that have not been part of Montana's bighorn sheep program will be part of this section. The elements include:

1) Criteria for identifying potential new transplant sites.
2) Process for recommending and implementing new transplants.
3) Process for augmenting existing bighorn populations.

As part of the process in evaluating potential habitat for transplanting bighorn sheep, a scoring system and form, Bighorn Sheep Transplant Site Assessment Form has been developed to help determine the feasibility of transplant sites to provide adequate habitat to sustain bighorn sheep (Appendix E).

New Site Habitat Evaluation Procedure (HEP)

A Habitat Evaluation Procedure (HEP) was developed to determine potential transplant sites by identifying suitable but unoccupied bighorn sheep habitats. The process uses a Geographical Information System (GIS) to develop a habitat suitability model that will be reviewed by local biologists to ensure that adequate habitat exists. A three-step process to identify potential bighorn sheep habitat was developed and consists of the following:

1) Candidate areas for bighorn transplant efforts are identified using a habitat suitability index map to display potential habitats on a landscape scale.
2) Wildlife biologists familiar with the candidate area delineate the outer extent of the potential habitat available to the transplant population, using the suitability index and their professional knowledge.
3) Using the delineated extent of the potential population, specific habitat criteria are assessed to determine if the area will support a minimum viable population. This assessment consists of GIS analysis of the habitat criteria that are then reviewed by the biologist to recommend modifications and provide interpretation.

A critical task, which FWP is using computer modeling and GIS analyses to more fully understand, is spatially identifying suitable locations for potential reintroduction sites. While many approaches have been developed to predict species distributions, there has been a movement toward modeling techniques that utilize non-parametric or iterative means to detect patterns in data (Elith et al. 2006). These are often referred to as machine learning approaches, and they would not be possible without modern computer processing capabilities. These approaches are advantageous in that they can fit more complex models than standard parametric methods, and they can be adjusted to prevent over-fitting (Phillips and Dudik 2008). FWP used a technique comparing animal locations to the available landscape, a presence/available approach, for the initial step of identifying suitable habitat, using a program called Maxent. This program generates a habitat suitability index that is used to determine possible species distribution. The analysis conducted is an iterative process that finds the probability distribution of maximum entropy (closest to uniform) to distinguish animal location characteristics from those of the overall study area (Phillips et al. 2006). While there are several caveats associated with the use of this technique, including difficulty in evaluating map accuracy and limited interpretation of how individual predictors influence animal locations, it has been shown to perform well at predicting species distributions when compared to other commonly used and novel approaches (Elith et al. 2006; Hernandez et al. 2006; Phillips et al. 2006; Hernandez et al. 2008).

The habitat suitability analysis requires information on bighorn sheep locations, as well as a suite of predictor variables representing characteristics of the available landscape. Bighorn sheep location data is collected via annual survey and inventory monitoring as well as various research efforts across the state. Predictor variables include biotic and abiotic components of the landscape that characterize or influence habitat conditions. Environmental variables include minimum and maximum annual air temperature, annual precipitation, and a solar radiation index (Keating et al. 2007). Topographical variables include elevation, slope, and a terrain roughness index, (Sappington et al. 2007), which measures slope variability. Landform variables include ecoregions (Omernik 1987), National Land Cover Dataset, geology, STATSGO soil type category, and soil temperature.

To improve the reliability of the analysis, it was conducted separately for each ecological region in Montana. Ecological regions are areas containing a number of bighorn sheep populations and having similar habitat characteristics. Ecological regions are discussed in the Habitat section later in this document. It is important to note that as data sources are updated the performance of the model will change. We anticipate that as new sheep locations are obtained and as GIS data layer accuracy and precision improve, the model performance will improve. The output of the model is a Habitat Suitability Index ranging from 0 to 1, from least to most suitable, respectively. Current results for the Elkhorn Mountains are shown in Figure 8.

