



**Summary of 2012 Special Status Species Searches for the Keystone XL Pipeline
Project Nebraska Reroute.**

For:
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1.0 INTRODUCTION

TransCanada Keystone Pipeline LP (Keystone) is currently in the regulatory permitting process for the proposed Keystone XL Pipeline Project (Project). The Nebraska Reroute of the Project encompasses the proposed pipeline and related facilities such as pump stations, transmission lines, pipe yards and contractor yards in Nebraska.

A potential regulatory issue that could affect the permitting process is the occurrence of special-status species. Special-status species include plant and wildlife species that have been assigned a rarity value based upon a state and/or federal ranking system. The following species have been identified by the United States Fish and Wildlife Service (USFWS) and the Nebraska Game and Parks Commission (NGPC) as special-status species that could potentially be affected by the Project in Nebraska:

- western prairie fringed orchid (*Platanthera praeclara*) a federal and state Threatened species,
- small white lady's slipper (*Cypripedium candidum*), a state Threatened species,
- least tern (*Sternula antillarum*), a federal and state Endangered Species,
- piping plover (*Charadrius melodus*), a federal and state Threatened species,
- North American river otter (*Lutra canadensis*), a state Threatened species,
- blacknose shiner (*Notropis heterolepis*), a state Endangered species,
- redbelly dace (*Chrosomus eos*), a state Threatened species, and
- finescale dace (*Phoxinus neogaeus*), a state Threatened species.

Surveys have been completed for the federally-listed species in areas of suitable habitat along the Project in 2009, 2010, and 2011. Surveys in 2012 occurred within several areas of potential and/or suitable habitat that were along one of the proposed Project routes or route variations at the time of survey. Some route modifications have occurred since surveys were completed. Consequently, survey locations presented in this report have been intersected with the Project's currently proposed August 15, 2012 construction corridor to identify their location relative to the current Project. Areas that were surveyed along a previous Project centerline are also noted with explanatory text to indicate if they are no longer affected by the current Project centerline.

2.0 METHODS

Surveys were completed for each of the species listed in Section 1.0 using methods appropriate to the habitat and species. Surveys were completed by plant ecologists or wildlife biologists, as appropriate, for each species. Surveyors were experienced with each species' characteristics and habitat requirements; the primary investigators for each survey team had a minimum of 15 years of experience in completing plant and/or wildlife surveys for rare species.

2.1 Western Prairie Fringed Orchid and Small White Lady's Slipper

The western prairie fringed orchid occurs in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Wyoming. Suitable habitat includes mesic and wet prairies, although plants have been found in roadside ditches and hay meadows (Sheviak and Bowles 2003, U.S. Fish and Wildlife Service 2011).

The small white lady's slipper occurs in the eastern Great Plains and upper Midwest states, with a distribution that extends to the east coast of the United States. Preferential habitat for this orchid includes wet prairies and fens with alkaline soils, edges of sedge meadows, and occasionally within roadside ditches.

Several sites were identified as potential habitat on the Project survey area through review of the Nebraska Natural Heritage Program (NNHP) distribution data and interpretation of aerial photography.

Surveys were completed between May 23 and June 16, 2012 for the small white lady's slipper and June 10 to June 18, 2012 for the western prairie fringed orchid. Dr. Kay Kottas of Prairie Legacy Inc. conducted the surveys with John Beaver from WESTECH Environmental Services Inc. Dr. Kottas has numerous years of experience conducting native prairie inventories in Nebraska as well as surveys for western prairie fringed orchid and blowout penstemon (*Penstemon haydenii*). Mr. Beaver has over 15 years of experience surveying for rare plant species across the west, including previous surveys for western prairie fringed orchid and small white lady's slipper.

Prior to surveying an area, surveyors reviewed literature on the species habitat requirements and physical characteristics and consulted survey techniques and timing information provided by a NNHP botanist in 2011. Surveyors also visited local, known populations of small white lady's slipper to become more familiar with the plant's characteristics. Local populations of western prairie fringed orchid were unavailable to visit but both Dr. Kottas and Mr. Beaver had observed this plant in 2011 on the previous Project route.

Surveyors carefully searched each area of potential habitat by slowly walking back and forth across the habitat. Surveyors searched suitable habitat from multiple directions to review each area from different light angles and to insure that plants were not missed during the initial walk through. Surveys for both orchid species were initiated one to two weeks earlier in 2012 than in 2011 to account for the potential of early blooming in response to a warm winter and premature spring.

No surveys for western prairie fringed orchid or small white lady's slipper were completed on the Northern Alternative as this alternative had not been identified during the survey window. Suitable habitat for both species may be present on each of this alternative. No surveys for western prairie fringed orchid or small white lady's slipper were completed on the Clarks or Western Alternatives as due to lack of access on the Clarks Alternative during the survey window and lack of habitat on the Western alternative.

2.2 Least Tern, Piping Plover, and River Otter

The least tern (interior population) and piping plover occur in numerous Midwestern, Southwestern, and Western states including Montana, South Dakota, and Nebraska. The North American river otter occur in streams, rivers, and lakes throughout the United States. The Final Environmental Impact Statement (FEIS) identified several river crossings on the Project that may provide suitable habitat for all of these species. Specifically, the FEIS identified the following rivers in Nebraska as potential habitat for at least one of these species:

- Niobrara River
- Elkhorn River
- Loup River
- Platte River

Surveys were completed at the rivers noted above in June and/or July. Surveyors completed observations on three separate days for several hours each day if suitable habitat was present. Observations were completed from several vantage points on the river bank within the Project corridor with 10x42 binoculars and 80 mm 20x60 power spotting scopes.

Surveys were completed at the Niobrara River at a crossing of the Project identified by the March 14, 2012 centerline. Surveys were not completed at the Northern Alternative crossing of the Niobrara River as this crossing had not been identified during the survey window. Surveys were completed at the Preferred Route (August 15, 2012 centerline) crossings of the Elkhorn and Loup rivers, and the Clarks Alternative (August 15, 2012) crossing of the Platte River.

The Elkhorn and Loup rivers were observed for three days each between June 13 and June 20. Surveyors completed surveys at the Niobrara River on June 22, 25, and 26, and the Platte River on July 15, 19, and 20. Surveyors included Dr. Kay Kottas of Prairie Legacy Inc., and Jessica Allewalt and Peter Bugoni of WESTECH Environmental Services, Inc. Each surveyor had multiple years of experience in surveying for rare species, including surveys for migratory birds and shorebirds.

2.3 Redbelly Dace, Finescale Dace, and Blacknose Shiner

The FEIS requires surveys for special-status fish species in waterbodies crossed by the Project where the method of crossing has the potential to affect fish populations. Review of the FEIS and NNHP distribution data demonstrated the need for sampling at tributaries to the Keya Paha, Niobrara, and Elkhorn rivers in Nebraska. One tributary to the Keya Paha River and twelve tributaries to the Niobrara River were identified for fish surveys in 2012 (based on the March 14, 2012 proposed pipeline location). WESTECH Environmental Services, Inc. retained fisheries biologist Adam Behmer to oversee the acquisition of a state scientific collector's permit and fish sampling activities. Mr. Behmer has over 5 years of experience conducting fish sampling within Nebraska, including special-status fish species

distribution surveys for NNHP. Mr. Behmer's Master's thesis included research on fish assemblages in the Niobrara River including the species of current interest to this report.

Prior to conducting surveys for redbelly dace, finescale dace, and blacknose shiner, Keystone was required to obtain a scientific collection permit from the NGPC. Obtaining a permit was initiated in 2011. A permit was obtained in early-August 2012. Surveys for this three fish species are scheduled to begin August 28, 2012. Surveys will be conducted at accessible tributaries to the Keya Paha, Niobrara, and Elkhorn rivers using a seine and block netting. Some of the survey sites may be located along previous Project crossings of tributaries to the Keya Paha or Niobrara rivers. These sites will be surveyed since they may be the only locations of these tributaries where survey can be conducted in 2012. Surveyors may extrapolate habitat conditions and survey results to future crossings of these same tributaries if appropriate.

3.0 RESULTS

Survey results for western prairie fringed orchid and small white lady's slipper sites are summarized in Table 1. Survey results for least tern, piping plover, and river otter are summarized in Table 2. Results of surveys for redbelly dace, finescale dace, and blacknose shiner will be submitted under separate cover once they are available. Site photographs are provided in Attachment A.

3.1 Western Prairie Fringed Orchid and Small White Lady's Slipper

No western prairie fringed orchid or small white lady's slipper plants were located during in 2012. The majority of properties identified for orchid survey were inaccessible to surveyors during the designated timeframes due to landowner denial. A total of 14 sites with potential habitat were identified in areas currently intersected by the August 15, 2012 centerline, of these sites survey was completed at 3 locations, the remaining areas could not be surveyed due to access denial.

