Implementation of the Whooping Crane Monitoring Protocol
Spring 2012

FINAL REPORT

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AIM Environmental Consultants and
Western Ecosystems Technology, Inc.

For
Committee's of the
Platte River Recovery Implementation Program

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The team of Western Ecosystems Technology, Inc. (WEST) and AIM Environmental Consultants was awarded a contract (*Contract for Services Agreement between the Nebraska Community Foundation, PRRIP, and WEST* dated 1 September 2011) to assist the Governance Committee in implementing specific monitoring associated with the Platte River Recovery Implementation Program (PRRIP). The specific task was to implement the protocol developed by the Technical Advisory Committee entitled *Whooping Crane Monitoring Protocol - Migrational Habitat Use in the Central Platte River Valley* dated 31 May 2011 during the spring and fall migrations along with corresponding analysis.

Study Area and Methods

The study area was the Platte River reach between U.S. Highway 283 (near Lexington) and Chapman, Nebraska. This reach was about 90 miles long and included an area extending 3.5 miles either side of the outermost banks of the Platte River. Twelve technicians were hired and trained to conduct field work from 21 March through 29 April 2012. A set of six data sheets was provided the PRRIP Executive Director's Office and all data were entered into a web-based Microsoft SharePoint database being developed for the PRRIP by Riverside Technology, Inc. using Microsoft InfoPath 2010.

Two air services were contracted and aerial surveys were conducted along specified routes near sunrise from 21 March through 29 April as weather permitted. Flights were initiated no earlier than 30 minutes before sunrise and typically were completed within 2 hours. Start times were delayed when weather/visibility conditions dictated. Flights were cancelled due to unsafe weather or mechanical problems. Cessna 172's were equipped with GPS units and each had two observers to conduct the surveys. Waypoints for each survey route were programmed into the GPS units onboard the aircraft. Surveys were flown at an altitude of 750' and at a speed of about 100 mph.

The study area was divided into two legs. The east leg surveyed the Platte River reach between Chapman and the Minden (Highway 10) bridges and the west leg surveyed from the

Minden to the Lexington (Highway 283) bridges. Each survey began flying upstream (east to west) along the south side of the main river channel with both observers looking out the passenger side of the aircraft. This provided optimum light conditions such that observers looked away from the rising sun thereby minimizing glare off reflective surfaces. Start points were alternated for each leg to address the concern that one end of the river transect would always be flown earlier than the other end. On the east leg, day one began at Chapman, flew the river west to Minden then flew a predetermined transect back to Chapman. Day two began at Wood River, flew the river to Minden, returned along a predetermined transect back to Chapman, then flew the rest of the river transect from Chapman to Wood River. The start points for the west leg were Minden and Odessa bridges. Day one began at Minden, flew the river west to Lexington then flew a predetermined transect back to Minden. Day two began at Odessa, flew the river to Lexington, returned along a predetermined transect back to Minden, then flew the rest of the river transect from Minden to Odessa. When the initial portion of the river transect was completed, one of 7 possible return transects was flown with observers looking out opposites sides of the aircraft: transects along the centerline of the main channel and 1, 2, and 3 miles north or south of the river respectively were flown with observers looking out opposite sides of the aircraft (Figure 1).

Four ground observers were stationed along the survey routes. Communication between the ground observers and the aircraft was accomplished through the use of two-way radios. In the event of a possible Whooping Crane sighting by the aircrew, the ground person nearest the sighting was contacted and immediately dispatched to the location in an effort to confirm the identity of the white object. Each technician had a set of color aerial photos of the river (photos were developed by the Executive Director's office and have been used since October 2008). The photos were inserted in polypropylene sheet protectors that enabled the observer to mark sighting locations on the photo for later reference. Efforts were made to photograph Whooping Cranes from the air using Nikon D90 digital cameras. In addition, a GPS reading of the location was taken by the air crew.

If a Whooping Crane was located by ground personnel, habitat use and activity monitoring commenced. Activity monitoring of the Whooping Crane or of a "focus" bird when more than one individual was present, was recorded every 15 minutes as one of the following categories: courtship, preening, defensive, feeding, alert, resting, or other activity as defined by the observer. These observations were continuous until the group was either lost from view or went to roost for the night. If a group was lost, observers spent a minimum of 2 hours attempting to re-locate the group. Each Whooping Crane sighting was assigned a unique number and later compared with the U.S. Fish and Wildlife Service's (USFWS) sighting records in Grand Island.

Whooping Crane movements, behavior, and diurnal habitat use were recorded when possible. All monitoring activities followed USFWS and Nebraska Game & Parks Commission guidelines. Jeanine Lackey, USFWS biologist, or Martha Tacha, USFWS Coordinator for the Cooperative Whooping Crane Tracking Project, kept our team apprised of the latest sighting reports. Landowner permission was obtained prior to entering any property.

Whooping Crane decoys were placed in the river channel at 10 randomly selected locations by personnel from the Executive Director's Office (Table 1) for the purposes of

determining survey detection rates. The aircrew did not know when or where the decoys were placed. Decoys were placed prior to the flights and ground crew personnel were notified of their location. Observations of Whooping Crane decoys by the aircrew were reported to the ground crew for confirmation.

Topographic profiles were measured at Whooping Crane roost sites using a Trimble GeoXH6000 GPS rented by AIM. When a crane group used a roost site for multiple days, a single profile was collected to represent that site. Three parallel transects 25m apart were established perpendicular to the general flow of the river at each site such that the middle transect crossed the crane. End points were determined when an obstruction greater than 1.5 m in height was encountered such that it formed a visual barrier to a crane. Photographs were taken from the roost site showing conditions upstream, downstream, left bank, and right bank. A laser level was used to obtain elevation data. Stream flow data were collected from the U.S. Geological Survey (USGS) gauging stations located at Overton, Kearney, and Grand Island. Leica laser rangefinders were used to measure the length of sandbars and distance to visual obstructions >1.5m above the water surface.

Results

Opportunistic Locates.—

We received 2 reports of Whooping Cranes from the public or PRRIP. On 9 April, David Baasch (PRRIP) reported the presence of 1 possible Whooping Crane on the river near the Wood River bridge. It was spotted by Department of Roads personnel and reported to USFWS in Grand Island. AIM's plane was in the vicinity at the time of the sighting and observed 7 different groups of American White Pelicans. An observer on the bridge confirmed the presence of pelicans therefore no ground search was conducted by AIM.

On April 18, David Baasch informed us that we did not detect a radio-marked Whooping Crane that stopped on the river on April 14 and migrated on April 15. AIM's flight was cancelled the morning of April 15 so it was not detected by AIM personnel. It was not reported by the public.

Aerial Survey.--

CONFIRMED WHOOPING CRANE SIGHTINGS-

Of a possible 40 morning flights scheduled per leg, the East Leg (Chapman – Minden) completed 26 (65%) flights while the West Leg (Minden – Lexington) flew 31 (78%). Adverse weather resulted in cancellations. We recorded 2 confirmed Whooping Crane sightings (Crane Group 2012SP03 on March 23 and 2012SP04 on March 24) while conducting the scheduled transect surveys (Figure 2). On March 24, the starting point for the East Leg was Wood River and 2012SP04 was seen on the return route only because it departed prior to the planes arrival on OSE. These two crane groups were followed for a combined 7 use days and measurements were taken at three use sites.

INDEX OF USE-

We completed 119 (74%) aerial survey transects out of 160 transects scheduled (2 transects per leg). Two Whooping Crane sightings were made on these transects. This resulted in an index of use (frequency of occurrence) of .02 sightings per transect. Both sightings occurred on the East Leg (OSE and 1NE).

OPPORTUNISTIC FLIGHTS-

No opportunistic flights were conducted.

OTHER WHITE OBJECT SIGHTINGS-

No on-ground follow-ups were conducted on objects other than Whooping Cranes at the request of the aircrew.

Searcher Efficiency Trials.—

Whooping Crane decoys were placed at 10 riverine locations between March 24 and April 22 (Table 1). The air observers detected a decoy at six sites for an overall detectability rate of 60%. On March 26, two off-river decoys were in place during the flight, one in a hayfield (X538987, Y4512271 detected) and one in a lowland grassland (X540266, Y4512786 missed). The two off-river decoys were not part of the random sample.

Table 1. Random locations of decoys for detectability trials.

Decoy	X	Y	Detected	Date Placed
1	565060	4529955	Yes	14-Apr
2	550175	4517695	No	3-Apr
3	540620	4512193	Yes	24-Mar
5	558245	4521430	Yes	18-Apr
6	440590	4507395	No	11-Apr
8	539130	4511540	Yes	25-Mar
9	459545	4503686	Yes	10-Apr
10	449830	4503195	No	21-Apr
11	485141	4501582	Yes	30-Mar
12	453700	4503790	No	20-Apr

Use-Site Characteristics, Diurnal Movements, and Activity.--

FLOW-

Streamflow measured at the USGS gauging stations located near Grand Island, Kearney, and Overton was similar to the median streamflow for each site during the survey (Figures 3-5). Note all flow data are provisional and subject to revision. Table 2 depicts the minimum and maximum values for unit (instantaneous) flows at each station during the survey period.

