APGA/USFS Tree Gene Conservation Partnership: Report on Scouting and Collection Efforts targeting *Quercus havardii*

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Project Overview

Quercus havardii (shinnery oak) is a Western shrub oak that occurs in (and stabilizes) sand dunes. Conservation threats include: habitat that is highly fragmented and shrinking due to land use change, rare natural regeneration, and low population sizes due to clonal propagation. The species occurs in two regions- the Staked Plains of Texas and New Mexico, up into western Oklahoma; and parts of Utah and Arizona. As typical of oaks, traditional seed banking cannot be used to preserve seeds. The Morton Arboretum, in partnership with numerous colleagues, scouted and collected acorns from both regions of the range. Seed was distributed to 11 partner institutes who will accession and attempt to grow shinnery oak. As Q. havardii was previously only in one public garden and one private arboretum, with collections only from two regions of Texas, this project greatly enhances the preservation of this species by preserving range-wide genetic variation from more than 30 populations in many ex situ locations.

Trip Narrative- Objectives

- Coordinate with partner biologists to determine appropriate locations of Q. havardii occurrence and timing of seed collections
- Survey and document status of Q. havardii populations across its known range
- Collect acorns for distribution to partner gardens
- Collect voucher specimens, leaves, and soil to enable future studies of this under-studied species
- Record potential threats to populations
- Record status of acorn production

Example of Q. havardii leaf and acorn

Soil samples gathered from the collection sites

Trip Narrative- Daily Field Log and Population Descriptions (note: a more detailed narrative was recorded and is available on request). The narrative begins in the middle of August in Texas and New Mexico, and then into Oklahoma. The narrative then continues in Arizona and Utah in late August.

Texas, New Mexico, and Oklahoma

8/11: We received our first acorns on arrival at the airport from Dr. Robert Cox at Texas Tech, who collected from a roadside population near Lubbock earlier that week. *This was labelled site QH-E-9.*

8/12: We sampled from the *site QH-E-1* (located on FM 1780), previously Fitzgerald Ranch/ Yoakum Dunes. This was a TNC property previously now owned and managed by TPWD. Total acreage is 14,000 so we drove around the site. The land is nearly pure shinnery oak with sparse grass, though about 1,000 acres have been treated with herbicide to allow grasses to return- multiple large tracts (several hundred acres) have been treated. Our guide was Brandon Childers of TPWD. On the drive we mostly encountered pure shinnery oak that was dense enough to make walking difficult at times. The land was mostly flat with occasional rolling dunes. Acorn production was highly variable, with perhaps half the places we stopped having acorns or caps.
We then drove to Caprockm, NM and westward (5 to 10 miles further) to the Mescalero Sands BLM property, *site QH-E-2*. We sampled two rough transects, north and east of the parking area. In the first transect, shinnery occurred in small bushes from 4 to 15 feet across, and these were very distinct. They only occurred every 10 to 20 meters, separated by other shrubs and grasses. Towards the end of our transect, shinnery became less common, and then as far as we could see there were no more going north. Our second transect began at the parking area, mounted the sand dune and continued along the dune. The first few individuals were in pure sand. These and the next few were very distinct clumps as

in the first transect, but soon the shinnery became mostly continuous on steep sand dune sides. No seed and very few caps were observed.
On the way home we stopped at a roadside occurrence on Highway 125 at which we did not record the exact location but was about 10 miles before Bledsoe, which we called *site QHE-Aux2*. We found abundant seed and gathered two semi-bulk seed samples from a stretch about 40 meters long, but only had time to take four leaf samples as it was getting dark.

Small shinnery oak at Mescalero Sand Dunes

8/13: The team departed Levelland at approximately 7:30 am, driving toward Milnesand, NM. On the ranchland, *Q. havardii* was mixed with grasses and shrubs. Continuing West of Bledsoe on FM 2182W and into New Mexico on NM 262, more roadside patches appeared. These patches occurred in a similar habitat to those seen just East of Bledsoe, but the soil was more clay-like. *Q. havardii* dominated many of these dunes. We stopped at a patch approximately 4.5 miles before NM 206, near a small, boarded-up farmhouse. A large number of acorns were present, both green and brown, and cutting open five of them showed that they all had some level of weevil damage. We collected leaves from two plants in addition to acorns found throughout the area nearby these plants- a bulk collection called *site QH-E-Aux3*. This weevil infestation was unusual- most sites had less weevil damage.
We then arrived at the Milnesand Prairie Preserve on Roosevelt Road 39 (gravel road), a site owned by The Nature Conservancy. The habitat was very flat with more compact sand and many grasses. This site was *site QH-E-3*. The first transect was mostly flat after some small (~3 meter tall) dunes near the road. The shinnery occurred continuously. Most plants were less than knee high, although a few were about waist high. We saw a few acorn caps (dry and black), but no full acorns. After the first transect, we drove one to two miles North past the cattle guard. We collected three small acorns along this route. We then drove back to Roosevelt Road 39, turned to the West, and continued for about half a mile. We stopped at an electrical box, walked about 20 meters in each direction, and collected roughly 15 acorns and a leaf sample along the road. We conducted another transect to the south of this position. A small number of acorns was collected from a couple small areas. Acorns varied between green and brown, healthy and dry. Many were smaller than at our first site.

Then we traveled to another prairie chicken preserve owned by the New Mexico Department of Game and Fish. Most shinnery here were knee to thigh high, and occurred in both continuous, dense areas and patches. *This is site QH-E-4*. About ten miles from the second prairie site, and 22 miles from Highway 125 on NM 262, we observed multiple long patches of shinnery on the roadside. We stopped at two such patches to collect acorns and leaves. The shinnery here were shin to thigh high, and a large amount of acorns were present. Each patch sampled was approximately 15 meters long, and the second patch was roughly two miles from the first. *This is site QH-E-Aux-4*.

