All location information has been removed from this document to protect the Blanding's Turtle populations.

TNC with State of Minnesota CFMS Contract No. A09492, Vendor # 078 129 006 05
Nongame Program, Section of Wildlife, Minnesota DNR, Rochester, MN 55906

BLANDINGS TURTLES, ROADS, & CULVERTS AT WEAVER DUNES

This report describes a specific subproject of the Weaver Dunes Blanding's Turtle Project, a multi-season on-going research and management initiative under the direction of Dr. Jeff Lang and staff of The Nature Conservancy. In it, I briefly describe the background, objectives and time lines, methodologies and preliminary results, and make provisional management recommendations. This report is authored by Jeffrey W. Lang, Professor, Department of Biology, Box 9019, University of North Dakota, Grand Forks, ND 58202 (phone: 701 777 4564, fax: 701 7772623, e-mail: jlang@badlands.nodak.edu, home phone: 701 772 0227), and is based on research (including time, expenses, and logistics) contributed to TNC.

Background

The Blanding's Turtle, *Emydoidea blandingii*, is listed as a State Threatened species in Minnesota and Wisconsin and is a Federal Candidate 2 species. The Mn DNR has prioritized Blanding's turtle concentrations for protection and research. Recently, two intensive studies of the species at Camp Ripley and in the Brainerd /Baxter area were completed. In brief, these studies have indicated that individual turtles rely on open, elevated areas for nesting (often in disturbed areas or along roadsides), and make long-distance overland movements between these traditional areas and associated wetland habitats, primarily shrub swamps, utilized for summer activities and for overwintering. In both areas, the turtle populations are healthy, but are vulnerable to direct mortality of adults, primarily along roads. This research was conducted by the U. of N. Dakota, under contract with the Mn DNR--Brainerd.

Blanding's turtles occur at high densities in the Weaver Dunes region and associated wetlands in southeastern Minnesota. This unusual concentration of a threatened species has focused attention on an area of ecological importance. In the late 1970's, Mike Pappas and Bruce Brecke marked and studied hundreds of turtles at Weaver Dunes, and their detailed observations over multiple years, including new data on overwintering, nesting, habitat selection, and population dynamics, were compiled in several unpublished reports.

Last season (1999), we completed an initial study to document the present distribution and abundance of Blanding's turtles at Weaver Dunes and associated wetlands, and to extend the earlier studies on this population. This on-going study (continuing in 2000) utilizes these data to determine the current status of the population, and to provide a baseline for assessing the impact of potentially detrimental activities, such as wetland and upland habitat alteration (draw-downs, cropping, etc), roadway maintenance and/or construction, and other development-related environmental changes that may directly or indirectly affect the turtles. A central focus of this multiple-year study is the effective partnering of various concerned agencies in a concerted effort to study and conserve this population.

A major management concern with Blandings turtles is road crossing, particularly by nesting females moving back and forth from wetlands and uplands. The viability of long-lived turtle species, such as the Blandings turtle, is dependent

on a low level of recruitment coupled with high adult survivorship. Road crossing has been identified as a critical threat, especially when populations are fragmented, resulting in mortality and/injury of all ages, but particularly of adults. However, there is little information at present on how to design structures that allow turtles to move back and forth across roadways between wetlands and into uplands when they nest. This subproject provides a basis for road and upland management in the Weaver Dunes, and should be applicable to populations of this species elsewhere.

Objectives & Time lines

The objectives of the proposed subproject are:

1. Determine the number of Blanding's turtles crossing Cty. , and the timing of movements into and out of the uplands east of the road.
2. Identify major crossing sites in this section of roadway
3. Document mortality of turtles on roads within the study area.
4. Investigate the ability of nesting turtles to utilize culverts of various sizes and lengths, as a potential way to reduce risks associated with road crossing.
5. Develop specific recommendations for roadway design in the Weaver Dunes area to augment safe passage of turtles, particularly during nesting, and general recommendations for the species elsewhere in Minnesota, based on appropriate experimentation and observations with this high-density turtle population.