Table 1 summarizes the results for accessible properties where an orchid survey was completed and suitable habitat was present.

Table 1. Summary of survey results for western prairie fringed orchid and small white lady's slipper. Keystone XL pipeline project, Nebraska reroute. 2012.

Site Approximate Milepost ^{1,2}	County	Comments
Formerly [redacted] - Site no longer intersects proposed NE reroute.	Keya Paha	<p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This location is good habitat for western prairie fringed orchid and small white lady's slipper. The site consists of mesic to wet meadows dominated by mostly native prairie or wetland species. Primary species in the wet meadow were woolly sedge, common spikerush, Dudley's rush, and hard stem bulrush. Big bluestem, needle and thread grass, and indian rice grass were present in the adjoining meadows.</p>
Formerly [redacted] - Site no longer intersects proposed NE reroute.	Holt	<p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This location is excellent habitat for western prairie fringed orchid and small white lady's slipper. The site consists of mesic and wet meadows dominated by native grasses and forbs. Primary species in the wet meadows and wetland fringes included Nebraska sedge, woolly sedge, bottlebrush sedge, common spikerush, Dudley's rush, and bulrush species.</p>
[redacted]	Holt	<p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This location has the potential to provide habitat for the western prairie fringed orchid and small white lady's slipper within the mesic drainage to the northeast of the pond. Primary species in the drainage included Kentucky bluegrass, red clover, water knotweed, foxtail barley, and woolly sedge.</p>
[redacted]	Antelope	<p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This site is good habitat for western prairie fringed orchid and small white lady's slipper. The site consists of mesic to wet meadows dominated by mostly native prairie or wetland species. Primary species included sedge and bulrush, big bluestem, porcupine grass, switchgrass, indiagrass, and smooth brome.</p>
[redacted]	Antelope	<p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This location contains a mix of fair and good habitat for western prairie fringed orchid and small white lady's</p>

Table 1. Summary of survey results for western prairie fringed orchid and small white lady's slipper. Keystone XL pipeline project, Nebraska reroute. 2012.

Site Approximate Milepost ^{1,2}	County	Comments
Formerly [redacted] Site no [redacted] longer intersects proposed NE reroute.	Nance	<p>slipper. Much of the area was overly shaded or too dry in 2012 to support the species (adjacent to Elkhorn River). Primary species in this location included indian rice grass, Kentucky bluegrass, and western wheatgrass. Noxious weed species of leafy spurge, musk thistle, and sulfur cinquefoil also present within floodplain area.</p> <p>No western prairie fringed orchids or small white lady's slippers were observed at the site.</p> <p>This location provides moderate habitat for both species, with mesic meadows containing native and introduced species. The primary species in this location were smooth brome, reed canary grass, and native forbs.</p>

¹ Milepost as reported in August 15, 2012 version of proposed Nebraska reroute.

² Surveys were originally completed at sites coincident to the March 14, 2012 proposed reroute. The August 15, 2012 revised Nebraska reroute no longer intersects some of the surveyed areas. Results are presented for documentation purposes and provide the former milepost values for reference.

3.2 Least Tern, Piping Plover, and River Otter

Least tern, piping plover, and river otter surveys were completed at the Niobrara, Elkhorn, Loup, and Platte rivers. Surveys at the Elkhorn, Loup, and Platte rivers were completed at the current crossings shown by the August 15, 2012 centerline; this crossing of the Platte River also coincides with the Clarks Alternative crossing of the Platte River. Surveys were completed at the March 14, 2012 crossing of the Niobrara River as the Northern Alternative crossing site had not been identified within the survey window.

Water elevations within the Niobrara, Elkhorn, and Loup rivers in June were sufficient to provide suitable nesting habitat and foraging opportunities for interior least terns and piping plovers. Numerous large, unvegetated sandbars and banks were exposed within all three river drainages. Four individual adult least terns were observed flying and foraging at the Niobrara River and four adult least terns were observed wading, flying, resting, and foraging along the Loup River. Surveyors did not observe a least tern pair or nest at either location. The presence of nests along the Niobrara River was inferred by the behavior of adult least terns, which were repeatedly observed transporting small fish to a location approximately one-half to three-quarters of a mile downstream of the observation point. No least terns were observed at the Elkhorn River. Water levels in the Elkhorn River were low in the vicinity of the survey site and portions of the exposed sandbars were vegetated. Piping plovers were not observed on the Niobrara, Elkhorn, or Loup rivers.

Surveyors did not observe either least tern or piping plover at the Platte River crossing. However, the Platte River was nearly dry at the proposed crossing location during the survey period and, therefore, did not provide adequate habitat for least terns or piping plovers. Further, the banks and sandbars within the Platte River are heavily vegetated indicating that even if adequate water were present in the river for least tern or piping plover, it is unlikely that this site would provide suitable nesting habitat.

The Niobrara, Elkhorn, Loup, and Platte rivers were evaluated for the presence of river otters. Each location was surveyed for evidence of river otter activity, such as slide areas along the river banks, burrows, latrine sites, or tracks. The river surfaces and banks were monitored for river otters while surveying for piping plovers and least terns. Slides and a den possibly belonging to river otter were discovered on a bank of the Loup River, but this supposition could not be confirmed due to a lack of tracks and/or scat. It is possible that the den and slide was used by beaver or muskrat. Neither river otters, nor definitive river otter sign, were observed during survey of the four river crossing locations.

3.3 Redbelly Dace, Finescale Dace, and Blacknose Shiner

Survey results for redbelly dace, finescale dace, and blacknose shiner will be submitted under separate cover once they are available. Table 3 identifies stream crossing where sampling will be conducted if access is allowed.

Table 2. Summary of survey results for least tern, piping plover, and river otter. Keystone XL pipeline project, Nebraska Reroute. 2012.

Site Approximate Milepost ¹	County(ies)	Comments
[Redacted]	Keya Paha/ Rock	Niobrara River. Excellent habitat for least terns and piping plovers with numerous sand bars. Least terns observed at regular intervals flying over river, foraging, and transporting fish to locations downstream. Other birds observed in riparian area included: bald eagle, killdeer, snowy egret, kestrel, sandpiper, and kingfisher.
[Redacted]	Antelope	Elkhorn River. Good habitat for least terns and piping plovers with numerous sand bars; however, neither species was observed. Low water level and some growth of sandbar willow and bulrush on sand bars. Variety of other birds observed including: killdeer, sandpiper, kingfisher, green heron, red-headed woodpecker, and turkey vulture.
[Redacted]	Nance	Loup River. Excellent habitat for least terns and piping plovers with numerous sand bars. Least terns observed on multiple days resting, foraging, flying, and wading. Other birds observed included cliff swallow, golden eagle, brown thrasher, Baltimore oriole, killdeer, and red-tailed hawk.
[Redacted]	Merrick	Platte River. Good habitat for least terns and piping plovers with numerous sand bars; however, very dry summer resulted in a nearly dry river by the time of survey. No wading or shorebirds of any kind were observed. Other observed species included great blue herons, killdeer, turkey vulture, American goldfinch, and a bald eagle.

¹ Milepost as reported in August 15, 2012 version of proposed Nebraska reroute.

Table 3. Stream crossings identified for for redbelly dace, finescale dace, and blacknose shiner surveys if access is allowed. Keystone XL pipeline project, Nebraska Reroute. 2012.

Site Approximate Milepost ^{1,2}	County	Stream Name
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Keya Paha	Spring Creek
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Keya Paha	Simpson Creek
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Holt	Otter Creek
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Holt	West Branch Clay Creek
[REDACTED]	Holt	Beaver Creek
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Holt	Unnamed
Formerly [REDACTED] - Site no longer intersects proposed NE reroute.	Holt	Unnamed
[REDACTED]	Holt	Big Sandy Creek
[REDACTED]	Holt	Middle Branch Eagle Creek
[REDACTED]	Holt	East Branch Eagle Creek
[REDACTED]	Holt	Redbird Creek
[REDACTED]	Holt	South Branch Redbird Creek
[REDACTED]	Antelope	Big Springs Creek

¹ Milepost as reported in August 15, 2012 version of proposed Nebraska reroute.

² Fish sampling sites were selected based on crossing locations on the March 14, 2012 proposed reroute. The August 15, 2012 revised Nebraska reroute no longer intersects some of the selected areas. Presented locations are for documentation purposes and will be updated accordingly once sampling has been completed.

