ESTIMATING THE VALUE OF ACCESS TO GAME RESOURCES ON NEW MEXICO STATE TRUST LANDS

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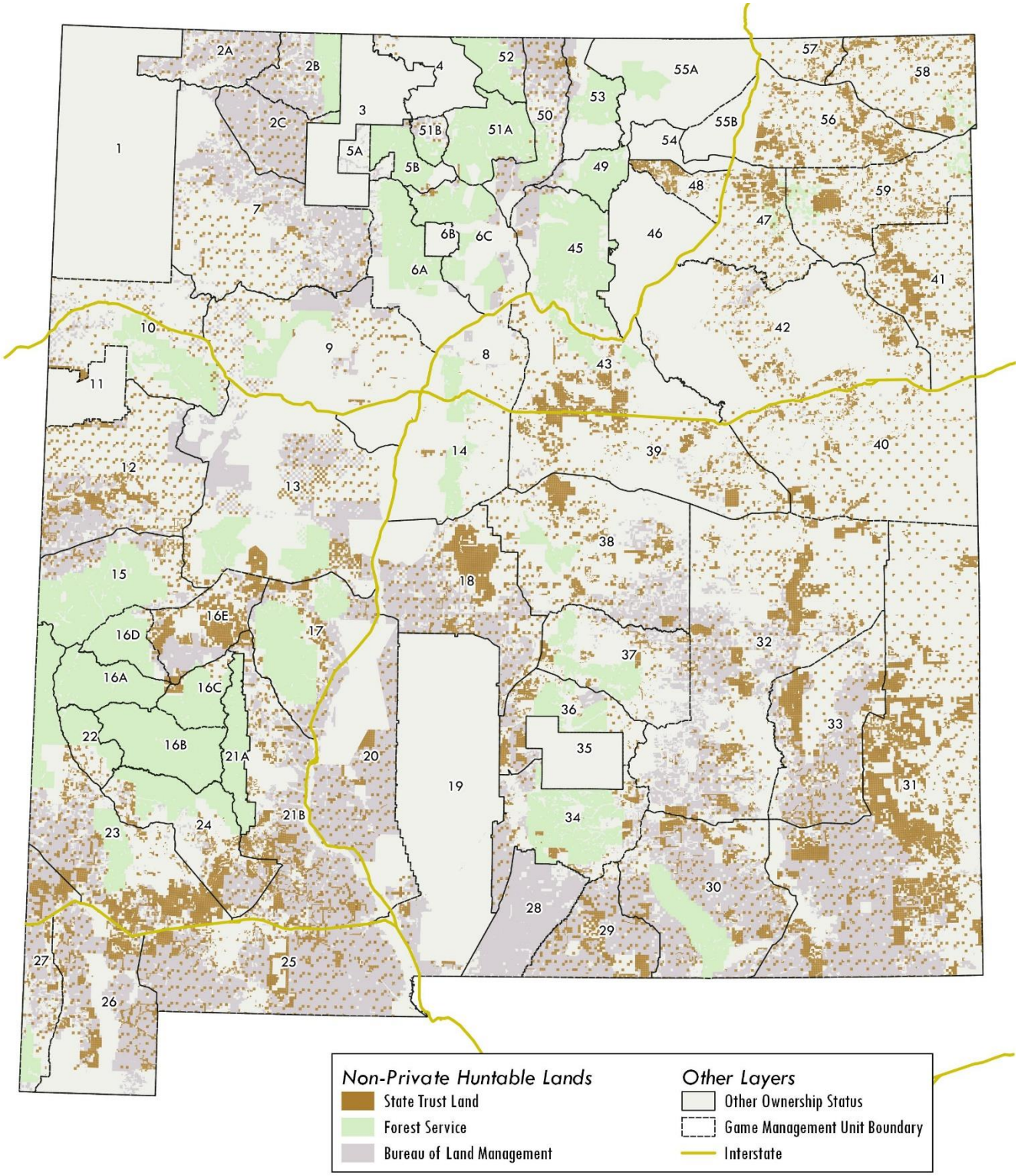

1 INTRODUCTION

1.1 REPORT PURPOSE AND OVERVIEW

The valuation methodology described in this report was developed by the Center for Applied Research (the Center) at the request of the New Mexico State Land Office (NMSLO) with the objective of estimating the value of public hunting access on New Mexico State Trust Lands. The leasing and rental of state trust land provides a sustainable revenue stream to New Mexico schools and public institutions, which are the direct beneficiaries of state trust land easements, leases, rights-of-way, and the extraction of resources from those lands. Furthermore, the leasing, rental, and extraction of resources from state trust lands is also an important source of employment and related economic activity in the local and state economies.

Periodically, the NMSLO enters into a formal easement agreement with the New Mexico State Game Commission that authorizes entry by licensed hunters, anglers, and trappers on state trust lands for the regulated harvest of protected game species. As part of this agreement, the State Game Commission (SGC), through the Department of Game and Fish (DGF), is also authorized to police state trust lands for the purpose of preventing illegal taking of protected species and trespassing. The purpose of this arrangement is two-fold: first, it provides the NMSLO with a mechanism to earn revenue from the game resources present on state trust lands; and second, it increases the land base that is publicly accessible to hunters, anglers, and trappers throughout the state — to whom access would otherwise be limited to lands managed by the Bureau of Land Management, United States Forest Service, and lands leased or owned by the SGC or DGF.

The value of the NMSLO's agreement with the SGC and the access to game resources on state trust lands that it conveys has been unclear in past iterations of the agreement largely due to the fact that the value of the game resources itself is not easily monetized using conventional valuation methods. In an effort to clarify this value, the valuation methodology and the application of that methodology presented in this report are designed to monetize the value of game resources on state trust lands based on the historical demand for those resources and the observed willingness-to-pay of individuals who seek to harvest those resources.

1.2 INTENDED USE AND USERS

This valuation report has been prepared for exclusive use by the NMSLO. By design, the results of this valuation are reported in a format that can easily be referenced in future iterations of the easement agreement between the NMSLO and the State Game Commission, though the use of this report and its findings need not be limited to this singular purpose. A key objective of the Center's research and analysis reported herein is to provide the NMLSO with a credible foundation for its negotiations with the SGC (or other interested lessee) to arrive at an agreed upon amount of compensation that would be paid to the NMSLO pursuant to New Mexico state law and regulation and the terms and conditions of a formal easement agreement conveying access to game resources on state trust lands by an interested party. The Center's valuation methodology, the data used in the valuation, and the outcome of the valuation are outlined in detail herein.

The effective date of this valuation is June 28, 2018.

1.3 DISCLAIMER AND NOTES ON REPORT USAGE

The analysis contained in this report and all related supplementary information are based upon the Center's best professional judgment and on sources of information purported to be reliable. However, no representation or warranty is made by the Center as to the accuracy or completeness of any third-party information used for this assessment. The analyses and conclusions presented in this report have been prepared by the Center on the basis of current knowledge and assumptions which are believed to be reasonable but may not be within the control of the Center. The assumptions used in preparing this report and all related supplemental and background information are inherently subject to significant uncertainties. If the assumptions used prove to be inaccurate, the conclusions expressed or inferred herein could be materially different from reality.

2 SCOPE OF VALUATION

2.1 STATE TRUST LANDS SUBJECT TO VALUATION

Under the terms of the easement agreement between the NMSLO and the SGC, over 8,800,000 surface acres are authorized for access by licensed hunters, anglers, and trappers. Only a small number of state trust land parcels are excluded from the terms of the agreement. For consistency, all New Mexico state trust lands, with the exception of those withdrawn from the latest iteration of the agreement between the NMSLO and the SGC (New Mexico State Land Office, 2014) — which was executed on October 5, 2016 — are addressed in the valuation program described herein. It should be noted, however, that certain state trust land parcels subject to the agreement are effectively omitted from some of valuation results for one of two reasons. First, these parcels have a high probability of being occupied by no marketable game species. Second, these parcels have a high probability of being occupied by a marketable game species, but are unlikely to be accessed by licensed hunters or trappers due to a combination of their juxtaposition within a DGF-designated Game Management Unit (GMU), their discontinuity with other state trust land parcels, or limitations on their contiguous surface acreage.

2.2 USES SUBJECT TO VALUATION

For the purposes of this valuation, the uses subject to valuation are limited to access by licensed hunters and trappers and the taking of protected game species in a manner that is consistent with the rules and regulations of the SGC, DGF, and the NMSLO. Broadly, these rules and regulations dictate when specific game species can be harvested, and the allowable number of each game species that can be harvested by each licensed hunter or trapper. While access to state trust lands to licensed anglers is also authorized by the agreement between the NMSLO and the SGC, the value of fishing resources is not addressed in this report, and would therefore be additive to the resulting game resource valuation that is summarized in Section 5.

It is necessarily assumed, given the limitations of the valuation approach described herein, that all state trust lands theoretically occupied by harvestable game species and not withdrawn from access can be accessed by hunters and trappers either by vehicle or on foot. The value of the

privilege to camp on or otherwise overnight on state trust lands and value of the ability to physically access state trust lands are outside of the scope of this valuation.

2.3 GAME SPECIES SUBJECT TO VALUATION

This report is specific to the value of access to protected game species that are authorized for harvest by the licensing requirements of the DGF. While the current iteration of the agreement between the NMSLO and the SGC does allow for harvesting of unprotected game species, the value of such access is not addressed herein. Generally, protected game species authorized for harvest can be divided into four basic categories: upland game, furbearers, migratory birds, and big game. Due to deficiencies in species distribution data, the value of access to certain game species necessarily has been omitted from this valuation. Further, game species that do not exhibit a significant presence on state trust lands have also been omitted. Finally, the value of access to migratory birds on state trust lands has been omitted due to the comparatively complex nature of DGF rules and regulations regarding their extraction and the general lack of data that could be used to estimate the demand for access to these species.[1]

Due to data availability and structure, the valuation approach employed by the Center differs to some degree between big game species and non-big game species (i.e., upland game, furbearers, and turkey).[2] To accommodate these differences, the details of the Center's valuation and the data and methodology used in arriving at that valuation are also discussed separately in accordance with these same broad categories.

3 VALUATION OF ACCESS TO NON-BIG GAME SPECIES

3.1 BASIC APPROACH TO ESTIMATING THE VALUE OF ACCESS TO NON-BIG GAME

The approach to estimating the value of access to non-big species is similar to that developed for estimating the value of access to big game species. The key difference in the two approaches primarily relates to the data sources used to define and quantify the three basic components of value: species distribution, hunter and trapper demand, and willingness-to-pay. To estimate the value of access, the Center developed a three-step algorithm wherein the first step is to estimate the georeferenced demand for each species individually. In the second step, this demand is multiplied by the species-specific willingness-to-pay of hunters and trappers seeking to harvest those species, which gives the total value of each species by geographical unit of interest.[3] In the third step, the results of the second step are apportioned to state trust lands and other land classifications where hunting is allowed based on the predicted species-specific distribution within that geographical unit of interest.

A simplified version of the algorithm used to value access to non-big game species on state trust lands is expressed formulaically in Equation (1):

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[1] The DGF does not have a system to report harvests of migratory bird species. Rather harvest information for these species is tracked by the U.S. Fish and Wildlife Service's Harvest Information Program.

[2] The definitions and categorization of "big game" species and "non-big game" utilized herein may differ from the DGF's formal definitions for these terms.

[3] The geographical unit of interest may be GMU or county depending on the geographical identifier the DGF requires in its annual harvest reporting for that individual species.

$$(1) \qquad value_{non-big\ game} = \sum_{s=1}^{n}\sum_{j=1}^{m} demand_{sj} \times wtp_s \times {stl\_po_{sj}}/{hunt\_po_{sj}}$$

Where *demand* represents the average annual harvest demand between 2014 and 2017 for each species *s* in each geographical unit of interest *j* for every legally harvestable species type (*n*) within every geographical unit of interest (*m*) where that species is predicted to be occupied; *wtp* represents the willingness-to-pay of hunters and trappers for species *s*; *stl_po* represents the number of accessible state trust land acres predicted to be occupied by species *s* in geographical unit of interest *j*; and *hunt_po* represents the total number of acres accessible to hunters and trappers predicted to be occupied by species *s* in unit of interest *j*.

Since primary data on hunters' and trappers' willingness-to-pay to harvest individual non-big game species could not be obtained for the purposes of this analysis, the *j* subscript has been omitted from the willingness-to-pay variable in Equation (1). The absence of this subscript reflects the necessary assumption that the willingness-to-pay of hunters and trappers does not differ throughout the state, or more explicitly, hunters and trappers as a group — though not as individuals — are indifferent to where they hunt or trap a specific species within the state as long as that species is present. The primary implication of this assumption is that the quality of non-big game species is assumed to be uniform across areas they occupy. For big game species such as elk, deer, and antelope, this may be viewed as an egregious assumption; however, for the non-big game species subject to this portion of the Center's analysis (e.g., quail, beaver, squirrel), it is much less a concern.

Additional information about the source and structure of the data used to quantify and define the three basic components of value shown in Equation (1) is provided in Section 3.3 of this report. Any additional assumptions necessitated by the source data are also described in detail therein.

3.2 IDENTIFICATION OF NON-BIG GAME SPECIES SUBJECT TO ANALYSIS

It was the initial objective of the Center's analysis to estimate the value of access to state trust lands for all protected game species for which the DGF grants licenses to harvest. However, limitations and/or structural deficiencies in the data available for some game species either prevented or significantly compromised reliable calculations of value enough to warrant exclusion of those species from this analysis. Table 1 contains an exhaustive list of the protected non-big game species considered in the course of this analysis and whether or not sufficient data was available to estimate species-specific values of access.