Q. havardii on prairie chicken reserve of NMDGF

8/14: The goal today was to travel to Tatum, NM to meet up with New Mexico nurseryman, soil scientist and oak enthusiast Michael Melendrez, and to meet several local landowners who wanted to show us some interesting shinnery populations. Michael Melendrez and his companion Ted had driven all the way from Los Lunas, NM. Before meeting Michael, we had some time in the early morning to scout roadsides. We travelled along a route towards Lovington, which would take us past some samples suggested by Dylan Schwilk and also by herbarium records. They suggested Q. havardii should be plentiful along the route to Lovington which is directly south of Tatum. From 30-27 miles before Lovington there were a number of good patches of havardii, some dominating the embankments. We drove on past the state line road a couple miles but didn't see any more havardii. We then drove south on state line road but only saw a small patch about 100 meters long directly in front of a farmhouse. About 2 miles south we saw a long patch but it was behind a fence. We drove another 3-4 miles and didn't see any more havardii. So we drove back to our main route (US 82, East of the border), and made a sample of 11 plants (spaced out evenly along a fenceline transect) for leaves, one seed bag (all collected from within two meters of plant number 3- possible maternal line), and 2 vouchers from a single plant. This is *site QH-E-Aux5.*
Then to get to Tatum, we went south on state line road, and took a right on 132 (where we saw a small patch just before the turn). We didn't see any more through our arrival at Tatum, NM, where we met Michael and Ted at a gas station. We were introduced to Wes Harris, a long time nurseryman (40 years,

also his family has hundreds of acres of ranch land) who is fascinated by Q. havardii. On his land, he showed us many oaks and other trees. We then saw two individuals that seemed like havardii. One was along a fenceline in which shin to knee high havardii was present. This tree was taller with a single bole about six inches in diameter, and perhaps 4 to 5 meters in height. We collected some acorns. Nearby was the supposed mother tree, a slightly smaller (9 meters) tree also supposedly havardii, and many single or small clumps of havardii. The second tree we saw was a massive spreading oak some 6 to 7 meters high and more than 12 meters across (measurements approximate). The leaves and acorns appeared like havardii. We collected seeds and leaves. Nearby were many small patches of havardii in clonal patches and scattered in ranchland. *This is site QH-E-Aux6.*
Our last stop was a supposed Texas live oak that we determined looked more like havardii. It was accompanied by large patches and then a sea of havardii. Interestingly the edge of the population was highly eroded (more than half a meter eroded- the root system was highly exposed). We collected from this tree and from two nearby patches that were 60 meters apart with the lone tree in the middle. We collected from normal prostrate havardii and two adjacent vertical stems over a meter in height. *This is site QH-E-Aux7.*

8/15: We had two goals today- to sample the Gene Howe WMA near Canadian, TX, and to sample a roadside population recorded from a 1960s herbarium sample near Wheeler, TX. We arrived at the WMA just after 9:00. We met Jamie Baker who is the manager on site. He gave us some acorns he'd collected and then we followed him out to the site location- a quite small patch after seeing the prairie chicken preserves in west Texas! Jamie said about 30 acres was shinnery. We first walked over much of the site to determine how to sample. Most shinnery was in a single block, with a few medium and small patches. We chose a transect through the main block with about 15 samples, then sampled some of the smaller patches. We found only the occasional acorn, so it was good Jamie had sampled earlier for us. We found several interesting specimens including a single upright tree that seemed a mix of havardii and other oak- glossy leaves, tree form, even larger acorns, and deeper lobes. *This is site QH-E-5*.
We then drove South from Canadian on US 60 and US 83 to Wheeler, TX. We found shinnery about 3 miles east of town on US 152 near the Wheeler airport. Most shinnery occurred on the south side of the road, but a couple small patches were seen on the north side as well. We sampled 15 plants for leaves, two for acorns, and took vouchers. *This is site QH-E-6.*

8/16: Our goals today were to sample a recorded site near Durham, OK, and to sample on the Black Kettle National Grassland (US Forest Service). On the way, we stopped at roadside population *site QH-E-AUX8*, and made a brief sampling. Then we got to Durham. Durham is a roadside crossing with just a few buildings. We headed south from Durham and soon found patchy havardii that was mostly chest to waist high or smaller (no tree forms) in sand banks along the roadside, as well as in large patches and even continuously in the fields beyond. We sampled 3 separate patches along this road. Only one of the patches had abundant seed. *This is site QH-E-7.*
After stopping at the Hitchin' Post convenience store, we drove to the headquarters of the Black Kettle National Grassland to meet US Forest Service staff. We were given a map in which several shinnery plots were suggested. We decided to sample in two separate plots. We turned left onto 33 near Roll, then left on FM 1780, a very small dirt road. We drove ½ to 1 mile and stopped at a small red gate on the left side and entered by foot. We chose a large tree (which appeared to be havardii) 50 meters in from the fence to begin sampling. After finishing this sample transect, we drove to another plot for a second transect. We drove south on the FM 1780 dirt road, and took the second or third right. We drove about five miles, passing occasional patches of shinnery and occasional dense fields of shinnery. After about five miles we turned north, drove less than a mile and found a large red gate (vehicle size). This sub-site was different than the last. Shinnery was less continuous, and we could distinctly see large patches that could be clones, separated by a matrix of grassland. We call these two locations together at Black Kettle, *site QH-E-8.*

Dense concentration of shinnery oak at Black Kettle National Grasslands

Utah and Arizona

Before we left for our trip we received material from a collaborator- leaves and a few seed from a site in Cottonwood, AZ from David Thornburg. The location is just outside Cottonwood- north of E Mingus Ave and west of I-89A. This population may be highly inbred as it is small and isolated from other known populations by hundreds of kilometers. The plants appear to be 'normal' havardii in form and leaf, though Q. turbinella is abundant in the nearby area. *This is site QH-W-1*.

8/25: This trip was undertaken by Dr. Hoban and Dr. McCauley (Fort Lewis College). Our first stop was near Mexican Water (just past Red Mesa), a roadside population just after the intersection of 160 and 191, after Walker Creek, mostly on the north side of the road. There was ranchland beyond the fence, but havardii was not observed there. The sand was quite soft and deep, and plants occurred only along about ¼ mile of the road, mostly in patches that ranged from a few to 10 meters in length or diameter. There were likely fewer than 100 plants, but they were abundant in this quite localized area. We found seed on only a couple plants and pooled these as a bulk sample. A sandstorm followed by lightning cut this visit quite short. *This* is *site QH-W-2*

8/26: We headed south on a dirt road out of Kayenta, Indian road 591. This population was in a lower area in which strong rainwaters clearly washed through- deep gulleys in the sand called 'washes' were apparent. Havardii occurs in the washes and above them in the flat to sloping plain, dominated by grasses and dotted with juniper. Havardii had the typical hummock form of 1 to 20 meters in width, though in some places in the plain, the plants were composed of an area of small sprouts only ankle high. We observed about 1 in 5 plants with caps on the plant or recent caps on the ground. Some plants seemed to

have a slight turbinella appearance (pointier at the tips), but most were typical havardii though again slightly wider and slightly more lobed than observed in Texas. We observed many seedlings throughout the population, at least 25, as we walked. They seemed to be all one year seedlings from last year, although a few small plants also were observed which may have been from relatively recent but not last year's seed crop. *This is site QH-W-3*. On our drive back to Kayenta we observed no havardii. Note that typically for the duration of the trip we did not see havardii along the roadsides at all, unlike in Texas and New Mexico where occurrences were relatively common along some roads.

