

Fort Davis National Historic Site Exotic Aoudad Impact and Issue Assessment

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Raymond Skiles
Wildlife Biologist (Retired)
National Park Service

BACKGROUND

National Park Service (NPS) staff for more than a decade have verbally reported concern over apparent impacts of exotic, non-native aoudad (Figure 1) upon Fort Davis National Historic Site (FODA, Site) cultural and natural resources.

NPS Policies direct “*exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species interferes with natural processes and the perpetuation of natural features, native species or natural habitats, or*

- *disrupts the genetic integrity of native species,*
- *disrupts the accurate presentation of a cultural landscape,*
- *damages cultural resources,*
- *significantly hampers the management of park or adjacent lands...*”

Aoudad, also called Barbary sheep, are native to the deserts of Asia and Africa, but are well established in Texas and were deliberately introduced starting in the 1950s (Mungall and Sheffield 1994). Aoudad share characteristics of both wild sheep and goats and have been the subject of some taxonomic contention (Cassinello 1998). Aoudad are adapted to hot, dry, and rocky areas because they evolved in extremely xeric environments. Activity is predominantly crepuscular, and aoudad seek areas with good access to protective refuge – particularly precipitous slopes (Cassinello et al. 2004, Simpson and Gray 1983). Given the opportunity, both males and females will use dry or wet wallows (Mungall and Sheffield 1994).



Figure 1: Aoudad. Shane Allen



Figure 2: Aoudad graze among historic FODA structures and cottonwood trees

Aoudad diet reflects adaptability to seasonal and regional conditions. They switch readily between forbs, grasses and browse and regularly consume “low quality” foods with low digestible protein. In the southwestern U.S. common browse species include juniper (*Juniperus* spp.), yucca (*Yucca* spp.), agarito (*Berberis trifoliata*), sotol (*Dasylion* spp.), prickly pear (*Opuntia* spp.), various grasses, sage (*Salvia* sp.), common horehound (*Marrubium vulgare*), *Solanum* (considered toxic), oaks (*Quercus* spp.), sumacs (*Rhus* spp.). A favorite is mountain mahogany (*Cercocarpus breviflorus*) (Mungall and Sheffield 1994).

A long-time area rancher I interviewed reports aoudad were first released on a ranch about 35 miles southeast of Fort Davis in the 1950’s. In addition to the Davis Mountains, in which FODA is located, aoudad have expanded into all mountainous areas of the Trans-Pecos region, including but not limited to the Delaware, Sierra Diablo, Apache, Bofecillos, Del Norte, and Deadhorse Mountains (Texas Parks and Wildlife Department Desert Bighorn Sheep Aerial Survey reports).

NPS and Texas Parks and Wildlife Department (TPWD) staff report aoudad to be abundant in all federal and state protected areas of the region, including Big Bend National Park, Guadalupe Mountains National Park, Big Bend Ranch State Park, Davis Mountains State Park, Chinati Mountains Natural Area, Black Gap Wildlife Management Area, Elephant Mountain Wildlife Management Area, and Sierra Diablo Wildlife Management Area.

This report provides an initial written assessment of issues associated with aoudad, their impacts, potential management strategies, and community / neighbor considerations.

Of the site’s 523 acres, 175 (70.8 hectares) are primarily managed to maintain historic structures, historic landscape and modern visitor and administrative support infrastructure. The remaining 348 ac. (141 ha.) are undeveloped and managed primarily for scenic integrity and natural resource values. I refer to the latter as the FODA natural zone.

1. Initial Evaluation of Aoudad Impacts Upon FODA Resources

Site visits, informed by staff interviews, documented a variety of natural and cultural resource impacts.

Cultural Resource Impacts

- **Wallow Pits in Historic Earthen Berms**

The most extensive readily apparent cultural resource impact by aoudad upon constructed historic elements of FODA is degradation of historic earthworks. FODA was constructed at the mouth of Hospital Canyon. The canyon is a constriction in a larger stormwater runoff drainage route. Earthen berms or embankments were constructed during the period of historic significance to divert stormwater runoff both north and south of the primary concentration of fort structures.

Aoudad use their paws and horns to loosen soil, then wallow or “dust” in the broad, shallow pits. Little is known of the purposes of this behavior, but such dusting is a common behavior of many

ungulates, possibly contributing to desirable skin and pelage condition, and/or to deter dermal parasites.