Table 1 – Non-big game species included and excluded from analysis

Game Species	Included in Analysis	Reason for Exclusion
Furbearers		
▪ American Badger	Yes	
▪ American Beaver	Yes	
▪ Ermine	No	None harvested between 2014 and 2017
▪ Muskrat	No	Predicted distribution data not available
▪ Nutria	No	None harvested between 2014 and 2017
▪ Kit Fox	Yes	

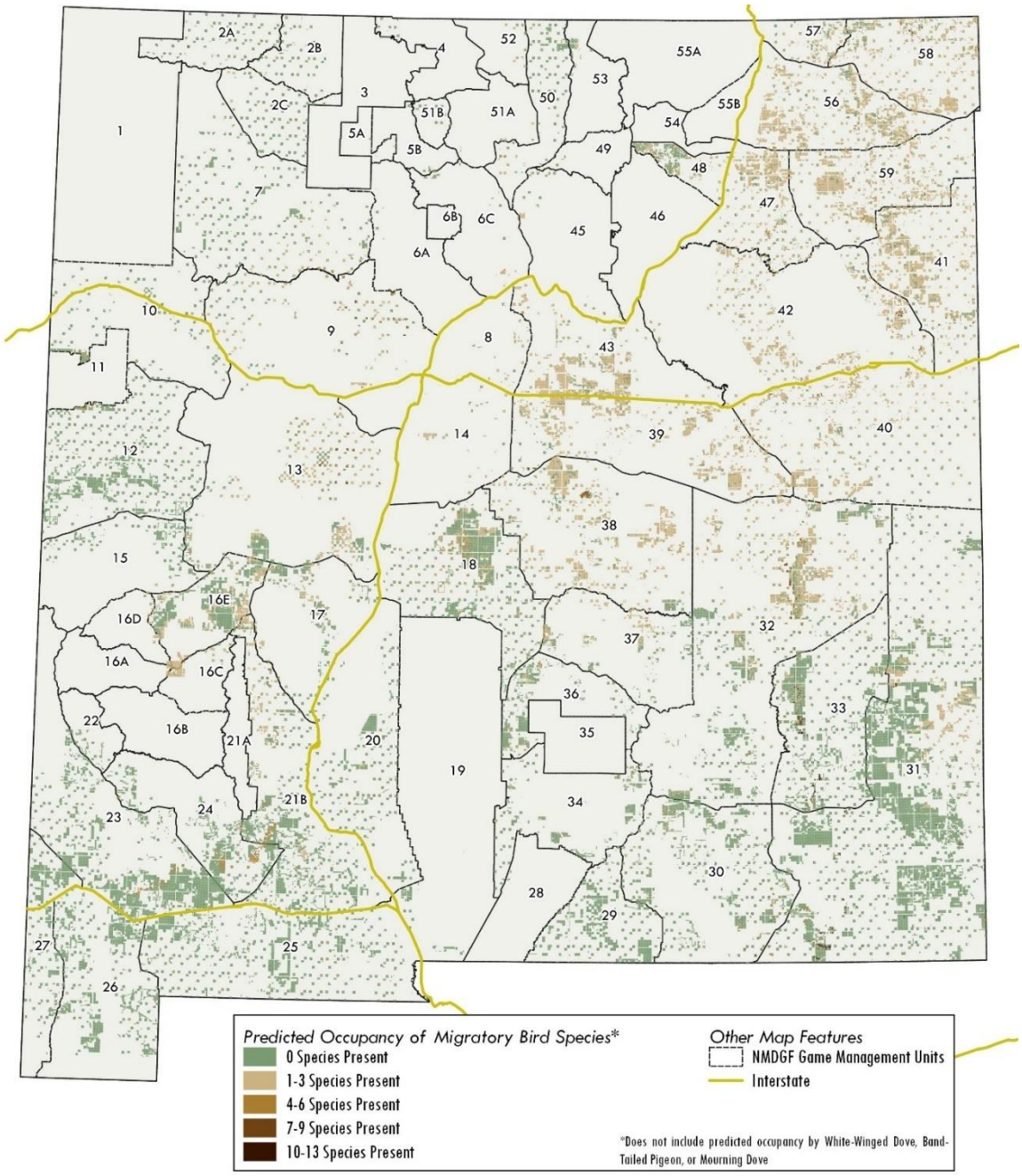
Game Species	Included in Analysis	Reason for Exclusion
▪ Long-Tailed Weasel	Yes	
▪ Red Fox	Yes	
▪ Gray Fox	Yes	
▪ Ringtail	Yes	
▪ Swift Fox	Yes	
▪ Bobcat	Yes	
▪ Raccoon	No	Predicted distribution data not available
Upland Game		
▪ Scaled Quail	Yes	
▪ Gambel's Quail	Yes	
▪ Montezuma Quail	Yes	
▪ Northern Bobwhite	Yes	
▪ Ring-Necked Pheasant	Yes	
▪ Dusky Grouse	Yes	
▪ Eurasian Collared-Dove	Yes	
▪ Abert's Squirrel	Yes	
▪ Red Squirrel	No	Predicted distribution data not available
▪ Fox Squirrel	Yes	
▪ Gray Squirrel	Yes	
Turkey*		
▪ Gould's Turkey	Yes	
▪ Merriam's Turkey	Yes	
▪ Rio Grande Turkey	Yes	
Migratory Birds		
▪ Mourning Dove	No	Georeferenced harvest data unavailable
▪ White-Winged Dove	No	Georeferenced harvest data unavailable
▪ Band-Tailed Pigeon	No	Georeferenced harvest data unavailable
▪ American Coot	No	Georeferenced harvest data unavailable
▪ Canadian Goose	No	Georeferenced harvest data unavailable
▪ Canvasback	No	Georeferenced harvest data unavailable
▪ Common Moorhen	No	Georeferenced harvest data unavailable
▪ Mallard	No	Georeferenced harvest data unavailable
▪ Northern Pintail	No	Georeferenced harvest data unavailable
▪ Redhead (Duck)	No	Georeferenced harvest data unavailable
▪ Ross's Goose	No	Georeferenced harvest data unavailable
▪ Sandhill Crane	No	Georeferenced harvest data unavailable
▪ Snow Goose	No	Georeferenced harvest data unavailable
▪ Sora	No	Georeferenced harvest data unavailable
▪ Virginia Rail	No	Georeferenced harvest data unavailable
▪ White-Fronted Goose	No	Georeferenced harvest data unavailable
▪ Wood Duck	No	Georeferenced harvest data unavailable
▪ Common Snipe	No	Georeferenced harvest data unavailable

*The DGF offers draw permits for specific turkey hunts, but most turkey tags are purchased over-the-counter. For this reason, access to turkey on state trust lands is valued herein using the methodology for non-big game rather than the methodology for big game.

As shown in Table 1, the value of access to state trust lands for the purpose of hunting any migratory game bird species is not addressed herein. The primary reason for this omission is the absence of suitable data which could be used to calculate harvest demand and match it to a geographical unit of interest.

Excluding band-tailed pigeons, white-winged doves, and mourning doves, which are ubiquitous and frequently hunted[4] throughout much of New Mexico, only about 11% of state trust land acreage is predicted to be occupied by any migratory game bird species at any time of year. Predicted migratory game bird occupancy is further illustrated in Figure 2. As shown therein, the majority of state trust land parcels are predicted to be unsuitable for hunting migratory game birds (as shown in green). Potentially suitable state trust land parcels for

Figure 2 – Predicted occupancy of state trust lands by migratory game bird species



[4] The U.S. Fish and Wildlife Service estimates that approximately 47,900±26% mourning doves, 35,000±45% white-winged doves, and 200±81% band-tailed pigeons were harvested statewide in New Mexico in 2016 (Raftovich, Chandler, & Fleming, August 2017).

hunting migratory game bird species are primarily clustered in the east central and northeastern portions of the state. In this context, potentially suitable state trust land parcels are characterized as exhibiting some proportion of predicted occupancy by at least one migratory game species. Highly suitable state trust land parcels (i.e., those with predicted occupancy by four or more migratory game species) are few, though where they do occur, these parcels are generally characterized by their proximity to wetlands or other year-round surface water features such as ponds, lakes, or streams with perennial flows.

3.3 DISCUSSION OF DATA SOURCES AND INPUT VARIABLES

The data used to estimate the value of access to state trust lands for the purpose of hunting or trapping non-big game species can be broken down into three broad categories which correspond with the three basic components of value discussed in Section 3.1: species distribution, harvest demand, and willingness-to-pay. A detailed discussion about the source and structure of the data used to quantify and define these three basic components of value is provided below.

3.3.1 Harvest Demand

With respect to non-big game species, the Center defines harvest demand as the historical rate at which individuals participate in hunting and trapping activities throughout the state of New Mexico — and some estimable portion of that demand is attributable to state trust lands. Since detailed data quantifying the demand

Table 2 – Summary of state-wide harvest demand

	Average Annual Number of Harvest Reports*	Estimated Number of Licenses Sold by Species
Furbearers†	*4,789*	*1,658*
American Badger	214	75
American Beaver	100	35
Ermine	0	0
Muskrat	76	27
Kit Fox	180	63
Long-Tailed Weasel	1	0
Red Fox	158	54
Gray Fox	2,093	723
Ringtail	59	20
Swift Fox	55	20
Bobcat	1,562	540
Raccoon	291	102
Upland Game‡	*3,551*	*79,210*
Abert's Squirrel	132	2,967
Dusky Grouse	382	8,626
Eurasian Collared Dove	523	11,743
Fox Squirrel	6	131
Gambel's Quail	521	11,738
Gray Squirrel	97	2,173
Montezuma Quail	51	1,128
Northern Bobwhite	170	3,762
Ring-Necked Pheasant	34	751
Scaled Quail	1,595	35,253
Red Squirrel	42	938
Turkey§	*0*	*13,168*
Merriam's Turkey	n/c	10,535
Rio Grande Turkey	n/c	1,975
Gould's Turkey	n/c	658

* Source: DGF Upland Game,Furbearer, and Turkey Harvest Reports: 14-15, 15-16, 16-17

† The average annual number of trapping licenses sold between 2014 and 2017 was 1,658.

‡ The average annual number of small game licenses sold between 2014 and 2017 was 79,210.

§ The average annual number of turkey licenses sold between 2014 and 2016 was 13,168. License allocation estimates were based on species distribution.

of hunters and trappers to harvest non-big game species specifically from state trust lands — as opposed to accessible private or public lands — is not available, state-wide harvest demand served as the basis for its calculation.

State-wide harvest demand by non-big game species was extracted from the DGF's harvest reports for the 2014-2015, 2015-2016, and 2016-2017 seasons (see Table 2). As part of its harvest reporting program, the DGF collects information about the number of licenses sold to small game hunters and trappers as well as geographically-coded, species-specific data about the success of those hunters and trappers. For all upland game species, harvest reporting is optional, and during the past two hunting seasons roughly 30% of upland game hunters chose to file a harvest report.[5] For trappers of protected furbearers, harvest reporting is mandatory.

Unfortunately, purchasers of small game licenses and trapping licenses are not required by the DGF to specifically identify the game species they intend to hunt or trap. Instead, small game licenses authorize hunters to hunt any eligible upland game species, and trapping licenses authorize trappers to trap any eligible furbearer species. A ratio of harvest reports (by species) to the total number of licenses sold was therefore used to approximate the number of licenses sold by species.[6] This process is described by Equation (2).

$$(2) \qquad licenses_s = \frac{1}{n}\left(\sum_{t=1}^{n} {reports_{st}}/{total\ reports_{ct}} \times total\ licenses_{ct}\right)$$

Where the number of *licenses* sold to hunt or trap protected game species *s* was estimated as the average annual number of harvest reports filed for species *s* divided by the total number of harvest reports filed for license category *c* (either upland game or furbearers) multiplied by the total number of category *c* licenses purchased. The resulting species-specific number of licenses sold was then apportioned to geographical units of interest using DGF harvest reports. Herein, the geographically apportioned, species-specific license sales are referred to as harvest demand, which is equivalent to the *demand* variable presented in Equation (1).

Harvest demand should not be confused with, or conflated to mean harvest success. In this context, demand represents an individual's decision to pay for the opportunity to hunt or trap a specific protected game species, which is a necessary condition for success, but independent from it. Since the overall objective of this analysis was to estimate the value of access to game species on state trust lands, the variable of interest pertaining to harvest demand is whether an individual is provided with the opportunity to access state trust lands. An individual's success in harvesting game from those lands is therefore not a relevant factor, nor is it relevant if a licensed individual chooses not to hunt at all.

3.3.2 Willingness-to-Pay of Hunters and Trappers

Ideally, the value of access to game resources on state trust lands would be predicated on the

[5] This figure is up dramatically from previous years. During the 2014-2015 hunting season, only 3% of licensed small game hunters filed a harvest report; compared to a reporting rate of 29.8% during the 2015-2016 season and 32.9% during the 2016-2017 season (New Mexico Department of Game & Fish, 2015, 2016, 2017).

[6] Since harvest reporting is optional for upland game species, this method of approximation necessarily assumes that individuals are equally likely to file a report for any given legally harvested upland game species. This assumption is not necessary for furbearers or turkey since harvest reporting for those license types is mandatory.

expressed willingness-to-pay of hunters and trappers for the opportunity to harvest a given game species. However, as previously mentioned, primary data on hunters' and trappers' willingness-to-pay to harvest individual non-big game species could not be obtained for the purposes of this analysis. Absent this level of detailed data, the most readily available alternative is the price paid by hunters and trappers to the DGF in exchange for the opportunity to hunt or trap specific game species (i.e., the cost of a license).

The Center recognizes that the cost of a license purchased from the DGF is an imperfect proxy for willingness-to-pay since the price is not established through competitive free market transactions. As the sole supplier of non-big game licenses, the DGF is free to exercise monopolistic control over the market — where the price of a license is largely guided by the DGF's costs of operation rather than supply and demand. Given the structure of the market, it is unlikely that the DGF-established price for non-big game licenses is set at an optimal level which would maximize economic efficiency. From a theoretical perspective, this is especially troublesome since the DGF also is not expected to behave like a conventional profit maximizing agent. If the DGF's pricing decisions do in fact distort the market, it is expected that some deadweight loss is prevalent. The existence of deadweight loss in the market for non-big game licenses could indicate that either the price of game licenses is less than hunters' and trappers' willingness-to-pay or the quantity of licenses supplied by the DGF is suboptimal. In either case, as it pertains to the valuation presented herein, this is a potential cause for concern and may result in an underestimation of the fair market value of access to state trust lands for the purpose of hunting non-big game species.

Despite the concerns presented above, without a more appropriate source of data the DGF's license pricing is the best available proxy for willingness-to-pay for the opportunity to hunt and trap non-big game species on New Mexico state trust lands. Table 3 therefore presents these prices and the residency-adjusted willingness-to-pay values referenced by the *wtp* variable presented in Equation (1).

Table 3 – Summary of willingness-to-pay by non-big game species category

	Resident Price*	Non-Res. Price*	Res./Non-Res. Sales Ratio†	Estimated Average Willingness-to-Pay
Furbearers	$20.00	$345.00	n/a	$20.00
Upland Game	$15.00	$65.00	0.776	$26.20
Turkey	$40.00	$165.00	n/a	$40.00

* License prices are valid for the 2017-2018 and 2018-2019 hunting seasons.

† Average annual. Source: DGF Upland Game Harvest Reports: 14-15, 15-16, 16-17

Notes: Prices do not include additional fees paid by licensees for Habitat Stamps or for Habitat Management & Access Validation, both of which are required for full authorization to hunt or trap in New Mexico. Resident vs. non-resident sales information was not available for trapping licenses. To provide a more conservative estimate, all trapper licenses and turkey licenses are assumed to have been sold to New Mexico residents.