4.0 SUMMARY

Keystone identified numerous sites to survey for special-status species along the proposed Nebraska reroute. These sites were identified through data provided by the NNHP, information contained in the FEIS, aerial photo interpretation, and previous field surveys on the project.

In total, sixty sites were identified for western prairie fringed orchid and small white lady's slipper surveys using the March 14, 2012 version of the pipeline reroute. Only ten of the sixty tracts were accessible to surveyors during the designated survey period. Six of the ten surveyed sites provided suitable habitat for the orchid species as reported in Section 3.1. Four of the ten tracts did not have suitable habitat. No western prairie fringed orchid or small white lady's slipper were found. Ultimately, only 3 of the 6 surveyed tracts are crossed by the current August 15, 2012 centerline. It has not been determined if suitable habitat for either western prairie fringed orchid or small white lady's slipper occurs along the Northern or Clarks Alternatives.

Four sites were surveyed for least tern and piping plover. Suitable nesting habitat was present in June at the Niobrara and Loup rivers. Good habitat was present at the Elkhorn River, and poor habitat was present in July along the Platte River due to drought conditions. Several least terns were observed on the Niobrara and Loup rivers. No piping plovers were observed. Suitable nesting habitat is probably not present at the Platte River crossing even if normal water levels return next spring since the sandbars and river banks are heavily vegetated. With the exception of the Niobrara River, all of the river crossings were surveyed at the August 15, 2012 crossing locations. The Niobrara River was surveyed at the March 14, 2012 crossing location as the Northern Alternative (August 15, 2012) location had not been identified during the survey window.

Four sites along the Niobrara, Elkhorn, Loup, and Platte rivers were surveyed for river otter. Suitable habitat was present on all rivers with the exception of the Platte River, which was nearly dry by the time the survey was conducted. No river otters were observed at any of the river crossings. Surveys were completed at the same crossings described above for least tern and piping plover.

Thirteen streams will be surveyed for the redbelly dace, finescale dace, and blacknose shiner. The results of these surveys will be submitted under separate cover.

5.0 REFERENCES

- Sheviak, C.J, and M.L. Bowles. 2003. *Platanthera praeclara*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 27+ vols. New York and Oxford. Vol. 26, pp. 552, 564, 566.
- U.S. Fish and Wildlife Service. 2011. Prairie fringed orchid fact sheet.
<http://www.fws.gov/midwest/endangered/plants/prairief.html> . Accessed June 15, 2011.

ATTACHMENT A
Site Photographs

Western prairie fringed orchid and small white lady's slipper habitat at former [REDACTED]
(no longer within environmental survey area)



Western prairie fringed orchid and small white lady's slipper habitat at [REDACTED]
(no longer within environmental survey area)



Western prairie fringed orchid and small white lady's slipper habitat at [REDACTED]



Western prairie fringed orchid and small white lady's slipper habitat at [redacted]



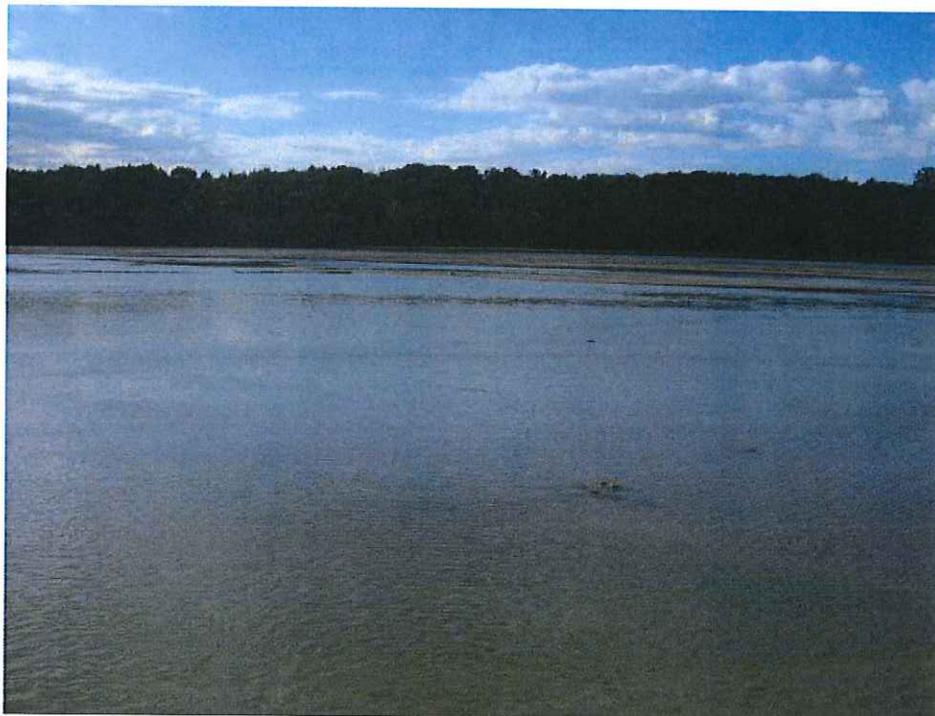
Western prairie fringed orchid and small white lady's slipper habitat at [redacted] in riparian area of Elkhorn River.



Several views of Niobrara River at [REDACTED] suitable least tern and piping plover habitat including unvegetated sand bars. Least terns observed feeding. First photo looking down river to east.



Looking across Niobrara River along center line to south.



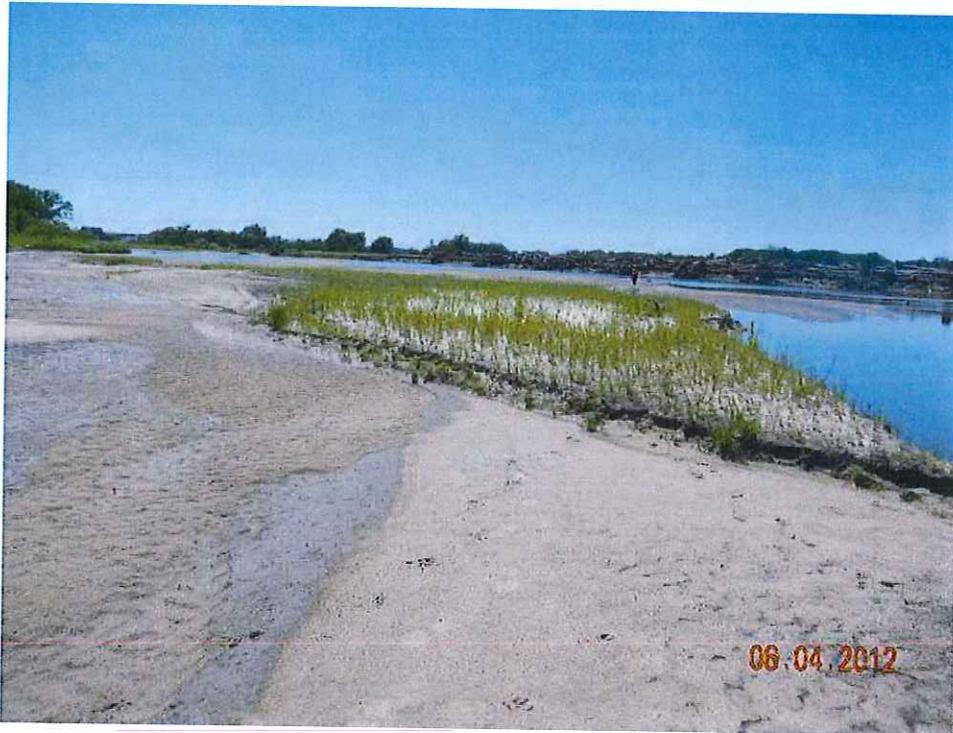
Upstream view of Niobrara River at [redacted] where least terns were observed.