Using the habitat suitability model output, biologists familiar with an area will delineate the area thought to be suitable for translocation. Once the area is delineated, we will determine if that area has adequate seasonal habitat to support a minimum viable population (MVP). The HEP, as described by Smith et al. (1991), focuses on quantifying

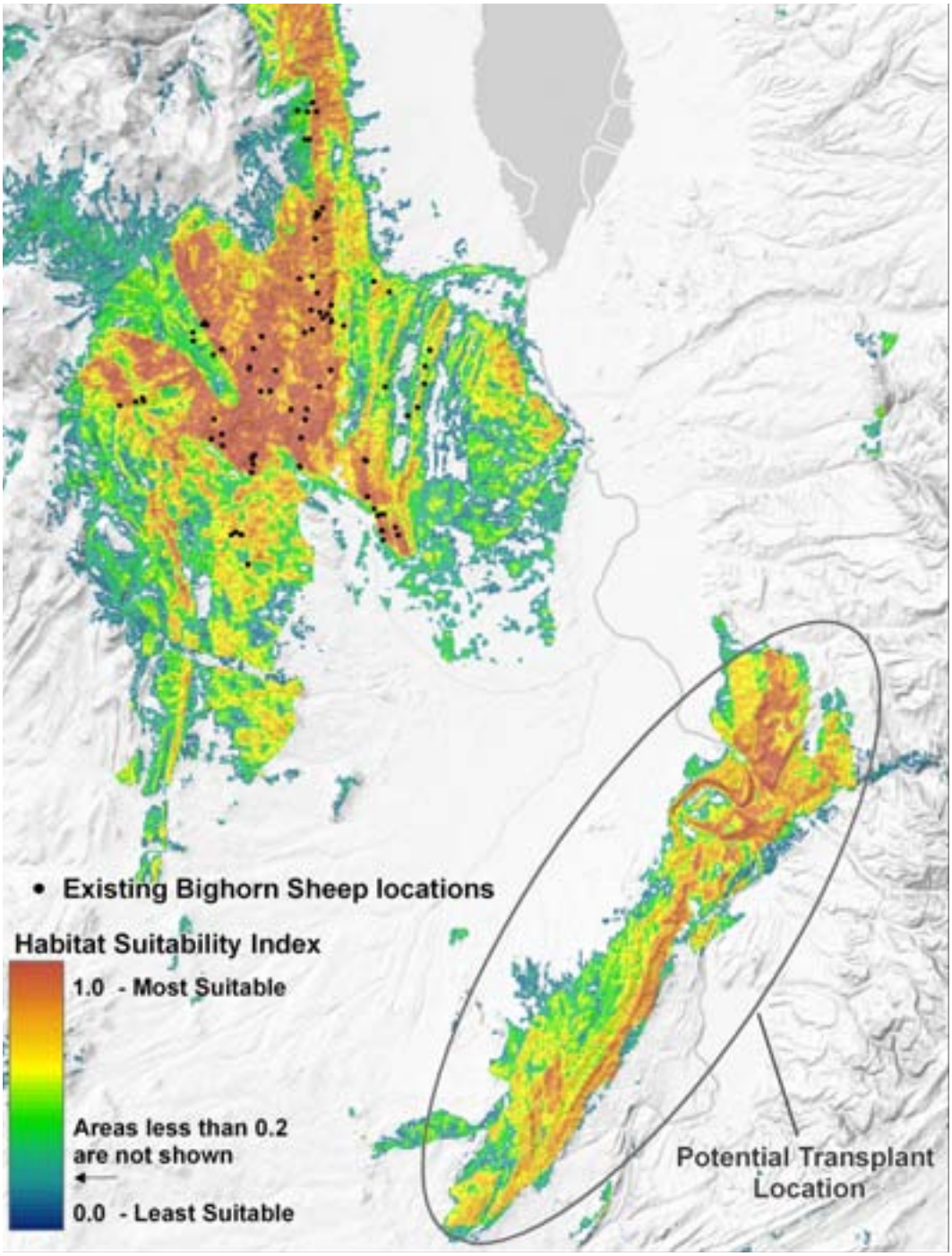

Figure 8. Map of inductive GIS model predicting suitable unoccupied habitat for bighorn sheep based on visual locations.