These activities were carried out during May-July 2000.

Progress to Date (prior to contracting date)

As of 24 May, various pieces of culvert, 36"round, 48"round, and 42"arch, were in place for these experiments. Loan of the culvert is courtesy of MnDOT-Rochester and MnDNR-Whitewater WMA, with the help of John Cole, Craig Falkum, John Evans. This subproject has been approved by the Office of Environmental Services, MnDOT; Brad Kovach expedited MnDot culvert loan. TNC staff on-site provided substantial logistic support for this subproject. A drift fence designed to capture turtles exiting the wetland adjacent to the junction at Cty Rd and Road was constructed, and the culverts positioned into the fence array to facilitate a test of culvert use by nesting turtles. Although our initial intent was to test all turtles captured in the drift fence, the number of Blandings turtles that we captured precluded any tests with other species during the time available. All captured turtles were carried across the road during these trials, and released in water in large wading pools, on the upland side of the road to facilitate their movements into the dunes to nest. In most instances, the turtles were subsequently captured when they encountered the fence as they returned to the marsh.

Personnel involved in this project

Jaime Edwards, Regional Nongame Specialist, DNR Rochester
Dr. Jeff Lang, Dept. Biology, Univ. North Dakota
John Levell, Bjorn Larson, Michelle Anderson, Rachel Palmersheim, & TNC staff
Brad Kovach, Craig Falkum, John Evans, MnDOT-Rochester and Twin Cities
Nick Gulden, DNR Winona and John Cole, Whitewater WMA

Methodologies and Preliminary Results

Turtle Captures: During the 2000 field season, a total of 1377 individual Blandings turtles were captured, measured, and released. Two-thirds of these (929) were unmarked, and 448 were previously marked individuals. Before the nesting season, 266 turtles were caught primarily with baited aquatic traps (~120 traps); and 20 turtles were recovered via telemetry after nesting. These 286 turtles were a mix of juveniles, males, and females. Roughly half of these were marked previously, and the remainder unmarked. Proportionately large numbers of turtles from previously studied localities were marked. In contrast, at a new locality used for overwintering (McD), most of the animals had not been marked previously. These capture data from various localities are summarized in Table 1; localities are shown in Figure 1.

During the nesting period (29 May-28 June), aquatic trapping was suspended and two specific techniques were used to capture nesting turtles. A 2000' drift fence was constructed around the marsh prior to 25 May, and traps were installed to capture turtles moving along the fence (Figure 2 and 3). The traps and drift fence were checked at least twice daily during the nesting period, and the turtles were removed, measured, and released, usually within 24-48 hrs. A series of release pools, constructed of large wading pools filled with water, were installed at specific locations along the east side of Cty. Rd. ; these were landscaped to ensure turtles could exit easily, and provided with marsh vegetation for hiding, and were also partially shaded (Figure 4). In addition, road patrols employing TNC workers and volunteers driving, biking, and on foot, were conducted every evening from 1600-2000 hrs on designated sections of Cty. Rd. . These areas included: are described in Table 2 and delineated on the accompanying map (Figure 1). The nesting dunes (shown as in Figure 1, and described in Table 2) were patrolled on foot most evenings in an effort to locate nesting turtles.

During the nesting season, a total of 1091 adult females were captured in a drift fence constructed around a marsh known to contain large numbers of females ready to nest or by hand along roads and in adjacent uplands. Of these, about two-thirds or 773 individuals were not marked previously; the remaining third or 318 females were animals marked earlier. Most of these animals were encountered heading east into the dunes to nest, but some were also recovered after nesting as they returned to their wetland of origin or a nearby wetland via roads and/or the drift fence. The capture/recapture data are summarized for turtles caught during the 2000 field season in Table 1.