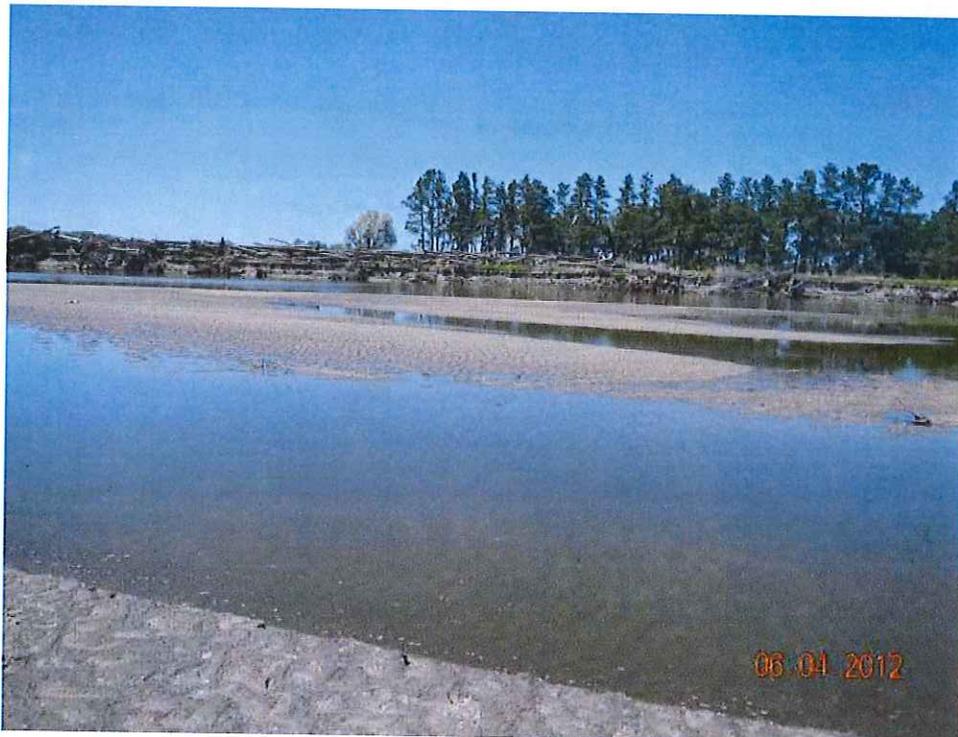
View of typical Niobrara River sand bars in vicinity of least terns observed feeding.



Several views of Elkhorn River at [REDACTED] No least terns or piping plovers observed.



View of Elkhorn River observation site looking south.



Looking downstream along Elkhorn River to east.



Main channel of Elkhorn River at observation site.



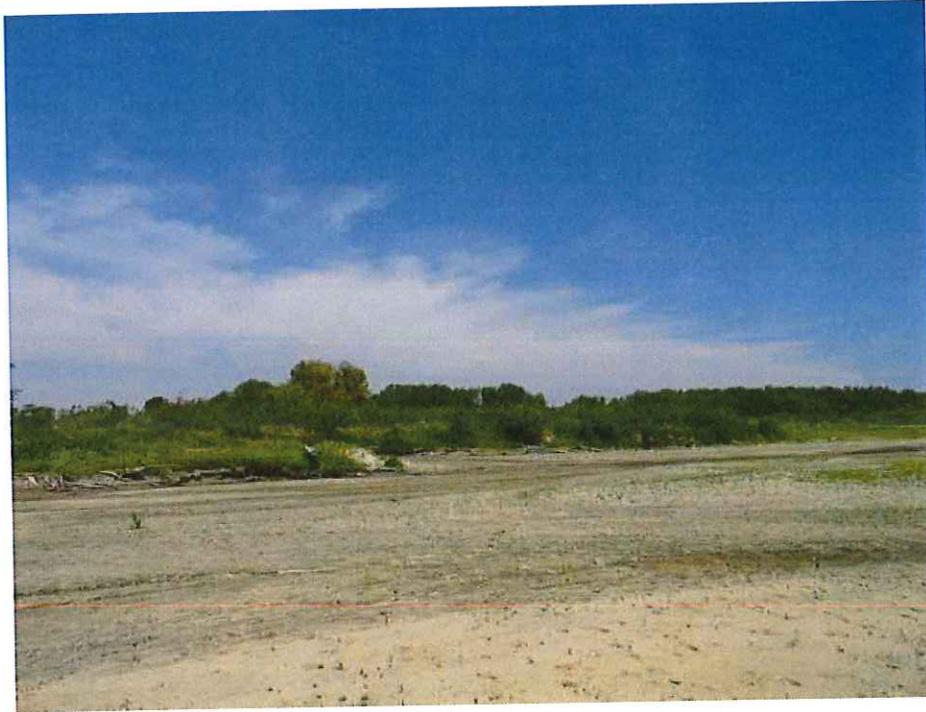
Loup River at [REDACTED] Bare sand bars ideal habitat for least terns and piping plovers.



Another view of the Loup River.



Looking north across Platte River at [REDACTED] No least terns or piping plovers observed, and river nearly dry at time of survey.



Looking upstream along the Platte River to the west.



Looking downstream along Platte River to the east. Note dry conditions and vegetation growth along river banks and sand bars.



Dry Platte River at [REDACTED]



Koch, Michelle

From: Robert Harms <robert_harms@fws.gov>
Sent: Tuesday, July 30, 2013 3:55 PM
To: Koch, Michelle; Steinauer, gerry; Fritz, Mike; Grell, Carey
Subject: FW: Results of western prairie fringed orchid habitat survey on Keystone XL to date
Attachments: Keystone XL WPFO Habitat Acreage as of 07302013.pdf

All—fyi.

Robert R. Harms
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
203 West Second Street
Grand Island, NE 68801
Office: (308) 382-6468, Extension 17
Cell: (308) 390-0871

From: John Beaver [mailto:JBeaver@westech-env.com]
Sent: Tuesday, July 30, 2013 3:01 PM
To: robert_harms@fws.gov
Cc: Jon Schmidt; 'Owen Sitton (Owen.Sitton@exp.com)'
Subject: Results of western prairie fringed orchid habitat survey on Keystone XL to date

Bob,

As we discussed on the phone, attached is a table with the acreage of western prairie fringed orchid habitat that was identified by Drs. Kay Kottas and Steve Cooper in June and early July of this year. No orchids were found. The acreage presented in the attached table is that within the project disturbance footprint as currently configured. Changes to the footprint may increase or decrease the amount of acreage reported in the future.

Before surveys were conducted, WESTECH spoke with Gerry Steinauer of NGPC, reviewed literature on the orchid, obtained orchid location records from the Nebraska Natural Heritage Program, and reviewed project-specific vegetation community mapping to identify parcels where suitable orchid habitat might be present. Survey permission was requested on 71 parcels where habitat might be present. Access was only granted on 25 parcels. Per our discussion, we are submitting the attached table with the current results of orchid habitat survey. We will wait to submit a final report detailing survey results until this fall in the hopes that additional parcels will become available for survey. At that time Drs. Kottas and Cooper will survey the remaining parcels with potentially suitable orchid habitat to determine if habitat is actually present and to delineate habitat boundaries.

In the attached table you will note that orchid habitat is distinguished by quality. These quality rankings were developed by Drs. Kottas and Cooper after reviewing Gerry Steinauer's habitat description as well as other literature. These distinctions were made in order to accurately quantify the range of potential habitat observed on the Keystone XL project.

Quality is defined as follows:

- a. Excellent Quality Habitat – Native tall-grass/lowland/mesic prairie with either shallow depth to water or soils that pond water. Area appears to be either mowed or lightly grazed every one to two years.

- b. Good Quality Habitat – Primarily native tall-grass/lowland/mesic prairie with a minor non-native grass component. Shallow depth to water or soils that pond water. Area appears to be either mowed or lightly grazed every one to two years.
- c. Fair Quality Habitat – Native tall-grass/lowland/mesic prairie with substantial non-native vegetation component of species such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), or alfalfa (*Medicago sativa*). Shallow depth to water or soils that pond water present in much of the site. Area appears to be either mowed or lightly grazed every one to two years.
- d. Poor Quality Habitat – Primarily non-native vegetation such as smooth brome with a minor native tall-grass/lowland/mesic prairie component. Shallow depth to water or soils that pond water present in some of the site. Area appears to be either mowed or grazed every one to two years.

Please let me know if you have any questions.

Regards,

John Beaver

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Western Prairie Fringed Orchid Habitat Acreage by County and Habitat Quality Rating					
Keystone XL Project as of July 30, 2013					
County	Excellent	Good	Fair	Poor	Total
Tripp	19.83	42.28	18.47	13.89	94.47
Keya Paha	--	--	2.64	0.61	3.25
Boyd	--	--	--	--	--
Holt	--	--	--	--	--
Rock	--	--	--	--	--
Antelope	1.34	--	--	--	1.34
Boone	--	--	--	--	--
Nance	--	--	--	--	--
Merrick	--	--	--	1.28	1.28
Total	21.17	42.28	21.11	15.78	100.34

Survey access was not allowed in Boyd, Holt, Rock, Boone or Nance counties at potential western prairie fringed orchid sites in June and July 2013. Access was also not available at all potential sites in Keya Paha or Antelope counties.