Table 2. Discharge values (cfs) at USGS gauging stations (provisional data).

	Overton	**Kearney**	**Grand Island**
Minimum	454	740	1160
Date	3/28	3/30	3/31
Maximum	2840	2480	2460
Date	4/18	4/18	4/19

The streamflow when Whooping Cranes were observed on the river and when roost channel profiles were measured are shown in Table 3.

Table 3. Flow conditions during Whooping Crane use and channel profile measurements. (Discharge is at the Platte River gauging station near Grand Island).

Use Site	Use Date	Measured Dates	Discharge (cfs) Use	Discharge (cfs) Measured
1	3/20	4/10	2170	1510
2	3/26	4/10	1730	1510
3	4/15	4/19	2170	2510

Flow conditions across the 7 use days in Spring 2012 averaged 2107 cfs (95% CI: 1981, 2233). Flow conditions across the 22 migration seasons monitored from 2001 to 2012 averaged 1159 cfs (95% CI: 1025, 1293) from a sample of 297 use locations (Figure 6).

RIVERINE USE SITES-

We collected riverine channel profile data at 3 Whooping Crane use sites. A total of 230 stations from 9 transects were surveyed during 2 survey periods (Figures 7-9).

Photographs depicting the habitat used at the Whooping Crane use sites are shown in Figures 10-12.

DISTANCE TO VISUAL OBSTRUCTION, SUBSTRATE, AND WATER DEPTH-

Visual obstructions from Whooping Crane use sites are given in Table 4. Substrate was characterized as fine sand to small gravel. The average water depth at the Whooping Crane roost locations was -3.3 $\pm$ 1.7 inches.

Table 4. Location, visual obstruction distance (yds), and substrate at the Whooping Crane use sites.

Use Site ID	UTMx	UTMy	Roost Depth (in)	VO Upstream Distance	VO Right Distance	VO Downstream Distance	VO Left Distance	Fine Sand (%)	Small Gravel (%)	Coarse Sand (%)	Large Gravel (%)
1	544529	4514398	3.5	78	97	142	235	20	18	60	2
2	541626	4512755	1	97	89	163	184	100	0	0	0
3	550859	4516002	5.3	315	73	183	170	100	0	0	0

Average distance to visual obstructions across the 7 use days in Spring 2012 averaged 490 feet (95% CI: 438, 541). Average distance to visual obstructions across the 22 migration seasons monitored from 2001 to 2012 averaged 488 feet (95% CI: 457, 519) from a sample of 282 use locations (Figure 13).

Distance to nearest visual obstructions across the 7 use days in Spring 2012 averaged 256 feet (95% CI: 245, 268). Distance to nearest visual obstructions (i.e. the closest obstruction at each site, not the average of the four measurements at each site) across the 22 migration seasons monitored from 2001 to 2012 averaged 261 feet (95% CI: 240, 283) from a sample of 282 use locations (Figure 14).

Roost depth for roosts detected in water across the 7 use days in Spring 2012 averaged 3.4 inches (95% CI: 2.5, 4.3). Roost depth across the 22 migration seasons monitored from 2001 to 2012 averaged 6.5 inches (95% CI: 5.8, 7.1) for the 210 roosts detected in water (Figure 15). There were no roosts observed in Spring 2012 above the water surface. For roosts on sandbars above the water surface across the 22 migration seasons monitored from 2001 to 2012, the average height was 2.9 inches (95% CI: 2.0, 3.8) for the 44 roosts detected (Figure 16).

UNOBSTRUCTED WIDTH-

Table 5 depicts unobstructed width as measured along the middle transect at the riverine use locations.

Table 5. Unobstructed width at use sites (units in feet).

Use Site ID	Unobstructed Width
1	1151
2	732
3	838

Unobstructed width across the 7 use days in Spring 2012 averaged 1013 feet (95% CI: 900, 1127). Unobstructed Width across the 20 migration seasons monitored from 2001 to 2012 averaged 790 feet (95% CI: 742, 837) from a sample of 180 use locations (Figure 17).

When unobstructed width is first averaged across use sites for a given crane group (using the USFWS crane group ID) and then averaged across the 2 crane groups, the average unobstructed channel width for Spring 2012 averaged 961 feet (95% CI: 813, 1108).

DIURNAL USE SITES-

Diurnal movements and activity data was collected when possible. Whooping Crane movements ranged within 4.8 miles of nocturnal roost sites. We documented 7 sections (section refers to square mile as used in Township and Range designation of property) of diurnal use locations during 6 days of observation (Figure 2, Table 6).

Table 6. Whooping Crane use locations.

Use Date	Crane Group ID	County	UTMx	UTMy	Habitat
3/21/2012	2012SP06	Hall	542211	4511329	Ag - Corn
3/21/2012	2012SP05	Hall	543418	4509382	Ag - Corn
3/22/2012	2012SP04	Hall	545407	4507761	Ag - Corn
3/22/2012	2012SP04	Hall	547210	4507933	Ag - Corn
3/22/2012	2012SP04	Hall	547228	4507189	Ag - Corn
3/23/2012	2012SP03	Hall	545802	4507168	Ag - Corn
3/23/2012	2012SP03	Hall	545859	4506633	Ag - Corn
3/24/2012	2012SP02	Hall	546890	4510982	Ag - Corn
3/24/2012	2012SP02	Hall	546469	4510147	Ag - Corn
3/24/2012	2012SP02	Hall	546311	4509517	Ag - Soy Bean
3/25/2012	2012SP01	Hall	546438	4509694	Ag - Corn
3/26/2012	2012SP01	Hall	546450	4509387	Ag - Soy Bean

CRANE-USE DAYS

Crane-use days were calculated by multiplying the number of Whooping Cranes by the number of days present. For this calculation, we assumed that a Whooping Crane observed during the morning aerial survey was present the previous day. Whooping Cranes were believed to be present in the study area 9 (22%) of the 40 days of the survey. We documented the presence of 2 Whooping Crane groups that contained a minimum of 1 bird each. A total of 9+ crane-use days by 2+ individuals was recorded (Table 7).

Table 7. Whooping Crane dates of occurrence and crane-use days.

Crane Group	Number of Cranes (ad:juv)	Dates of Occurrence	# of days present	Crane-Use Days
2012SP01-06	1:0	March 21-26	7	7
2012SP07	1:unk*	April 14-15	2	2+
TOTAL	2:unk	March 21- April 15	9	9+

* The number of individuals in this radioed group was not known.

LAND-COVER CLASS-

Ag-Corn and Ag-Soybeans were the cover-types used by Whooping Cranes during the day. All nocturnal roost locations were in Wetted Channel. There were 20 observations resulting in 55% of the observations in corn, 10% in soybeans, and 35% in the wetted channel (Figure 18).

Land cover class usage across the 11 spring migration seasons monitored from 2001 to 2011 resulted in 440 observations with 50% of observations in corn, 33% in wetted channel, 5% in soybeans, 5% in emergents, 3% lowland grasses, 2% in other land cover types, 1% in alfalfa, and less than 1% in palustrine wetlands, upland grasses and other land cover types (Figure 19).

ACTIVITY-

About 50.5 hours of continuous and instantaneous use (time budget) data of Whooping Cranes was collected by ground personnel during 6 days of observation. Eighty-one percent (40.5 hrs) of the observations were in Ag-Corn and 19% (10.0 hrs) were in Ag-Soybeans. Feeding was the most common activity observed (Table 8).

Table 8. Whooping Crane activity by habitat.

Habitat	Activity	# of Points	Total Points	Percent
Ag - Corn	Alert	17	174	9.77%
Ag - Corn	Defensive	3	174	1.72%
Ag - Corn	Feeding	141	174	81.03%
Ag - Corn	Preening	2	174	1.15%
Ag - Corn	Resting	11	174	6.32%
Ag - Soy Bean	Alert	6	41	14.63%
Ag - Soy Bean	Defensive	1	41	2.44%
Ag - Soy Bean	Feeding	34	41	82.93%

Search Effort.--

Ground searches were initiated on 5 occasions. A total of 5.3 hours was expended in this effort and 85 miles were driven. Search duration extended from 0.4 to 2.5 hours. Whooping Cranes were found on 3 occasions.

Program ID and U.S. Fish & Wildlife Service ID Comparisons.--

Table 9 compares the Program numbering system with the USFWS database (Martha Tacha, personal communication). Two groups of Whooping Cranes were present in the study area during the survey.

Table 9. Comparison of Program Crane ID and USFWS Crane ID.