Turtle Numbers: The numbers of reproductive females that were tallied daily for these various localities by employing the methods described above are shown for the nesting period in Table 2. A total of 516 turtles were collected in the drift fence (DF), or nearly half of the overall total. The remainder were collected primarily along identified stretches of Cty. Rd. , especially just south and north of the drift fence. These three localities accounted for 82% of all the nesting turtles caught; 68% were found along Cty. Rd. at the two localities

FIGURE 1 REMOVED FROM DOCUMENT
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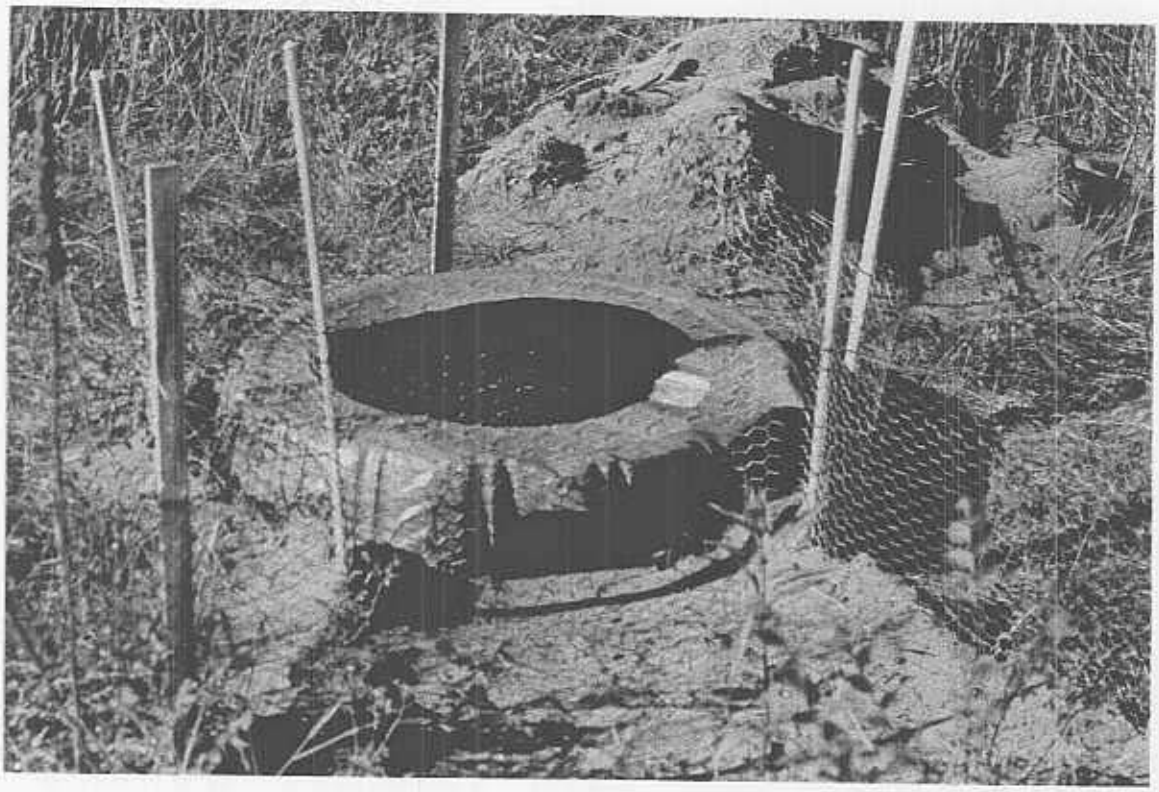
Figure 2. (above) View of installation of 2000′ drift fence adjacent to marsh. The fence was contructed of 18″ chicken wire and lathe; wading pool traps were positioned to collect turtles exiting and returning to the the marsh.

Figure 3. (below) Turtle trap made with two plastic wading pools. Bottom pool is filled with water, and covered with inverted pool with skylight. A ground level gangplank (2 x 4′ piece of plywood) extended into trap entry.