winter range, lambing habitat, summer range, and, depending on quantities of each, the ability of the area to support an MVP. While there is no consensus in the scientific literature as to what constitutes an MVP, Berger (1990) suggested, based on his assessment of 129 native populations of bighorn sheep in five western states that populations consisting of more than 100 bighorn sheep persisted for up to 70 years. Similarly, Geist (1975) suggested a minimum population of 125 animals for persistence, and Smith et al. (1991) also used this figure. Smith et al. (1991) used a density of 7.7 animals/km^2 for the entire potential habitat, based on their study area in Utah, and thus the area required to support an MVP of 125 animals can be calculated. This may be a high density for some habitats in Montana. It is suggested that if density is known for a nearby existing population from similar habitat to a potential transplant site, then using that figure is appropriate. Zeigenfuss et al. (2000), using a modified version of the Smith model and average bighorn densities for a variety of study sites, found that in prairie-badland habitats and using a density of 3.85 bighorns/km^2, it took 32km^2 of suitable habitat to support an MVP of 125 sheep. Likewise, in Rocky Mountain

habitats with an average density of 1.47 bighorns/km^2 it took 85km^2 of suitable habitat to support an MVP of 125 sheep. For displaying this model, density figures suggested by Smith et al. (1991) have been used. It can now be determined if there is enough potential habitat to support an MVP of bighorns. Again, using the 7.7 bighorn sheep/km^2 (20 per mi^2) and an MVP of 125 bighorn sheep, it would take approximately 17 km^2 (6.5 mi^2) of base or year-round habitat to support an MVP.

To determine how many bighorn sheep each area can potentially support, specific habitat criteria will be used to identify winter, lambing, and summer habitat using a combination of GIS data and biologist knowledge. Escape terrain is the primary habitat component influencing seasonal habitat and the ability of an area to provide suitable habitat to support an MVP. Escape terrain is characterized by areas relatively barren of vegetation, such as rocky slopes, with more than 60% (27 degrees) slope (Smith et al. 1991). Activity patterns for a Utah sheep population indicated that 95% of activity occurs within 300 meters of escape terrain (Smith et al. 1991). Escape terrain was calculated using a digital elevation model from the United States Geological Survey. The stepwise process, illustrated by Figure 9, is as follows:

1) Using the density of 7.7 bighorn sheep/km^2 (20 per mi^2) and an MVP of 125 bighorn sheep, it would take at least 17 km^2 (6.5 mi^2) of base habitat to support an MVP. In this example, there is a total of 78.1 km^2 of core or base habitat.
2) Winter range is defined as all escape terrain that receives less than 25 cm (approximately 10 inches) of snow pack. Research in Utah indicated that bighorn sheep abandoned ranges when snow pack exceeded 25 cm (Smith et al. 1991). Smith et al. (1991) found that when averaging bighorn sheep densities across a number of western winter ranges that densities should not exceed 20 km^2 (50 mi^2). To sustain an MVP of 125 bighorn sheep, it would therefore require 6.5 km^2 (2.5 mi^2) of available winter range. In this example, there is a total of 4.9 km^2 of winter range.
3) Determine if adequate lambing habitat exists to support an MVP of bighorn sheep. Areas qualifying as lambing habitat are defined as escape terrain with southern exposure (90 to 270 degrees). These areas should have good visibility, be within 1,000 m of water, and be at least two ha (five acres) in size. An MVP (N=125) of bighorn sheep would be expected to have 50 to 60 breeding ewes (Buechner 1960; Oldemeyer et al. 1971; Holl 1982). Holl (1982) showed that 60 ha of escape terrain were required to support 10 lambing ewes. Therefore it is estimated that a minimum of 3.0 to 3.6 km^2 (1.2 to 1.4 mi^2) of suitable escape terrain would be required to support 50 to 60 lambing ewes. In this example, there is total of 5.9 km^2 of lambing habitat.
4) Determine if adequate summer range exists to support an MVP of bighorn sheep. Summer range is defined by Smith et al. (1991) as those areas utilized by all bighorns not involved in lambing activities from May through August. Summer range for these animals would not include lambing areas. These areas are defined as all buffer areas adjacent to but not including escape terrain and areas with slopes less than 60% where visibility tends to be good. An MVP of 125 bighorn sheep would have 65 to 75 nonbreeding animals occupying summer range. Using the density figure from Step 1, it would take an estimated 8.4 to 9.7 km^2 (3.2 to 3.6 mi^2) to support this many bighorn sheep. In this example, there is a total of 60.1 km^2 of summer range.
5) Assuming there is adequate habitat to support an MVP of bighorn sheep as defined above, the final step in determining if a site is potential habitat is a qualitative assessment of how the different seasonal ranges are arranged and connected. Escape terrain, water, and forage need to be intermixed throughout the potential range. It is essential that the areas calculated for the different seasonal ranges have areas large enough to support an MVP. The exception would be if there was suitable habitat for fewer than an MVP but a strong likelihood for connection with nearby populations of bighorn sheep existed. In this example, it would appear that there is inadequate lambing habitat; however, some of the winter range actually would overlap with lambing habitat range, so the actual amount of lambing habitat would be sufficient for an MVP.