Aoudad pits are commonly between three feet and eight feet in diameter, and up to eight inches deep. In all cases, soil stability is degraded, and soil stabilizing vegetation and crusts are displaced.

Soil disturbed by aoudad pitting is highly vulnerable to wind and rain-induced erosion. Pit creation on earthworks at FODA reduce berm heights, making them vulnerable to over-topping and erosion by rain and stormwater, and increase the potential for berm failure during rainstorm runoff events.

I used GAIA GPS to map and measure the primary FODA stormwater diversion earthworks (Figure 3) and create points for each pit found. After using a standard tape measure to determine width of 10 pits, I used that training to estimate the diameter of each subsequent pit observed on the earthworks.

I measured the earthworks to be 0.77 mile in length (1355 yards, 1239 meters). Atop the earthworks I scanned visually for recently dug and recently active aoudad pits (Figure 4). I counted 34 recently active pits. Numerous additional pits appeared to have been made in previous years and seasons, but exhibited degradation of form, some degree of soil stabilization, and minor vegetative re-growth. The numerous wallows apparently made and used in previous seasons, including old pits under recent diggings, were not counted, but represent even more extensive impact than the recent diggings.



Figure 3: Historic water diversion earthworks (L), and map of earthworks (R), in red

Of the 34 pits counted, the average estimated diameter was 1.63 meter (5.34 ft). They ranged from 3' to 8' in diameter. The majority (24) were five feet or greater in diameter. When surface damage areas of the recently active round pits are calculated, damage to the earthworks alone amounts to 71.5 square meters (85.5 square yards) of recent damage to the historic feature. Again, it appears that such activity has occurred over many years, with much of the long-term

damage not quantified in this rapid assessment of recent damage only. See the monitoring discussion, below.



Figure 4: Aoudad pits in historic water diversion earthworks

- Direct Contact with Historic Structures

Other cultural resource damage is more difficult to detect. FODA facility management staff interviews revealed little direct observation of aoudad impact upon site buildings and ruins. John Lowe, former Chief of Facility Management reported occasions when fresh mortar had been the focus of aoudad chewing, possibly for minerals nutrients, and he on occasions observed aoudad hoof impacts on low foundations.

- Grazing on Maintained Historic Landscape

Staff reported frequent first-person observations of aoudad, usually in groups, grazing within and among fort structures, ruins, and maintained grounds. Up to sixty aoudad in a group were reported grazing within the historic zone. Most groups within the historic zone reported to me by staff were several to 15-20 aoudad. Of note, the irrigated, mown lawn of the historic cottonwood grove is reported by staff to be a focus of aoudad activity and grazing (Figure 5), particularly during dry seasons and drought periods.

- Non-Native Large Mammals in the Historic Scene

Among NPS historic site values are contributing visual landscape scenes observed by site visitors. FODA has a diverse native wildlife, including large mammals such as desert mule deer,

white-tailed deer, and javelina. Unfortunately, the large mammal most frequently seen by site visitors is the non-native aoudad, introduced long after the historic period of significance. Their presence introduces a non-native, non-historic element into the visual scene of the site.

No wildlife or aoudad-specific sighting documentation program has been in place at FODA. However, from June 29 through August 9, 2021, staff and visitors were asked to make written documentation of aoudad observations. Covid and other restrictions resulted in only part of observations being reported. All written reports were recorded on card-sized, paper NPS Natural History Observation Form 10-257. During this short period, twelve observations were recorded. They included some reports of unknown numbers, individuals and groups numbering 3, 5, 12, 14, 20, and 40 aoudad.

Natural Resource Impacts

I walked 5.3 miles over several natural zone routes (Figure 4), both on and off-trail, observing, creating GPS points, and photographing signs and evidence of apparent aoudad impacts. This being an initial assessment, discussion of approaches to confirm this assessment and quantify impacts is discussed in section 3, below.

- **Grazing and Browsing**

The most significant broad natural resource impacts I observed in the natural zone of FODA were grazing and browsing impacts upon many species of vegetation (Figures 6,7). Upon entering the natural zone, it is highly apparent to the trained eye that moderate to heavy browsing and grazing is occurring in many areas of FODA.