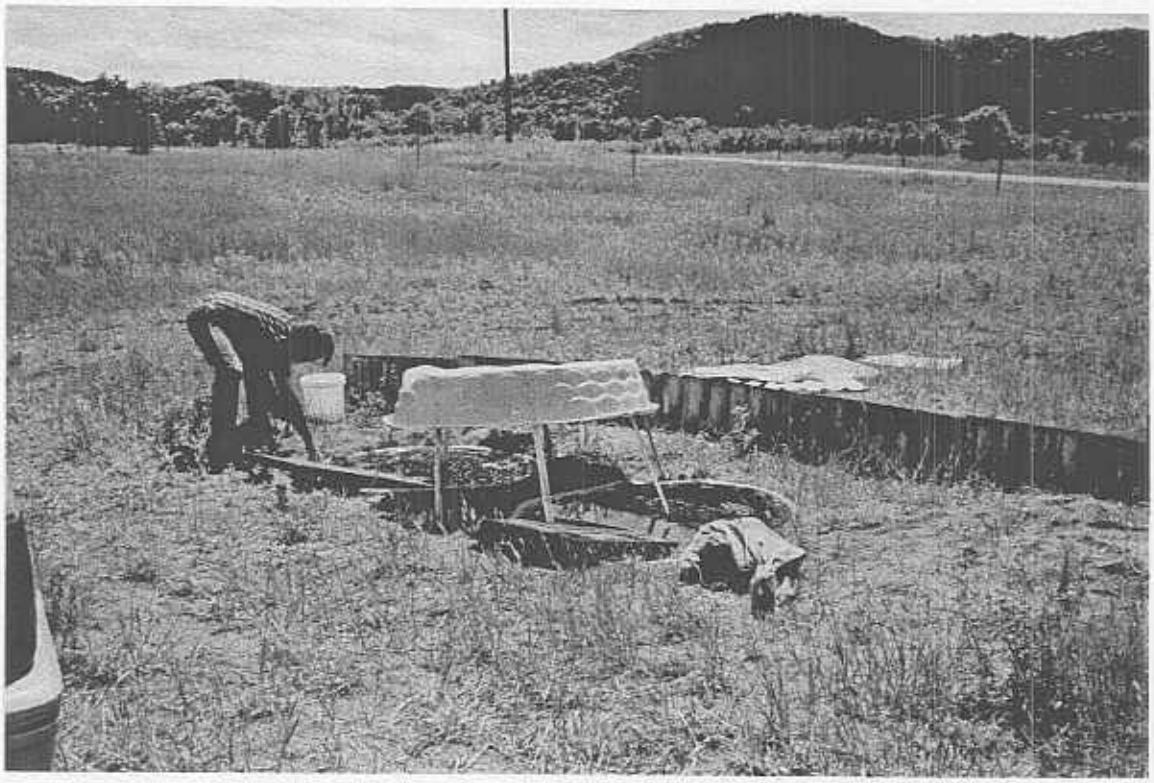


Figure 4. (above) Release pools in field directly east of drift fence across road. Platforms in pools provided cover, basking sites, and exit ramps. Pools were shaded and contained aquatic vegetation from the marsh; visual barrier separated release area from the road, drift fence and marsh (in background).

Figure 5. (below) Road-killed female Blandings turtle with eggs visible, on Cty Rd. 11June2000

immediately adjacent to the Property,

Timing of Movements: The nesting season extended from at least the 29th of May when the first nesting females were observed crossing Cty. Rd. until the 26th of June when the last reproductive female was caught in the drift fence. It is likely that the nesting season in 2000 extended several days on either side of these dates, because some nesting females avoided capture on the road throughout the period, and also because the typical transit time for a turtle to move to the dunes and return was 2-6 days. Nevertheless, the daily capture chronology indicated in Table 2 provides a realistic estimate of the timing of nesting movements made by turtles on their way to the dunes to lay eggs. These movements clearly peaked on 8-10 June when 413 nesting females were captured, or 38% of the total for the 29 day period that nesting movements were recorded.