After assessing the areas of suitable habitat that exist in Montana, we can determine which occupied and unoccupied areas of this habitat are exposed to risks. The primary risk is proximity to domestic sheep, as indicated

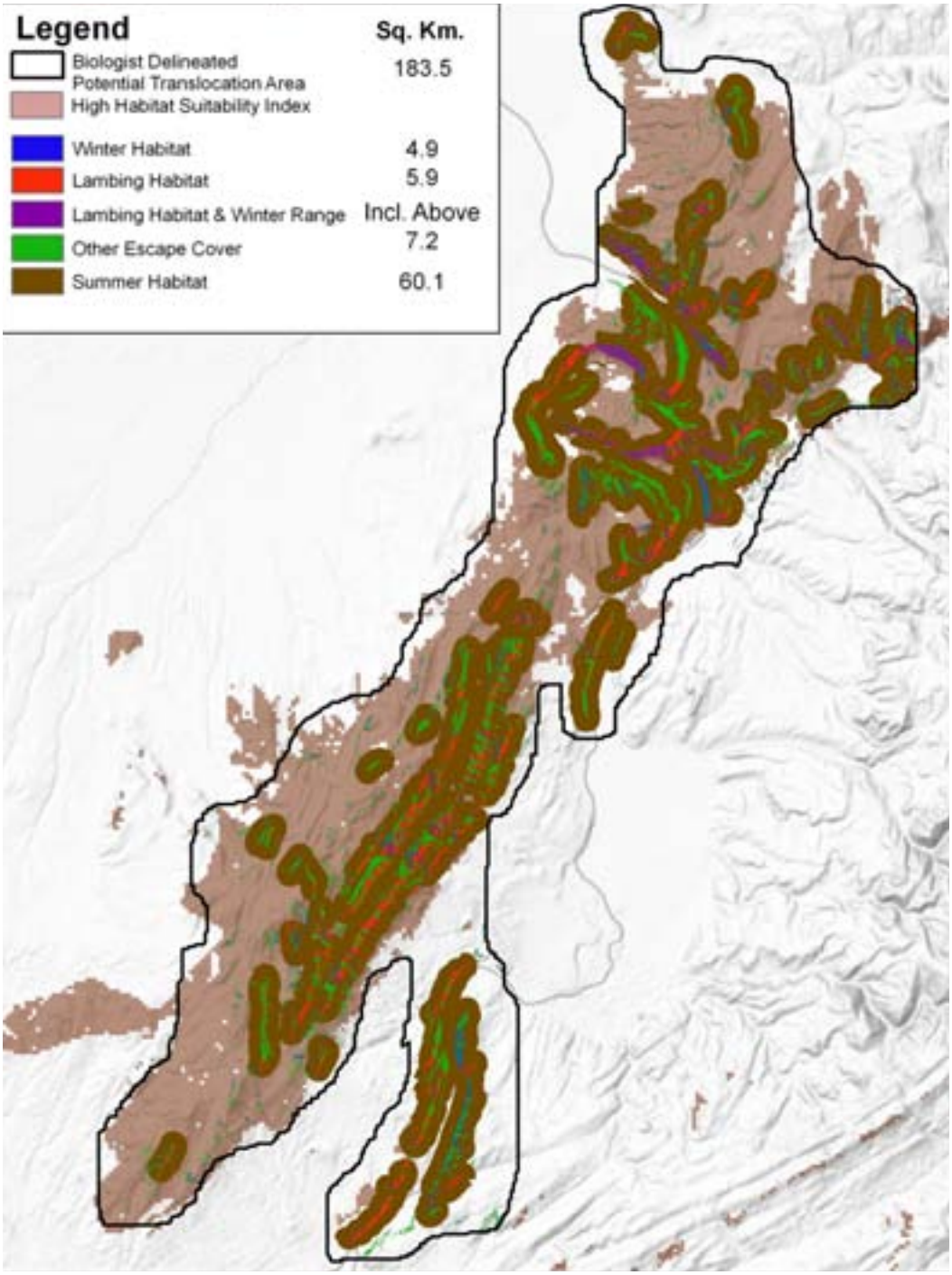

Figure 9. Example of seasonal range identification.

elsewhere in this Conservation Strategy. While some existing bighorn sheep populations in Montana occur in areas close to domestic sheep or goats, ranking of new transplant sites will be higher if there are no domestic sheep or goats in the immediate area. Zeigenfuss et al. (2000), when looking at a number of successful and unsuccessful bighorn sheep transplants, found that successful populations were an average of 23 km (14.3 mi) from domestic sheep. Likewise Singer et al. (2000), when evaluating success of 100 translocations of bighorn sheep, found that successful populations were an average of 20 km (12.4 mi) from domestic sheep. Areas within 23 km of known domestic sheep or goat distribution pose a higher risk for commingling of bighorn sheep and domestics and potential disease transmission. Before a decision to translocate bighorn sheep to such areas is made, other mitigating factors should be evaluated. For example, even though a potential transplant site may be less than 23 km from domestic sheep or goats, other physical characteristics of the site may provide for effective separation between the bighorn sheep and domestic animals. Identifying areas of federal grazing allotments has provided an initial assessment of these risks (Figure 10). However, by comprehensively mapping