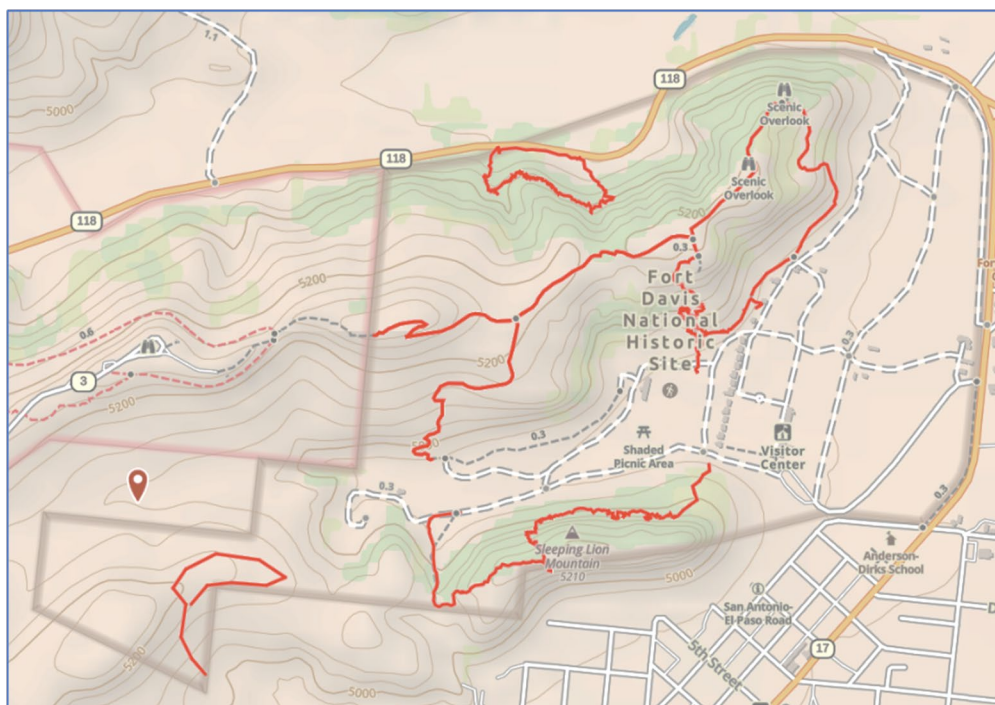


Figure 5: Author's walking routes for natural resource impact initial assessment

While deer and javelina at high population density are capable of similar impacts, staff verbally report only rare occurrence of those species, in contrast to frequent observations of often large numbers of aoudad. Thus, while additional confirmation of species' relative contribution to impacts is warranted, this initial assessment assumes most apparent natural resource impact is attributable to aoudad.



Figure 6: Grazing impacts include extensive shrub browsing and reduced grasses



Figure 7: Browse impact on native juniper (L), feeding impact on prickly pear (R)

I observed extensive and widespread evidence of apparently heavy shrub foliage consumption. In many areas, grasses were consumed to the ground, without standing dead biomass, as would otherwise be present in early summer prior to summer rains. Particularly palatable shrub species, such as juniper (Figure 6) and acacias demonstrated heavy browse, including distinct browse lines (Figure 7). Succulent species show extensive grazing damage. These include prickly pear (*Opuntia* sp., Figure 7), and almost all Spanish daggers (*Yucca torreyi*) have lost their new growth and seasonal blooms to grazing.

- Soil and ground disturbance

Soil damage due to aoudad is apparent in many locations. Along the FODA natural zone on-trail routes I walked were evidence of:

Wallow pits (Figure 8), similar to those among historic structures, described above. GPS failure allowed only partial GPS documentation of pits encountered, but successful GPS locations plus others seen allow me to estimate I encountered approximately 120 pits. Given the narrow, linear nature of my walking route, this number likely represents only a small fraction of overall FODA aoudad soil-pit impact.

Trailing (Figure 9) as defined here are linear, bare, disturbed-soil animal travel corridors caused by frequent and repeated hoof impacts. Given the abundance of aoudad trails encountered, generally being at angles to my walking route, I did not attempt to quantify aoudad trail extent.

Soil destabilization on slopes, apparently due to frequent and repeated non-linear hoof impacts of multiple animals while grazing. Stones typically embedded in soil and grass root growth are displaced and associated soils loosened and eroded. Downslope movement of stone and soil, without long-term vegetative growth to stabilize them, create erosion and soil/stone-movement zones.