Hoback August Survey Report

**Results of Survey for American Burying Beetle,
Nicrophorus americanus, in Northern KeyaPaha,
Western Boyd, Eastern Holt and Antelope Counties**

12 September 2012

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Executive Summary

Recent work in the Nebraska sandhills led to the development of a predictive model of American Burying Beetle (ABB) occurrence based on soil type, land use, and presence of wetlands. This model generates areas of predicted ABB occurrence. Currently the model predicts ABB are concentrated in Rock County and western and central Holt Counties. In addition, the model predicts high priority conservation areas in Antelope County. However, the eastern edge of the predicted area of occurrence has received almost no surveys for American burying beetle and the predicted occurrence in Antelope County has not been confirmed.

ABB surveys were conducted in August at the northern and eastern edge of the predictive Sandhills model to determine presence of ABB. Transects of pitfall traps spaced one mile apart were placed near the edge of the known Nebraska range of ABB where public road access was available and surveyed for five nights. A total of 54 locations were sampled for 5 trap nights each with 27 locations capturing 95 ABBs. Capture rates ranged from 0.2 ABB per trap night to 3.0 ABB per trap night. During these surveys, no ABB were caught in Boyd or Antelope Counties. ABB captures occurred in northwestern Holt County but not east of Highway 183 ²⁸¹

From these results, the existing Sandhills model cannot be directly applied outside of the Sandhills ecoregion. Overall, few ABB were collected during these surveys compared to ABB collected from control sites at the same time. The results suggest that ABB in the northern Sandhills occur in greater numbers in western Holt County than in KeyaPaha or eastern / southern Holt Counties..

1.0 Introduction

The American Burying Beetle (*Nicrophorus americanus*) is a member of the carrion beetle family Silphidae, an important group of detritivores that recycle decaying materials into the ecosystem. The ABB is the largest carrion-feeding insect in North America reaching a length of about 4 centimeters and a weight of up to 3 grams. Although it has historically been recorded from at least 150 counties in 35 states in the eastern and central United States, it declined from the 1920s to the 1960s and is currently only found at the peripheries of its former range. In 1983, the ABB was included as an endangered species in the Invertebrate Red Book published by the International Union for the Conservation of Nature. In the United States, it was placed on the state and federal endangered species lists in August, 1989.

The causes for the decline of this species are complex and remain unresolved. Nevertheless, to implement an effective recovery program, it is necessary to investigate possible factors influencing this decline and characterize the commonality of features of the remaining populations. Foremost among these are the effects of habitat fragmentation and loss of suitable habitat to anthropogenic change and potentially natural succession.

Like other carrion beetles, ABBs search the environment for fresh carcasses, which they use for feeding and rearing offspring. Because carrion is typically a limited resource, the discovery of a carcass often occurs within two days, but has been reported to occur as quickly as 35 minutes post death (Milne and Milne 1976). Usually, multiple individuals comprising several species discover the carcass. As the beetles arrive at the carcass, a fierce competition erupts. This competition can lead to damage to beetles including loss of legs, antennae, and even mortality (Bedick et al. 1999).

If the carcass is fresh and is of appropriate size, competition ensues until there is only a single beetle pair occupying the carcass. This pair is generally the largest individuals of the largest species that discovered the carcass with the other beetles either being driven away or killed by the victorious pair (Wilson and Fudge 1984). The victorious pair will then work cooperatively to quickly entomb the acquired carcass. This behavior seems to have evolved out of necessity to remove the carcass from the realm of discovery by other invertebrate necrophores as well as vertebrate scavengers. Studies have demonstrated that there is an intense competition between flies and ants for the resources present in the carcass (Scott 1998). If flies discover and reproduce on the carcass prior to Nicrophorinae beetles, the developing dipteran larvae can quickly consume all the nutrients within the carcass effectively eliminating the carcass as a reproductive resource for the beetles. If discovered by ants, adult beetles must fend away the ants and sometimes become victims of aggressive ant colonies (Ratcliffe 1996).

After finding a suitable burial locality, the parental beetles will begin plowing under the carcass creating a compacted depression that will become the final resting place for the carcass. As the

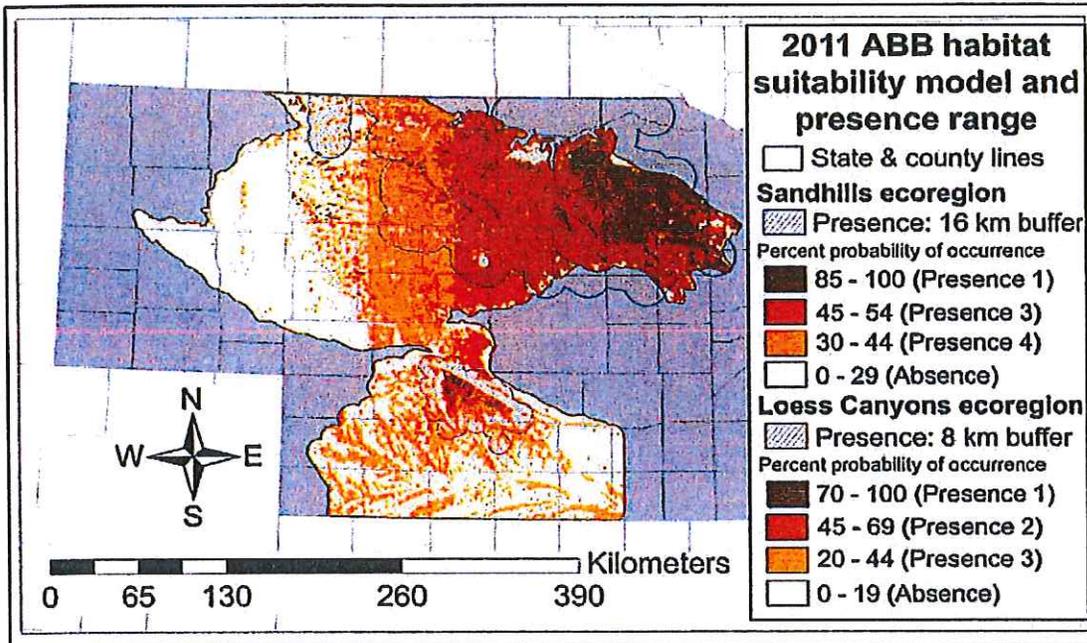
carcass falls into the depression through the action of gravity, it is forced into a tight ball by the beetles. The carcass is further molded into a tight ball as the beetles move over the carcass and remove the fur or feathers from the carcass (Milne and Milne 1976).

Considering the broad geographic range formerly occupied by the ABB, it is unlikely that vegetation or soil type were historically limiting. Habitats in Texas where these beetles have been recently found consist of grassland prairie, forest edge, and scrubland. Unlike other members of the *Nicrophorus* genus, no strong correlation with soil type or land use seems to exist (Bishop et al. 2002; Jurzenski 2012).

2.0 Nebraska Occurrence

ABBs occur in two Nebraska regions. In the south, they occur in the loess canyons and in the north a large population occurs in the Sandhills. In the northern Sandhills, the populations of ABBs are concentrated in Holt, Garfield, and Rock counties (Figure 1). The predicted range extends into Boyd, northern Holt, and Antelope Counties. The outer line on the northeast of the map represents a 10 mile buffer from closest positive capture of ABB.

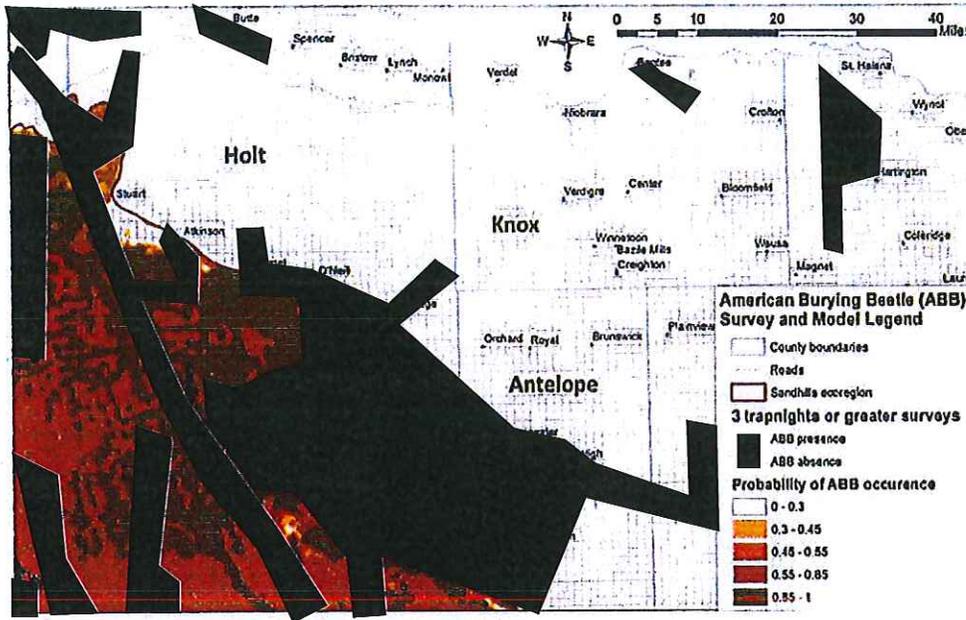
Figure 1. Predictive Habitat Suitability Model for Nebraska (Jurzenski and McPherron data)



The model was developed for the Sandhills ecoregion and does not extend into a large area of Holt, Boyd, and Antelope Counties that has received little sampling effort (Figure 2). The land use of this area is undergoing changes with conversion of rangeland to pivot irrigated cropland along with the planned development of wind farm projects.