Program Crane ID (Prefix 2012SP)	Program Name	USFWS Crane ID	Dates of Occurrence	# of cranes
01-06	Wild Rose Single	12A-02	3/4-3/26	1:0
07	Radioed Adult	NA	4/14-15	1:unk

Summary of Confirmed Sightings in the U.S.--

The number of confirmed Whooping Crane sightings in Nebraska was 13 including those contained herein (Martha Tacha, personal communication). As of 14 April 2012, there were 28 confirmed sightings in the United States as follows: North Dakota- 5; South Dakota- 2; Nebraska- 13; Kansas- 6; Oklahoma- 0, and Texas- 2.

Radio-marked Whooping Cranes and Platte River Use.—

Since 2009, 35 GPS radios have been affixed to the legs of Whooping Cranes and 25 radios were active prior to this spring's migration. AIM personnel did not detect a radio-marked Whooping Crane that was known to be on the river near the Trust bunker the evening of April 14. The flight was cancelled on April 15 and the crane migrated that morning

The winter count of Whooping Cranes was estimated at 254 individuals (Strobel, B., et. al. 2012. Aransas-Wood Buffalo Whooping Crane Abundance Survey (2011-2012). 26pp.). The two Whooping Cranes that were confirmed on the Platte River represented 0.3% of the Aransas-Wood Buffalo Whooping Crane population believed to be alive at the beginning of the spring migration in late February (Table 10; Figure 20). This estimate is calculated from survey results from whooping crane abundance surveys involving new survey methodology and is not directly comparable to past calculations. On average, 4.0% of the population stopped on the Platte River (0.5% to 13.4%) during 2001 through 2011 (Table 10).

Table 10. A comparison of the Whooping Crane population change and the percent of that population stopping on the Platte River.

	SPRING				FALL			
Year	WC Pop March	# Platte	Crane-Use Days	% Using Platte	WC Pop Dec	# Platte	Crane-Use Days	% Using Platte
2001	174	1	11	0.6	174	1	2	0.5
2002	174	1	26	0.6	185	19	121	9.8
2003	184	NA	NA	NA	194	1	2	0.5
2004	193	1	1	0.5	214	6	18	2.8
2005	214	4	13	1.9	216	2	2	0.9
2006	211	7	54	3.3	237	3	45	1.3
2007	237	9	71	3.8	266	10	23	3.8
2008	266	3	27	1.1	270	20	42	7.4
2009	247	6	42	2.4	264	12	44	4.6
2010	263	10	42	3.8	281	15	32	5.3
2011	269	36	120	13.4	316*	6	12	1.9
2012**	254	2***	9***	0.3				

*August population
**Change in winter census methodology
***Maximum estimate

Incidental Take.—

The USFWS requested information and documentation of any human activity that occurred in the proximity of Whooping Cranes that could constitute "take" as defined by the Endangered Species Act i.e. "*…to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect, or attempt to engage in any such conduct"*.

LETHAL OR CRIPPLING TAKE-

AIM's monitoring effort did not result in any crippling or lethal take of Whooping Cranes this season.

HARASSMENT-

AIM and Program personnel did not observe or engage in any activity that could be construed as "harassment" as defined by USFWS.

PUBLIC DISTURBANCE-

AIM personnel observed 5 instances of public disturbance of Whooping Cranes this season (Figure 21). On March 21, a vehicle traveling down the county road approached the Whooping Crane which was feeding near the road, causing it to fly. It landed about ½ mi south to a new location.

On March 23, we documented two instances of disturbance of the Whooping Crane caused by the public. At 10:45 CDT, a vehicle stopped about 100 yards from the crane. It became alert and walked away from the vehicle. At 11:27 CDT, a 4-wheeler approached to within 100 yards of the bird causing it to flush. The crane landed about 400 yds from that location.

On March 24, we documented 2 instances of disturbance. At 9:39 CDT, 2 tractors entered the field where the crane was foraging, apparently causing it to fly when they approached to within 500 yds. At 10:11 CDT, a crane-watcher slammed their door while they exited their vehicle when the crane was within 100 yards of them. It flew and landed about ½ mile from that location.

Discussion

Severe drought conditions in Texas and an abnormally mild winter in the central and southern Plains states evidently affected Whooping Cranes. They were widely dispersed during the winter months and began their "spring" migration earlier than in past years. The first record in Nebraska occurred in late January when a family group of 3 individuals were observed on the Platte River near Overton. As many as 11 Whooping Cranes were present on the Platte in early March, both occasions are well before the initiation of the spring survey on March 21. After that date, we documented only 1 Whooping Crane in the study area (not counting the radioed crane). Typically the peak stop-over period on the Platte River in spring is early April. This year was an exception.

Supplements

QAQC was done completed by Shay Howlin, WEST Inc.

Original Data Sheets
CD containing selected photographs and electronic copy of the final report.

Figure 1. River flight transects and 7 return flight transects flown during the aerial surveys. Only a portion of the study area is shown (taken from *Monitoring Whooping Crane Migrational Habitat Use in the Central Platte River Valley* 31 May 2011).

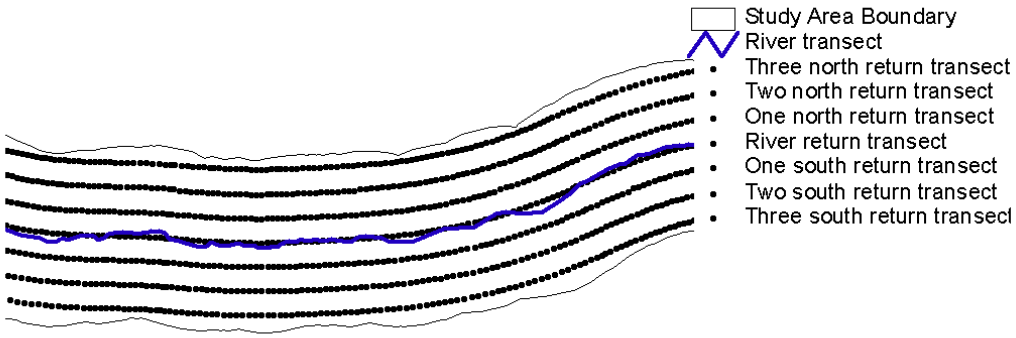


Figure 2. Whooping Crane Use Sites 1, 2, and 3 located west of the U.S. 281 bridge in Hall County. Crane Group 2012SP01-06 used Use Sites 1 and 2. Crane Group 2012SP07 used Use Site 3. Diurnal use areas are depicted by date. See Sharepoint database for detailed information.