Figure 8: Aoudad pits in FODA natural zone

Soil destabilization in shading and resting areas, is common at the foot of the tall, north-facing rock formations of Sleeping Lion and North Ridge. These sites are also associated with large tree presence. It is apparent aoudad spend significant time here, with consequent

digging (similar to pitting, described above) and, along with intensive general hoof impact, have denuded soils and removed low-growing vegetation.



Figure 9: Aoudad trails (away from human use areas)

2. Potential Impact Assessment and Monitoring Strategies

When considering management of exotic species, according to NPS policies, “...*superintendents should evaluate the species’ current or potential impact on park resources ...*”

Short-Term Impact Evaluation Options

- Document ungulate observations in writing.

Simple presence of large ungulates results in significant vegetative impact. Aoudad eat approximately 3.5% of their body weight, equivalent to 7 pounds of forage per day by a 200-lb animal. Based on these estimates, 20 aoudad consume at least 140 pounds of vegetation per day. Additionally, lactating herbivores typically eat 35-50% more per day (Lyons et al. 1999).

The NPS has a traditional, paper-based Natural History Observation Card, available from GPO. Many parks have long made these short forms available at visitor contact stations. Visitor contact staff encourage visitors and other staff to use the form to quickly write basic information about observations of interest.

While these forms can be used to document a wide variety of species, the program could be implemented at FODA for at least aoudad and other ungulate species with potential to create

similar resource impacts. This would provide minimum data on aoudad occurrence, group size, sex and age structure, and comparative species frequency.

- Automated Cameras

Staff reports and my visits indicate that although aoudad are highly mobile, even in rugged terrain, and over time may occur in almost all areas of FODA, there are areas and routes of more frequent use. Camera stations, including still and/or video capture can document group sizes, age structure, frequency of use, and in certain locations, behavioral information. Even individual animals can sometimes be identified, helping over time to determine whether they and their group(s) frequent a local area, or if many wide-ranging groups use the site over time.

Staff indicate historic zone locations of value might be the open space and ridge just west of Church Camp, the southwestern corner of the parade ground, and the cottonwood grove. My natural-area walking assessment identified camera potential at a few aoudad trails that ascend the rocky ridges of Sleeping Lion Mountain and the North Ridge and suggest high potential along the pipeline route between the old water tank and Church Camp.

Medium-Term Impact Evaluation Options

- Stem-Count Index

This assessment included a FODA field visit by two biologists from the local Texas Parks and Wildlife Department, Wildlife Division office. This resulted in their offer to provide initial application of a quantifiable method to measure browsing animal impacts on vegetation. The method is described in *Stem Count Index, a Habitat Appraisal Method for South Texas* (Rutledge et.al. 2008). TPWD participants offered to conduct an application of this method at FODA as early as Fall, 2021. Longer-term application is discussed below.

- Habitat Condition Assessment via Remote Sensing

This assessment included a meeting with Sul Ross State University's Borderland Research Institute director, the institute's Habitat specialist, and two graduate students. Their habitat specialist described a process to use remotely-sensed, primarily satellite imagery to assess range and habitat conditions.

- Search, document and map impact area of aoudad pits and trails. Given the destruction of vegetation and soil quality by these impacts, any level of mapping and measuring these is valid impact documentation. Although all pits and trails are not likely to be found, such data can be considered minimum levels of impact.

Long-Term Impact Evaluation Options

- Earthen berm monitoring

Given the historic significance of the earthen water diversion structures, their degradation should be monitored. A monitoring strategy would be informed by a physical science professional, possibly available at SRSU. Such monitoring would likely include permanent fixed cross-sectional transects at 50 or 100-foot intervals. Data would include height, width, and slopes at

each transect. The repeat interval would initially be annual, with modification depending upon rate of change detected during initial years.

- **Stem-Count Index**

The TPWD index described above produces increasingly valid results and trends if applied consistently over the long term of multiple years. Higher quality data is gained if the same person or persons apply the strategy over multiple cycles and years. TPWD staff are willing to train NPS staff, volunteers, or others in the method.

- **USDA-NRCS Resource Assessment**

This assessment included consultation with the U.S. Department of Agriculture, Natural Resource Conservation Service (Alpine, Texas office) grazing lands specialist. He offered USDA consultation and assistance in developing potential browse, rangeland, wildlife, and other resource assessments.