3.3.3 Predicted Occupancy and Species Distribution

The U.S. Geological Service's National Gap Analysis Program (GAP) (USGS Gap Analysis Program, 2011) was used as the primary source of data to determine the suitability of specific state trust land parcels (and sub parcels) to provide habitat to individual protected non-big

game species. GAP data are the result of a coordinated effort between numerous federal and state agencies and non-profit organizations with the united objective of creating a seamless mapping system for land cover and native vertebrate species habitat range and distribution. For the purposes of the Center's analysis, however, only the GAP distribution models were utilized, and it should also be noted that much of the GAP distribution data utilized by the Center in this analysis was originally developed by the Southwest Regional Gap Analysis Project (SWReGAP), subsequently compiled by the USGS GAP, and made available to the public.

The GAP distribution models are designed to produce geospatial data showing predicted occupancy by species based on a spatial arrangement of environmental and habitat characteristics. Broadly, these characteristics pertain to a land area's hydrology, geology, topography, and ecology. These physical characteristics of the land are then compared against species-specific habitat associations and historically observed presence[7] to produce a probabilistic estimate of where individual species are likely to be found during a given season, such as summer and winter.

To utilize the GAP distribution data, the Center developed a geospatial method of analysis designed to quantify the area within each geographical unit of interest[8] that is predicted to be occupied by a given species. Within the GAP distribution models, predicted occupancy is provided in a binary format (i.e., the species is either present or not present) rather than as a continuous variable with probability values between 0 and 1.[9] It is also worth noting that GAP distribution models are specified to estimate predicted occupancy with a resolution of thirty feet by thirty feet. Stated differently, if any portion of a given nine hundred square feet area is determined by the distribution model to be suitable and probable habitat for a given species, then that entire nine hundred square foot area is identified as probable habitat for that species (i.e., that area is assigned a value of 1).

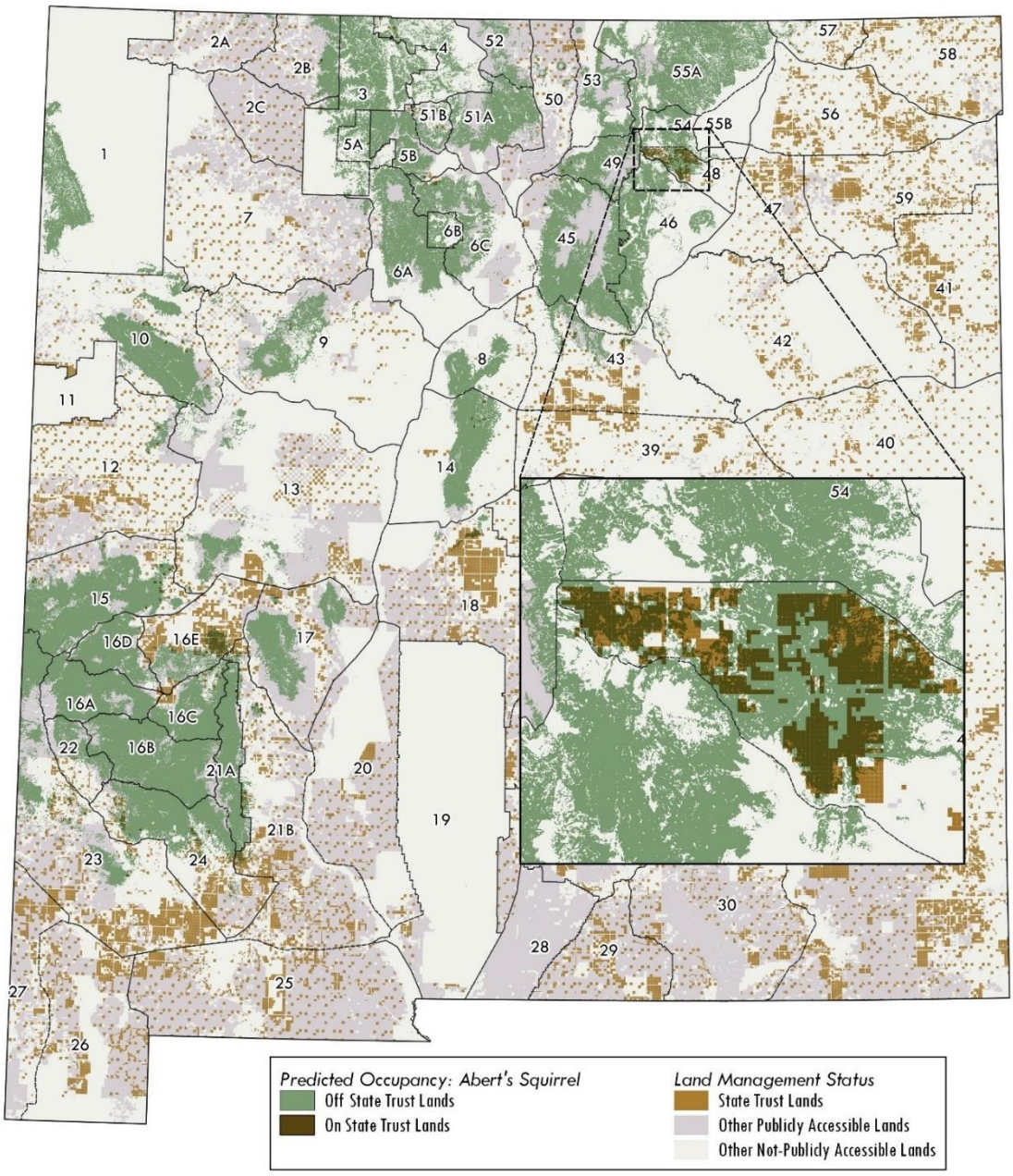
After quantifying and geospatially locating predicted occupancy within the geographical unit of interest, each unit of interest was further subdivided by land management entity and legal accessibility by hunters. This process and the general format of the GAP distribution data utilized in this analysis is graphically illustrated in Figure 3. The objective of this step in the analysis was to quantify the extent of a given species distribution on state trust lands as a proportion of the total hunter-accessible lands in each geographical unit of interest. The resulting ratio is then utilized in the primary valuation model for non-big game species as is defined by Equation (1) in Section 3.1.

3.4 SUMMARY OF VALUATION OF ACCESS TO NON-BIG GAME SPECIES

The estimated annual value of access to New Mexico state trust lands for the purpose of hunting and trapping protected non-big game species authorized for harvest by the DGF is summarized in Table 4. As shown in the table, value of access differs greatly between game species based on the overall demand to hunt or trap that species, the observed price hunters

[7] Historically observed presence in this context refers to a species' total range of observation and does not necessarily reflect individual species population surveys or geospatial analysis.
[8] Here, geographical unit of interest may refer either to a specific New Mexico county or a specific game management unit.
[9] Though as mentioned above, for certain species, a secondary variable within the distribution model data output does allow for predicted occupancy differences by season (e.g., winter and summer).

Figure 3 – GAP distribution model data illustration: Abert's Squirrel



and trappers are willing to pay for the opportunity to hunt or trap that species, and the total proportion of that games species' legally accessible habitat that is located on state trust lands.

Based on the three basic components of value described above, the estimated value of access for non-big game species is approximately $574,000 per year. However, the Center recognizes that the primary source of predicted habitat and occupancy information utilized in arriving at this figure (i.e., National GAP data) has known limitations. According to a 2010 assessment of the accuracy of the National Gap Analysis Program in the Southwestern U.S. (Boykin, Thompson, & Propeck-Gray, 2010), the spatial data utilized by GAP to model habitat characteristics was found, through physical ground-truthing, to be inaccurate approximately

40% of the time. The study did not find that the extremity of these inaccuracies was systematic or predictable, and therefore the true extent of their implications is also unknown. Further, depending on the level and type of inaccuracy associated with a given geographical location, there may not be any implications at all with respect to the model's ability to accurately predict habitat. Nonetheless, to reconcile the Boykin et al. (2010) study's findings with the valuation methodology outlined in this report and provide a more conservative range of value, a low-end estimated value of access was calculated as 60% of the Center's primary estimated (high-end) value. Both low-end and high-end values of access are presented by species in Table 4.

Table 4 – Summary of value of access to non-big game species on New Mexico state trust lands

	Harvest Demand* *(demand)*		Willingness-to-Pay *(wtp)*		Huntable Habitat Ratio *(stl_po/ hunt_po)*		Low-End Estimated Value†		High-End Estimated Value‡
Furbearers *(rounded)*							***$ 5,000***	*to*	***$ 9,000***
American Badger	75	x	$20.00	x	0.27	=	$ 246	*to*	$ 409
American Beaver	35	x	$20.00	x	0.10	=	$ 43	*to*	$ 72
Ermine	0	x	$20.00	x	0.03	=	$ -	*to*	$ -
Muskrat	27	x	$20.00	x	n/a	=	n/c	*to*	n/c
Kit Fox	63	x	$20.00	x	0.26	=	$ 194	*to*	$ 324
Long-Tailed Weasel	0	x	$20.00	x	0.20	=	$ 1	*to*	$ 1
Red Fox	54	x	$20.00	x	0.20	=	$ 133	*to*	$ 221
Gray Fox	723	x	$20.00	x	0.29	=	$ 2,554	*to*	$ 4,256
Ringtail	20	x	$20.00	x	0.25	=	$ 61	*to*	$ 102
Swift Fox	20	x	$20.00	x	0.57	=	$ 134	*to*	$ 223
Bobcat	540	x	$20.00	x	0.29	=	$ 1,867	*to*	$ 3,111
Raccoon	102	x	$20.00	x	n/a	=	n/c	*to*	n/c
Upland Game *(rounded)*							***$ 306,000***	*to*	***$ 509,000***
Abert's Squirrel	2,967	x	$26.20	x	0.04	=	$ 1,932	*to*	$ 3,220
Dusky Grouse	8,626	x	$26.20	x	0.05	=	$ 6,750	*to*	$ 11,251
Eurasian Collared Dove	11,743	x	$26.20	x	0.17	=	$ 31,559	*to*	$ 52,599
Fox Squirrel	131	x	$26.20	x	0.04	=	$ 82	*to*	$ 136
Gambel's Quail	11,738	x	$26.20	x	0.27	=	$ 49,618	*to*	$ 82,697
Gray Squirrel	2,173	x	$26.20	x	0.00	=	$ 91	*to*	$ 152
Montezuma Quail	1,128	x	$26.20	x	0.23	=	$ 4,007	*to*	$ 6,679
Northern Bobwhite	3,762	x	$26.20	x	0.46	=	$ 27,393	*to*	$ 45,654
Ring-Necked Pheasant	751	x	$26.20	x	0.48	=	$ 5,653	*to*	$ 9,422
Scaled Quail	35,253	x	$26.20	x	0.32	=	$ 178,552	*to*	$ 297,587
Red Squirrel	938	x	$26.20	x	n/a	=	n/c	*to*	n/c
Turkey *(rounded)*							***$ 34,000***	*to*	***$ 56,000***
Merriam's Turkey	10,535	x	$40.00	x	0.12		$ 31,585		$ 52,641
Rio Grande Turkey	1,975	x	$40.00	x	0.04		$ 1,788		$ 2,979
Gould's Turkey	658	x	$40.00	x	0.01		$ 175		$ 291
Estimated Total Annual Value *(rounded)*							**$ 345,000**	*to*	**$ 574,000**

Notes: n/a: data not available, n/c: value not calculable

* In this table, harvest demand is expressed as the total number of individuals willing to pay for the opportunity to hunt a given species anywhere in the state of New Mexico during a given hunting year.

† To provide a conservative range of value, the values in this column are calculated as 60% of the Center's estimate of the value for each species. See (Boykin, Thompson, & Propeck-Gray, 2010).

‡ The values in this column represent the Center's estimate of value without any additional adjustments.

To summarize, the Center estimates the value of access to non-big game species on New Mexico state trust lands to be between approximately $345,000 and $574,000 per year.

4 VALUATION OF ACCESS TO BIG GAME SPECIES

4.1 BASIC APPROACH TO ESTIMATING THE VALUE OF ACCESS TO BIG GAME

The approach to estimating the value of access to state trust lands for the purpose of hunting big game species is similar to that developed for estimating the value of access to non-big game. However, the underlying data sources used to construct the three basic components of value (i.e., species distribution, harvest demand, and willingness-to-pay) differ greatly. As with non-big game species, to estimate the value of access to big game, the Center developed a three-step algorithm wherein the first step was to estimate the georeferenced demand for each species individually. In the second step, this demand was multiplied by the species-specific willingness-to-pay of hunters and trappers seeking to harvest those species, which gives the total value of each species by game management unit. In the third step, the results of the second step were apportioned to state trust lands and other land classifications where hunting is allowed based on the unit-specific acreage of large contiguous state trust land parcels as a proportion of unit-specific, non-private, legally accessible acreage.

A simplified version of the algorithm used to value access to big game species on state trust lands is expressed formulaically in Equation (3).

$$(3) \qquad value_{big\ game} = \sum_{s=1}^{n}\sum_{j=1}^{m} demand_{sj} \times wtp_{sj} \times {stl\_po_j}/{hunt\_po_j}$$

Where *demand* represents the average annual harvest demand during the 2015-2016 and 2016-2017 hunting years for each species *s* in each GMU of interest *j* for every legally harvestable big game species type (*n*) within every GMU of interest (*m*) where that species has a known presence; *wtp* represents the willingness-to-pay of hunters for the opportunity to hunt species *s* in GMU of interest *j*; *stl_po* represents the number of accessible state trust land acres in GMU of interest *j*; and *hunt_po* represents the total number of non-private acres accessible to hunters in GMU of interest *j*.

Note that Equation (3) is nearly identical to its non-big game counterpart — Equation (1), which is discussed in Section 3.1 — except for one major difference. As part of this research effort, the Center obtained primary data on hunters' willingness-to-pay to harvest individual big game species that could be geospatially analyzed. Hence the inclusion of the *j* subscript on the willingness-to-pay variable in Equation (3). The richness of this dataset precludes the need to assume that the willingness-to-pay of hunters does not differ throughout the state. As a result, the approach utilized to estimate the value of access to big game species can control for species quality as well as species distribution. This dataset also frees the model from valuation inaccuracies that could be created by potential market distortions resulting from the DGF's pricing behavior. Whereas such distortions could not be controlled for using the value estimation algorithm used for non-big game (see Section 3.3.2).

Additional information about the source and structure of the data used to quantify and define the three basic components of value shown in Equation (3) is provided in Section 4.3 of this report. Any additional assumptions necessitated by the source data are also described in detail therein.