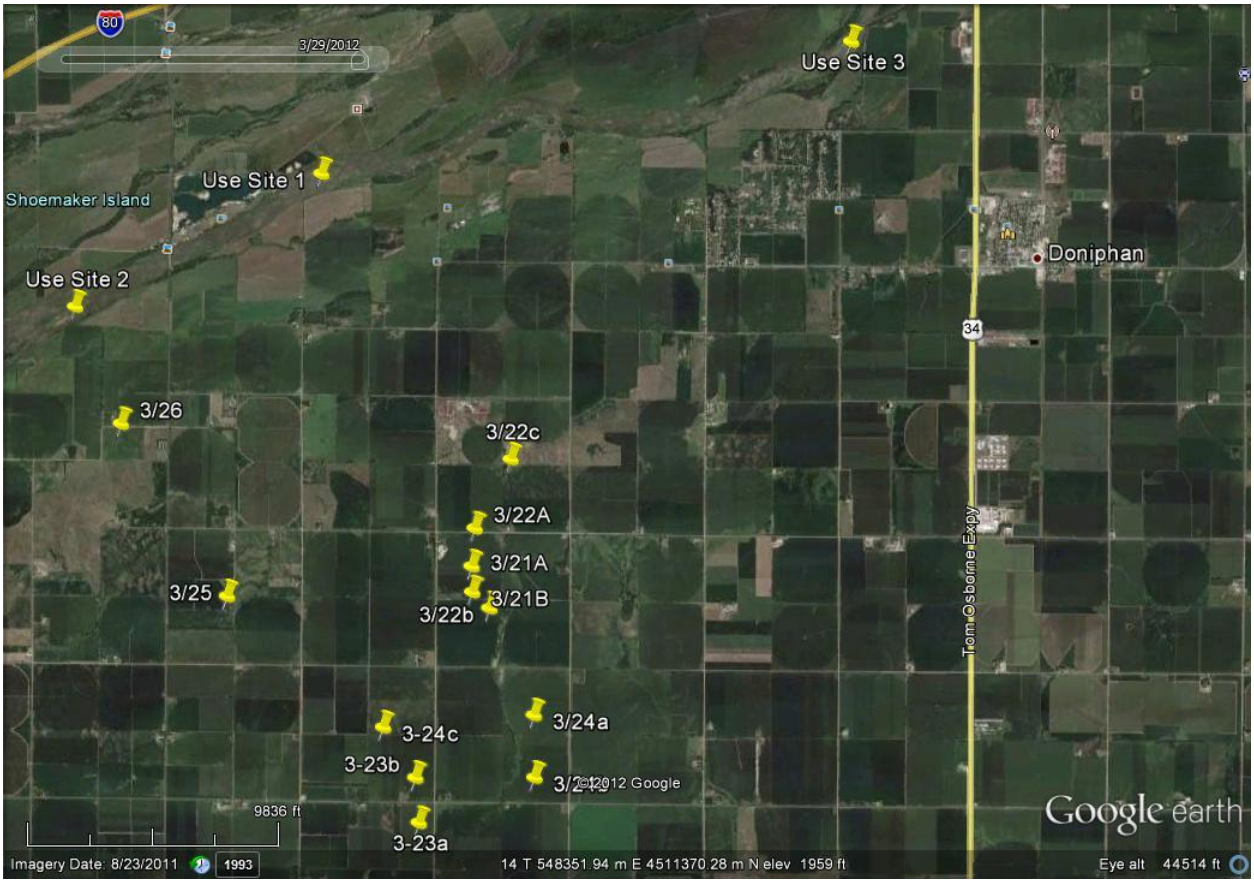
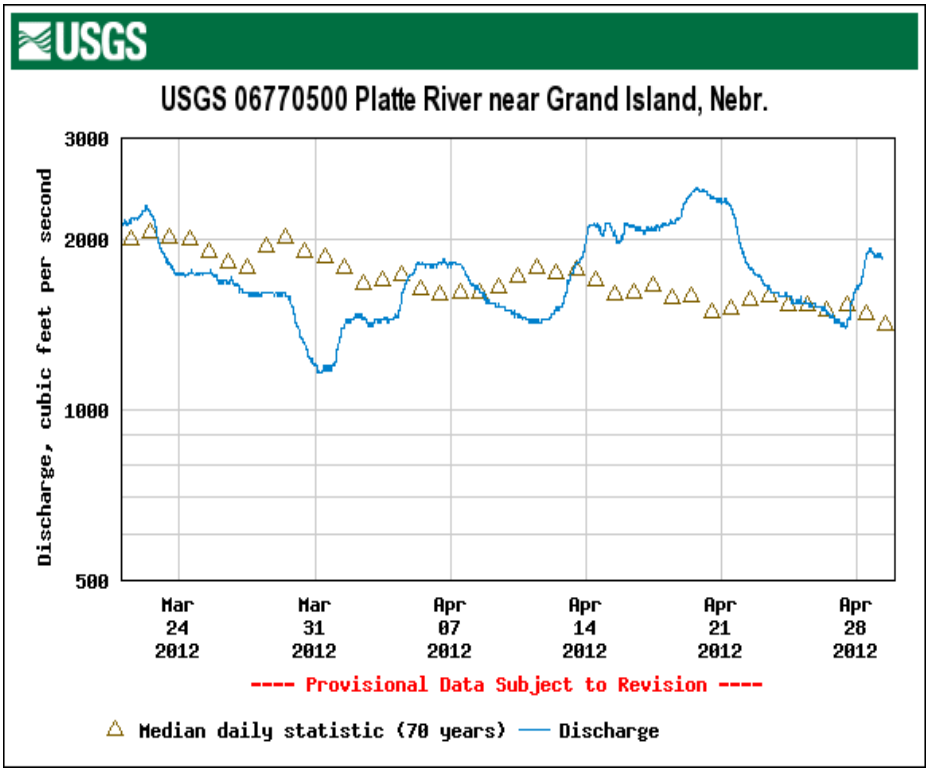


Figure 3. Platte River discharge (cfs) and gage height at Grand Island.



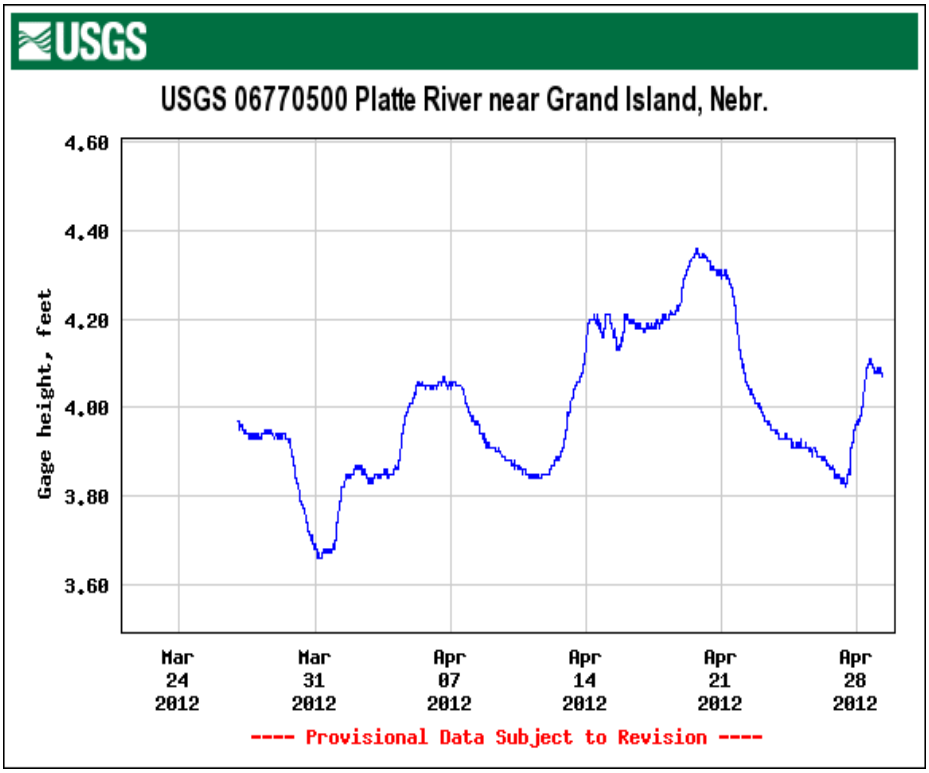
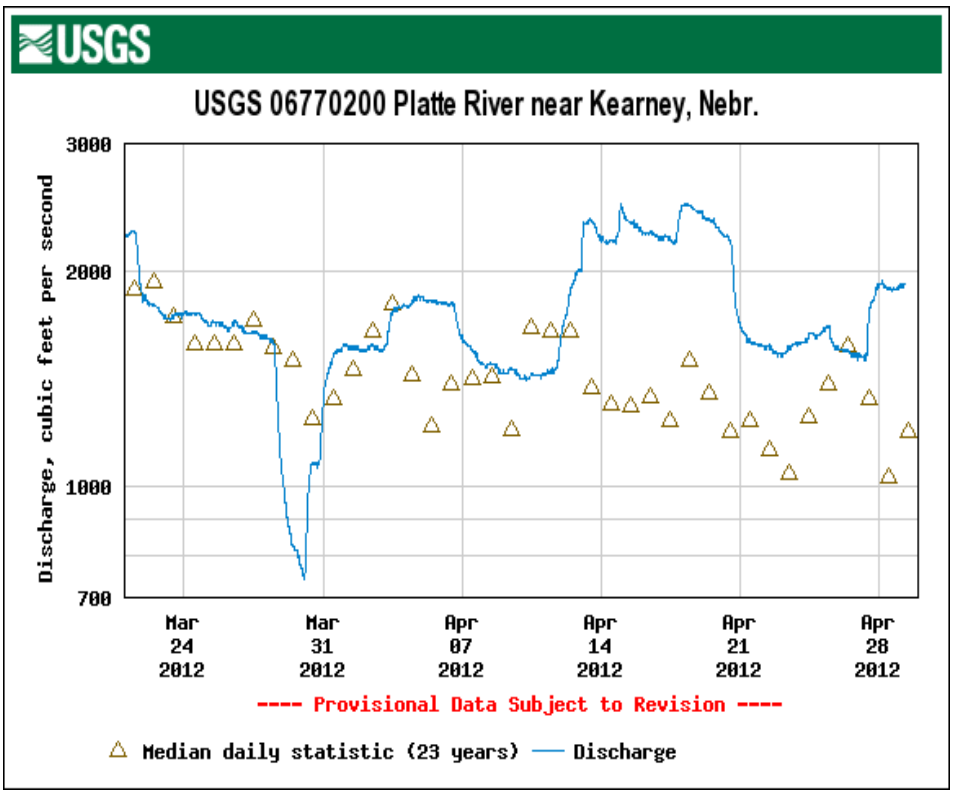


Figure 4. Platte River discharge (cfs) at Kearney.