Local weather conditions modulate day-to-day nesting movements. Cool weather, particularly on overcast days, inhibits nesting movements, whereas warm, sunny days, especially preceding or following rain tend to facilitate turtle movement to the dunes. For example, cool weather on 2-3 June resulted in less turtle movement, followed by increased movements when conditions became more favorable in the days following (Table 2). Although precise data on time of day for movements is not available, the timing of daily movements is very predictable, based on observations of this population in 1999 and 2000. Turtles move overland in late afternoon and early evening, with most crossing roads and adjacent fields between 1600-2000 hrs. Peak movement is apparent between 1700 to 1900, depending on local weather conditions.

Turtle Crossings: Return movements following nesting are less predictable, and are not summarized here, but are relevant when considering the number of road crossings by reproductive females. These movements tend to be made primarily throughout the daylight hours, as well as at night. Peak return movements occur in the early morning and in the late afternoon and evening, and typically peak seasonally 2-4 days after peak movements to the dunes. Nesting turtles usually return from the dunes via the same routes back to the wetlands from whence they came. Consequently, the actual road crossings by nesting females are at least twice the values tallied in Table 2 for the 2000 nesting season. For example, crossings at the two localities adjacent to the Property are estimated to be double the number indicated in Table 2, or a total of 1480 road crossings by 740 nesting females on a 0.75 mile section of Cty. Rd. between and the during the 2000 nesting season. Since not all turtles using this section of roadway were captured (road patrol was used on the section rather than a drift fence), it is likely that these numbers are minimal and that the actual number of crossings exceeded 1500 during this one month period, probably by at least a hundred or more additional turtle crossings.

These data for the 2000 nesting season appear to be representative of the annual nesting pattern. Our observations in 1999 provided preliminary information about the importance of a main movement corridor centered on the

Property along Cty. Rd. , and was critical in designing the strategies employed this season, i.e., using a drift fence and road patrols to capture turtles. In fact, many turtles (>100) crossing the drift fence this season were still marked with red paint that was applied last season to mark a sample of nesting turtles crossing the road at the drift fence location. Additional information from many previously marked turtles indicates that individual turtles use the same routes in successive years to move to and from the dunes where they nest.

Previous records of nesting movements by reproductive Blandings turtles along the sections of Cty. Rd. monitored this season provide additional support for the long term use of this section of roadway as a main movement corridor to the nesting dunes to the east. During 1974-80, Mike Pappas and Bruce Brecke marked a total of 590 reproductive females in Areas I to IV which correspond to the localities , as described in Table 2. A summary of their data is included in Table 3, for the areas denoted in Figure 6. The areas corresponding to (=Areas II and III) accounted for 68% of the females they marked. These data illustrate that this specific section of roadway was also used as a main movement corridor 20-25 years ago. Casual observations during the nesting seasons in the intervening years suggest that the nesting movements documented in 2000 are representative of the annual nesting pattern for this large population of Blandings turtles.

Tracking marked turtles, particularly by telemetry, has indicated that individuals move long distances (>1-2 miles) across wetlands and along water courses, e.g., Creek, to the complex of wetlands immediately adjacent to Cty. Rd. near the . intersection. Telemetered reproductive females have been followed daily as they have made incremental movements from the mouth of Creek up the channel and into the wetlands. Other individuals have been tracked from home areas far to the west near Hwy. moving directly east across the entire lower section of the wetlands, and then across a field behind the wetland, before stopping in just before emerging to nest. These prenesting movements are initiated weeks-days prior to actual overland movement to the dunes, and result in large numbers of reproductive females concentrated in specific wetlands just before and after nesting. For example, drift fence data indicate that more than 500 females moved through the wetland during this nesting season.

Historically, the proximity of the wetlands and the adjacent channels of Creek to the nearby dunes (identified as , along either side of Rd; Figure 1) may explain why reproductive females concentrate in large numbers in these particular wetlands and why the primary movement corridor for a large segment of the Weaver Dunes Blandings turtle population is located in the sections of Cty. Rd. . Because of their proximity to the dunes, these wetlands appear to provide the shortest overland route to the most favorable nesting areas, i.e., . A short overland travel route would benefit individual turtles by minimizing exposure to predators while the turtle was on land. In addition, the large concentration of reproductive turtles may have facilitated synchronous movements into the dunes. Synchrony in nesting behavior would likely result in additional anti-predator

benefits for reproductive females, their eggs, and the resultant hatchlings, particularly if hatchlings emerge and return in large numbers at the same time, as the observations noted below suggest.