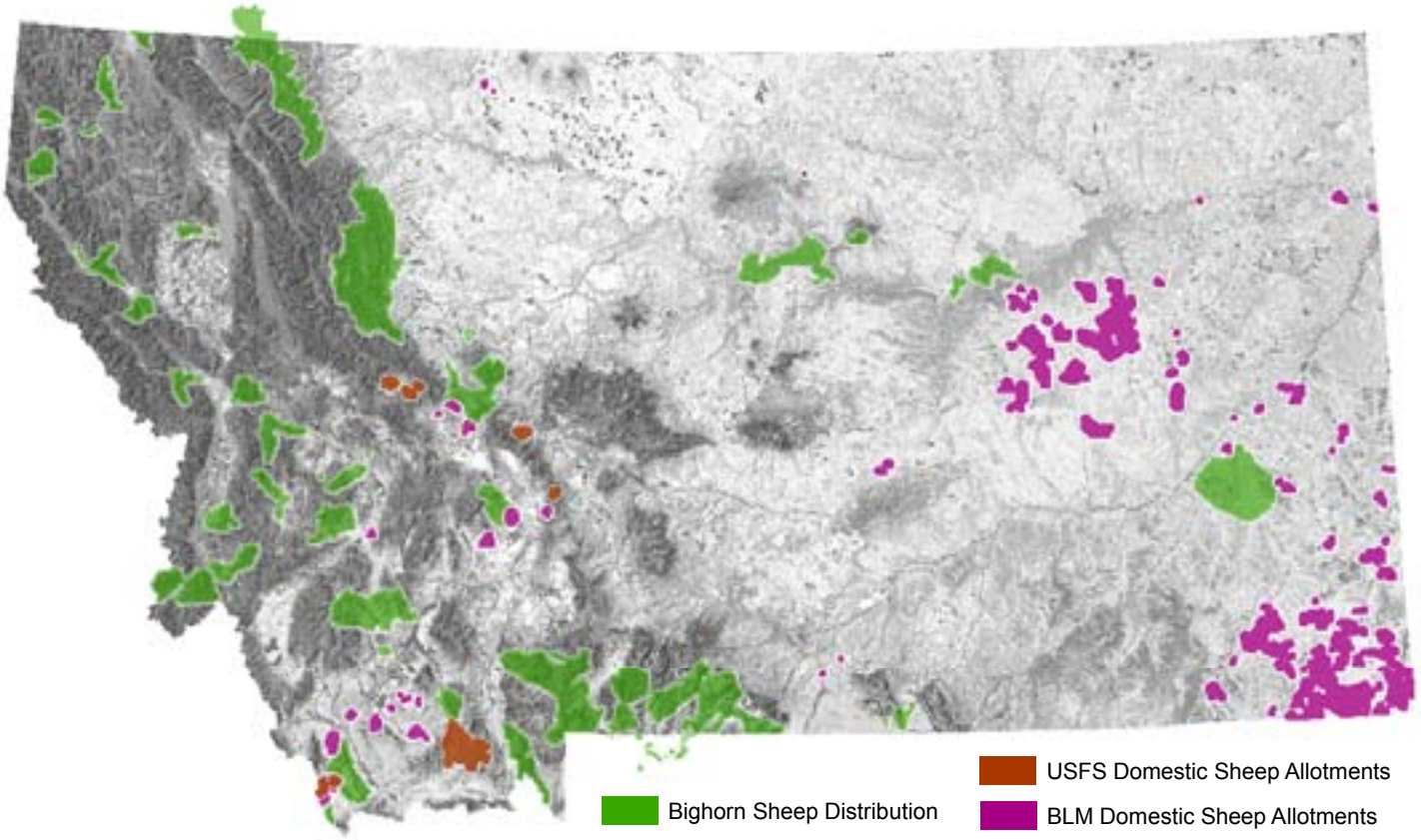

Figure 10. Distribution of domestic sheep allotments on USFS and BLM-managed lands in Montana.

additional locations of domestic sheep grazing, a more complete picture can be obtained.

In addition to the risks associated with domestic sheep, commercial development of suitable habitat patches, including energy and subdivision development, may preclude the presence of bighorn sheep on suitable range. Increased mapping efforts will allow FWP to identify areas recently lost, under immediate threat of development, or that may face development pressures in the future.

Once the above data is generated, the "Bighorn Sheep Transplant Site Assessment Form" (Appendix E) can be filled out and sent to the biologist responsible for the area. The availability of accurate and complete GIS data will allow FWP to continue to refine the models described above. As these layers are refined and data availability increases, model performance will be improved.

Protocols for Trapping and Transplanting Bighorn Sheep to New Areas and Augmenting Existing Populations

New Site Selection Criteria

The FWP Commission recognizes that transplantations of bighorns are absolutely necessary to reestablish this public-trust wildlife species to much of its original range, from which it has been extirpated. Transplanting of bighorn sheep into unoccupied habitat is regulated by and subject to Montana's Importation, Introduction, and Transplantation of Wildlife statutes MCA 87-5-701-721. In particular, statute 87-5-711 "Control of importation and transplantation or introduction of wildlife" in relation to transplanting wildlife species states in part: "Except as otherwise provided, the importation for introduction or the transplantation of any wildlife is prohibited unless the commission determines, based on scientific investigation and after public hearing, that a species of wildlife poses no threat of harm to native wildlife and plants or to agricultural production and that the transplantation or introduction of a species has significant public benefits." To promote the restoration and conservation of historic bighorn sheep populations and their habitats, and to reduce the possibility of disease outbreaks in newly established transplanted bighorn herds, and to avoid harmful effects on agricultural or livestock production, it is the policy of the FWP Commission and Department, to follow the following protocol:

1) FWP will give preference to those sites that are historic habitat for bighorn sheep, on land that is primarily publicly owned. Before initiating a transplant FWP will coordinate and cooperate with local landowners and land management

agencies to ensure domestic livestock use on or near such sites is compatible with bighorn sheep conservation objectives. Additionally, the needs of other native wildlife and plants in the area will be considered.

2) Approve transplants only where FWP has determined (see Habitat Evaluation Procedures in the Translocation Section of the Montana Bighorn Sheep Conservation Strategy) there is sufficient winter and other seasonal range capacity to support the anticipated population size while considering potential competition with other wild or domestic ungulates and the potential for mitigating such competition.