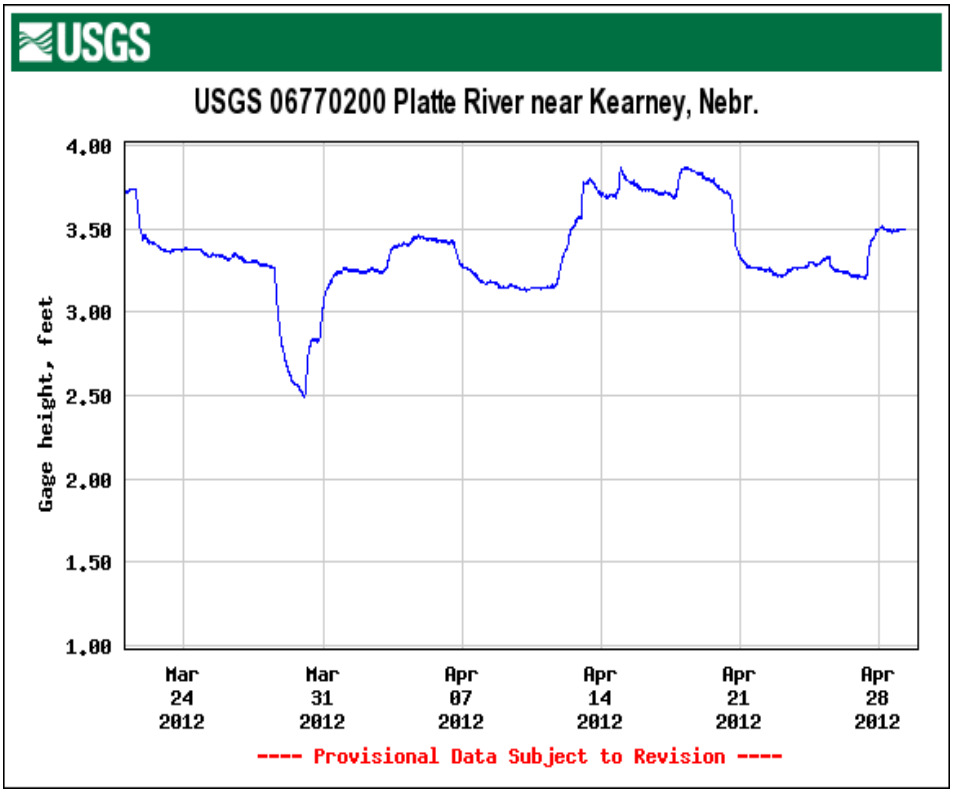
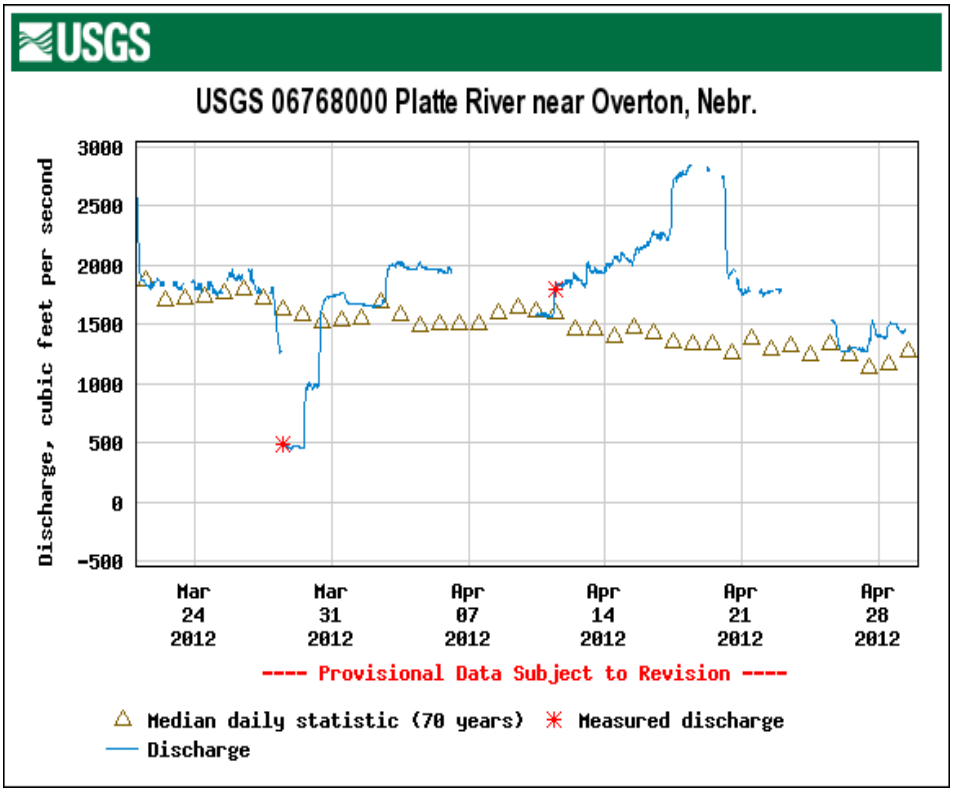


Figure 5. Platte River discharge (cfs) at Overton.



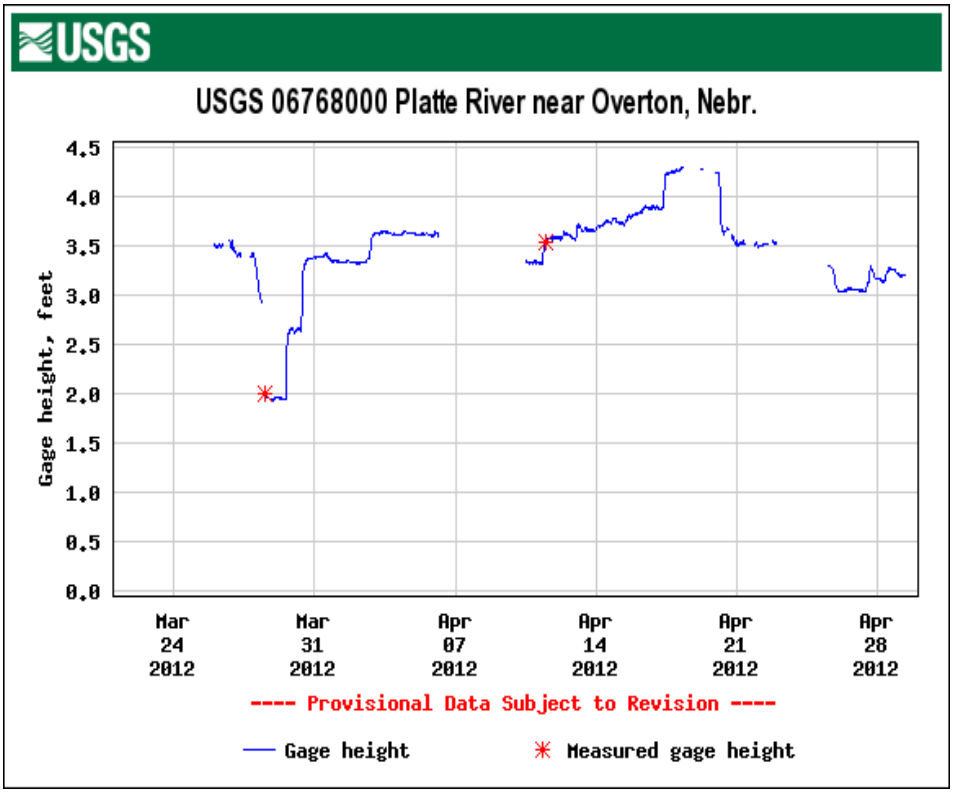


Figure 6. Frequency of flow conditions (cfs) across the 22 migration seasons monitored from 2001 to 2012.

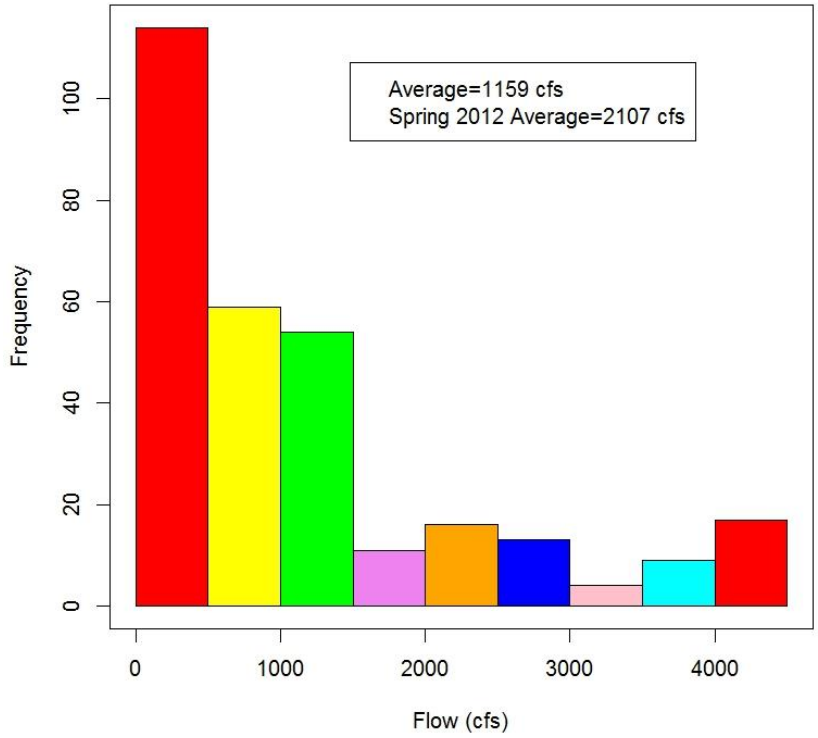


Figure 7. Use Site 1 Crane Group 2012SP03 southwest of Trust's headquarters at Wild Rose Ranch. (Note water depth is positive.)