4.2 IDENTIFICATION OF BIG GAME SPECIES SUBJECT TO ANALYSIS

As previously noted, it was the initial objective of the Center's analysis to estimate the value of access to state trust lands as it pertains to all protected game species for which the DGF grants licenses to harvest. However, limitations and/or structural deficiencies in the data available for some game species either prevented or significantly compromised reliable calculations of value enough to warrant exclusion of those species from this analysis.

Table 5 contains an exhaustive list of the protected big game species considered in the course of this analysis and whether or not sufficient data was available to estimate species-specific values of access. Any species for which sufficient data for all three of the basic components of value (i.e., harvest demand, willingness-to-pay, and species distribution) could not be acquired or estimated was necessarily excluded from analysis. Of the eleven big game species targeted for analysis, four (oryx, ibex, bighorn sheep, and cougar) were excluded — primarily because information pertaining to harvest demand could not be obtained. The relative complexity of the draw license system for oryx and ibex combined with their severely limited distribution throughout the state also complicated their analysis.[10] Fortunately, these factors also suggest that the value of access to these species on state trust lands should be quite limited.

It should be noted that source data used in calculating the three basic components of value defined by Equation (3), may differ to some degree between species. These differences and their potential implications are discussed in greater detail in Section 4.3.

Table 5 - Big game species included and excluded from analysis

Game Species	State Trust Acreage in Permitted GMUs*	Included in Analysis	Reason for Exclusion
Antelope	7,770,000	Y	
Barbary Sheep	1,230,000	Y	
Bear	110,000	Y	
Bighorn Sheep	1,630,000	N	Insufficient willingness-to-pay & distribution data
Cougar	n/c	N	Insufficient demand and willingness-to-pay data
Deer	7,790,000	Y	
Elk	4,290,000	Y	
Ibex	n/c	N	Insufficient demand and willingness-to-pay data
Javelina	1,439,571	Y	
Oryx	n/c	N	Insufficient demand and willingness-to-pay data

Notes: n/c: value not calculable

*Approximate state trust land acreage in GMUs for which the DGF issued draw licenses during the 2015-16 or 2016-17 hunting years. Note that these acreages are presented here for the purpose of illustration only. These exact figures are not specifically utilized in any aspect of the valuation approach described herein.

[10] Ibex draw licenses are offered once-in-a-lifetime or as part of population management hunts. In either case, hunting is generally limited to the Florida Mountains area in GMU 25. Many of the premier draw licenses for oryx are also offered once-in-a-lifetime and hunting is either limited to the White Sands Missile Range (access to which is limited to hunters who hire a guide or outfitter) or the areas immediately surround the Missile Range (due to very limited species distribution).

4.3 DISCUSSION OF DATA SOURCES AND INPUT VARIABLES

To estimate the value of access to state trust lands for the purpose of hunting big game species, the Center utilized three separate datasets to quantify each of the three basic components of value discussed in Section 4.1: species distribution, harvest demand, and willingness-to-pay. A detailed discussion about the source and structure of the data used to quantify and define these three basic components of value, as wells as a summary of the steps taken by the Center to prepare these data for analytical use, is provided below.

4.3.1 Harvest Demand

With respect to big game species, the Center defines harvest demand as rate at which individuals demonstrate their desire to participate in hunting activities throughout the state of New Mexico. Desire, in this context, is quantified by the number of individuals who apply for a draw license through the DGF's Draw Hunt System. In a presumed effort to provide transparency to the public (primarily to draw participants), each year the DGF prepares a detailed Drawing Odds Report that contains draw participant information by species and GMU. The odds of being successful in the draw are calculated as the total number of available licenses to hunt a given species in a given GMU divided by the total number of individuals who apply for a draw license to hunt that species in that GMU. It should be noted that this is a generalization of how the Draw Hunt System functions. The system has built into it a large degree of nuance that complicate the odds an entrant is successful in the draw[11], fortunately, this nuance has little-to-no bearing on the Center's particular use of the dataset in this analysis.

The Draw Hunt System is also complicated by the fact that certain draw hunts — characterized by a specific combination of species and authorized hunting area — pertain to geographical areas that do not strictly correspond to a specific GMU. In some hunts, a successful draw entrant is licensed to hunt in multiple GMUs or portions of multiple GMUs, and in some hunts successful entrants are only licensed to hunt in certain portions of a single GMU. As a result, demand for a specific hunt cannot be easily traced to a specific GMU in all cases. Therefore, prior to the Center's use of draw odds data in estimating harvest demand, these issues were addressed through an acreage apportionment exercise. In this exercise, the number of draw entrants[12] in each hunt were allocated to individual GMUs (or subsections thereof) based on the acreage of each constituent GMU in each hunt as a proportion of the total acreage authorized by that hunt.[13] The results of this exercise are summarized in Appendix A.

Draw participation is an ideal data source for estimating harvest demand for two important reasons:

1. First, the draw data provide a mechanism to differentiate and query harvest demand

[11] For instance, success rates differ depending on an entrant's residency status and whether an entrant is applying with a registered outfitter. The Draw Hunt System is also a preference-based system where entrants are offered the option to enter the draw for multiple GMUs, but successes are awarded in order of preference. The system also limits entrants' participation in the draw for certain hunts based on entrant characteristics, e.g., certain hunts are limited to entrants under the age of 18, or active military personnel, or mobility-impaired individuals. For more information, see (New Mexico Department of Game & Fish, 2018a).

[12] For the purposes of this valuation, the number of draw entrants (harvest demand) for a given hunt is represented as the sum of individuals indicating a given hunt as their first, second, or third preference.

[13] Species-specific harvest limits were assigned to individual GMUs using a similar methodology.

by two observable and quantifiable criteria: species type and geographical location (GMU). In turn, this allows the Center to assign a species-specific continuous numeric demand variable to individual state trust land parcels and provides an empirical basis for differentiation in the value of access; where parcels situated in GMUs associated with many draw entrants are generally considered more valuable compared to parcels in GMUs with few draw entrants.

2. Second, the draw data are based on the collective knowledge of individuals who are most attuned to the quantity, quality, and distribution of big game species in New Mexico. Since the draw system is preference based, through their assignment of ordered preferences, draw entrants in essence provide their own personal ranking of the quantity and quality of game species by geographical location. Observed in aggregate, the individually-assigned rankings of quantity and quality can be used to assign global rankings to GMUs across the entire state.

The above-identified second characteristic of the draw participation data also allows the Center to limit the use of GAP predicted occupancy information that was critical to the non-big game portion of this analysis. The probable habitat characteristics implied by the draw data have, to a large degree, been physically verified by the draw participants[14] and therefore can be used to supplement and/or validate the habitat prediction models used by the Center to geo-reference the distribution of game species.

4.3.2 Limitations on Supply

For big game species, one's desire to participate in a given hunt is constrained by the number of draw licenses that are awarded for that hunt. Together, these two parameters dictate an individual's odds of being successful in the Draw Hunt System and the concomitant odds that an individual will access state trust lands to hunt a given big game species. As such, it is also necessary to account for both parameters in estimating the value of access to big game on state trust lands; since harvest demand in the case of big game is moderated by harvest supply.[15]

As mention in the above discussion of harvest demand, in some hunts, a successful draw entrant is licensed to hunt in multiple GMUs or portions of multiple GMUs, and in some hunts successful entrants are only licensed to hunt in certain portions of a single GMU. As a result, just as the demand for a specific hunt cannot be easily traced to a specific GMU in all cases, neither can the limits on supply. Therefore, prior to the Center's use of draw odds data in estimating harvest supply, these issues were addressed through an acreage apportionment exercise. In this exercise, the permitted number of successful draw entrants for each hunt were allocated to individual GMUs (or subsections thereof) based on the acreage of each constituent GMU in each hunt as a proportion of the total acreage authorized by that hunt. The results of this exercise for harvest limits are summarized in Appendix A.

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[14] This statement assumes that draw participants, on average, assign hunt preferences based on reasonable first or second-hand information about the quality and/or quantity of a given species in a given area.

[15] For the purposes of this valuation, the Center assumes harvest supply (i.e., the number of licenses that are awarded to draw entrants) is optimally regulated by the DGF. Further, when calculating average annual limits by species by GMU, first choice demand was used in model specification in place of available licenses for hunts with license limits that exceeded the number of first choice preferences.

4.3.3 Willingness-to-Pay of Big Game Hunters

As discussed in Section 3.3.2, the Center recognizes that the cost of a licenses purchased from the DGF is a flawed proxy for the willingness-to-pay of hunters for access to hunt game species in New Mexico since the price is not established through competitive free market transactions. Rather, license prices are established by a single supplier (i.e., the DGF), which, as a pseudo-government entity, is not expected to behave as a conventional profit maximizing agent. To avoid this concern and its implications, and provide a fair-market estimate of the willingness-to-pay for access to big game on state trust lands, the Center conducted an extensive data collection effort designed to acquire primary data regarding the private market value of access to hunt big game species. Since the price of access paid by hunters and outfitters to private landowners is established through arms-length negotiations between willing buyers and willing sellers, these prices are expected to be free of many of the market distortions intrinsic in the DGF's pricing structure.

Sources of Primary Data

Market pricing data for access to big game resources was collected from two basic sources:

1. Private landowners throughout New Mexico who participate in the DGF's Antelope Private Lands Use System (A-PLUS) or Elk Private Lands Use System (E-PLUS). Contact information for A-PLUS landowners was extracted from the DGF's Landowner List for the Antelope Private Lands Use System for the 2017-2018 hunting year; and contact information for E-PLUS landowners was extracted from the Landowner List (inside the Core Occupied Elk Range) for the Elk Private Lands Use System for the 2017-2018 hunting year.[16]

2. Registered outfitters who are both active in and residents of New Mexico. Contact information for these individuals was extracted from the DGF's Guide and Outfitter Program's 2018 Active NM Outfitters Report.[17]

Approach to Data Collection

Using the A-PLUS, E-PLUS, and registered outfitter lists identified above, the Center developed a randomized sampling and data collection methodology designed to populate a dataset that could be used to ascertain the fair market value of hunting access by GMU and game species. Each list of individuals was randomized and sampled separately to acquire an adequate sampling of access prices by species. This method of randomization was necessary since most participants in the A-PLUS program do not sell access (in the form of authorization certificates) to individuals seeking to hunt elk, and the opposite is true for participants in the

[16] See (New Mexico Department of Game & Fish, 2017a) for electronic access to the landowner participant list for the A-PLUS program, and see (New Mexico Department of Game & Fish, 2017b) for access to the landowner participant list for the E-PLUS program.

[17] New Mexico residency is not a precondition for inclusion in the DGF's Guide and Outfitter Program's list of active outfitters. However, to increase response rates and improve the accuracy of reported pricing data, outfitters with a contact address outside of New Mexico were not contacted by the Center as part of the data collection effort discussed herein. See (New Mexico Department of Game & Fish, 2018b) for electronic access to the 2018 Active NM Outfitters Report.

(footnote continued)

E-PLUS program. That is, most E-PLUS participants do not sell access to individuals seeking to hunt antelope. There is, however, a fair number of individuals who are participants in both programs (i.e., those individuals whose land provides habitat to both elk and antelope). Care was taken to ensure that these individuals were not sampled more than once.

Working from randomized lists, Center representatives initiated contact with landowners and outfitters using the phone numbers on file with the DGF.[18] If the target individual could not be reached, whenever possible, a voicemail was left requesting a return call at the individual's earliest convenience. Due to project time constraints, follow-up calls were not made to unresponsive individuals unless they indicated a willingness to participate at a later time. Return calls in response to voicemail messages left by Center representatives were accepted and data were collected from return callers who were willing to participate.

The survey instruments for A-PLUS participants, E-PLUS participants, and outfitters differed to some degree, but were all designed to solicit comparable information. For A-PLUS and E-PLUS participants, Center representatives were instructed to explain the purpose of the call and request the target individual's permission to participate in a brief phone interview. Target individuals who expressed a willingness to participate in the interview were asked three basic questions which are paraphrased here:

1. Have you ever sold any of your authorization certificates (private landowner tags) to a third-party in the past?

2. If so, how much did you charge for each authorization certificate (private landowner tag)?

3. Have you ever sold access to your lands to anyone requesting to hunt any other big game species other than antelope (for A-PLUS participants; elk for E-PLUS participants)? If so, how much did you charge for that access opportunity (trespass fee)?[19]

Respondents who answered Question 1 in the affirmative and were willing to provide a response to Question 2 were asked to clarify whether their response to Question 2 included ancillary benefits to the purchaser such as lodging, provisions, guide services, or transportation. Where necessary, respondents were asked to disaggregate such benefits from the price provided in their initial response to Question 2. If respondents were unwilling or unable to do so, then their response to Question 2 was not recorded. Respondents in the affirmative to Question 3 were subjected to a similar clarification exercise.

Disaggregating the cost of access from the cost of ancillary benefits was especially important in phone interviews with registered outfitters. Outfitters are not accustomed to providing information about what they (or their clients) pay to landowners for access and/or

[18] A number of individuals could not be reached at the phone numbers provided in the DGF's landowner and outfitter lists for technical reasons. Many of the phone numbers were either disconnected or unreachable, unanswered without voicemail, or belonging to a person other than that identified by the DGF. See Appendix B for more information.

[19] Question 3 was included in the survey instruments to gather private market data for access prices associated with protected big-game species other than antelope and elk. Private landowners may choose to authorize a hunter, who has been successful in the draw, to access and hunt on their lands for a fee. This type of fee is often referred to as a trespass fee.

authorization certificates. As a result, considerable effort was often required of Center representatives to solicit target information from outfitter respondents. Furthermore, many outfitters were extremely reluctant to divulge the requested information because they believed it would provide unwanted exposure of their business model, or because it would potentially jeopardize their arrangement with the landowner. Due to these complications in the data collection process, primary data collected from outfitters was not utilized by the Center in most aspects of the valuation of access to big game species.

The survey instruments utilized by Center representatives are provided in Appendix B.1. These instruments include the general narrative utilized in calls that were successful in connecting to target individuals, and calls where those individuals could not be reached and a voicemail was left. Summary statistics pertaining to call success rates and the species-specific access pricing data solicited as part of this data collection effort are provided in Appendix B.2.

Data Limitations and Caveats

Some landowners targeted in the Center's data collection program indicated that they made conscious efforts to improve or increase the quality of habitat on their lands for big game species. Efforts that were explicitly identified by landowners include: cultivation of preferred big-game fodder, dispersion of artificial salt and mineral sources, improvement of water access, provision and enhancement of tree cover, and setting limitations or prohibitions on the raising of domestic livestock. According to these landowners, such efforts were explicitly undertaken with the objective of increasing the value and price of access to their lands for hunting big game species.