- **SRSU-Borderlands Research Institute Cooperation**

The SRSU-BRI consultation included an offer to develop a cooperative arrangement to apply SRSU expertise in developing and/or implementing impact monitoring strategies. These might include student opportunities for work on FODA in various capacities, and long-term implementation of strategies developed through TPWD, USDA, or in-house expertise.

- **NPS Chihuahuan Desert Inventory and Monitoring Program**

Ten permanent field-monitoring sites were established and sampled beginning in 2011 by the NPS Chihuahuan Desert Inventory and Monitoring (CHDN) staff, based in Las Cruces, New Mexico. These sites are to be re-evaluated at five-year intervals. The objectives are to determine the status of and detect trends in vegetation cover, vegetation frequency, soil cover (including bare ground), biological soil crusts, and surface soil stability. The CHDN initial report is available at: <https://irma.nps.gov/DataStore/Reference/Profile/2195355>

The CHDN monitoring sites on FODA could be paired with fenced exclusions that prevent large ungulate access, and the same monitoring strategy applied inside the exclusions. By comparison, the paired data sets would help demonstrate type and extent of aoudad impact upon study resources.

3. Potential Aoudad Control and Impact Mitigation Strategies

The consultations with TPWD biologists and SRSU – Borderlands Research Institute staff included discussing a variety of potential control and impact mitigation strategies, along with pros and cons of each.

- **Fencing**

Fencing to exclude aoudad needs to be at least eight, possibly ten feet high (<https://fossilrim.org/animals/aoudad/>). The FODA boundary is about 4.9 miles in length (measured on Google Earth Pro), with one mile along the residential and commercial interface with the town of Fort Davis. Most of the boundary is not particularly rugged terrain, thus fencing would not encounter major terrain challenges. The one-mile Fort Davis residential and

commercial interface would not necessarily require fencing, although there could be potential for occasional aoudad entry via that section. Provisions for occasional removal of aoudad would be necessary to address occasional aoudad entry. A gate or gates near corners might allow animals to be herded out. Lethal removal could be another solution to occasional incursions. Installation cost would be significant, but modest compared to many other NPS fencing projects. An example is the White Sands National Park exotic oryx exclusion fence, 108 km (67 mi.) long. Any such fence would also exclude medium and large-bodied mammals, including javelina, coyote, mule deer, and white-tailed deer. Most of the boundary is not visible from the historic structure zone of FODA, thus visual intrusion upon the historic scene would be modest.

- **Field-Based Lethal Removal**

Lethal removal of free-ranging aoudad via aerial (helicopter-based) shooting is quite effective and is widely applied in the Trans-Pecos region. Annual TDPD aerial shooting removes high numbers of aoudad annually in native desert bighorn sheep habitat. This includes state parks and wildlife management areas, private ranches, and a cooperative NPS/TPWD program within Big Bend National Park. Large ranches on occasion use private helicopter animal-control contractors to reduce aoudad resource competition with livestock. However, given the sound intrusion, high number of animals killed, and potential for significant visible evidence of dead and sometimes wounded animals, these programs are less viable adjacent to human residential areas and communities. Still, given the potential for aoudad that occur on FODA to range widely, it may be possible to partner with adjacent large ranches for aerial control of benefit to FODA.

Ground-based lethal removal via field shooting has potential for removing aoudad. Day or nighttime shooting with standard (noise not suppressed) weapons would likely not be successful. After initial shots, remaining animals rapidly scatter and rush to cover in rocky or wooded areas. They then become much more wary and more difficult to shoot and react even more swiftly to gunshots. However, sharpshooter nighttime reduction (not eradication) of deer is applied in several NPS units, particularly historic sites, and battlefields in the eastern U.S., often near urban and residential developments. These applications are often in broad, open meadow or mown areas. Feral hogs are routinely removed from Great Smokies NP woodlands and mountains via ground-based nighttime sharpshooters with night vision technology and suppressed (aka “silenced”) firearms. Elk are reduced in open areas of mixed woodland by daytime shooting in Rocky Mountain and Theodore Roosevelt national parks. Baiting can help concentrate animals in open areas and could be a consideration at FODA when combined with suppressed night-time sharpshooting.