Hatchling movements: At present, there is little recent information about the movements of hatchlings back into the surrounding wetlands where most, if not all, overwinter. Observations in 1974-1977 by Mike Pappas and Bruce Brecke documented that hatching occurred in mid-August through mid-September, and that many hatchlings moved across roads throughout the area from late August through September. Hatchlings moved during daylight hours, primarily in the early morning and late afternoon. Soaking rains were typically followed by major hatchlings movements across Cty. Rd. .

A total of 244, 198, and 519 hatchlings were collected crossing Cty. Rd. in 1974, 1975, and 1976 respectively on sections that corresponded to , with a large majority of animals from the sections. In 1977, a 1575 m drift fence was utilized for 32 days and 603 hatchlings were recorded crossing Cty. Rd. between 10 August and 11 September, .

These data indicate that in past years the main movement corridor used by nesting females was also a major route for hatchlings moving from nesting areas into wetlands across Cty. Rd. . Additional information would be desirable regarding hatchlings movements at present, but it seems likely that these areas remain a major corridor for hatchlings movements.

Main Movement Corridor: Additional observations in 2000 have documented that nearly all of the upland habitat within the main movement corridor is utilized at times by turtles for nesting. Specifically, Blandings turtle nests that had been predated were located in suitable locations, typically higher patches of ground, within the fields crossed by turtles enroute to the dunes. In 2000, these included the WMA field , the crop land and the old fields , the field east of and west of Cty. Rd. where the drift fence was located, the fields west and southwest of , and the field . Our experience in the dunes regularly used for nesting is that predated nests are a reliable indicator of where Blandings turtles nest, and that some proportion (possibly as high as 1:1) of nests are not detected/predated by predators. These observations, in turn, suggest that the fields (especially those noted above) enroute to the dunes do provide suitable nesting sites, and may account for as much as 10-20% of the Blandings turtle nests laid annually by this population.

Important features along the main movement corridor are summarized in a schematic map of the sections of Cty. Rd. (Figure 7). The location of the drift fence, release pools, predated nests, major avenues of nesting turtle movements, as well as identified sections of roadways patrolled for turtles. In the accompanying photos, representative views of a major crossing point opposite the drift fence are described in the legends of Figures 8-15.

Road mortality/collecting/turtle signs: Despite the unprecedented turtle traffic

across roadways in the Weaver Dunes area, particularly along Cty. Rd. , few turtle fatalities have been documented. An important caveat is that in 1999 and in 2000, our activities associated with studying nesting females may have affected turtle road injuries/fatalities. In 1999, turtles were frequently moved across Cty. Rd. during the peak periods of nesting when they were marked. In 2000, nearly all of the turtles encountered on roads were collected to be measured and marked, and were subsequently released off roadways in release ponds. Thus, our observations during these studies may not be representative of the situation when a research presence is minimal.

In 1999, two fatalities were recorded, one close to the junction of Hwy. with Cty. Rd. , and the other at the Rd. intersection with Cty. Rd. . Both occurred during the nesting season; one presumably happened at night during a heavy rain. In both instances, the dead females contained eggs and were moving toward the dunes. In 2000, two females with eggs died as a result of injuries from vehicles along Cty. Rd. . Both incidents occurred on weekends when traffic was relatively heavy. One turtle was found in mid-afternoon along the section of Cty. Rd. (Figure 5); the other was injured along the section during the Memorial Day weekend, and died several days later.