On the other hand, some landowners expressed frustration with the use of their lands by big game species — citing habitat destruction and competition for fodder with domestic livestock as their primary concerns. These landowners admitted to accepting what they perceived as below-market value for authorization certificates and trespass fees in hopes that the lower prices would entice big-game hunters.

Based on the data collected, being on either side of the landowner spectrum described above does not appear to be systematically correlated with any single geography or region within the state. Therefore, the Center did not make any attempt to control for these reported behaviors by landowners. It is assumed that landowner behaviors related to big game cultivation are normally distributed. If this assumption is valid, then the average landowner reported value of access by GMU provides a realistic estimate of the fair market value of access.

A more concerning characteristic of the primary data collection effort introduced above is that the majority of landowners interviewed did not charge trespass fees for predatory big game species, i.e., bear and cougar. Most large landowners participating in the E-PLUS and A-PLUS programs utilize their lands for raising cattle and other domestic livestock that are at risk of depredation by predatory game species. As a result, these landowners are incentivized not to charge individuals seeking to hunt predatory game species. Landowners who are not in the business of raising livestock, but want to maximize income from the sale of authorization certificates and trespass fees, exhibit similar behaviors. However, because the NMSLO does not benefit financially from the removal of predatory game species in the same way that private

landowners do, this observed dynamic should not be construed to indicate that the value of access to state trust lands to hunt predatory game species should be zero. Stated differently, the behavior of landowners who choose not charge trespass fees to predatory game hunters is not evidence that hunters aren't willing to pay for the opportunity to hunt those species — it only provides evidence that they aren't required to.

Based on the arguments described above, in estimating the value of access to hunt predatory game species, a secondary source of willingness-to-pay data that is not complicated by the unique incentive structure of private landowners is warranted. Absent an alternative source of primary data, the DGF's license pricing is the best available proxy for hunters' willingness-to-pay for the opportunity to hunt predatory game species on New Mexico state trust lands, and therefore it is also the data source utilized herein.

4.4 ANALYSIS AND USE OF WILLINGNESS-TO-PAY DATA

Primary data collected by the Center on hunters' willingness-to-pay for the opportunity to access big game species on private lands was used to develop a predictive pricing model capable of estimating the value of any given state trust land parcel based on its location[20], size, and contiguity with other state trust land parcels. What follows in this section is a summary of the process used in arriving at the pricing model that was ultimately selected by the Center.

4.4.1 Initial Empirical Model Specification

Using the sample data on hunters' willingness-to-pay, the Center specified the regression model described in Equation (4) to explore the relationships between willingness-to-pay and species-specific harvest supply (average annual number of draw licenses awarded) and harvest demand (average annual number of draw entrants).[21]

$$(4) \qquad wtp_{isj} = \propto + \beta_1 demand_{sj} + \beta_2 supply_{sj} + \beta_3 accessible_j + \eta \boldsymbol{X}_i + \boldsymbol{\lambda}_s + \varepsilon_{isj}$$

Where the dependent variable *wtp* is the observed price of a private landowner authorization certificate or grant of access to hunt big game species *s* in GMU *j*. Which is a function of the *demand* to hunt game species *s* in GMU *j,* measured by the average annual number of draw participants in 2016 and 2017 for that species; and *supply* is the DGF-designated average annual number of awarded licenses to draw participants to hunt game species *s* in GMU *j*. *Accessible* represents the ratio of publicly accessible lands to private lands in GMU *j*.[22] **X** is a vector of hunt-type characteristics that are expected to have influence over the observed price, including indicators for permitted sporting arm and gender specifications. Species fixed effects (**λ**) are also included in the model to allow the price to differ between big game species; and ε is idiosyncratic error that cannot be absorbed elsewhere by the model specification.

[20] In this context, "location" refers to the game management unit in which a given parcel is located and its associated harvest demand, harvest supply, species diversity, and species quality.

[21] Average annual harvest limits and harvest demand by GMU were calculated from the DGF's 2016 Drawing Odds Complete Report (New Mexico Department of Game & Fish, 2016b) and 2017 Drawing Odds Complete Report (New Mexico Department of Game & Fish, 2017c).

[22] The log form of *accessible* was also explored (see columns (3) and (4) in Table 6) to assess whether the effect of increased accessibility diminishes as a GMU's publicly accessible acreage increases. The existence of such a relationship was rejected since these models had less explanatory power than their counterparts that employed the levels-form of *accessible*.

Table 6 – Summary of the estimated effect of harvest demand and supply on hunters' willingness-to-pay for access to hunt on private lands

	Willingness-to-pay (*wtp*)			
	(1)	**(2)**	**(3)**	**(4)**
demand	0.41	0.39	0.40	0.39
	(0.08)	(0.07)	(0.07)	(0.06)
supply	-3.48	-3.19	-4.43	-3.95
	(0.71)	(0.6)	(0.72)	(0.64)
accessible	46.13	41.38		
	(4.6)	(3.97)		
ln(accessible)			457.17	367.68
			(107.77)	(96.09)
Observations	299	299	299	299
R^2	0.37	0.50	0.33	0.45
Hunt-type controls	No	Yes	No	Yes
Species fixed effects	Yes	Yes	Yes	Yes

Notes: Standard errors are shown in parenthesis. All estimates are statistically significant at the 1% level, unless otherwise noted.

*Statistically significant at the 10% level; **at 5% level.

Empty cells represent variables that were excluded from the particular model shown.

Without controlling for each GMU's publicly accessible acreage (*accessible*), the observed effect of harvest demand on willingness-to-pay could have two overlapping explanations: (a) demand is positively correlated with species quality and/or quantity, or (b) demand is positively correlated with unit-wide accessibility. The same is true for the observed effect of harvest supply. The effect could be attributed to: (a) harvest supply being positively correlated with species quantity (though not necessarily with quality), or (b) to harvest supply being negatively correlated with unit-wide accessibility. Therefore, since both harvest supply and harvest demand are likely correlated with accessibility, it was necessary to include a third variable (i.e., *accessible*) to absorb that portion of the effect on willingness-to-pay and avoid biasing the coefficients β_1 and β_2.

It should be noted that harvest demand and harvest supply are modeled as separate variables rather than interacted variables (i.e., as draw odds), because they are each expected to affect willingness-to-pay independently. This expectation is borne out by the regression results shown in Table 6. Willingness-to-pay is positively correlated with demand — that is, landowners can charge an estimated \$0.39-\$0.41 more for access for every additional unit of demand. Harvest supply has the opposite effect on willingness-to-pay. As harvest supply increases, landowners are forced to charge an estimated \$3.19-\$4.43 less for access for every additional unit of supply. Willingness-to-pay is also shown to have a positive relationship with a GMU's number of publicly accessible acres. As the publicly accessible share of a given GMU increases, hunters' willingness-to-pay to hunt on private lands increases by an estimated \$41.38-\$46.13 per one percentage point increase in the ratio of publicly accessible lands to private lands.

4.4.2 Assessing the Influence of Parcel Size and Contiguity

To assess the extent to which hunters' willingness-to-pay for private landowner authorization certificates and access opportunities may be driven by fact that private landowners are able to provide unrestricted access to large contiguous areas, the Center specified a second empirical model. The regression described in Equation (5) estimates the relevance of parcel size as a predictor of willingness-to-pay:

$$(5) \qquad wtp_{irsj} = \propto + \omega size_r + \eta \boldsymbol{X}_i + \zeta \boldsymbol{Z}_r + \boldsymbol{\lambda}_s + \boldsymbol{\gamma}_j + \varepsilon_{isj}$$

Where *wtp* is the observed price of a private landowner authorization certificate or grant of access to hunt big game species *s* in GMU *j* on ranch *r,* as a function of the *size* (measured in acres) of ranch *r*. Here again, **X** is a vector of hunt-type characteristics and **Z** represents a vector of ranch-specific characteristics, including indicators for the number, type, and gender specifications of the authorization certificates granted to the owner of ranch *r*. To control for variation in demand and species quality across GMUs that may also affect hunters' willingness-to-pay, GMU fixed effects (**γ**) were included in the model in addition to species fixed effects (**λ**) which allow the effect of size on willingness-to-pay to differ between big game species. Here again, ε is idiosyncratic error that cannot be absorbed elsewhere by the model specification.

In interpreting the estimates associated with Equation (5), a positive and statistically significant coefficient ω would indicate that the size of the area made accessible to hunters on private land is positively correlated with willingness-to-pay. A negative and statistically significant coefficient ω would likely be interpreted as erroneous since it is highly unlikely that smaller properties would garner higher prices on average than larger properties.[23] A statistically insignificant coefficient ω would suggest that the size of the area made accessible to hunters is not a significant factor in hunters' decisions about willingness-to-pay.

The results of this model, as applied to the private landowner pricing data collected by the Center as part of this research effort, are shown in Table 7. The results indicate that the number of acres made accessible to hunters (i.e., *size*) is statistically significant and positive. As shown therein, the willingness-to-pay of hunters increases by approximately $0.02-$0.03 per additional acre of private land that is made accessible.

4.4.3 Final Empirical Model Specification

The results shown in Table 7 suggest that the size and contiguity of the area made accessible for hunting is a significant factor in hunters' willingness-to-pay decisions. These results also suggest that a similar variable should be included in the Center's predictive pricing model for state trust lands. Even though "ranch size" is not a variable that can be explicitly linked to state trust lands, the inclusion of this variable is possible because contiguity and parcel size *are* calculable variables for state trust land parcels throughout New Mexico, and these variables are expected to have a similar relationship with hunters' willingness-to-pay for access. To

[23] Although, a negative relationship between willingness-to-pay and accessible acreage could be plausible if the underlying sample data were predominantly comprised of smaller than average land areas that are occupied by higher than average quality or quantity of game.

address this conclusion, in Equation (6), the Center's initial model (see Section 4.4.1) was re-specified to include parcel *size* as an independent variable:

$$(6) \qquad wtp_{irsj} = \propto + \beta_1 demand_{sj} + \beta_2 supply_{sj} + \beta_3 accessible_j + \beta_4 size_r + \eta \boldsymbol{X}_i + \boldsymbol{\lambda}_s + \varepsilon_{isj}$$

Where the dependent variable *wtp* is the observed price of a private landowner authorization certificate or grant of access to hunt big game species *s* in GMU *j* on ranch *r*. Which is a function of the *demand* to hunt game species *s* in GMU *j,* measured by the average annual number of draw participants in 2016 and 2017 for that species; *supply,* which is the DGF-designated average annual number of awarded licenses to draw participants to hunt game species *s* in GMU *j*; and the *size* (measured in acres) of ranch *r*. *Accessible* represents the proportion of GMU *j* that is publicly accessible to hunters. **X** is a vector of hunt-type characteristics that are expected to have influence over the observed price, including indicators for permitted sporting arm and gender specifications. Species fixed effects (**λ**) are also included in the model to allow the price to differ between big game species; and ε is idiosyncratic error that cannot be absorbed elsewhere by the model specification.

Table 7 – Estimates of the effect of accessible acres on hunters' willingness-to-pay

	Willingness-to-pay (*wtp*)			
	(1)	**(2)**	**(3)**	**(4)**
size	0.033**	0.028**	0.020**	0.021**
	(0.013)	(0.013)	(0.011)	(0.011)
Observations	299	299	299	186
R^2	0.12	0.26	0.48	0.49
Species fixed effects	Yes	Yes	Yes	Yes
Hunt-type controls	No	Yes	Yes	Yes
Game unit fixed effects	No	No	Yes	Yes
Ranch controls	No	No	No	Yes

Notes: Standard errors are shown in parenthesis. All estimates are statistically significant at the 1% level, unless otherwise noted.

*Statistically significant at the 10% level; **at 5% level.

Empty cells represent variables that were excluded from the particular model shown.

4.4.4 Results of Willingness-to-Pay Analysis

Table 8 contains the results of the model specified by Equation (6) as applied to the willingness-to-pay data collected from private landowners throughout New Mexico. The estimated coefficients shown therein form the basis of the Center's predictive pricing model, which is designed to estimate the value of any given state trust land parcel using the dependent variables discussed in Section 4.4.3. Since the model's functional form was specified using variables that are available for state trust land parcels as well as the private landowner parcels, the parameter estimates shown in Table 8 can be directly applied to the state trust land parcels targeted for valuation.

As an illustration of the model's use, based on the model parameters described in Table 8, column (2), the estimated willingness-to-pay (before controlling for habitat parameters) for access to hunt a mature bull elk on some contiguous state trust land parcel p that is of suitable size (see Section 4.5) is calculated as:

$$wtp_{psj} = \$932.50 + \$0.38 \times demand_{sj} - \$3.10 \times supply_{sj} + \$41.84 \times accessible_{j} + \$0.02 \times size_{r} + \$2{,}317.21$$

Table 8 – Summary of model parameters used to value access to big game resources on state trust lands

	Willingness-to-pay (*wtp*)	
	(1)	**(2)**
demand	0.41	0.38
	(0.08)	(0.07)
supply	-3.39	-3.10
	(0.71)	(0.61)
accessible	46.56	41.84
	(4.74)	(4.09)
size	0.03**	0.02**
	(0.01)	(0.01)
Species modifiers		
barbary sheep	1997.97	1756.44
	(294.3)	(288.83)
deer	1056.22	824.17
	(325.16)	(323)
elk	1674.97	2317.21
	(322.36)	(354.76)
Hunt-type modifiers		
female		-833.41
		(100.2)
archery		-341.65
		(59.83)
Constant (α)	692.04**	932.50
	(221.54)	(213.56)
Observations	299	299
R^2	0.40	0.53
Species fixed effects	Yes	Yes
Hunt-type controls	No	Yes

Notes: Standard errors are shown in parenthesis. All estimates are statistically significant at the 1% level, unless otherwise noted: *statistically significant at the 10% level; **at 5% level.

In column (1), the constant (α) represents the baseline willingness-to-pay for access to hunt an antelope without controlling for sex or sporting arm. In column (2), the constant (α) represents the baseline willingness-to-pay for access to hunt a male antelope with a rifle.

Empty cells represent variables that were excluded from the particular model shown.

4.5 ASSUMPTIONS REGARDING PARCEL SIZE AND CONTIGUITY

Some of the private landowners interviewed during the Center's primary data collection efforts commented that the value of access to their lands was in part a function of the large, contiguous, and undeveloped area they make accessible to hunters. Some of those same individuals also stated that the 640-acre checkerboard nature of state trust lands throughout New Mexico would render them unsuitable for hunting many big game species. The full merit of this statement is difficult to quantify since many of the single-section (640 acre) state trust land parcels are adjacent to, or surrounded by, freely accessible public lands, thereby making them part of a much larger contiguous hunting area. Still, the Center recognizes that there is some degree of merit to this argument and it was therefore worth addressing if only to provide a more conservative estimate of the value of hunting access on state trust lands.