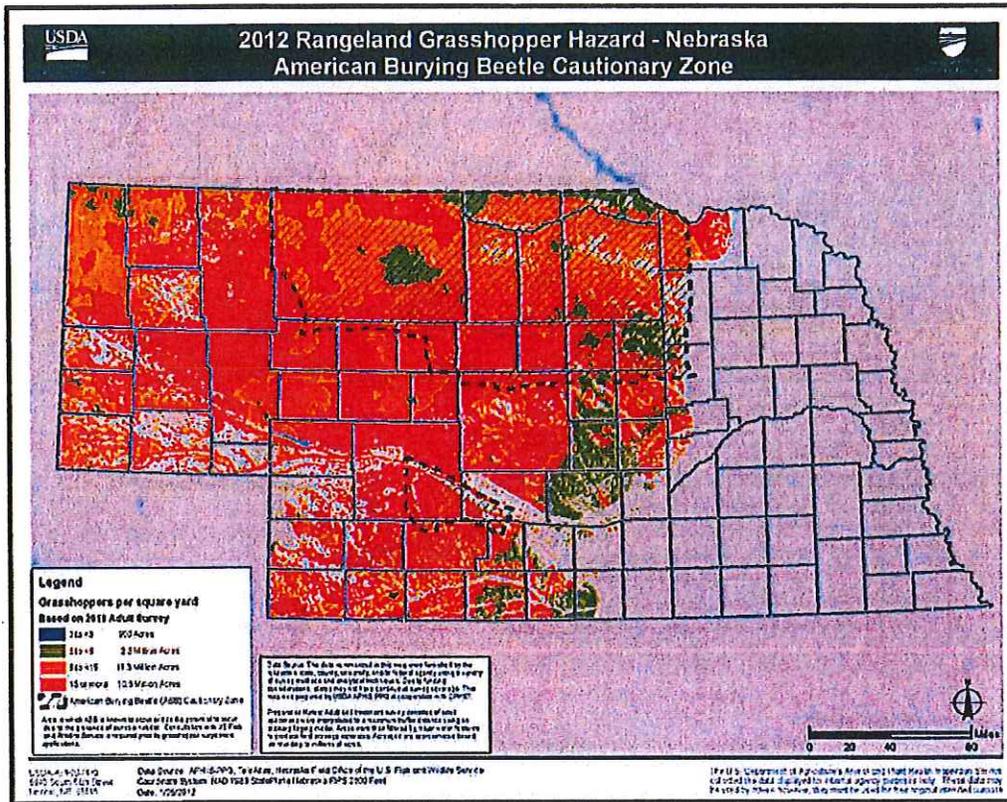
See Figure 2, which depicts the Sandhills Ecoregion Predictive modeling densities with field sampling results (positive (black dots) and negative (white dots) records for ABB). Relatively little sampling effort has occurred in northern Holt County.

Figure 2. Sandhills Ecoregion Predictive modeling densities



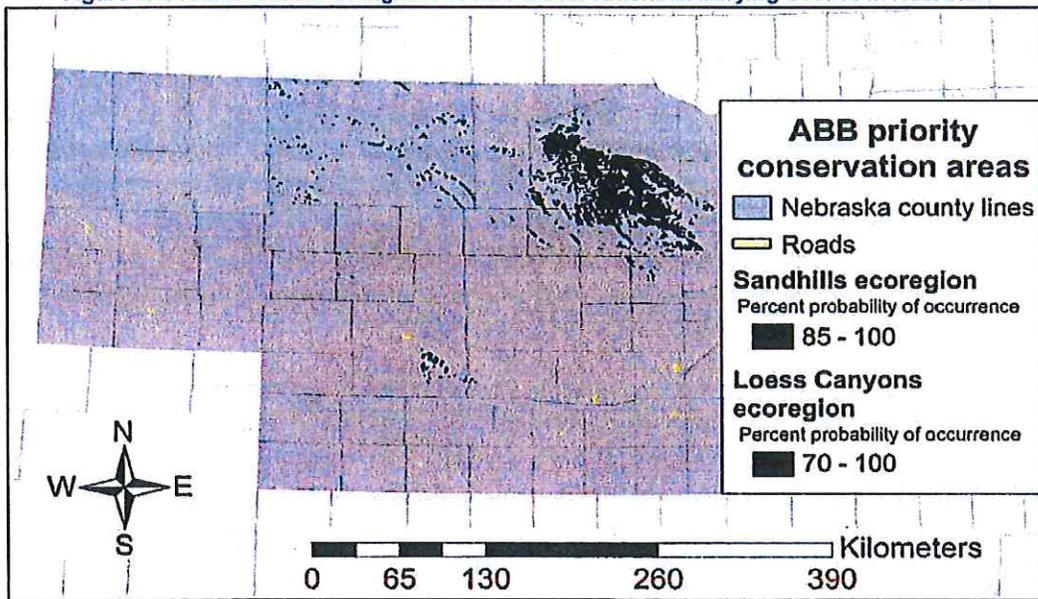
Conducting surveys in eastern Holt, Boyd, and Antelope Counties also impacts proposed grasshopper control efforts advocated by the US Department of Agriculture. When numbers of grasshoppers exceed eight grasshoppers, per square yard (Figure 3), the recommendation is to apply pesticides to control grasshopper numbers. The 2012 grasshopper predictive map shows grasshopper numbers at these threshold levels in eastern Holt County.

Figure 3. Predictive map of rangeland grasshoppers for 2012



Finally, the ABB model predicts areas in need of high priority for conservation (Figure 4). It is paramount that these areas be surveyed prior to acquisition of conservation areas.

Figure 4. Predicted areas of highest occurrence for American burying beetles in Nebraska



3.0 Survey Protocol

Sample sites were chosen after approval from US Fish and Wildlife Service (USFWS) and Nebraska Game and Parks Commission, where public road access was available and rangeland or hay meadow habitat was present. Trapping methods for presence/absence surveys for ABB were conducted with a modified version of the USFWS's (1991) protocol, as described by Bedick et al. (2004) between August 2 and August 17. Adult ABBs were captured by use of baited pitfall traps consisting of a five-gallon (18.92 Liter) plastic bucket (diameter 28.5cm). Bedick (1997) found a five-gallon bucket to be the most appropriate pitfall trap when sampling for the ABB because they provide a larger surface area for each beetle to escape from other carrion beetles. Transects were created in public road right-of-ways in appropriate habitat by digging in three traps on east-west roads at one mile intervals.

All buckets were washed using bleach and thoroughly rinsed prior to being used as traps. All buckets were buried in the ground, with approximately 4-5 cm of the bucket above ground level. Soil was then built up around the bucket, creating a gradient from ground level upwards to the bucket rim. This was done to limit the amount of water entering the buckets through runoff and splashing of water during rainfall events. Buckets were located on the terrain so as to prevent inundation during rainfall events as beetles can drown very easily in even a small amount of water. Traps were not placed within 10 feet of ant colonies, as they can kill the beetles that have been captured. Approximately 2-3 inches of moist soil was placed in the bottom of the bucket, in order to give trapped carrion beetles room to burrow into the soil to avoid competitors, high temperatures, and low moisture levels above the soil. To prevent rainfall and debris from directly entering the bucket, a square piece of plywood (37 cm by 37 cm) was placed on top of the trap, supported by two sticks 2.5 cm in thickness. Additional weight (soil, rocks, etc.) was then placed on top of the trap cover to reduce bait loss to vertebrate scavengers and to prevent the cover from being moved by wind.

All traps were baited with previously-frozen, 275-374 g laboratory rats (*Rattus norvegicus* – available from RodentPro.com). The bait was aged in airtight containers for 3 to 7 days, depending on the temperature and other weather conditions. Traps were set on the first trap day before 1800 hours and checked every subsequent morning by 1200 hours. Trapping was conducted for a five consecutive days and weather conditions were appropriate (>55°F, no hard rain, no high winds) for ABB activity on all trapping days.