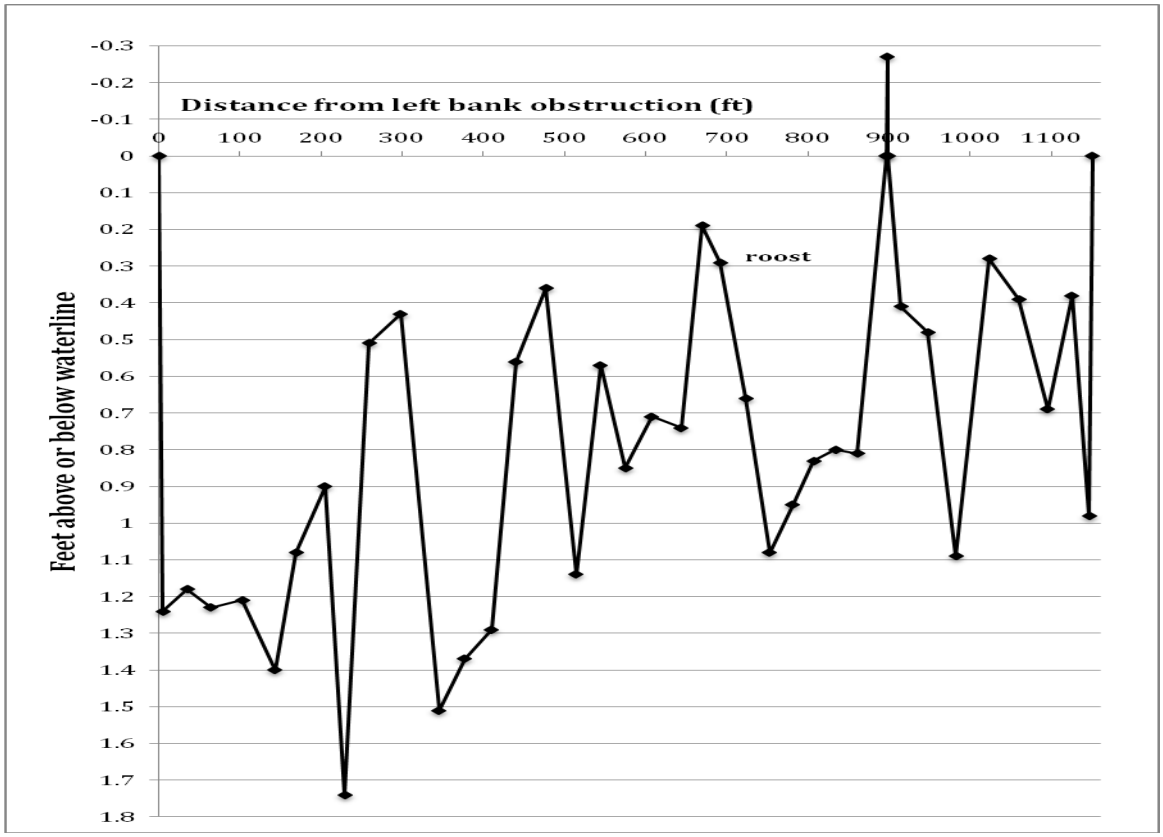


Figure 8. Use Site 2 Crane Group 2012SP06 ¾ mi west of the Alda bridge. (Note water depth is positive.)

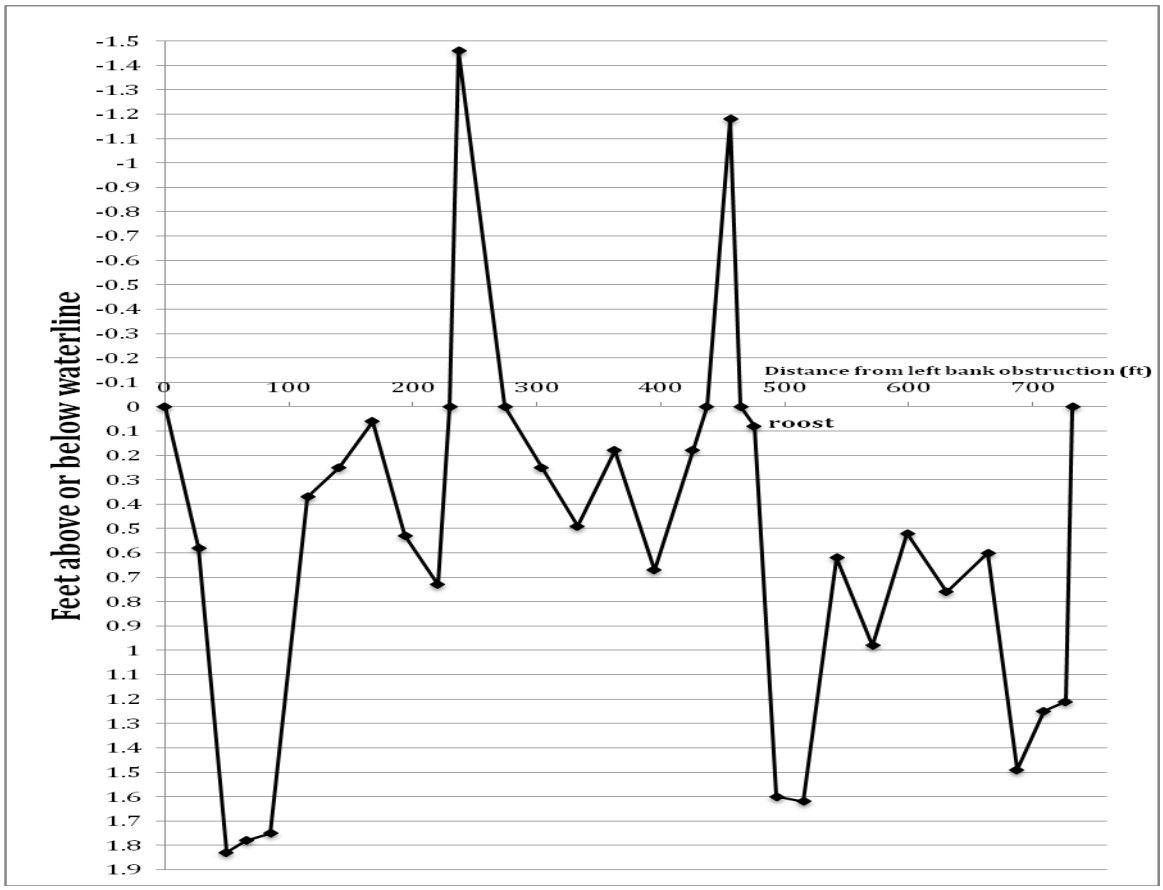


Figure 9. Use Site 3 Crane Group 2012SP07 east of the Trust's bunker blind. (Note water depth is positive.)