To address the above-stated concern, the Center used geospatial analysis tools to redefine all legally accessible state trust land parcels throughout the state based on their contiguity within established GMUs. Once state trust land parcel boundaries had been redrawn based on contiguity (rather than legal descriptions), each parcel was classified by its contiguous acreage within each GMU.[24] To determine which redrawn state trust land parcels should be included or omitted from the analysis, contiguity classifications were develop using the size of the accessible area made available to hunters by the private landowners interviewed by the Center.

These classifications are defined below and a summary of the parcels comprising each class is provided in Table 9.

1. *First Quartile*: Any state trust land parcel containing more than 1,920 contiguous acres, which is a larger contiguous area than is made accessible by 25% of sampled private landowners who sell access to hunters.
2. *Average*: Any state trust land parcel containing more than 10,630 contiguous acres, which is equal to the average contiguous area that is made accessible by the sampled private landowners who sell access to hunters.

Table 9 – Summary of state trust land parcels omitted/included in the valuation of access to big game

	Threshold for Inclusion in Valuation*	
	First Quartile *(>1,920 acres)*	**Average** *(>10,630 acres)*
Number of Parcels	518	103
Average Parcel Size *(acres)*	10,468	36,516
Median Parcel Size *(acres)*	3,893	19,844
Total Acreage	**5,422,555**	**3,761,112**

* Thresholds for inclusion were established based on the first quartile and average sizes of the ranches controlled by private landowner respondents in the Center's pricing data collection effort.

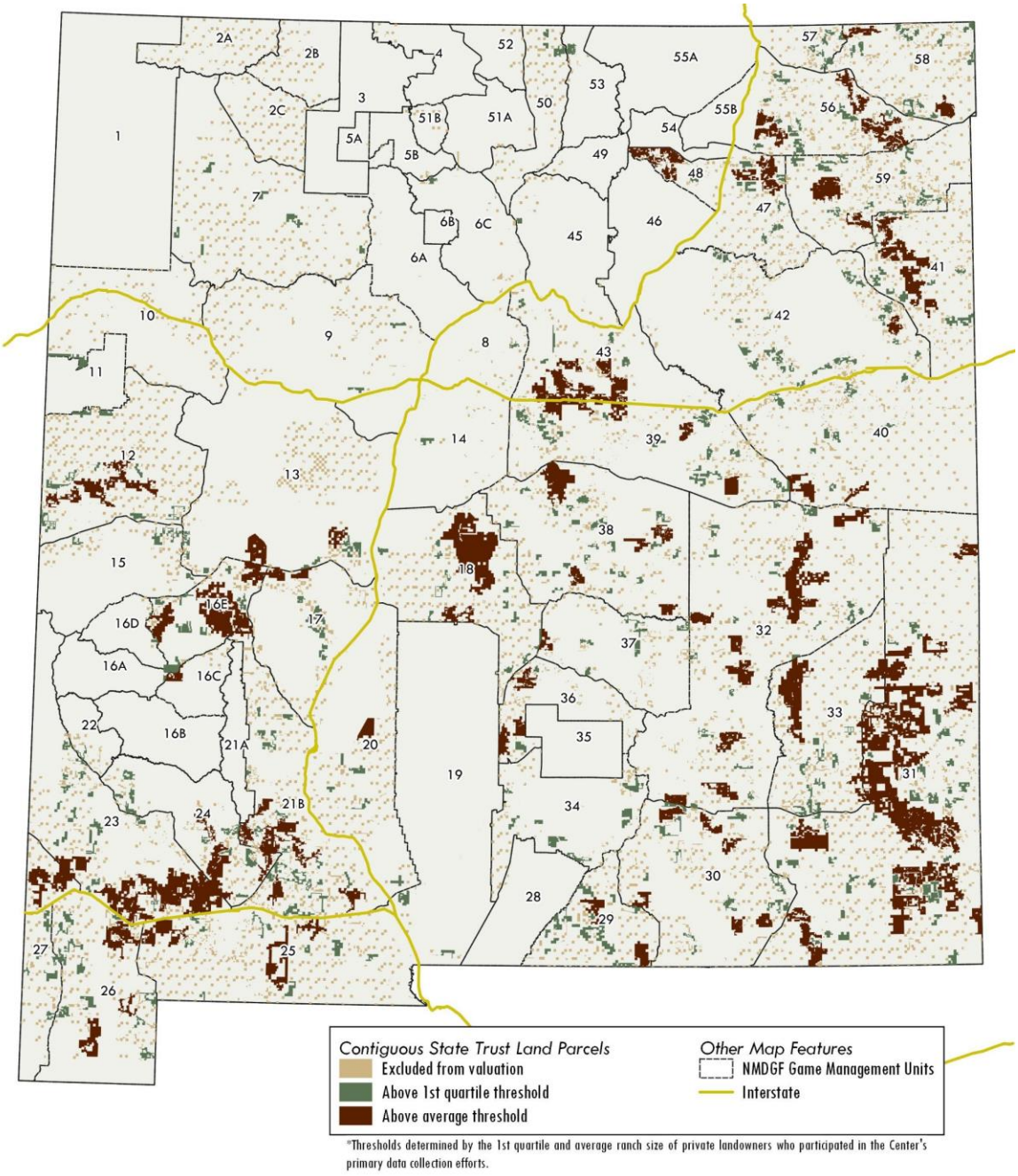
Notes: The number of parcels and total acreage subject to valuation varies to some degree by species to accommodate the variation in GMU definitions by species employed by the DGF. The figures shown here correspond with parcels shown in Figure 4.

[24] This process was performed in multiple iterations to account for GMU boundaries maintained by the DGF that differ by species. For instance, many draw hunts for antelope are assigned to GMU 16, whereas draw hunts for elk in GMU 16 are assigned at the subunit level, i.e., GMU 16A, 16B, 16C, 16D, or 16E. See Appendix C for more information.

These two classifications were also used to calculate a range in value of access to big game species on state trust lands. The high-end estimate of value is predicated on state trust land parcels with contiguous areas that exceed the *First Quartile* threshold; and the low-end estimate of value is predicated on state trust land parcels with contiguous areas that exceed the *Average* threshold. In both estimates of value, parcels below the inclusion threshold are excluded from valuation. That is, hunters' willingness-to-pay for access to big game on state trust land parcels below the threshold is considered to be zero.

The specific state trust land parcels that were utlimately included in the Center's valuation are shown by contiguity class in Figure 4.

Figure 4 – State trust land parcels by contiguity class



4.6 SUMMARY OF VALUATION FOR ACCESS TO BIG GAME SPECIES

The estimated annual value of access to New Mexico state trust lands for the purpose of hunting protected big game species that are authorized for harvest by the DGF is summarized in Table 10. As shown in the table, the parcel-to-parcel value of access differs greatly between game species based on the overall demand to hunt that species, the observed price hunters are willing to pay for the opportunity to hunt that species[25], and the total proportion of that species' publicly accessible habitat that is located on state trust lands.

Based on the three basic components of value described above, the estimated value of access to big game species on the state trust land parcels identified in Section 4.5 is between approximately $2,607,000 and $3,109,000 per year. Again, note that the low-end estimate of value includes all contiguous state trust land parcels that contain more than 10,630 acres, and the high-end estimate of value includes all contiguous state trust land parcels that contain more than 1,920 acres.

Table 10 - Summary of value of access to big game species on New Mexico state trust lands

	Low-End Estimates		*High-End Estimates*	
	Average Willingness-to-Pay per Access*	**Estimated Total Annual Value†**	**Average Willingness-to-Pay per Access***	**Estimated Total Annual Value†**
Big Game Species				
Antelope	$ 1,672	$ 177,000	$ 1,038	$ 178,000
Barbary Sheep	$ 3,429	$ 109,000	$ 2,788	$ 147,000
Bear‡	$ 62	$ 1,000	$ 62	$ 2,000
Bighorn Sheep	n/a	n/c	n/a	n/c
Cougar	n/a	n/c	n/a	n/c
Deer	$ 2,497	$ 1,474,000	$ 1,855	$ 1,686,000
Elk	$ 3,990	$ 843,000	$ 3,349	$ 1,092,000
Ibex	n/a	n/c	n/a	n/c
Javelina‡	$ 73	$ 3,000	$ 73	$ 4,000
Oryx	n/a	n/c	n/a	n/c
Estimated Total Annual Value		**$2,607,000**		**$ 3,109,000**

Notes: n/a: data not available, n/c: value not calculable

* Unless otherwise noted, willingness-to-pay per access was calculated using the predictive pricing model parameters presented in Section 4.4.4 of this report. Low-end willingness-to-pay estimates are higher than corresponding high-end willingness-to-pay estimates because underlying parcel size is a model parameter and the specific state trust land parcels subject to valuation in the low-end estimates are larger on average than those included in the high-end estimates.

† Values in this column have been rounded to the nearest thousands of dollars.

‡ For these big game species, sufficient willingness-to-pay data was not provided by private landowners interviewed by the Center. Therefore, species-specific DGF license prices were utilized as a proxy for hunters' willingness-to-pay. These prices do not include additional fees paid by licensees for Habitat Stamps or for Habitat Management & Access Validation, both of which are required for full authorization to hunt big game in New Mexico. Resident vs. non-resident sales information was not available for any big game species. To provide a more conservative estimate, all licenses sold by the DGF to hunt the big game species denoted here are assumed to have been sold to New Mexico residents.

[25] Additional species-specific statistics pertaining to the observed willingness-to-pay for access to hunt big game are contained in Appendix B.2.

5 SUMMARY OF VALUE AND DISCUSSION OF RESULTS

5.1 SUMMARY OF THE VALUE OF ACCESS TO GAME RESOURCES ON STATE TRUST LANDS

The total estimated value of access to state trust lands for the purpose of legally harvesting protected game species in a manner that is consistent with the rules and regulations of the State Game Commission, Department of Game & Fish, and the New Mexico State Land Office is summarized in Table 11. As shown therein, the Center estimates the total value of access to be between $2,952,000 and 3,683,000 per year.

Table 11 – Summary of valuation of access to game resources on state trust lands

	Low-End Estimated Annual Value of Access	High-End Estimated Annual Value of Access
Furbearers*	$ 5,000	$ 9,000
Upland Game*	$ 306,000	$ 509,000
Turkey*	$ 34,000	$ 56,000
Big Game†	$ 2,607,000	$ 3,109,000
Estimated Total Annual Value	**$ 2,952,000**	**$ 3,683,000**

Notes: All estimated values have been rounded to the nearest thousands of dollars.

* See Section 3 for a full discussion of the Center's approach to valuation of access to these game species.

† See Section 4 for a full discussion of the Center's approach to valuation of access to these game species.

It should be noted that the values expressed in Table 11 and the methodology conveyed in this report are accompanied by numerous caveats and potential limitations on use. All assumptions employed by the Center in estimating the value of access to game resources on state trust lands have been identified and described in detail where appropriate throughout the body of this report, however, some of the assumptions and caveats that are viewed by the Center as critical to interpreting the results in Table 11 are restated below in Section 5.2 for ease of reference.

5.2 ANALYTICAL ASSUMPTIONS AND STUDY LIMITATIONS

The values presented in Table 11 — high-end and low-end — are likely representative of an underestimation of the value of access to game resources on state trust lands since these values do not account for the value of access to several protected game species that may be harvested from state trust lands. These species include all migratory birds, some upland game and furbearers (see Section 3.2 for a specific list), cougar, bighorn sheep, oryx, and ibex. Furthermore, the Center's valuation does not and cannot account for game resources that are illegally harvest from state trust lands. Though it should be stated that neither the extent to which this may be an issue, nor the potential value associated therewith was explored as part of the analysis presented in this report. Unprotected game species for which the DGF does not issue hunting licenses or any other form of harvest authorization permit have also been excluded from this analysis.

Due to data limitations, for certain game species the DGF's license pricing was utilized as a proxy for the willingness-to-pay of hunters and trappers who seek to harvest those species. As

detailed in Section 3.3.2, it is likely that the license pricing system established by the DGF systematically underestimates the willingness-to-pay of hunters and trappers since license pricing is largely guided by the DGF's costs of operation rather than supply and demand. Similarly, the approach to valuation discussed herein rests on the assumption that species-specific harvest quotas and rates are optimally regulated by the DGF. Whether this statement is true or false is outside of the scope of this analysis, however, if it is false, the results presented in Table 11 would likely be underestimating the true value of access to game resources on state trust lands.

Finally, readers should note that the valuation approach presented in this report was designed to provide a macro-level estimate of the value of access to *all* game resources on *all* state trust lands in New Mexico. As such, the modeling framework developed by the Center for this specific task may perform poorly for individual state trust land parcels or individual game species. Should the NMSLO become interested in micro-level assessments of specific land parcels and/or specific game species, the Center would recommend the use of an alternative approach to valuation.