At each trap site, a Global Positioning System (GPS) location was taken and digital photographs were taken at all successful trap locations. All carrion beetles captured were identified to species, and the ABB were sexed by use of Ratcliffe (1996). All ABB captured were marked using a drop of car touch up paint placed on the pronotum or the posterior portion of one or both elytra. Paint will be applied in a manner that will not cause damage to the elytra.

Captured ABB were released in individual burrows as quickly as possible near the point of capture.

4.0 Survey Locations

A total of 54 trap locations were surveyed (Table 1). Traps were set in areas with appropriate habitat (rangeland, hay meadows) where public road access was present. 30 traps were placed in Holt County, 12 traps were placed in KeyaPaha, 6 traps were placed in Boyd, and 6 were placed in Antelope. Very little habitat likely to support ABB is present east of Highway 183 in Holt County or in Antelope County. Habitat in Boyd County is being altered by the building of new pivots irrigation fields as a result of a lifting of the well moratorium in that county.

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12 September 2012

Table 1. Survey locations

GPS Trapping Locations	County	Easting	Northing	Set Date	Finish Date
K1A	Keya Paha			8/3/2012	8/7/2012
K1B	Keya Paha			8/3/2012	8/7/2012
K2A	Keya Paha			8/3/2012	8/7/2012
K2B	Keya Paha			8/3/2012	8/7/2012
K2C	Keya Paha			8/3/2012	8/7/2012
K3A	Keya Paha			8/3/2012	8/7/2012
K3B	Keya Paha			8/3/2012	8/7/2012
K4A	Keya Paha			8/3/2012	8/7/2012
K4B	Keya Paha			8/3/2012	8/7/2012
K5A	Keya Paha			8/3/2012	8/7/2012
K5B	Keya Paha			8/3/2012	8/7/2012
K5C	Keya Paha			8/3/2012	8/7/2012
H1A	Holt			8/3/2012	8/7/2012
H1B	Holt			8/3/2012	8/7/2012
H2A	Holt			8/4/2012	8/8/2012
H2B	Holt			8/4/2012	8/8/2012
H3A	Holt			8/4/2012	8/8/2012
H3B	Holt			8/4/2012	8/8/2012
H3C	Holt			8/4/2012	8/8/2012
H4A	Holt			8/4/2012	8/8/2012
H4B	Holt			8/4/2012	8/8/2012
H4C	Holt			8/4/2012	8/8/2012
H20A	Holt			8/8/2012	8/13/2012
H20B	Holt			8/8/2012	8/13/2012
H20C	Holt			8/8/2012	8/13/2012
H21A	Holt			8/8/2012	8/13/2012
H21B	Holt			8/8/2012	8/13/2012
H21C	Holt			8/8/2012	8/13/2012
H22A	Holt			8/8/2012	8/13/2012
H22B	Holt			8/8/2012	8/13/2012
H22C	Holt			8/8/2012	8/13/2012
H23A	Holt			8/8/2012	8/13/2012
H23B	Holt			8/8/2012	8/13/2012
H23C	Holt			8/8/2012	8/13/2012
H24A	Holt			8/8/2012	8/13/2012
H24B	Holt			8/8/2012	8/13/2012
A1A	Antelope			8/7/2012	8/12/2012
A1B	Antelope			8/7/2012	8/12/2012
A2A	Antelope			8/7/2012	8/12/2012
A2B	Antelope			8/7/2012	8/12/2012
A3A	Antelope			8/7/2012	8/12/2012
A3B	Antelope			8/7/2012	8/12/2012
A4A	Holt			8/7/2012	8/12/2012
A4B	Holt			8/7/2012	8/12/2012
A5A	Holt			8/7/2012	8/12/2012
A5B	Holt			8/7/2012	8/12/2012
B1A	Keya Paha			8/12/2012	8/17/2012
B1B	Keya Paha			8/12/2012	8/17/2012
B3A	Boyd			8/12/2012	8/17/2012
B3B	Boyd			8/12/2012	8/17/2012
B3C	Boyd			8/12/2012	8/17/2012
B4A	Boyd			8/12/2012	8/17/2012
B4B	Boyd			8/12/2012	8/17/2012
B4C	Boyd			8/12/2012	8/17/2012

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A total of 7,702 silphids were trapped during sampling belonging to 13 species. The most abundant species captured was *Nicrophorus marginatus* (approximately 70%) and the second most abundant species captured was *Nicrophorus carolinus* (18%). ABB were captured at 27 survey locations with 95 individuals captured once and one individual recaptured once. Only 5 senescent beetles were captured compared to 90 teneralis. Although the results of few senescent beetles require further investigation, it is possible that hot dry conditions caused greater stress in older beetles. Alternatively, old beetles may have double brooded or teneral beetles may have been trapped after dispersing from high quality areas. The sex ratio of teneralis was slightly female biased (49 females to 42 males). Pronotal widths were in the normal range observed in Nebraska (Table 2).

Table 2. American burying beetles captured during August surveys

Date	Site ID	Sex	Pronotal width	Age	Recapture?
6-Aug	H1A	M	10.22	T	
6-Aug	H1B	F	9.14	T	
6-Aug	H1B	M	11.06	T	
6-Aug	H1B	M	10.70	T	
6-Aug	H1B	F	9.00	T	
6-Aug	H1B	F	9.44	T	
7-Aug	H1B	M	10.33	T	
7-Aug	H1B	F	11.13	T	
7-Aug	H1B	M	10.54	T	
7-Aug	H1B	M	10.52	T	
7-Aug	H1B	F	10.34	S	
7-Aug	H1B	M	9.66	T	
7-Aug	H1B	F	8.89	T	
7-Aug	H1B	F	8.91	T	
7-Aug	H1B	F	7.71	T	
11-Aug	H20A	F	9.74	T	
12-Aug	H20A	F	9.74	T	yes
8-Aug	H21A	F	8.61	T	
8-Aug	H21A	F	9.43	T	
8-Aug	H21A	M	11.27	S	
11-Aug	H21B	F	10.03	T	
12-Aug	H21B	F	10.02	T	
8-Aug	H21C	F	10.12	T	
9-Aug	H22A	F	10.27	T	
10-Aug	H22A	F	9.26	T	
10-Aug	H22B	F	7.48	T	
12-Aug	H22B	F	7.48	T	
8-Aug	H23A	F	9.09	T	

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Date	Site ID	Sex	Pronotal width	Age	Recapture?
8-Aug	H23C	M	11.26	T	
8-Aug	H23C	M	11.71	T	
9-Aug	H23C	M	1.98	T	
8-Aug	H24A	F	8.24	T	
9-Aug	H24A	F	8.33	S	
5-Aug	H2A	F	9.13	T	
7-Aug	H2A	M	9.79	T	
7-Aug	H2A	F	9.7	T	
8-Aug	H2A	M	11.34	T	
8-Aug	H2A	F	7.44	T	
8-Aug	H2A	F	9.39	T	
8-Aug	H2A	M	8.91	T	
8-Aug	H2A	F	10.62	T	
5-Aug	H2B	F	11.46	T	
5-Aug	H2B	M	9.14	T	
6-Aug	H2B	F	10.66	T	
6-Aug	H2B	F	11.28	T	
7-Aug	H2B	F	10.4	T	
7-Aug	H2B	F	10.79	T	
7-Aug	H2B	F	9.07	T	
7-Aug	H2B	M	10.66	T	
7-Aug	H2B	F	8.34	T	
7-Aug	H2B	M	10.55	T	
8-Aug	H2B	M	11.39	T	
8-Aug	H2B	M	9.39	T	
8-Aug	H2B	M	10.08	T	
8-Aug	H2B	F	8.99	T	
8-Aug	H2B	M	9.14	T	
5-Aug	H3A	M	8.13	T	
6-Aug	H3B	F	9.67	T	
7-Aug	H3B	F	8.92	T	
8-Aug	H3B	M	9.48	T	
7-Aug	H3C	M	9.48	T	
8-Aug	H3C	F	9.21	T	
7-Aug	H4A	F	8.88	T	
7-Aug	H4A	M	10.44	T	
8-Aug	H4A	F	8.01	S	
8-Aug	H4A	F	8.03	T	
5-Aug	H4B	M	9.25	T	
6-Aug	H4B	M	8.63	T	
7-Aug	H4B	F	8.7	T	

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Date	Site ID	Sex	Pronotal width	Age	Recapture?
6-Aug	H4C	M	10.91	T	
6-Aug	H4C	M	10.53	S	
7-Aug	H4C	M	10.73	T	
6-Aug	K1B	M	10.06	T	
5-Aug	K2B	M	10.00	T	
5-Aug	K2B	M	10.59	T	
6-Aug	K2B	M	9.48	T	
3-Aug	K2C	M	10.67	T	
7-Aug	K3A	F	NA	T	
7-Aug	K3B	F	NA	T	
7-Aug	K3B	M	NA	T	
7-Aug	K3B	M	NA	T	
5-Aug	K4A	M	11.42	T	
6-Aug	K4A	M	11.14	T	
6-Aug	K4A	F	8.85	T	
6-Aug	K4A	M	9.94	T	
3-Aug	K4A	F	8.94	T	
4-Aug	K4A	M	10.16	T	
5-Aug	K4B	F	9.54	T	
6-Aug	K4B	M	9.84	T	
7-Aug	K4B	F	NA	T	
6-Aug	K5A	F	8.82	T	
3-Aug	K5A	F	9.88	T	
6-Aug	K5B	F	10.16	T	
7-Aug	K5B	F	NA	T	
3-Aug	H1A	M	9.54	T	
3-Aug	H1A	M	9.21	T	

During surveys, all trap nights exhibited suitable conditions for ABB activity. Two rain events occurred and midnight temperatures were above 60° F for most sampling nights (Table 3).