- **Bait and Capture with Lethal or Live Removal**

Two primary methods of capture were identified, drop-nets and corral traps. Drop-nets generally can capture up to 20 individual large mammals. A large net is supported on vertical posts at a high enough level to allow animals to become accustomed to feeding on bait below the net. When enough animals are under the net, the net is released onto the animals. An adequate number of people must be available to secure each animal in the net and manage animal euthanasia or live removal. Humane euthanasia requires qualified persons using penetrating captive bolt or gunshot, plus exsanguination. Unfortunately, a few aoudad near the net edge are likely to escape. Those will be, and will cause others to be, very wary and unlikely to be so readily captured in the future.

A corral trap can be permanently constructed, or made of portable, temporary panels. Sides must be at least 10' tall to contain animals highly motivated to escape. I interviewed a long-time local rancher who has experience corral-trapping aoudad. His experience is with a 50' diameter corral. Livestock bait such as alfalfa, corn, or mineral blocks are attractive to aoudad. His and other ranch traps often surround a drinking water source as well. Baiting the open-gated trap can take several weeks, or even several months to cause large numbers of aoudad to be comfortable entering the trap together. The traps are accompanied by real-time video and remote-closure gates. Up to 150 aoudad have been captured at one time. Once captured, the animals are usually docile until humans approach. Once in the trap, the animals may be loaded into smaller conveyance, such as a livestock trailer for transport and disposition. Euthanasia is an option, as well as live translocation. More than 1300 live-captured (via helicopter net-gun) mouflon sheep (*Ovis aries*) were removed from Amistad National Recreation Area and transported for release on a distant private game ranch.

Both net-capture and corral-capture, and euthanasia or live removal may be performed by qualified NPS staff and cooperators, or by contract wildlife capture companies. SRSU, TPWD, and likely USDA are available for cooperation and assistance.

- **Opportunistic Shooting by NPS Staff**

Opportunistic shooting would take the form of allowing trained, qualified NPS staff to use firearms to shoot individual aoudad when encountered while performing their other duties. This would not be an effective approach by itself. Aoudad would easily recover any small population losses from using only this approach without a larger, coordinated removal program.

- **Fertility Control**

According to *A Comprehensive Review of National Park Service Ungulate Management* (Plumb et al. 2014), fertility control in national parks typically requires the following conditions: the fertility control agent must be federally approved for target species, have multi-year efficacy, may be delivered remotely, would not prevent human consumption or affect non-target animals that consume the carcass, would not have long-term or permanent effects on reproductive behavior, and would not have unintended effects on animal behavior. Despite extensive research efforts, no fertility control drug meets all these requirements (Plumb et al. 2014) and none have been tested in captive or free-ranging aoudad. In addition, research has shown the population reduction via fertility control is only applicable to or effective in closed populations or intensely managed small segments of a population (Plumb et al. 2014).

4. Public, Neighbor, and Other Agency Consultation and Cooperation Needs and Opportunities

According to NPS Policies, *...Many actions taken by the National Park Service, unless categorically excluded from further National Environmental Policy Act analysis, require public*

involvement and analysis of alternatives. They also require compliance with the National Historic Preservation Act, and related legislation.

Wildlife management in units of the national park system is often controversial, particularly when lethal removal is proposed. This is true regardless of a species' native or exotic status. While the public constituency for NPS units are national and state-wide, regional, and local communities are often the most affected by NPS actions and are likely to desire involvement in decisions and actions proposed by their local NPS unit.

Smaller units such as FODA, when hoping to address mobile species such as aoudad are well served to seek cooperative action with managers of lands outside unit boundaries. Thus, this section provides an overview of neighbor and community properties and ownership.

- Jeff Davis County

A primarily rural county, the population was 1,996 in 2020 (Census.gov), with an estimated medium income in 2019 of \$53,088 (census.gov/quickfacts). Most of the population lives in the county seat, Fort Davis, and the small community of Valentine. Several hundred live in subdivided rural acreage several miles from Fort Davis, and on large livestock ranches.

My knowledge (living in the region, with numerous acquaintances) of the Jeff Davis community indicates a high level of association with domestic and wild animals. Livestock ranching has historically been a dominant economic activity. In recent decades, hunting has become a primary source of income for owners of larger private properties. Hunting focus has historically been deer, with javelina and gamebird contributions. However, commercial exotic aoudad hunts have become a significant income factor for some of the large properties, and several local hunt guide and outfitter companies specialize in aoudad hunting on private ranches. Hunting also contributes financially to lodging, restaurant, grocery store, and other local businesses.