8/27: The next morning we set out for the two populations near Page, located from herbarium records (havardii or welshii). The first involved a 40 minute drive on 89 and a left onto an initially paved and then dirt track road. Havardii is obvious at two points on the roadside. The leaves were not quite normal for havardii- some were greener rather than blue grey, but this may have been the rain and low lighting. The soil here is unusual for havardii- a dense clay that was ochre to red color, with small gravel. One cap was observed but it looked quite old. The population is extremely small (~10 plants) and could even be just a couple clones. Hybrids were found two miles up the road. *This is site QH-W-4.*
The other population was near mile marker 537. It begins at a pulloff- an unmarked scenic view. Several havardii are observed around the parking area. The population extends northwards a half kilometer down a steep cliff (45 degrees in places) around 100 meters vertical and then into some sandy wash- population ends once the wash becomes flat (few hundred meters). It also extends at least half kilometer westwards along the cliff side, just below the road, and on small rocky outcrops going down the cliff. The descent is steep- requiring scrambling and both hands and feet. We found no seed at all but sampled 30 plants including a couple possible clones, for leaves. We found only two old caps, which were quite large (as large as the bigger acorns in Texas). This was a larger population than the Kayenta location, perhaps 150 or 200 plants we saw, and maybe others we did not see. There are other canyon faces in the area where one might predict more havardii occurrences, if sand is sufficient- though suitable habitat is frequently observed on our explorations with no havardii! We were sometimes surprised how havardii exists on rocky edges, with just a little sand, but the rock may be quite loose underneath. *This is site QH-E-5.*

Q. havardii patch off steep descent from pull-off near Page

8/28: We chose to search for plants North of Monument Valley that Dr. McCauley had observed earlier in the year (though occurrences are known also to the South of the valley). We found abundant plants along the roadside for at least a kilometer, and some plants existing beyond the fence on the south side of the road. Along the roadside havardii was quite dominant, as it was in Texas. The plants were generally large bushes and appeared vigorous. We saw caps under some plants, but it was not clear if this was the present or previous year's acorn crops. We only found one seed on one plant in spite of thorough searching. The population size may be ~200 plants. *This is site QH-W-6.*
After this sampling we drove onward to Cedar Mesa. The approach was rough, up a narrow gravel road with many switchbacks- grade is 8 to 10%. Once at the top, we drove out about 5 km- the road turns to gravel and meets the edge of the mesa at a broad overlook with a wide rock platform about 200 meters out from the parking. Havardii can be observed abundantly with binoculars. We sampled this site in a rough oval. The habitat is quite rocky, though with patches of sand occurring frequently. The sand has a dry crust to it in places, while in other places is mixed with gravel or has a gravel layer on top. Of the sites visited so far, this one probably had the most havardii. Plants vary in size from size of small rosebush to 30 meters in diameter, mostly lower form. Alas, seed production was very low, with only three plants having one seed each, though we examined all plants along our route. Old caps were occasionally observed but these were usually dry and black- not from this year. Total population size might be ~300 plants. *This is site QH-W-7.*
Very shortly after driving down the Mesa we saw another roadside occurrence in a deep wash. There is a drainage pipe under the road. Location is East side of St. Rt. 261 ca. 4.5 miles NW of intersection with US Rt. 163. This is just west across the plain from Belle Butte. We examined the population for seed but found none, though of the 12 plants examined, two had recent caps. *This is site QH-W-Aux1.*

8/29: The next day we aimed to sample potential sites past Fry Canyon and Hite, on the way to Hinksville. After leaving Blanding, we first stopped to examine a potential hybrid zone with probable havardii influence. This location was called Butler Wash, a canyon turning into a short gulley. We observed about 10 Q. gambellii, which were typically 3 to 5 meters tall, some with what appeared to be sprouts. We also saw one plant that is sometimes called undulata, and has a blending of characters of gambellii and havardii. This plant was about 6 to 8 meters tall and had 2 seeds that we could see but we did not sample due to this being an obvious hybrid. *This is site QH-W-Aux2.*
We drove onward through very dry country with deep canyons. We searched for a population past Fry Canyon and before Hite (Fortknocker Canyon area), but did not find anything. Therefore we continued on towards a location "northwest of junction Highway 95/276 to Bullfrog along Highway 95" (as stated in the herbarium records). The sand was tan to red, and often quite packed rather than loose. We soon observed a couple of havardii on rocky bluffs above the road and about one mile later parked the car to explore more. We found numerous individuals scattered over a long slope downward, and also scattered through a wash. We sampled leaves in this area, but found no seed on any plants. Towards the end we found a scrap of decayed acorn. We decided to climb up a very steep set of rocks to a rise about 30 meters up. At the top of these rocks we found a broad expanse of several acres with many more havardii. Up here we found numerous caps and decayed acorns under individuals (approximately one in four individuals), and only one seed on one plant. *This is site QH-W-8.*
We then drove south on 276 from the intersection to investigate another herbarium location, and we were very surprised to find many more havardii than we had yet seen. Havardii was near dominant or co-dominant in a flat sandy area, reminiscent of its abundance in parts of Texas. There were at least 4 to 5 kilometers of havardii (all north of Trachyte Point), and more than a thousand individuals (possibly multiple thousands). Plants were mostly large hummocks of several to 10 meters in width. Plants in this area were extremely productive, with one in five plants having caps on the ground. However, few acorns had survived- many were desiccated and shrunk or rattled when shaken- very dry here. A very few individuals (one in 30) had a couple of acorns still attached. We searched the leaf litter and among the stems of many individuals and made a bulk collection of seed. This collection was dominated by 5 or 6 maternal plants that produced the most seed. *This is site QH-W-Aux3.*

8/30: For our final day, we aimed for the northernmost records of havardii. Our first population was on Sand Flats Road just a couple of miles East of Moab. After just a couple miles, we saw many havardii on a long, shallow slope below sandstone rocks. This slope was cut at one end by several washes that were 2 to 3 meters deep. The sand here also had a distinct crust to it in most places, and thick black cryptobiotic soil was often apparent. Plants were mostly bushes, though a few of the spreading habit, ankle height. We then descended one wash, followed it to its end, found another wash and sampled heading back towards the car. We found only one seed on one plant. We observed a few caps but most were older and black. *This is site QH-W-9.*

We then proceeded north of Moab, and past the entrance to Arches National Park. We saw several possible havardii near the entrance and near the parking lot. We continued north towards an occurrence supposed to be 17 miles north of Moab, near the airport. We also knew of an occurrence from a scout, on a BLM road in this direction. We drove past 313 and took the next BLM road (378) that we saw, and found a likely hybrid near a parking lot, with no other oaks nearby. We sampled leaves for DNA analysis, but no seed as it was a hybrid. *This is site QH-W-Aux4*.