3) Use transplants to establish and encourage bighorn herds into naturally connected metapopulations, for the demographic and genetic benefits of such metapopulations, while maintaining adequate separation from domestic sheep or goats to diminish the potential for commingling and potentially serious disease problems.

4) Consider only transplants to those sites with a majority of public land and/or landowner-granted legal hunter access, which is negotiated for a long enough period to ensure that hunting and/or trapping/relocation can be used to control herd size in the future.

5) Approve transplants only after considering public input on issues relating to the proposal, including possible negative impacts to agricultural production or livestock. FWP will make efforts to notify local landowners of the potential transplant and develop appropriate agreements, prior to approval, with individual landowners and/or agencies that own significant portions of the area where bighorns are expected to establish. FWP will seek to satisfy or mitigate local concerns and eliminate and/or mitigate possible negative impacts to agricultural production or livestock, and maintain respectful landowner relations.

6) FWP will use hunting and trapping for relocation to control herd sizes and distributions. If an increase in herd objective is proposed or an increase in herd distribution occurs, FWP and the Commission will consider habitat limitations, landowner tolerances and other factors in evaluating and responding to the proposal or the increase in distribution; but will not abdicate their public-trust responsibility to manage a population to benefit all citizens, considering all legal and ethical responsibilities of the agency, landowners and the public.

7) Approve transplants only where there are significant public benefits outweighing any public concerns or issues.

8) Assume the risk of transplant failure, holding no landowner or public grazing allotment lessee responsible without proof of negligence or intent.

9) Evaluate the potential for future consumptive and non-consumptive uses, including access. Recently transplanted bighorn, and/or augmented herds, must not be hunted until they have reached 80% of a Minimum Viable Population (N=125) and there is sufficient annual recruitment to maintain herd growth while allowing for anticipated hunter harvest.

10) The FWP Region responsible for the transplant will produce a management plan for the population as it nears objectives, following the format for such plans as in the Conservation Strategy. This will include the criteria and process for implementing hunting, including the process for how license levels are set.

11) In the unlikely event that bighorns from a recently transplanted herd establish in an unexpected area used by domestic livestock, FWP will participate in discussions and negotiations with state and/or federal agencies and private parties, seeking an equitable solution to eliminate, compensate for, or mitigate possible negative impacts of bighorns on ranching operations.

Criteria For Augmenting An Existing Population

1) If translocation is proposed to a historical site, or one with a depressed population, evaluate the habitat to determine the reason(s) for the lack of bighorns and determine if the area can support more. The reasons for the initial extirpation or reduction will be determined and corrective measures taken. If predators are thought to be suppressing bighorns on otherwise healthy range, this issue needs to be addressed in a proposal that includes potential type of predators and

courses of action to reduce predation rates.

2) Determine the health status of the source herd and the recipient herd (e.g., fecal lungworm larvae trends, serological profile) to ensure that sick bighorns are not translocated to healthy populations and vice versa.

3) Keep genetic strains intact as much as possible by emphasizing transplants within contiguous ranges. If the objective of the transplant were to improve genetic variability, the transplant would generally consist of a limited number of rams. These rams could be trapped in conjunction with a new transplant to reduce costs of the augmentation.

4) Evaluate the potential for future consumptive and nonconsumptive uses, including access. Recently transplanted bighorns and/or augmented herds must not be hunted (see Population Management section for criteria) until they have stabilized and can withstand harvest (i.e., close monitoring is needed to demonstrate that there is sufficient recruitment and good health).

5) When augmenting an existing population that has gone through a major decline, it may be desirable, depending on the current status of the population, to provide consecutive year transplants for reestablishment of the population.

Regional Responsibilities

Each FWP Region will annually determine priority areas for transplants and prepare an annual summary with the following criteria and components:

1) Describe augmentation or new transplant.
   a) If augmentation, then give status of the herd already present (include serological profile if available or other indication of herd condition). If a population decline occurred as a result of a die-off, provide an assessment of the cause of the die-off and what course of action has been taken to rectify the situation.
   b) Regions are required to produce an Environmental Assessment in compliance with the Montana Environmental Policy Act (MEPA) for all new transplants.