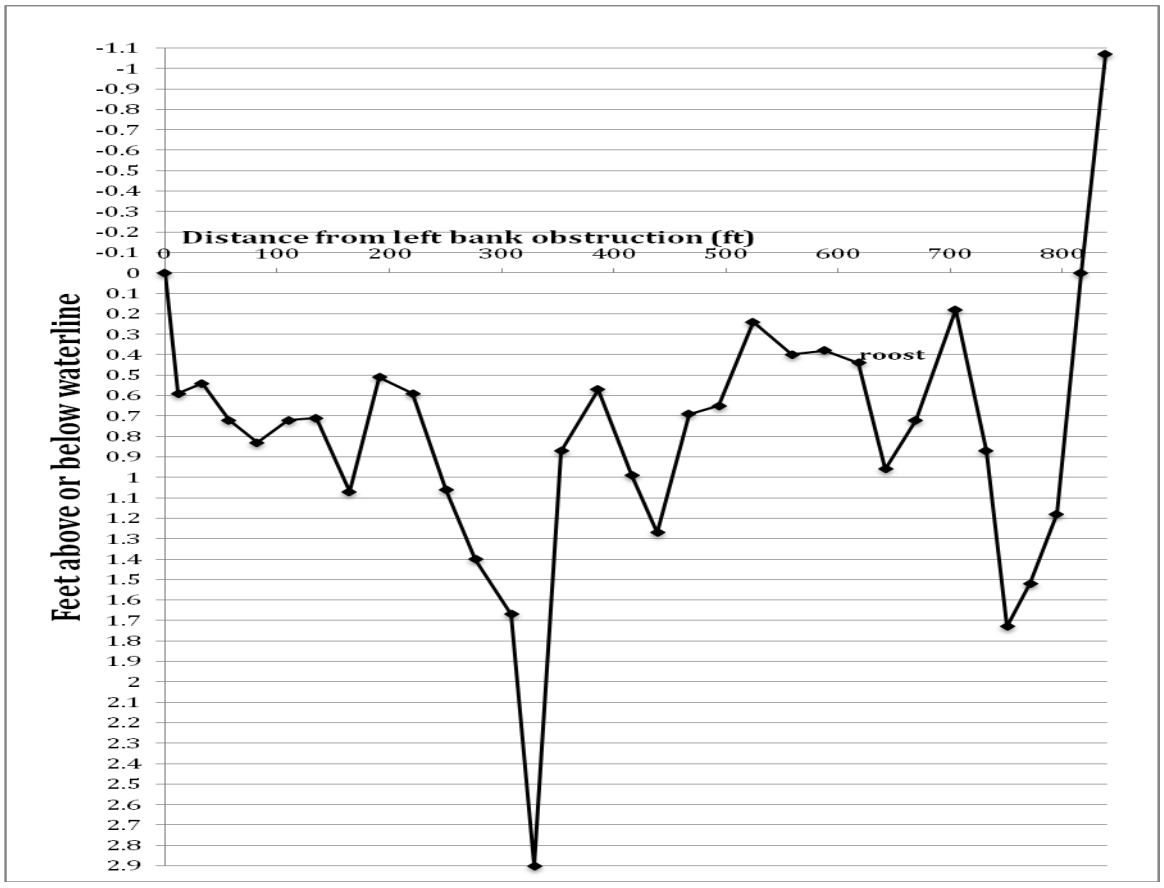


Figure 10. Whooping Crane Use Site 1.25 miles east of the Alda bridge (Sec 5 T9 R10 Hall County). Crane Group 2012SP03.

Upstream

Left Bank

Downstream

Right Bank

Figure 11. Whooping Crane Use Site 2 0.75 miles west of the Alda bridge (Sec 12 T9 R11 Hall County). Crane Group 2012SP06.

Upstream

Left Bank

Downstream

Right Bank

Figure 12. Whooping Crane Use Site 3 1.25 miles west of the U.S. 281 bridge (Sec 35 T10 R10 Hall County). Crane Group 2012SP07.

Upstream

Left Bank

Downstream

Right Bank

Figure 13. Frequency of average distance to visual obstruction (feet) across the 22 migration seasons monitored from 2001 to 2012.

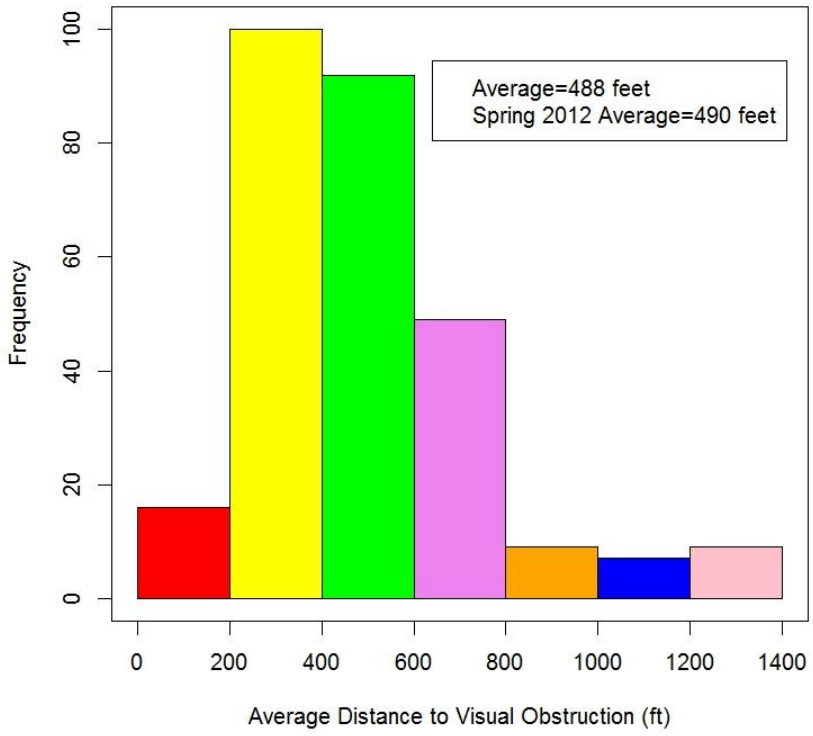


Figure 14. Frequency of distance to nearest visual obstruction (feet) across the 22 migration seasons monitored from 2001 to 2012.

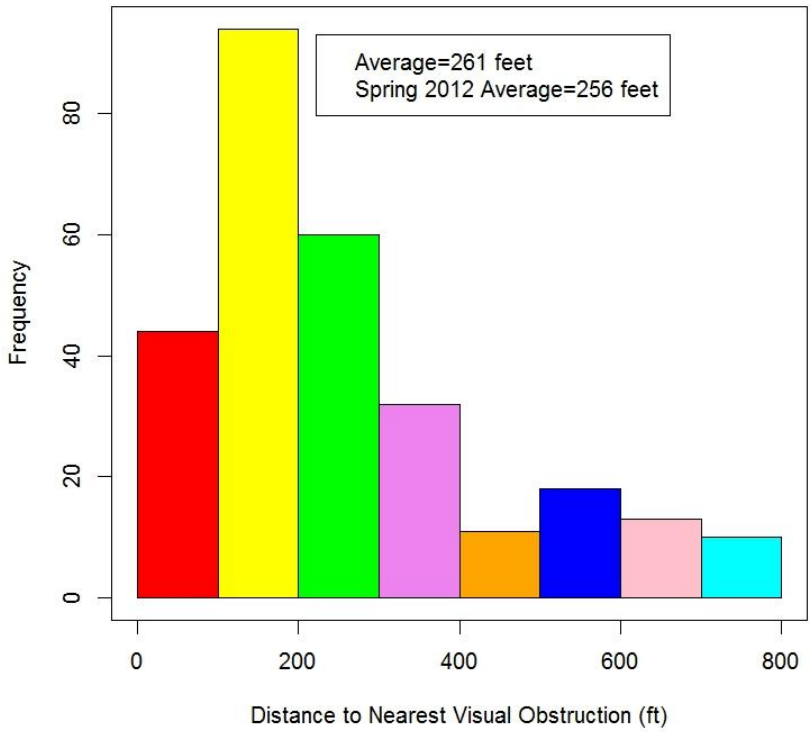


Figure 15. Frequency of roost depth (feet) for roosts in the water across the 22 migration seasons monitored from 2001 to 2012.

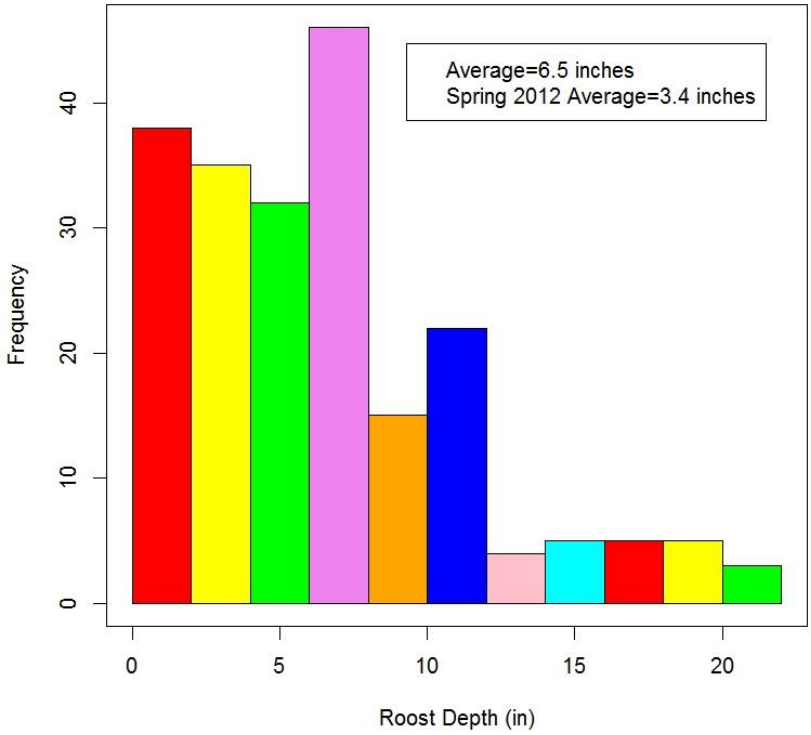


Figure 16. Frequency of roost depth (feet) for roosts above the water surface across the 22 migration seasons monitored from 2001 to 2012.