We continued north and pulled off at the next road. We drove upwards from the highway into forbidding country- mostly gravel and little plant cover. We saw a small cluster of 2 or 3 plants about 100 meters from the road but continued onwards. We soon saw a few small clumps off to the left, and parked to explore. We found a sizeable population in which we could see more than a dozen individuals. The population extended into several washes and also on the rocky area above washes. We collected throughout the area of this population but alas found no seed on any plants, nor any caps. The soil was grey but had crytobiotic crust and shallow sand. The patches were scattered and ranged from bush form to the spreading, sparse, ankle height variety. Two 'tree' types were observed, up to 2 m tall, with a single trunk. *This is site QH-W-10*.

Q. havardii (lower left) off Sand Flats Road, near Moab, UT

Q. havardii, lower center, at final site west of Arches National Park, BLM land

We also received seed from collaborators. We received seed from three sites in southwest Texas from Andrew McNeil Marshall who collected in Howard, Ward, and Crane counties- *sites QH-E-10, QH-E-11, and QH-E-12.* In addition, Rob Hannawacker collected near Moab, which is site *QH-W-Aux10*.

Trip Narrative- observed and surmised threats

The major threat to this species in Texas, Oklahoma and New Mexico seems to be lack of habitat. Much of the suitable habitat is cropland (especially cotton) or managed ranchland. On some ranches Q. havardii can be found in large numbers, but more often than not Q. havardii was not observed on ranchland (likely due to removal by ranchers as it can poison cattle). It could be readily observed along fencerows and right-of-ways near ranchland, but not actually in the pastures. In addition, any roadside location could be subject to mowing or removal. Loss of roadside populations would greatly diminish the available habitat. Habitat is alos actively being converted to oil and gas extraction. The other major threat would be low/ no regeneration. We only found seedlings in one site. Regeneration seems to be very rare. In particular, in Arizona and Utah the climate is exceptionally dry and hot- acorns seem to last very little time on the ground before drying up. As climate becomes warmer and drier, regeneration may become even rarer.

Lesser threats that were observed included damage from gall wasps (QH-E-1, QH-E-2, QH-E-5) feral pigs (QH-E-1), grasshoppers (QH-E-1, QH-E-3, QH-E-7), wind damage (QH-E-5), hybridization (QH-E-Aux8), tracks from off road vehicles (QH-W-7, QH-E-2), or a possible fungus (QH-E-6, QH-E-7). Hybridization likely occurs to an unknown degree in Arizona and Utah from long distance pollen from gambelii or turbinella, and a DNA analysis would be useful. However with few exceptions, at Q. havardii sites there were no other oaks present in the immediate area and hybridization should be low.

Trip Narrative- Participants with addresses and contributions

Matt Lobdell, the Morton Arboretum
4100 Illinois Rt 53, Lisle IL, 60532
Role: Recipient of seed, plans to accession seed

Andrew Bunting, Chicago Botanic Garden
1000 Lake Cook Road, Glencoe, IL 60022
Role: Recipient of seed, plans to accession seed

Todd Lasseigne, Tulsa Botanic Garden
P.O. Box 707, Tulsa, OK 74101
Role: Recipient of seed, plans to accession seed

Mark Siegwarth, Boyce Thompson Arboretum
37615 US Hwy 60, Superior, AZ 85173
Role: Recipient of seed, plans to accession seed

Andrew McNeil-Marshall, Lady Bird Johnson Wildflower Center
4801 La Crosse Ave, Austin, TX 78739
Role: Recipient of seed, plans to accession seed; also collected seed from three sites

Jason W. Baker, Red Butte Garden
300 Wakara Way, Salt Lake City, UT 84108
Role: Recipient of seed, plans to accession seed

Cindy Newlander, Denver Botanic Gardens
909 York Street, Denver, CO 80206
Role: Recipient of seed, plans to accession seed

Guy Sternberg, Starhill Forest Arboretum
12000 Boy Scout Trail, Petersburg, Illinois 62675
Role: Recipient of seed, plans to accession seed

Shannon Still, UC Davis Arboretum
One Shields Ave. University of California Davis, Davis, CA 95616
Role: Recipient of seed, plans to accession seed

Chris Walters USDA-ARS National Center for Genetic Resources Preservation
Fort Collins, Colorado 80521
Role: Recipient of seed, plans to research desiccation and freezing tolerance

Valerie Pence, Cincinnati Zoo & Botanical Garden
3400 Vine Street, Cincinnati, OH 45220
Role: Recipient of seed, plans to research seedling germination

Tish McDaniel, The Nature Conservancy
Milnesand Prairie Preserve
Role: Offered guidance, monitored seed production timing, and granted permission to sample TNC land

Robert Cox, Texas Tech University
Role: Offered guidance, assisted by sampling acorns from population outside of Lubbock

Robb Hannawacker, National Parks Service
Role: Offered guidance, monitored seed production timing; also sampled seed from lands near Moab, Utah

Ross McCauley, Fort Lewis College, Durango, CO
Role: Offered guidance, monitored seed production timing, assisted with sampling in the field for all Utah and Arizona populations

Chip Ruthven, Texas Parks and Wildlife Department
3036 FM 3256, Paducah, Texas 79248
Role: Role: Offered guidance, monitored seed production timing, and granted permission to sample TPWD land

Jamie Baker, Texas Parks and Wildlife Department
Role: Role: Role: Offered guidance, monitored seed production timing, and sampled seed from TPWD land

Grant Beauprez, New Mexico Dept. of Game and Fish
202 CR 3, Texico, NM 88135
Role: Offered guidance and assistance in locating NMDGF land with shinnery oak

Donald Auer, Wildlife Management Division, New Mexico Dept. of Game & Fish
Santa Fe, New Mexico
Role: Offered guidance and granted permission to sampled NMDGF land

Amanda Scott, BLM, Utah, Monticello Canyon Country Field Office
Role: assisted with permission to sample BLM land

Gerald Cook, BLM, Utah, Henry Mountains Field Station
Role: assisted with permission to sample BLM land

Zoe Davidson, BLM, New Mexico
Role: assisted with permission to sample BLM land

Kim Allison, BLM, Utah, Moab Field Office
Role: assisted with permission to sample BLM land