6 REFERENCES

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APPENDIX A: BIG GAME HARVEST DEMAND & SUPPLY

Table A1 – Results of acreage-based apportionment of draw hunts by game species

			Draw Hunt Limits								*Draw Hunt Demand*							
GMU	**Total Acres**	**STL Acres**	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey
1	2,508,665	2,386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1,498,797	111,413	3	0	0	0	590	0	5	5	510	0	0	0	5890	0	46	44
3	844,449	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	443,871	3,671	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	410,825	4,186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1,711,622	14,791	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2,194,077	151,092	16	0	0	45	135	0	0	0	524	0	0	695	706	0	0	0
8	589,775	11,346	4	0	0	100	0	0	0	10	117	0	0	1065	0	0	0	247
9	2,131,455	80,531	9	0	0	40	700	0	0	0	313	0	0	720	1091	0	0	0
10	1,430,123	70,466	0	0	0	480	610	0	0	0	0	0	0	3469	3132	0	0	0
11	409,434	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1,660,734	298,344	22	0	0	160	150	0	0	0	491	0	0	363	1852	0	0	0
13	2,849,435	205,973	30	0	6	750	815	0	0	0	790	0	1532	3494	5488	0	0	0
14	1,059,658	16,092	7	0	0	110	0	0	0	0	210	0	0	1993	0	0	0	0
15	1,047,512	61,271	39	0	0	365	1820	0	0	0	1363	0	0	1116	17845	0	0	0
16	2,240,602	260,769	92	0	0	1425	0	0	0	0	3201	0	0	6512	0	0	0	0
17	1,054,911	104,644	37	0	4	466	675	0	0	0	1295	0	1125	6827	5548	0	0	0
18	1,564,350	355,041	56	0	0	300	50	0	0	0	2056	0	0	1087	168	0	0	0
19	2,720,928	18,752	0	0	1	0	0	34	0	0	0	0	177	0	0	41	0	0
20	1,637,073	133,757	12	0	5	315	0	0	0	0	239	0	1284	1047	0	0	0	0
21	1,933,111	354,451	0	0	0	1800	0	0	0	0	0	0	0	4302	0	0	0	0
22	251,874	13,125	0	0	1	275	160	0	0	0	0	0	240	556	1128	0	0	0
23	1,877,916	410,398	19	0	6	0	395	329	0	0	674	0	1630	0	2147	402	0	0
24	968,135	167,545	10	0	3	1850	65	167	0	0	356	0	825	3806	549	204	0	0
25	2,026,736	328,943	13	0	0	315	0	419	0	0	445	0	0	891	0	512	0	0
26	1,477,129	246,495	7	0	5	315	0	225	0	0	239	0	1178	594	0	275	0	0
27	664,493	129,382	4	0	3	385	0	126	0	0	134	0	660	1394	0	154	0	0
28	687,600	796	15	23	0	40	20	10	0	0	429	1668	0	282	254	196	0	0
29	755,707	175,899	40	185	0	560	0	0	0	0	740	1169	0	822	0	0	0	0
30	1,881,994	270,121	25	415	0	2400	40	0	0	0	280	2612	0	8495	960	0	0	0
31	5,340,531	1,333,222	151	0	0	1315	0	0	0	0	2657	0	0	7731	0	0	0	0
32	3,886,481	550,447	135	312	0	1615	0	0	0	0	3579	1566	0	4289	0	0	0	0
33	1,453,065	305,586	84	0	0	545	0	0	0	0	2185	0	0	4137	0	0	0	0
34	1,077,420	83,143	0	179	0	2685	2010	0	0	0	0	901	0	8317	28045	0	0	0

			Draw Hunt Limits								*Draw Hunt Demand*							
GMU	**Total Acres**	**STL Acres**	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey
35	459,840	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	635,001	95,115	21	83	0	350	833	0	0	0	772	418	0	1311	11272	0	0	0
37	1,052,837	76,942	26	101	0	1025	175	0	0	0	939	508	0	3894	2075	0	0	0
38	2,082,158	290,920	42	0	0	550	15	0	0	0	1528	0	0	1856	186	0	0	0
39	1,686,814	262,746	35	0	0	160	0	0	0	0	1287	0	0	324	0	0	0	0
40	2,415,273	225,558	28	0	0	150	0	0	0	0	1010	0	0	255	0	0	0	0
41	1,174,371	240,418	94	0	0	135	0	0	0	0	1256	0	0	618	0	0	0	0
42	2,746,506	196,885	90	0	0	87	0	0	0	0	1207	0	0	226	0	0	0	0
43	1,217,330	195,997	0	0	0	53	30	0	0	0	0	0	0	353	166	0	0	0
45	973,898	12,413	0	0	19	850	620	0	0	0	0	0	1575	5006	3219	0	0	0
46	807,095	1,241	1	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0
47	771,381	140,686	71	0	0	61	0	0	0	0	953	0	0	204	0	0	0	0
48	242,005	66,603	26	0	0	145	460	0	0	0	352	0	0	700	1739	0	0	0
49	271,624	1,448	0	0	1	280	434	0	0	0	0	0	293	2066	3191	0	0	0
50	590,046	55,822	0	0	2	101	444	0	0	0	0	0	548	664	1305	0	0	0
51	634,728	11,522	0	0	0	0	1919	0	0	0	0	0	0	0	12229	0	0	0
52	269,213	6,016	90	0	0	285	1461	0	0	0	1660	0	0	2738	11080	0	0	0
53	437,822	10,480	0	0	4	260	140	0	0	0	0	0	611	1204	507	0	0	0
54	219,897	110	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
55	1,246,708	0	45	0	2	0	0	0	0	0	594	0	336	0	0	0	0	0
56	1,140,076	246,564	96	0	0	60	30	0	0	0	1291	0	0	274	356	0	0	0
57	274,170	40,256	16	0	0	100	3	0	0	0	211	0	0	389	44	0	0	0
58	979,724	174,662	79	0	1	120	17	0	0	0	1057	0	295	418	215	0	0	0
59	1,208,476	220,006	116	0	0	135	0	0	0	0	1549	0	0	183	0	0	0	0
16A	413,096	2,915	0	0	0	0	775	0	0	0	0	0	0	0	14857	0	0	0
16B	603,728	0	0	0	3	0	550	0	0	0	0	0	827	0	3879	0	0	0
16C	307,204	17,852	0	0	0	0	520	0	0	0	0	0	0	0	5829	0	0	0
16D	301,875	8,364	0	0	0	0	380	0	0	0	0	0	0	0	10482	0	0	0
16E	614,698	231,638	0	0	0	0	465	0	0	0	0	0	0	0	3152	0	0	0
19NR	397,457	18,449	0	0	0	20	0	0	0	0	0	0	0	174	0	0	0	0
19R	2,329,426	316	5	0	0	0	0	0	0	0	98	0	0	0	0	0	0	0
21A	300,403	38	0	0	0	0	230	0	0	0	0	0	0	0	1729	0	0	0
21B	1,632,708	354,413	0	0	0	0	165	0	0	0	0	0	0	0	630	0	0	0
21N	835,643	85,688	23	0	0	0	0	0	0	0	812	0	0	0	0	0	0	0
21S	1,097,468	268,764	13	0	0	0	0	0	0	0	488	0	0	0	0	0	0	0
23BM	165,712	298	0	0	0	325	0	0	0	0	0	0	0	2316	0	0	0	0
23NBM	1,712,221	410,099	0	0	0	2050	0	0	0	0	0	0	0	3531	0	0	0	0

			Draw Hunt Limits								*Draw Hunt Demand*							
GMU	**Total Acres**	**STL Acres**	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey
2A	504,438	38,552	0	0	0	360	0	0	0	0	0	0	0	2288	0	0	0	0
2ANO	352,624	23,230	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	113
2AO	151,814	15,321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B	477,666	26,568	0	0	0	1825	0	0	0	60	0	0	0	21083	0	0	0	218
2C	516,693	46,293	0	0	0	98	0	0	0	74	0	0	0	7752	0	0	0	266
32FS	34,349	964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32NR	3,476,431	506,835	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32R	410,050	43,613	18	0	0	0	0	0	0	0	797	0	0	0	0	0	0	0
32RFS	444,399	44,577	0	0	0	30	0	0	0	0	0	0	0	290	0	0	0	0
33WH	3,080		0	0	0	40	0	0	0	4	0	0	0	19	0	0	0	26
36FS	21,632	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36NFS	613,369	95,108	0	0	0	700	0	0	0	0	0	0	0	2980	0	0	0	0
43E	492,825	53,356	33	0	0	0	0	0	0	0	440	0	0	0	0	0	0	0
43W	724,506	142,641	10	0	0	0	0	0	0	0	281	0	0	0	0	0	0	0
4H	11,010		0	0	0	0	20	0	5	0	0	0	0	0	72	0	196	0
4HC	24,026		0	0	0	55	55	0	0	0	0	0	0	1784	635	0	0	0
4S	20,102		0	0	0	0	80	0	10	0	0	0	0	0	1893	0	309	0
50N	279,873	40,638	75	0	0	0	0	0	0	0	1380	0	0	0	0	0	0	0
50S	310,173	15,184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51A	508,939	4,170	0	0	0	210	0	0	0	0	0	0	0	1962	0	0	0	0
51B	125,789	7,351	0	0	0	40	0	0	0	0	0	0	0	908	0	0	0	0
53C	3,621	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53NC	434,201	10,390	0	0	0	0	450	0	0	0	0	0	0	0	1555	0	0	0
54/55C	32,127		0	0	0	30	0	0	0	0	0	0	0	154	0	0	0	0
54/55EC	37,565		0	0	0	0	0	0	12	0	0	0	0	0	0	0	137	0
54CS	19,677		0	0	0	0	100	0	0	0	0	0	0	0	236	0	0	0
55A	1,006,608		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55B	240,099		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55CN	12,450		0	0	0	0	100	0	0	0	0	0	0	0	171	0	0	0
55E	5,438		0	0	0	10	20	0	0	0	0	0	0	172	158	0	0	0
55U	13,293		0	0	0	20	70	0	0	0	0	0	0	129	249	0	0	0
55V	99,590		0	0	0	0	285	0	40	20	0	0	0	0	4678	0	471	454
5A	146,224	1,455	0	0	0	60	90	0	0	0	0	0	0	860	444	0	0	0
5B	264,601	2,731	0	0	0	25	672	0	0	0	0	0	0	3769	3500	0	0	0
6A	845,440	2,134	0	0	0	158	653	0	0	0	0	0	0	2881	7843	0	0	0
6B	88,785	0	0	0	0	0	245	0	0	20	0	0	0	0	6564	0	0	640
6C	777,397	12,657	0	0	0	162	856	0	0	0	0	0	0	2960	4783	0	0	0

			Draw Hunt Limits								*Draw Hunt Demand*							
GMU	**Total Acres**	**STL Acres**	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey	Antelope	Barbary	Big Horn	Deer	Elk	Javelina	Bear	Turkey
9M	14,298		0	0	0	0	37	0	5	5	0	0	0	0	390	0	125	308
2AP	172,649		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2BP	73,702		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4P	340,957		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5AP	122,516		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2CP	27,684		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57S	3,600		0	0	0	20	5	0	5	0	0	0	0	296	62	0	74	0
57NS	270,570	40,256	0	0	0	100	3	0	0	0	0	0	0	363	42	0	0	0

APPENDIX B: PRIMARY DATA FOR BIG GAME SPECIES

B.1 LANDOWNER AND OUTFITTER SURVEY INSTRUMENTS

B.1.1 Private Landowner Participants in the Elk Private Lands Use System (E-PLUS)

If someone answers:

Hello. I obtained your contact information from the Game and Fish Department's Elk-PLUS participating landowner list. Would you be willing to answer a few questions about the private landowner elk authorization certificates provided to you by the Game and Fish?

My name is [*name of caller*], and I'm calling you on behalf of the Center for Applied Research. The Center is an economic consulting firm headquartered in Denver, Colorado specializing in land and resource valuation. Our firm has been retained by the New Mexico State Land Office to assist in their efforts to estimate the value of game resources on New Mexico state trust lands. As part of this effort, we're reaching out to private landowners such as yourself to obtain a better understanding of the market value of access to private lands for the purpose of hunting big game species such as elk, antelope, and deer.

We understand that you, as an E-PLUS participant may negotiate with hunters seeking to hunt on your land or outfitters seeking to guide hunts on your land, and we're hoping that you would be willing to answer a few questions on this topic. These questions are as follows:

1) Have you ever sold any or all your private landowner elk tags to a third-party?
2) How much did you charge?

   Follow-up: Does this price include any ancillary benefits provided to the purchaser, such as lodging, transportation, or guide services?

   Follow-up: Does this price differ by the sex of the elk or the sporting arm of the hunter?
3) Have you ever sold access to your lands to hunt other game species such as deer, bear, cougar, or antelope?

   Follow-up: How much did charge?

   Follow-up: Does this price include any ancillary benefits provided to the purchaser, such as lodging, transportation, or guide services?

   Follow-up: Does this price differ by the sex of the [*game type*] or the sporting arm of the hunter?

If leaving a message:

Hello. My name is [*name of caller*] and I obtained your contact information from the Game and Fish Department's Elk PLUS participating landowner list. I'm conducting a survey on behalf of the Center for Applied Research and I was hoping to ask you a few questions about your private landowner tags for elk. I'd greatly appreciate a call back whenever you get the opportunity. My number is [*callback number*]. Thanks a lot!

B.1.2 Private Landowner Participants in the Antelope Private Lands Use System (A-PLUS)

If someone answers:

Hello. I obtained your contact information from the Game and Fish Department's Antelope-PLUS participating landowner list. Would you be willing to answer a few questions about the private landowner antelope authorization certificates provided to you by the Game and Fish?

My name is [*name of caller*], and I'm calling you on behalf of the Center for Applied Research. The Center is an economic consulting firm headquartered in Denver, Colorado specializing in land and resource valuation. Our firm has been retained by the New Mexico State Land Office to assist in their efforts to estimate the value of game resources on New Mexico state trust lands. As part of this effort, we're reaching out to private landowners such as yourself to obtain a better understanding of the market value of access to private lands for the purpose of hunting big game species such as elk, antelope, and deer.

We understand that you, as an A-PLUS participant may negotiate with hunters seeking to hunt on your land or outfitters seeking to guide hunts on your land, and we're hoping that you would be willing to answer a few questions on this topic. These questions are as follows:

1) Have you ever sold any or all your private landowner antelope tags to a third-party?
2) How much did you charge?

    Follow-up: Does this price include any ancillary benefits provided to the purchaser, such as lodging, transportation, or guide services?

    Follow-up: Does this price differ by the sex of the antelope or the sporting arm of the hunter?
3) Have you ever sold access to your lands to hunt other game species such as deer, bear, cougar, or elk?

    Follow-up: How much did charge?

    Follow-up: Does this price include any ancillary benefits provided to the purchaser, such as lodging, transportation, or guide services?

    Follow-up: Does this price differ by the sex of the [*game type*] or the sporting arm of the hunter?

If leaving a message:

Hello. My name is [*name of caller*] and I obtained your contact information from the Game and Fish Department's Antelope PLUS participating landowner list. I'm conducting a survey on behalf of the Center for Applied Research and I was hoping to ask you a few questions about your private landowner tags for antelope. I'd greatly appreciate a call back whenever you get the opportunity. My number is [*callback number*]. Thanks a lot!

B.1.3 New Mexico Registered Outfitter

If someone answers:

Hello. My name is [*name of caller*]. I obtained your contact information from the Game and Fish Department's active outfitters list and I'm hoping you'll be willing to answer a few questions for me about the price of private landowner tags for big game throughout New Mexico.

Please know that I am not calling as a hunter or prospective customer. Rather, I'm calling you on behalf of the Center for Applied Research. The Center is an economic consulting firm headquartered in Denver, Colorado specializing in land and resource valuation. Our firm has been retained by the New Mexico State Land Office to assist in their efforts to estimate the value of game resources on New Mexico state trust lands. As part of this effort, we're trying to determine the market value of access to private lands for the purpose of hunting big game species such as elk, antelope, and deer.

We understand that you, as an outfitter, and/or your clients frequently compensate private landowners for authorization certificates or pay trespass fees as part of your guided hunts and we're hoping that you would be willing to share some level of information with us regarding the amounts you pay to those landowners.