Table 3. Weather conditions during sampling

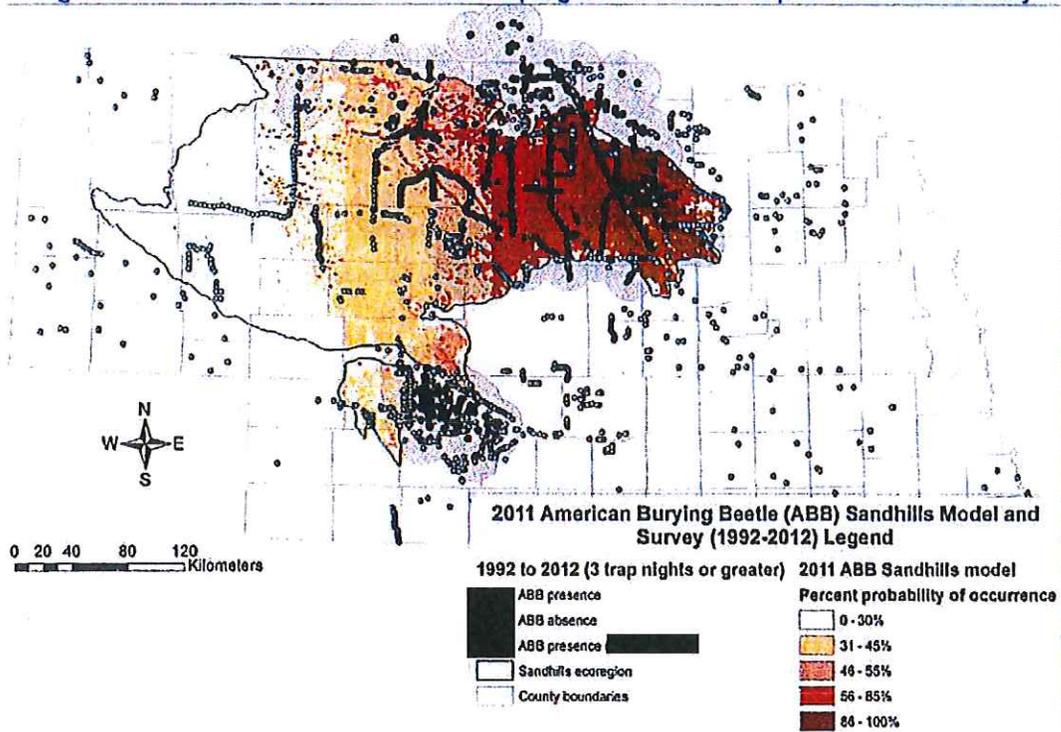
ABB trapping Weather Data		
O'Neill Weather Station		
Trap Night Date	Midnight Temp (F)	Precip. Inches. (10pm-2am)
8/3/2012	75.2	0
8/4/2012	67.1	0.45
8/5/2012	59.9	0
8/6/2012	70.2	0

ABB trapping Weather Data		
O'Neill Weather Station		
8/7/2012	71.4	0
8/8/2012	68.0	0
8/9/2012	65.7	0
8/10/2012	64.4	0
8/11/2012	62.6	0.03
8/12/2012	60.4	0
8/13/2012	62.6	0
8/14/2012	70.7	0
8/15/2012	63.7	0
8/16/2012	63.2	0
8/17/2012	62.1	0

Overall, ABB capture occurrence reveals a greater distribution of ABB north and east than was predicted by the Sandhills model. No ABB were captured east of Highway 183 in Holt County and it is likely that disturbance from agriculture and the railroad prevents long-term occupation of habitats east of the highway or further south. Northern Boyd County has recent records of ABB (2012) but southern Boyd County does not appear to currently support ABB. Based on the results of this survey, it is highly unlikely that ABB will be encountered in Antelope County and this county should be considered historical only. Based on these results, proposed disturbance of habitat west of highway 183 in Holt County should be reviewed by appropriate agencies, while habitat to the east appears unlikely to support ABB. Future sampling should be focused on northern Boyd and Knox Counties to determine the presence of ABB.

A map was generated using traps where ABB were captured between 1992 and 2012 and a buffer of 10 miles was drawn around these traps (Figure 5). The results of the 2012 surveys also suggest that predicted areas of priority for conservation (Figure 4) must be revised.

Figure 5. ABB occurrence based on 2012 sampling results overlaid on predictive model density



5.0 References

- Anderson R. S. 1982. On the decreasing abundance of *Nicrophorus americanus* Oliver (Coleoptera: Silphidae) in eastern North America. *The Coleopterists Bulletin* 36: 362-365.
- Bedick J. C., B. C. Ratcliffe, W. W. Hoback and L. G. Higley. 1999. Distribution, ecology and population dynamics of the American burying beetle [*Nicrophorus americanus* Oliver (Coleoptera, Silphidae)] in south-central Nebraska, USA. *Journal of Insect Conservation* 3: 171-181.
- Bedick JC, Ratcliffe BC, Higley LG. 2004. A new sampling protocol for the endangered American burying beetle, *Nicrophorus americanus* Olivier (Coleoptera: Silphidae). *The Coleopterists Bulletin* 58(1):57-70.
- Creighton, J. C. and G. D. Schnell. 1998. Short-term movement patterns of the endangered American burying beetle *Nicrophorus americanus*. *Biological Conservation*. V 86 (3) 281-287.
- Creighton, J. C., C. C. Vaughn, B. R. Chapman. 1993. Habitat preference of the endangered American burying beetle (*Nicrophorus americanus*) in Oklahoma. *The Southwestern Naturalist* 38: 275-277
- Godwin, W.B. and V. Minich. 2003. Status of the American burying beetle, *Nicrophorus americanus* Olivier, (Coleoptera: Silphidae) at Camp Maxey, Lamar County, Texas.
- Jurzenski, J. Conservation tools for the federally endangered American burying beetle, *Nicrophorus americanus* Olivier in Nebraska. PhD dissertation. 173 pp.
- Lomolino M.V., J. C. Creighton, G. D. Schnell and D. L. Certain. 1995. Ecology and conservation of the endangered American burying beetle (*Nicrophorus americanus*). *Conservation Biology* 9: 605-614.
- Lomolino M.V. and J. C. Creighton. 1996. Habitat selection, breeding success and conservation of the endangered American burying beetle *Nicrophorus americanus*. *Biological Conservation* 77: 235-241.
- Milne LJ, Milne MJ. 1976. The social behavior of burying beetles. *Scientific American* 235:84-89.
- Ratcliffe B. 1996. The carrion beetles (Coleoptera: Silphidae) of Nebraska. *Bulletin of the University of Nebraska State Museum* 13:1-100.
- Ratcliffe, B. C. and S. Spomer. 2002. Nebraska's Endangered Species Part 1: Introduction and the Insects. *Museum Notes*. Number 113. University of Nebraska State Museum, Lincoln, Nebraska.

- Sikes, D. S. and C. J. Raitel. 2002. A review of hypotheses of decline of the endangered American burying beetle (Silphidae: *Nicrophorus americanus* Oliver). *Journal of Insect Conservation* 6: 103-113
- U.S. Fish and Wildlife Service. 1991. American Burying Beetle (*Nicrophorus americanus*) Recovery Plan. Newton Corner, Massachusetts. 80 pp.
- Wilson DS, Fudge J. 1984. Burying beetles: intraspecific interactions and reproductive success in the field. *Ecological Entomology* 9:195-203.