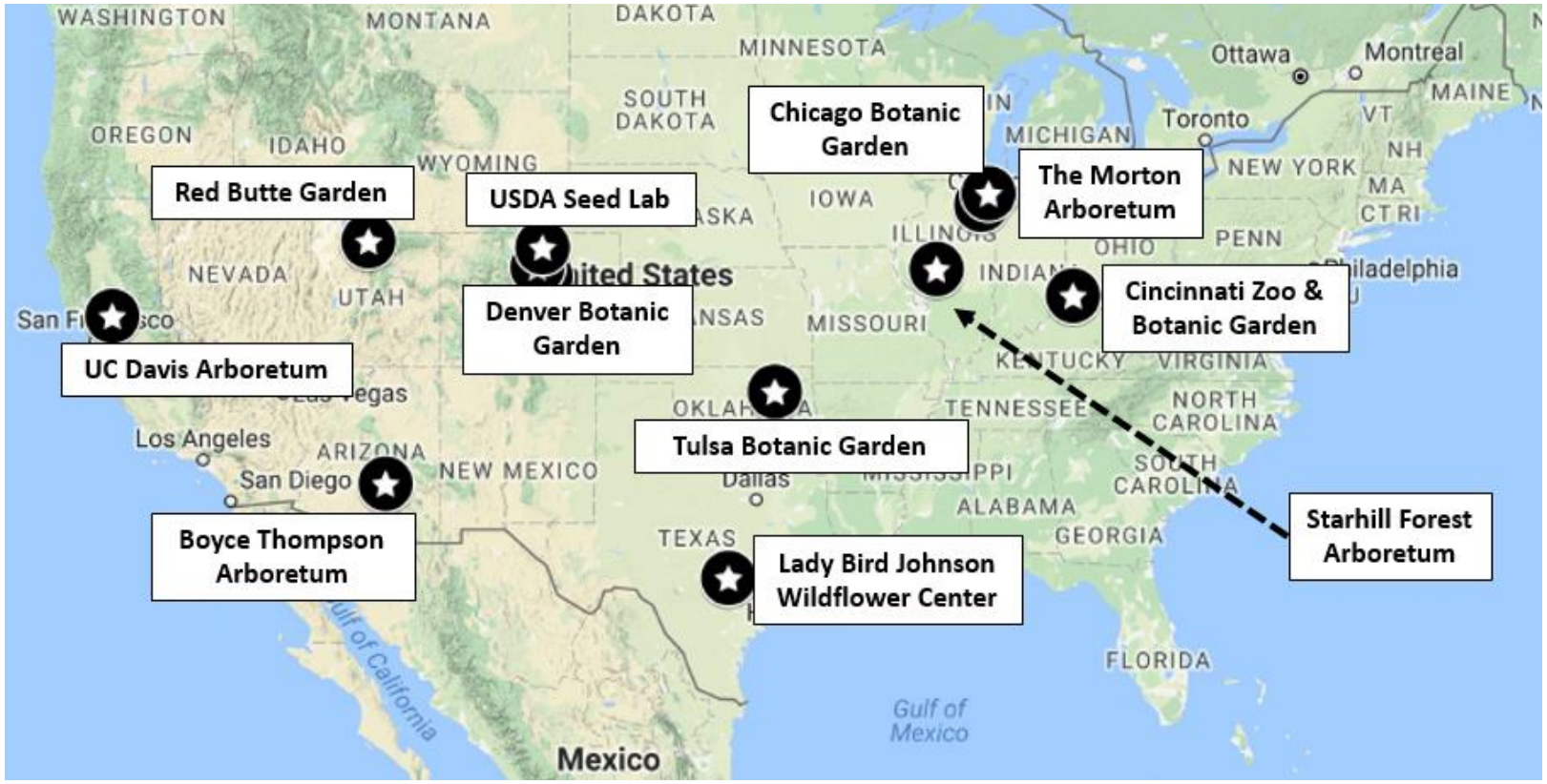
David Thornburg, retired
Role: assisted with planning; sampled site near Cottonwood, AZ

Tom Smeltzer, Black Kettle and McClellan Creek National Grasslands, USFS
18555 Hwy 47A, Cheyenne, OK 73628
Role: Offered guidance, monitored seed production timing, and granted permission to sample USFS land

Left: Quercus havardii from seedlings collected on this trip in greenhouse at the Morton Arboretum
Right: Quercus havardii leaves in the field at site in Utah

Current Status of Samples

A total of 1751 seed were collected from 30 of the 39 populations visited (although 11 populations produced fewer than 20 seed each, so 19 populations were conserved with at least 20 seed each). Acorns were sent to all partners in September 2016 along with advice for planting. Acorns kept by the Conservation Biology lab at the Morton Arboretum were sown after 2-4 weeks in refrigeration, as signs of germination were already observed. Medium is a 3:1 sand:potting soil mix, and watering occurs approximately once per week. Below is a map of locations where Q. havardii seed was distributed. All sites are for ex situ conservation via accession except the USDA Seed Lab and Cincinnati Zoo and Botanic Garden which are for seed biology research. The species should now be well preserved at sites across the country. Vouchers will be kept at the Fort Lewis Herbarium, the Morton Arboretum Herbarium, and the US National Herbarium.



Complete list of all site locations that were visited and collected from

Site Name	Part of Range	County	State	Latitude	Longitude	Collector	Tree DNA Sampled	Vouchers	Bulk Seed Bags	Maternal Seed Bags	Total # Seed	Soil Samples
QH-E-1	East	Yoakum	TX	33.37273	-102.61685	S. Hoban/D. Duckett/B. Childers	21	1	12	3	320	2
QH-E-2	East	Chaves	NM	33.40777	-103.86739	S. Hoban/D. Duckett	25	3	1	1	5	0
QH-E-3	East	Roosevelt	NM	33.71194	-103.34434	S. Hoban/D. Duckett	27	0	4	0	66	0
QH-E-4	East	Roosevelt	NM	33.60871	-103.18341	S. Hoban/D. Duckett	19	2	4	1	16	0
QH-E-5	East	Hemphill	TX	35.903	-100.27587	S. Hoban/D. Duckett/J. Baker/S. Cogar	32	2	13	5	163	0
QH-E-6	East	Wheeler	TX	35.4453	-100.1993	S. Hoban/D. Duckett	15	2	1	1	38	0
QH-E-7	East	Roger Mills	OK	35.76709	-99.925583	S. Hoban/D. Duckett	27	0	1	0	30	0
QH-E-8	East	Roger Mills	OK	35.79435	-99.817206	S. Hoban/D. Duckett	29	4	2	1	73	4
QH-E-9	East	Terry	TX	33.23896	-102.25482	R. Cox	0	0	1	0	37	0
QH-E-10	East	Howard	TX	32.28617	-101.33199	A. McNeil-Marshall	9	1	0	9	194	0
QH-E-11	East	Ward	TX	31.62684	-102.813	A. McNeil-Marshall	5	1	0	5	65	0
QH-E-12	East	Crane	TX	31.3823	-102.60638	A. McNeil-Marshall	1	0	0	1	11	0