2) The following processes and timeframes for recommending a new transplant or augmentation of an existing population will be adhered to:
   a) A Habitat Evaluation Procedure and the accompanying HEP Assessment Form needs to be completed for each potential new transplant site and sent to the Wildlife Division administrator at least two weeks prior to the March wildlife managers meeting. Assessment forms will be compiled by the division and sent to the Regions for review prior to the March meeting.
   b) At the March meeting, potential translocation sites, including new sites and augmentation of existing herds, will be prioritized by the division administrator, management bureau chief and regional wildlife managers based on criteria contained in the HEP Assessment Form and the Process for Prioritizing Translocations (see below).
   c) For new transplants, all contacts with appropriate agencies, landowners, domestic animal producers/lessees will have been made regarding the transplant prior to the March meeting. While written agreements and MEPA analysis are not necessary for augmentation of an existing population appropriate agencies and private parties should be notified of the action in a timely manner.
   d) New transplants and proposed augmentations will be presented to the FWP Commission at their May meeting for tentative approval to move forward. Final approval will occur by the Commission at their July meeting.
   e) By August 1, the MEPA process has been completed and all the appropriate parties have signed agreements.

3) Regions will provide listings of the numbers of sheep available for transplant to other areas to the Wildlife Division administrator by December 15 each year.

Process for Prioritizing Translocations

There are a number of qualitative and quantitative factors that help prioritize potential transplant sites that should be considered prior to looking at sites in detail, regardless of the process used to identify sites. These include:

1) Preference will be given those areas that had historical populations and still contain suitable habitat.
2) Preference will be given those sites not in close proximity to domestic sheep and those with limited competition from other livestock or wild ungulates.
3) Preference will be given to those sites with a majority of public land and/or legal access in order to ensure the huntability of the herd in the future.
4) Only those sites with landowner agreements (as defined in number 5 in New Site Selection Criteria) completed and signed will be approved.

Wildlife Division Responsibilities

1) The Wildlife Division administrator will allocate available sheep to sites in priority established under Regional Responsibilities 2(b) above. Implementation will be limited to available funding and bighorn sheep trapped in any one year.
2) Transplant costs excluding personnel services will be borne by the portion of annual bighorn sheep auction revenue budgeted for that purpose during biennial project proposal planning.
3) Monitoring costs to determine success in excess of annual budgets will be borne by the portion of annual bighorn sheep auction revenue budgeted for that purpose during biennial project proposal planning.

Characteristics of the Source Herd, Transporting, Release, and Monitoring

The following are a number of pertinent recommendations in relation to source herd characteristics. A good source of information regarding most aspects of transplanting bighorn sheep can be found in Foster (2004).

1) Source herds should have a recent health profile completed.
2) The number of animals per transplant considered adequate to establish a new population or reestablish (augment) an existing population is a minimum of 20 bighorns.
3) Ewes from various age classes are recommended, so young ewes can learn from older ewes at the new site.
4) A ram to ewe ratio of 1:3 to 5 with rams four years old or younger, as they are more likely to associate with the ewe and lamb groups than older rams.
5) Release animals on good quality winter range near (i.e., within 300 m) escape terrain.
6) To reduce the possibility of introducing disease into an existing population, transplants will in general not be authorized to augment established herds of 100 or more animals.
7) A minimum of 20% of released animals should be fitted with radio collars. If contact with domestic animals is a possibility, the number of animals with radio collars should be increased to facilitate more effective monitoring.
8) Radio collars should be relocated from the air at least once a month to determine seasonal distribution and subsequent home ranges. At the same time, all bighorn sheep should be classified as to sex and age with emphasis on lamb production and survival.

Examples of Memorandum of Understanding (MOU) and Other Agreements in Relation to New Transplants of Bighorn Sheep on Public and Private Lands (on File)

1) MOU between federal agencies managing domestic sheep allotments, permittees, and FWP in relation to a new transplant of bighorn sheep.
2) MOU between mining company, BLM, and FWP in relation to a newly transplanted sheep population on BLM lands leased by a mining company.
3) Examples of landowner agreements in relation to a new transplant of bighorn sheep where private lands may be used by bighorn sheep.