Many subdivided acreage dwellers see wildlife viewing as a significant value. Many do not discern in this value between native and exotic wildlife species.

Tourism has become a major, if not the major economic driver in the region. Davis Mountains State Park and FODA are major attractions to the area. The parks are well known and have significant constituencies locally, statewide, and beyond.

- Fort Davis Community

FODA is adjacent to and closely associated with the Fort Davis community. One mile of the FODA boundary is adjacent to Fort Davis residential, school, and commercial development. The population was estimated in 2019 to be 1201 (<https://suburbanstats.org/>), with low median income. The population is nearly 50% each of white and Hispanic heritage.

(<https://fortdavis.com/wp-content/uploads/2016/04/Demographic-Information.pdf>).

I visited the Jeff Davis County Appraisal District office and drove public roads and streets along the one-mile FODA / Fort Davis community boundary and inventoried properties and apparent property types. Single-family dwellings, generally on large or multiple lots up to an acre or more

in size, account for 28 properties. Only one appeared to be unoccupied. Additionally, FODA appears to share a common boundary with one church and a local public school. Just west of the direct residential interface, and south of FODA, are several approximately 40-acre tracts situated between FODA and west Fort Davis.

- Davis Mountains State Park

FODA shares a one-half mile common boundary with Davis Mountains State Park. The parks share various programs, including a hiking trail that connects the two units. Both are guided by legislation and policy that focus upon native species conservation and education. At 2,700 acres, Davis Mountains State Park is significantly larger than FODA, and most of the state park acreage is a natural zone.

There is high potential for FODA to develop a cooperative approach to managing aoudad, as most issues described in this report are likely of concern to the state park as well.

- Private Ranches

The largest FODA boundary interface (2.44 miles) is with two large private ranches. I did not contact the ranch owners or managers. In addition to public information from the Jeff Davis County Appraisal District, I interviewed a local acquaintance with close knowledge of local ranch properties. The two ranches each share about 1.2 miles of boundary with FODA.

On the FODA southwest boundary is a very large property owned by Calamity Creek LLC, based in Dallas, TX. It is also known locally as Red Barn Ranch, or the Beal property, for owner Barry Beal. The appraisal office was not able to conveniently determine the ranch size. However, all indications I encountered suggest it is one of the largest in the area. To the north of FODA, across State Highway 118 lies the Robert (Mac) Sproul Ranch. Again, lack of automation at the appraisal office meant ranch size data was not readily accessible. However, the ranch appears to be of significant size.

Given the two large, undeveloped ranches and the state park constitute three-fifths of the property adjacent to FODA, there appears to be significant potential for cooperative aoudad management.

Raymond Skiles
802 N. Walker Street, Alpine, TX 79830
432-693-7246, raymond_skiles@bigbend.net

B.S. Wildlife and Fisheries Sciences, Texas A&M University, 1979
Wildlife Biologist, National Park Service, Big Bend National Park (Ret.)
Coordinator, Big Bend National Park Exotic Animal Management Plan, 2018
Author, Big Bend NP / Texas Parks and Wildlife Department Cooperative Agreement for
Aoudad Control in Big Bend National Park, TX. 2018

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List of Consultants

Will Rhodes
Wildlife Biologist
Texas Parks and Wildlife Department
105 Court Avenue, Fort Davis, TX 79734
432-244-9894
will.rhodes@tpwd.texas.gov

Austin W. Stolte
Wildlife Biologist
Trans-Pecos Wildlife District
109 S. Cockrell, Alpine, TX 79830
432-244-9916
austin.stolte@tpwd.texas.gov

Louis A. Harveson, Director
Borderlands Research Institute
Sul Ross State University
PO Box C-21, Alpine, TX 79832
[432-837-8225](tel:432-837-8225)
harveson@sulross.edu

Carlos E. Gonzalez
Professor in Habitat Research and Management
Borderlands Research Institute
Sul Ross State University
PO Box C-21, Alpine, TX 79832

432-837-8632

carlos.gonzalez-gonzalez@sulross.edu

Rode Mills
Rangeland Management Specialist
Natural Resources Conservation Service
1805 State Hwy. 118 North, Alpine, TX 79830
432-837-5864 ext. 3
rode.mills@usda.gov

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