QH-E-13	East	Crosby	TX	33.45861	-101.3906	C. Cannon	8	7	0	0	0	0
QH-E-14	East	Crosby	TX	33.43528	-101.0739	C. Cannon	12	4	1?	0?	5	0
QH-E-15	East	Crosby	TX	unknown	unknown	C. Cannon	12	3	8?	0?	291	0
QH-E-AUX2	East	Lea	NM	33.3729	-103.23238	S. Hoban/D. Duckett	4	0	1	0	28	0
QH-E-AUX3	East	Roosevelt	NM	33.64291	-103.26221	S. Hoban/D. Duckett	2	0	1	0	38	0
QH-E-AUX4	East	Cochran	TX	33.62676	-103.05192	S. Hoban/D. Duckett	0	0	2	0	65	0
QH-E-AUX5	East	Yoakum	TX	33.14972	-102.93982	S. Hoban/D. Duckett	11	2	1	0	20	0
QH-E-AUX6	East	Lea	NM	33.20302	-103.11081	S. Hoban/D. Duckett	1	0	0	2	27	0
QH-E-AUX7	East	Lea	NM	33.57045	-103.05292	S. Hoban/D. Duckett	6	0	1	0	13	0
QH-E-AUX8	East	Wheeler	TX	35.44871	-100.11228	S. Hoban/D. Duckett	11	0	3	0	52	0
QH-W-1	West	Yavapai	AZ	34.72734	-111.98501	David Thornburg	39	1	0	2	4	2
QH-W-2	West	Navajo	AZ	36.92716	-109.61794	S. Hoban/R. McCauley	11	0	1	0	11	0
QH-W-3	West	Navajo	AZ	36.61623	-110.13288	S. Hoban/R. McCauley	33	1	1	8	77	4
QH-W-4	West	Kane	UT	37.09571	-111.9837	S. Hoban/R. McCauley	33	5	0	0	0	2
QH-W-5	West	Coconino	AZ	36.78601	-111.53988	S. Hoban/R. McCauley	30	1	0	0	0	0

QH-W-6	West	San Juan	UT	37.06437	-110.06867	S. Hoban/R. McCauley	35	1	0	1	1	0
QH-W-7	West	San Juan	UT	37.23394	-109.97309	S. Hoban/R. McCauley	32	2	0	3	3	1
QH-W-8	West	Garfield	UT	38.06525	-110.60189	S. Hoban/R. McCauley	39	2	0	1	1	0
QH-W-9	West	Grand	UT	38.57306	-109.52689	S. Hoban/R. McCauley	35	1	0	1	1	2
QH-W-10	West	Grand	UT	38.76172	-109.72495	S. Hoban/R. McCauley	31	1	0	0	0	2
QH-W-11	West	Cibola	NM	34.99829	-107.17167	R. McCauley	20	2	0	0	0	0
QH-W-12	West	Fremont	CO	38.50231	-105.10608	R. McCauley	20	2	0	0	0	0
QH-W-AUX1	West	San Juan	UT	37.24165	-109.91227	S. Hoban/R. McCauley	8	1	0	0	0	0
QH-W-AUX2	West	San Juan	UT	37.52254	-109.63393	S. Hoban/R. McCauley	5	0	0	0	0	0
QH-W-AUX3	West	Garfield	UT	38.00006	-110.56879	S. Hoban/R. McCauley	18	1	1	0	58	0
QH-W-AUX4	West	Grand	UT	38.69719	-109.6946	S. Hoban/R. McCauley	1	0	0	0	0	0
QH-W-AUX10	West	Grand	UT	38.69987	-109.65727	R. Hannawacker	0	0	3	0	38	0

Permits and Correspondence with property owners/ managers.

Chip Ruthven <Chip.Ruthven@tpwd.texas.gov> Jun 17
to Matt, Brandon, Dennis, me

Sean,

Collecting seed and leaf material from *Q. havardii* at Yoakum Dunes will be fine. Please coordinate these activities with Brandon Childers (copied on this email) who is the on-site manager. We also have *Q. havardii* at the Matador WMA (Cottle Co.) and you are welcome to collect there as well. Please coordinate with Matt Poole or myself for collection at that location. I believe this e-mail will suffice for permission to collect these samples on our WMAs through coordination with on-site staff.

Sincerely,

Chip Ruthven
Project Leader, Panhandle WMAs
Texas Parks and Wildlife Department
3036 FM 3256

McDaniel, Tish <tish.mcdaniel@cehmm.org> Jun 18
to Robert, me, Dave

Sean, We welcome you to eastern NM to collect Quercus harvardii in situ. As the time for collection nears, give me a call and we can set up a meeting place near Milnesand, NM. Portales, NM will be the best place to find a hotel (35 miles north). As for a permit to sample on TNC land, that is a question back to Bob and Dave with TNC. Bob has given you permission via this email to gain access on to the property. The ranch manager, Kyle Dillard, will be notified about your plans.

I look forward to meeting you. Tish

Tish McDaniel
CEHMM
Project Manager
109 Tanning Way
Clovis, NM 88101
tish.mcdaniel@cehmm.org
575-714-4577

Robert Findling <rfindling@tnc.org> Jun 23
to me, Tish, Dave

Sean:

Yes, it is our intention to grant you access for the purpose of collecting samples of Quercus harvardii and other Quercus species, although I expect the only other oak present is a hybrid of Quercus harvardii and Quercus stellata.

Bob

Smeltzer, Tom G -FS <tsmeltzer@fs.fed.us> Jul 5

to me

Thanks for the additional information. That quantity will fall under incidental amounts and not commercial so no permit is needed. Please coordinate collection dates with my office. If assistance is needed on collection locations we would be happy to help out.

Thanks, Tom

From: Sean Hoban [mailto:shoban@mortonarb.org]
Sent: Tuesday, July 05, 2016 9:44 AM

Smeltzer, Tom G -FS <tsmeltzer@fs.fed.us> Jul 19

to Chuck, me

Sean,

I won't have anyone available to meet with you on the weekends, but collecting on your own won't be a problem. We can make maps and point you in the right direction if needed. We would be happy to meet with you if you arrive on a weekday.

Please coordinate with Range Specialist, Chuck Milner on your visit. I will brief him on what we have talked about and he is cc on this message. I will be out of the office later this week.

There are no special requirements needed. Just be cautious **not** to park a hot vehicle in tall grass due to fire danger and close any gates that you open.

I will try to look at some acorns this afternoon and give you an update.

JUN 3 0 2016

Form 5510-1
(July 2011)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FREE USE APPLICATION AND PERMIT
VEGETATIVE OR MINERAL MATERIAL

FORM APPROVED
OMB NO. 1004-0001
Expires: June 30, 2013

Permit Number

Expiration Date 6/30/17

District Canyon Country
Monticello FO

APPLICATION

Name of applicant Sean Hoban
The Morton Arboretum

Address *(include zip code)* 4100 Illinois Rt 53
3rd Floor Research Bldg Rm 324
Lisle, IL 60532

Kind of material Quercus Quercus havardii (oak)

Estimated quantity ——

Give legal land description

TOWNSHIP	RANGE	SECTION	SUBDIVISION
Please see attached Map			

State of Utah

County of San Juan

Materials are to be used for Research

I HEREBY AGREE TO COMPLY WITH the special conditions as set forth below. I CERTIFY That the: (a) materials to be removed are to be used for the purpose noted above; (b) none of the materials removed are to be sold or bartered; (c) removal of materials can begin only upon receipt of an approved copy of this permit; and, (d) the Bureau of Land Management (BLM) must be notified upon completion of removal.