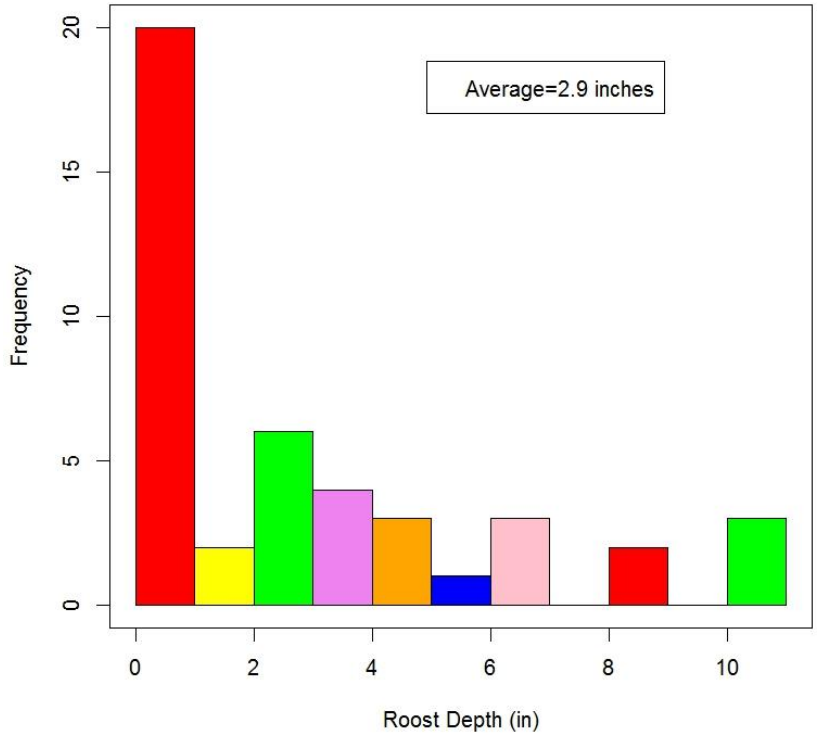


Figure 17. Frequency of unobstructed width (feet) across the 22 migration seasons monitored from 2001 to 2012.

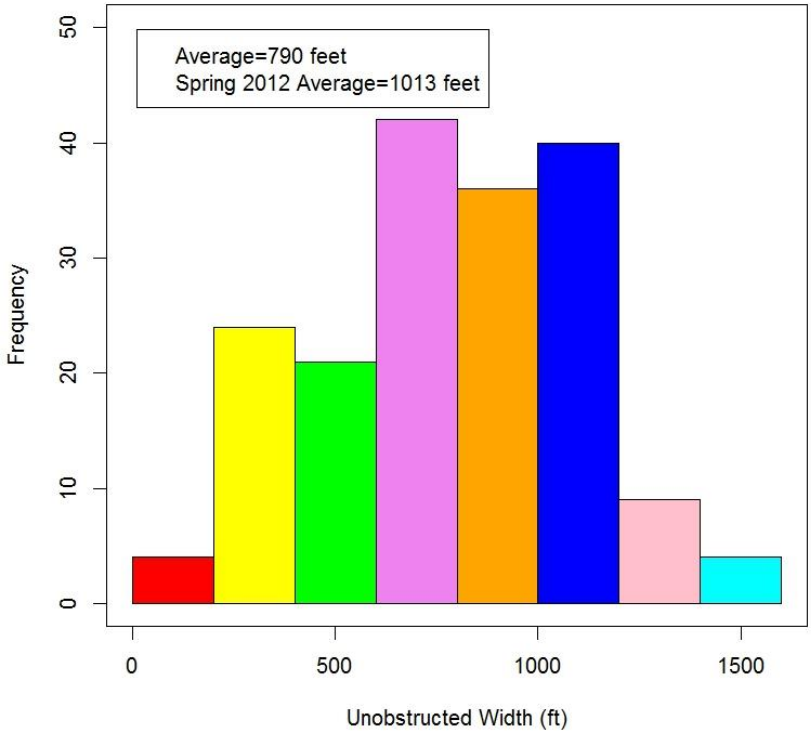


Figure 18. Relative proportions of land cover classes used during Spring 2012.

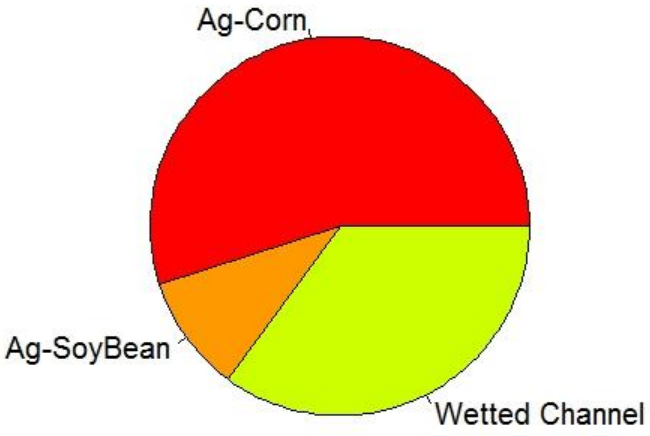


Figure 19. Relative proportions of land cover classes used across the 11 spring migration seasons.

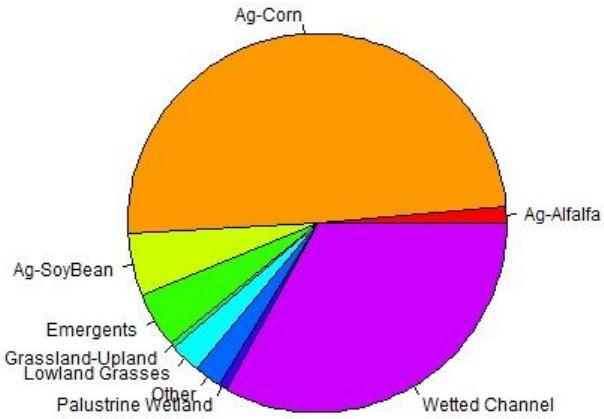


Figure 20. Estimates of Whooping Crane population size and percentage of population detected on the Platte River. Changes in survey methodology in January 2012 (indicated by dashed line) result in estimates of population size that are not directly comparable to previous estimates.

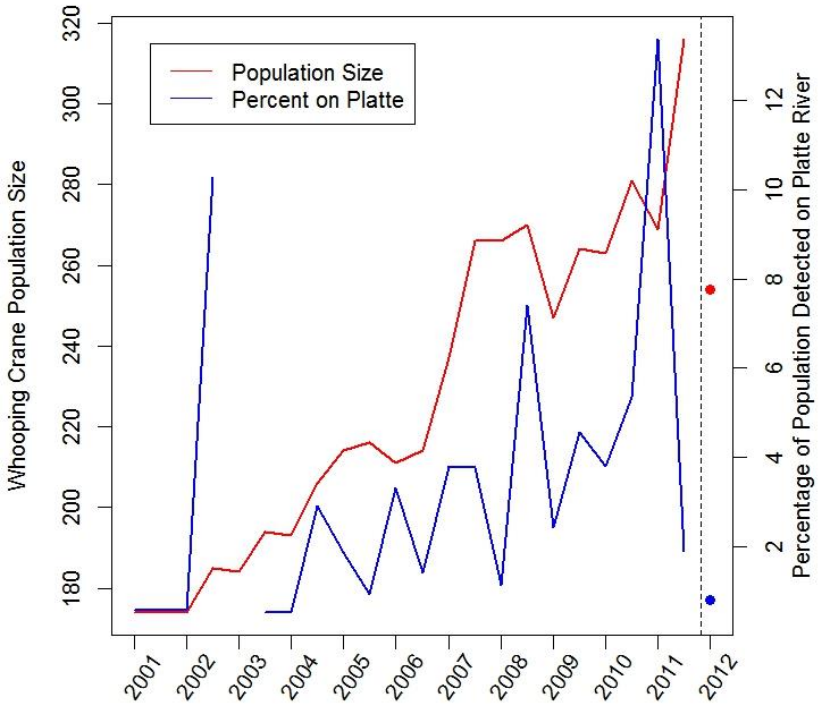


Figure 21. Example of public disturbance of the Whooping Crane. Note the crane is exhibiting no adverse response to the vehicle and photographer in this photo.