Our objective is to establish a price per opportunity to hunt an elk, deer, or antelope on private lands and match this with a locational attribute in order to approximate the value of hunting access and resources on state trust lands. If you're willing to assist in this effort, the questions are as follows:

1) Have you ever purchased a private landowner tag or paid a trespass fee to hunt or guide a hunt on private lands?
2) How much did you pay [*repeat by game type*]?
    - *Follow-up*: Did this price include any ancillary benefits provided by the landowner such as lodging or transportation?
    - *Follow-up*: Did this price include any ancillary benefits provided by you to your client or to the landowner?
    - *Follow-up*: Was this price based on the sex of the [*game type*] or the sporting arm of the hunter?
    - *Follow-up*: In what game management unit was the hunt authorized?
    - *Follow-up*: Was the purchased private landowner tag a ranch-only or unit-wide tag?

If leaving a message:

Hello. My name is [*name of caller*] and I obtained your contact information from the Game and Fish Department's active outfitters list. I'm conducting a survey on behalf of the Center for Applied Research and I was hoping to ask you a few questions about the price of private landowner tags for big game throughout New Mexico. I'd greatly appreciate a call back whenever you get the opportunity. My number is [*callback number*]. Thanks a lot!

B.2 SUMMARY OF LANDOWNER AND OUTFITTER DATA COLLECTION EFFORTS

B.2.1 Data Collection Sampling Statistics

Table B1 – Data collection sampling statistics

Call Statistics	E-PLUS Participants	A-PLUS Participants	Registered New Mexico Outfitters
List Members*	**724**	**718**	**172**
Attempts Made	166	232	172
Messages Left	65	91	76
No Connection†	35	62	4
Completed	66	79	85
Data Provided	46	65	27
Completion Rate‡	39.76%	34.05%	49.42%
Sample Success Rate§	**27.71%**	**28.02%**	**15.70%**
Overall Success Rate‖	**6.35%**	**9.05%**	**15.70%**

* Total number of unique individuals. Both the E-PLUS and A-PLUS participant lists contained individuals with multiple participating properties.

† Due to inactive voicemail, wrong number, call rejected by serivice provider, or other technical malfunction.

‡ The number of successfully completed calls divided by the number of attempts made.

§ The number of instances where data was provided divided by the number of attempts made.

‖ The number of instances where data was provided divided by the total population size (i.e., list members)

B.2.2 Summary Statistics for Collected Data

Table B2 – Summary statistics for collected outfitter and landowner data

	Antelope	Barbary Sheep	Bear	Deer	Elk	Lion	Oryx	Turkey
Sample Size	102	12	4	20	165	2	1	2
Male	95	12	4	20	133	2	1	2
Female	7	0	0	32	0	0	0	0
Average price								
Mean	1,505	2,750	1,475	1,949	2,889	350	1,500	458
Median	1,200	2,750	750	2,125	1,800	350	1,500	458
Standard Deviation	1,094	783	1,704	1,418	3,064	212	n/c	59
Harvest supply*								
Mean	58	130	n/c	232	576	n/c	n/c	n/c
Median	50	92	n/c	135	520	n/c	n/c	n/c
Standard Deviation	43	148	n/c	255	625	n/c	n/c	n/c
Harvest demand†								
Mean	1,237	740	n/c	1,285	5,156	n/c	n/c	n/c
Median	1,256	463	n/c	618	3,132	n/c	n/c	n/c
Standard Deviation	941	933	n/c	1,479	6,688	n/c	n/c	n/c
Accessibility ratio‡								
Mean	1.37	1.85	0.90	1.42	5.80	n/c	1.71	0.25
Median	0.39	1.61	0.90	0.44	1.48	n/c	1.71	0.25
Standard Deviation	2.11	1.25	0.82	2.66	27.56	n/c	n/c	0.11
Ranch size *(acres)*								
Mean	11,199	11,099	17,664	14,791	4,112	n/c	n/c	30,329
Median	16,412	4,193	4,999	4,584	2,174	n/c	n/c	30,329
Standard Deviation	15,177	16,663	25,878	19,780	7,983	n/c	n/c	36,961
State trust land *(acres)*								
Mean	226,331	136,045	72,618	112,373	57,080	n/c	355,041	130,131
Median	240,418	89,129	35,233	73,704	11,522	n/c	355,041	130,131
Standard Deviation	125,165	111,543	103,722	89,120	82,186	n/c	n/c	127,102

Notes: n/c: value not calculable

* Draw tag limits in GMUs where the DGF offers draw hunts.

† Draw participants in GMUs where the DGF offers draw hunts.

‡ The number of open acres in a GMU where species-specific hunts are permitted, divided by the number of private acres.

APPENDIX C: BIG GAME PARCELS SUBJECT TO VALUATION

Since the GMU boundaries maintained by the DGF differ by species, contiguous state trust land parcels were defined and valued separately for each species. DGF GMU boundaries can be summarized in two basic formats: aggregated and disaggregated. For instance, many draw hunts for antelope are assigned to GMU 16, whereas draw hunts for elk in GMU 16 are assigned at the subunit level, i.e., GMU 16A, 16B, 16C, 16D, or 16E. Therefore, the value of access to antelope on state trust lands was developed herein based aggregated GMU boundaries and the value of access to elk on state trust lands was developed herein based on disaggregated GMU boundaries.

Tables C.1 and C.2 contain summary statistics for all of the state trust land parcels that were considered as part of the Center's valuation of access to big game resources on state trust lands under each aggregation scenario and inclusion threshold.

Table C1 – Summary statistics for contiguous state trust land parcels defined by disaggregated GMU boundaries and inclusion threshold

	Number of Parcels		Total Acreage of Parcels	
GMU	*(>1,920 acres)*	*(>10,630 acres)*	*(>1,920 acres)*	*(>10,630 acres)*
7	7	0	28,191.41	0.00
8	1	0	2,481.32	0.00
9	2	0	8,136.84	0.00
10	2	0	14,489.47	0.00
12	12	3	150,087.05	100,024.22
13	11	2	85,177.17	54,122.86
14	1	0	5,163.36	0.00
15	5	0	20,672.49	0.00
17	9	2	52,403.46	24,125.21
18	15	2	250,815.58	212,113.29
19	2	0	13,691.79	0.00
20	6	1	40,448.17	19,122.92
22	1	0	2,519.02	0.00
23	20	2	327,540.68	270,442.46
24	13	3	129,162.35	83,806.31
25	15	4	156,849.30	114,359.12
26	15	3	159,592.62	91,103.34
27	9	2	86,568.97	61,225.19
29	18	2	115,078.69	44,069.92
30	19	6	146,078.19	88,560.77
31	53	14	1,060,843.56	906,351.04
32	28	8	360,725.79	294,628.55
33	14	3	196,287.11	146,755.51
34	9	0	46,720.39	0.00

GMU	Number of Parcels (>1,920 acres)	Number of Parcels (>10,630 acres)	Total Acreage of Parcels (>1,920 acres)	Total Acreage of Parcels (>10,630 acres)
36	5	3	63,939.23	55,078.66
37	8	1	39,945.32	12,587.45
38	27	5	195,439.03	122,125.94
39	22	4	169,109.52	88,270.50
40	13	2	77,058.84	41,116.75
41	14	3	165,211.82	120,913.10
42	22	1	91,118.95	14,326.19
43	8	3	158,041.45	139,910.50
45	1	0	2,380.41	0.00
47	9	2	82,159.04	53,934.61
48	3	2	54,194.19	51,237.36
50	3	0	11,838.73	0.00
53	1	0	7,017.70	0.00
56	15	5	173,134.26	126,998.62
57	6	0	17,637.94	0.00
58	16	2	86,231.09	37,008.18
59	16	2	116,178.39	62,026.33
16A	1	0	2,914.76	0.00
16C	1	1	11,265.12	11,265.12
16D	2	0	5,698.49	0.00
16E	10	3	210,350.29	172,292.36
21B	27	7	218,274.20	141,209.84
6C	1	0	3,691.48	0.00
Average	**11**	**2**	**115,373.51**	**80,023.66**
Total	**518**	**103**	**5,422,555.03**	**3,761,112.22**

Table C2 – Summary statistics for contiguous state trust land parcels defined by aggregated GMU boundaries and inclusion threshold

GMU	Number of Parcels (>1,920 acres)	Number of Parcels (>10,630 acres)	Total Acreage of Parcels (>1,920 acres)	Total Acreage of Parcels (>10,630 acres)
7	7	0	28,191.41	0.00
8	1	0	2,481.32	0.00
9	2	0	8,136.84	0.00
10	2	0	14,489.47	0.00
12	12	3	150,087.05	100,024.22
13	11	2	85,177.17	54,122.86
14	1	0	5,163.36	0.00
15	5	0	20,672.49	0.00

GMU	Number of Parcels (>1,920 acres)	Number of Parcels (>10,630 acres)	Total Acreage of Parcels (>1,920 acres)	Total Acreage of Parcels (>10,630 acres)
16	10	4	230,228.65	200,985.32
17	9	2	52,403.46	24,125.21
18	15	2	250,815.58	212,113.29
19	2	0	13,691.79	0.00
20	6	1	40,448.17	19,122.92
21	27	7	218,283.99	141,214.67
22	1	0	2,519.02	0.00
23	20	2	327,540.68	270,442.46
24	13	3	129,162.35	83,806.31
25	15	4	156,849.30	114,359.12
26	15	3	159,592.62	91,103.34
27	9	2	86,568.97	61,225.19
29	18	2	115,078.69	44,069.92
30	19	6	146,078.19	88,560.77
31	53	14	1,060,843.56	906,351.04
32	28	8	360,725.79	294,628.55
33	14	3	196,287.11	146,755.51
34	9	0	46,720.39	0.00
36	5	3	63,939.23	55,078.66
37	8	1	39,945.32	12,587.45
38	27	5	195,439.03	122,125.94
39	22	4	169,109.52	88,270.50
40	13	2	77,058.84	41,116.75
41	14	3	165,211.82	120,913.10
42	22	1	91,118.95	14,326.19
43	8	3	158,041.45	139,910.50
45	1	0	2,380.41	0.00
47	9	2	82,159.04	53,934.61
48	3	2	54,194.19	51,237.36
50	3	0	11,838.73	0.00
53	1	0	7,017.70	0.00
56	15	5	173,134.26	126,998.62
57	6	0	17,637.94	0.00
58	16	2	86,231.09	37,008.18
59	16	2	116,178.39	62,026.33
6C	1	0	3,691.48	0.00
Average	**12**	**2**	**123,240.11**	**85,876.02**
Total	**514**	**103**	**5,422,564.81**	**3,778,544.89**

Figures C1 and C2 are graphical illustrations of the parcels summarized by Tables C1 and C2, respectively.

Figure C1 – State trust land parcels by contiguity class as defined by disaggregated GMU boundaries

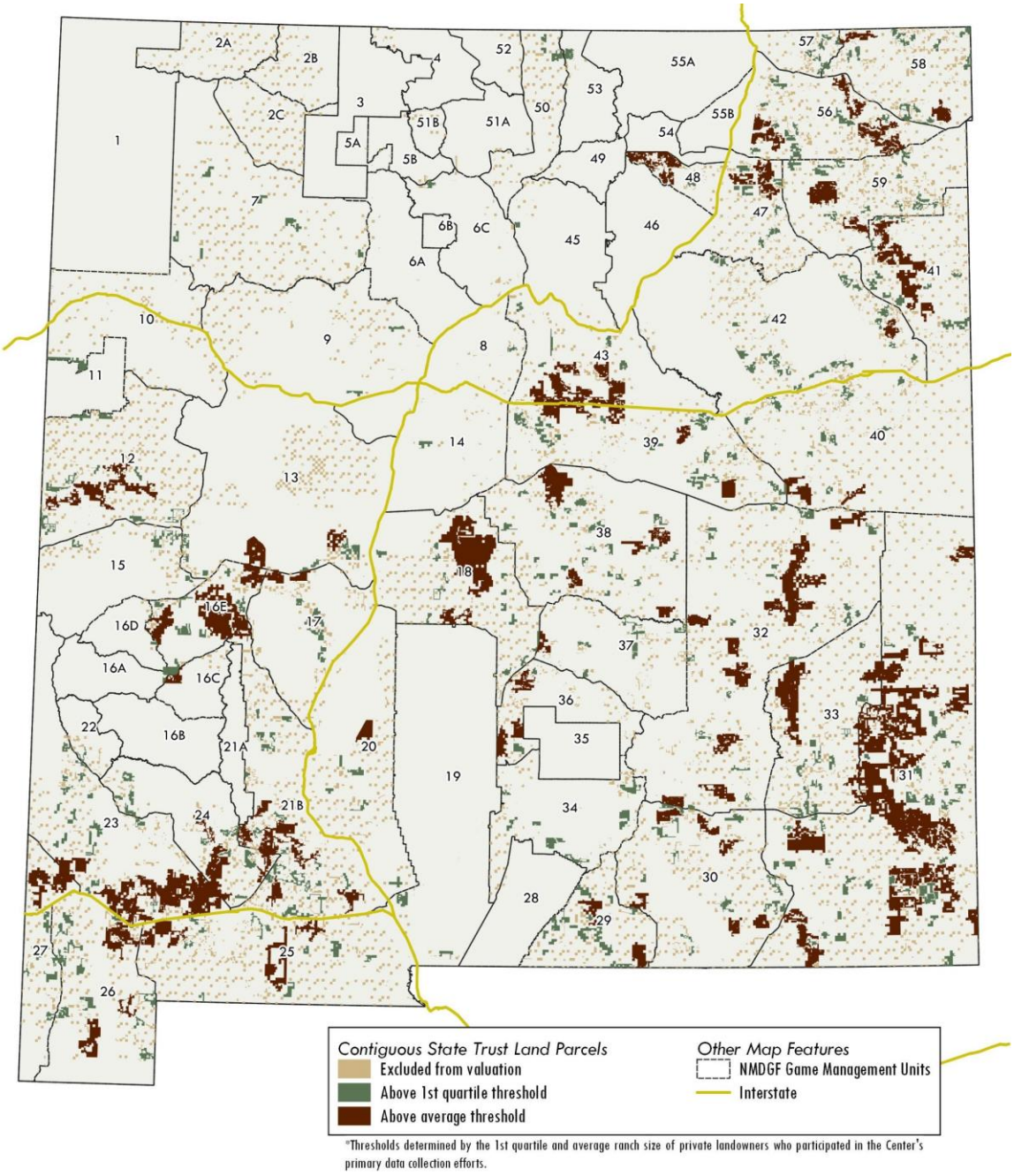

Figure C2 – State trust land parcels by contiguity class as defined by aggregated GMU boundaries