I CERTIFY That I am a citizen of the United States, and of the age of majority in the State in which I reside.

I FURTHER CERTIFY That the statements made by me in this application are true, complete, and correct to the best of my knowledge and belief and are made in good faith.

6/30/16
(Date)

Sean Hoban
(Signature of Applicant)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

PERMIT

SPECIAL CONDITIONS

This permit is hereby issued for the materials applied for but may be canceled if it appears that this permit was issued erroneously or the terms or conditions contained herein are not observed. It will be subject to the following special conditions:

Please see attached

Conservation practices must be carried out as provided by 43 CFR 5511 1-1(b), 2-3(c), and 3-3;

Equipment, personal property, and improvements must be removed within ninety (90) days after expiration date 43 CFR 5511 3-5);

Any use of the surface of the lands involved in this permit must not interfere with any mining claim subject to the provisions of Section 4 of the Act of July 23, 1955 (30 U.S.C. 613);

The permittee must clean up all work areas and must remove or dispose of all refuse resulting from the permittee's operations;

This permit is issued under the Act of July 31, 1947, as amended, and 43 U.S.C. and 1201, and under the free use privilege of the Act of May 14, 1898 (Alaska only).

An annual report indicating the amount (cu. yds. or tons) of material removed must be filed with the District Office on the anniversary date of the permit, or within *thirty* (30) days *after* permit expiration (Alaska only).

(Date)

(Signature of BLM)

(Continued on page 2)

☐ APPLICANT ☐ FIELD OFFICE

JUN 3 0 2016

Form 5510-1
(July 2011)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0001
Expires: June 30, 2013

FREE USE APPLICATION AND PERMIT
VEGETATIVE OR MINERAL MATERIAL

Permit Number

Expiration Date 6/30/17

District Canyon Country
Monticello FO

APPLICATION

Name of applicant Sean Hoban
The Morton Arboretum

Address *(include zip code)* 4100 Illinois Rt 53
3rd Floor Research Bldg Rm 324
Lisle, IL 60532

Kind of material Quercus Quercus havardii (oak)

Estimated quantity ——

Give legal land description

TOWNSHIP	RANGE	SECTION	SUBDIVISION
Please see attached Map			

State of Utah

County of San Juan

Materials are to be used for Research

I HEREBY AGREE TO COMPLY WITH the special conditions as set forth below. I CERTIFY That the: (a) materials to be removed are to be used for the purpose noted above; (b) none of the materials removed are to be sold or bartered, (c) removal of materials can begin only upon receipt of an approved copy of this permit; and, (d) the Bureau of Land Management (BLM) must be notified upon completion of removal

I CERTIFY That I am a citizen of the United States, and of the age of majority in the State in which I reside

I FURTHER CERTIFY That the statements made by me in this application are true, complete, and correct to the best of my knowledge and belief and are made in good faith

6/30/16
(Date)

Sean Hoban
(Signature of Applicant)

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PERMIT

SPECIAL CONDITIONS

This permit is hereby issued for the materials applied for but may be canceled if it appears that this permit was issued erroneously or the terms or conditions contained herein are not observed. It will be subject to the following special conditions:

Please see attached

Conservation practices must be carried out as provided by 43 CFR 5511 1-1(b), 2-3(c), and 3-3.

Equipment, personal property, and improvements must be removed within ninety (90) days after expiration date 43 CFR 5511 3-5);

Any use of the surface of the lands involved in this permit must not interfere with any mining claim subject to the provisions of Section 4 of the Act of July 23, 1955 (30 U S C 613);

The permittee must clean up all work areas and must remove or dispose of all refuse resulting from the permittee's operations;

This permit is issued under the Act of July 31, 1947, as amended, and 43 U S C and 1201, and under the free use privilege of the Act of May 14, 1898 (Alaska only)

An annual report indicating the amount (cu. yds. or tons) of material removed must be filed with the District Office on the anniversary date of the permit, or within *thirty* (30) days *after* permit expiration (Alaska only).

7/1/16
(Date)

M Scott
(Signature of BLM)

(Continued on page 2)

☐ APPLICANT ☐ FIELD OFFICE

Form 5510-1
(August 31, 2016)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0001
Expires: May 1, 2016

FREE USE APPLICATION AND PERMIT

VEGETATIVE MATERIAL

Permit Number

Expiration Date

District: Cedar City

APPLICATION

Name of applicant: Sean Hoban

Address (include zip code): 4100 Illinois Rt. 53, Research Bldg. #324, Lisle IL 60532

Kind of material: Acorns, Plants, Plant Parts, soil w/ Rhizomes Harvested

Estimated quantity: See proposal

Give legal land description

TOWNSHIP	RANGE	SECTION	SUBDIVISION
See Maps			

State of: Utah

County of: Wayne, Garfield

Materials are to be used for: Conservation, genetic Study, Research

I HEREBY AGREE TO COMPLY WITH the special conditions as set forth below. I CERTIFY That the (a) materials to be removed are to be used for the purpose stated above; (b) none of the materials removed are to be sold or bartered; (c) removal of materials can begin only upon receipt of an approved copy of this permit; and (d) the Bureau of Land Management (BLM) must be notified upon completion of removal.

SIGN HERE

I CERTIFY That I am a citizen of the United States, and of the age of majority in the State in which I reside.

I FURTHER CERTIFY That the statements made by me in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

7/7/16
(Date)

Sean Hoban
(Signature of Applicant)

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PERMIT SPECIAL CONDITIONS

This permit is hereby issued for the materials applied for but may be canceled if it appears that this permit was issued erroneously or the terms or conditions contained herein are not observed. It will be subject to the following special conditions:

Conservation practices must be carried out as provided by 43 CFR 5511.1-1(b), 2-3(e), and 3-3.

Equipment, personal property, and improvements must be removed within ninety (90) days after expiration date 43 CFR 5511.3-5)

Any use of the surface of the lands involved in this permit must not interfere with any mining claim subject to the provisions of Section 4 of the Act of July 23, 1955 (30 U.S.C. 613).

The permittee must clean up all work areas and must remove or dispose of all refuse resulting from the permittee's operations.

This permit is issued under the Act of July 31, 1947, as amended, and 43 U.S.C. and 1201, and under the free use privilege of the Act of May 14, 1898 (Alaska only).

(Date)

(Signature of BLM)

(Continued on page 2)

☐ APPLICANT ☐ FIELD OFFICE

Form 5510-1
(August 31, 2016)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FREE USE APPLICATION AND PERMIT

VEGETATIVE MATERIAL

FORM APPROVED
OMB NO. 1004-0001
Expires: May 1, 2016

Permit Number

Expiration Date

District

APPLICATION

Name of applicant Sean Hoban

Address *(include zip code)*
4100 Illinois Rt. 53
Research Adm.n Buildings
Lisle, IL. 60532

Kind of material Seeds, Plant parts, of Quercus harvardii

Estimated quantity ~~From~~ See proposal

Give legal land description

TOWNSHIP	RANGE	SECTION	SUBDIVISION
See map			

State of Utah

County of Grand and San Juan

Materials are to be used for Conservation

I HEREBY AGREE TO COMPLY WITH the special conditions as set forth below. I CERTIFY That the: (a) materials to be removed are to be used for the purpose noted above; (b) none of the materials removed are to be sold or bartered; (c) removal of materials can begin only upon receipt of an approved copy of this permit; and, (d) the Bureau of Land Management (BLM) must be notified upon completion of removal.

I CERTIFY That I am a citizen of the United States, and of the age of majority in the State in which I reside.

I FURTHER CERTIFY That the statements made by me in this application are true, complete, and correct to the best of my knowledge and belief and are made in good faith.

7/7/16
(Date)

(Signature of Applicant)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

PERMIT SPECIAL
CONDITIONS

This permit is hereby issued for the materials applied for but may be canceled if it appears that this permit was issued erroneously or the terms or conditions contained herein are not observed. It will be subject to the following special conditions:

See Attachment A

Conservation practices must be carried out as provided by 43 CFR 5511.1-1(b),.2-3(c), and .3-3;

Equipment, personal property, and improvements must be removed within ninety (90) days after expiration date 43 CFR 5511.3-5);

Any use of the surface of the lands involved in this permit must not interfere with any mining claim subject to the provisions of Section 4 of the Act of July 23, 1955 (30 U.S.C 613);

The permittee must clean up all work areas and must remove or dispose of all refuse resulting from the permittee's operations;

This permit is issued under the Act of July 31, 1947, as amended, and 43 U.S.C. and 1201, and under the free use privilege of the Act of May 14, 1898 (Alaska only).

(Date)

(Signature of BLM)

(Continued on page 2)

☐ APPLICANT ☐ FIELD OFFICE

LIMITED LICENSE AGREEMENT

This Limited License Agreement ("Agreement") is entered into as of the _7__ day of __July__, 2016_ between the New Mexico Game Commission ("Commission") and ___*Dr. Sean Hoban*_____ ("Licensee").

WHEREAS, the Commission is the owner of parcels of realty known as _____ *the Prairie Chicken Wildlife Areas and the Sandhills Prairie Conservation Area*_____ and legally described as _____ *the Prairie Chicken Wildlife Areas and the Sandhills Prairie Conservation Area* _____ ("Property"); and

WHEREAS, Licensee desires to obtain from the Commission the right to conduct hereinafter described activities on all or certain portions of the Property, and;

WHEREAS, the Commission is empowered and authorized to permit access to the Property for the purposes and at the time set forth below provided there is no grant of an interest in real property, and

WHEREAS, the New Mexico Department of Game and Fish ("Department") is authorized to act for the Commission in the implementation of this license,

THEREFOR, the parties agree as follows:

1. LICENSE: The Commission hereby gives Licensee a non-exclusive terminable license to conduct the following activities on the hereinafter described portion of the Property (see paragraph 3): _____ *Assess the condition, health, demography and any threats to populations of Quercus (oaks). Collect the following: 3 herbarium vouchers of the genus Quercus per species (focusing on Q havardii but possibly also Q grisea or similar oaks) per visited site; 20 acorns, or 10% or less of the acorns present (whichever amount is smaller to ensure the population and wildlife have enough acorns) per sampled plant, or one small branch (for grafting/ rooting) if acorns not present, or one small rhizome segment, from up to 40 plants of Quercus per population; 5 leaves and a small twig for DNA extraction and analysis, , to ensure correct identification, and morphological analysis, for up to 40 individual plants of Quercus per population; Up to 4 soil cores per population for pH and basic soil analysis. Distribute collected seeds to 8 botanic gardens across the US where they will be preserved.* _____

2. LIMITED RIGHT AND TIME OF ACCESS: Licensee shall have no right to access the Property, or any portion thereof, for any purpose other than as set forth in Paragraph 1 other than at the following times and on the following dates: _____*Daylight hours, July 15 - October 31 2016*_____

3. Access for the purposes set forth above shall be limited to the following described portion[s] of the Property: __*Established roads or any location accessible by foot.* _____

4. COMPLIANCE WITH LAWS: At all times Licensee and its employees, agents or invitees shall use or be on the Property, Licensee agrees that any activities conducted thereon shall fully comply with all provisions of local, state and federal law and any such activities shall not be conducted unless and until Licensee shall have obtained all necessary approvals, consents and licenses from local, state and federal agencies and shall have delivered copies of such consent, approvals and licenses to the Department, as applicable.

5. NON - ASSIGNABILITY: Neither the rights nor obligations of Licensee contained in this agreement may be assigned to another or others by Licensee. Only the obligations of Licensee contained herein shall bind its successors in interest.

6. INDEMNITY: Licensee agrees and covenants to indemnify, hold harmless and defend the Commission, the Department and the State of New Mexico, and their respective employees, members, representatives and agents of and from any liability, costs (including costs of defense), demands, causes of action, judgements, claims, obligations or other responsibilities of any nature whatsoever arising out of or attributable to the use and enjoyment of the rights granted herein, or any activities or failures to act on the part of Licensee under the terms of this Agreement.

Prior to entering onto the Property under this Agreement, Licensee shall deliver to the Commission a certificate evidencing proof of general liability insurance coverage, in a form acceptable to the Department, in an amount not less than $_1,000,000__ showing the Commission, the Department and the State as additional insureds.

7. NO EASEMENT INTENDED: The parties agree that nothing herein contained shall be deemed to be nor is it intended to create a real property interest of any nature, including but not limited to an easement or license coupled with an interest.

8. CONSIDERATION: As and for consideration for the license herein given Licensee shall deliver to the Department, for the benefit of the Commission, the following: ____*Final copies of any internal or scientific reports produced as an outcome of this work; acknowledgement of assistance of the New Mexico Department of Fish and Game in such reports; reasonable and timely access to data, photographs or other outcomes of this work.*

_____

Executed as of the date first set forth above.

New Mexico Department of Game and Fish

By: _____
Alexandra Sandoval, Director, and
Secretary of the Commission

_____
Licensee

By: _____
Its: _____

Executed as of the date first set forth above.

New Mexico Department of Game and Fish

By: Alexandra Sandoval
Alexandra Sandoval, Director, and
Secretary of the Commission

Licensee

By: Sean Hogan

Its: Tree Conservation Biologist
The Morton Arboretum