Injuries by vehicles are particularly difficult to document when the turtle is not killed immediately on the road, but may die sometime later, after moving off the roadway. Shell injuries are noted when turtles are measured, and major injuries attributable to vehicle injury are uncommon (<2%). Our observations indicate, that with few exceptions, motorists make efforts to accommodate turtles crossing roads. This is particularly evident with local traffic, and on the non-paved township roads where speeds are reduced. Higher speeds on Cty. Rd. probably account for an increased likelihood of a turtle being hit and killed by a vehicle. In addition, visibility is reduced because the road is undulating at several specific places within the main movement corridor. Large numbers of turtles cross the road at these low sites, and injuries/fatalities appear to be more likely in these locations because the low visibility and high speed combine to allow motorists less advance notice of a turtle on the road (Figure 7; see also Figures 8-15).

In addition, there were several instances during the 2000 season of people sighted who were suspected of illegally collecting turtles in the area, and at least one report of an individual working in Winona, claiming to be making money selling turtles/eggs collected locally. No additional details are available.

The turtle road signs provided by the MnDNR-Rochester Nongame Office were installed by turtle project staff at two locations along Cty. Rd. , and at the Rd. intersection. The signs were installed on 25 May, and removed on 30 June. One of the large diamond signs with a turtle logo was stolen on the night of 29 June, despite the use of tamper-proof nuts and bolts to secure the signs. It was suggested that TNC staff put up and take down the signs each year, on a schedule that corresponds directly to turtle nesting, to maximize their effectiveness in alerting drivers about turtles on the roads.

Culvert Experiments: In late May, culverts of various sizes and lengths were provided on loan from MnDOT and Mn DNR for these trials. The culverts were

arranged in an experimental array, facing east-west, provided with gates for different configurations, surrounded by fencing enclosing a release pool on the west side, filled with a shallow layer of dirt, and equipped with runways and traps on the east side surrounded with fencing. Various views of the culvert array are shown in Figures 16-19 and described in the accompanying legends.

Turtles caught in the drift fence heading east into the dunes were tested for a day (~24 hrs; 1700 to 1700 hrs) before being released on the east side of Cty. Rd. at one of several release sites. In one trial, turtles returning from the dunes following nesting were tested in the reverse direction, heading west to simulate return movements back to the wetlands of origin. The number of turtles tested varied from day to day, and turtles typically were tested in one trial only. At the start of each trial, the turtles were released in the release pool on the west side of the culvert array; and on the following day, the number of turtles in each trap or remaining in each culvert were tallied, along with the number of turtles remaining in the release area. In each trial, turtles were presented with two choices of culverts. Three types of culverts were tested in this manner; and in addition, the ends of several culverts were partially covered in an effort to assess how the overall light intensity at the far end of a culvert might influence turtle movement through the culvert (Figures 16-19).

The results of individual trials are tallied in Table 4, and a summary of the combined results for each test configuration is shown at the bottom of Table 4. A total of 400 individual turtles were tested in the various experimental arrays; in addition, 19 turtles were retested three times in covered vs. open culverts. In all cases, a majority of the turtles tested entered the culverts and moved through them. Turtles did not demonstrate a clear preference for culvert size or shape, given the choices available. In most trials, the distribution of turtles at the end of the trial was about equal between the two choices. The clearest preference was evident in three successive trials with the same nineteen turtles tested repeatedly. These turtles avoided the culvert which was covered, when treatments were alternated from day to day (Table 4). However, the combined results for 66 turtles tested were less convincing, and indicated that turtles moved through a culvert even when it was covered to darken the exit end.

This series of experiments demonstrated that nesting Blandings turtles do move through large sections of culvert, ranging in size from 36-48" and varying in shape from round to squashed (=arched). Turtles moved both east and west in the experimental array, so presumably nesting movements across roads could be accommodated via proper placement of culverts of appropriate size and shape together with associated landscaping. Although one series of trials indicated that open vs. closed culverts were preferred, turtles moved through culverts even when light intensity at the far end was reduced. Overall, the trials with culverts have focused attention on passages beneath roads as a possible solution for road crossing by Blandings turtles. Several newspaper accounts dealt with aspects of this work, and are included here as Figures 20 and 21. A brief discussion of road crossings and culverts along Cty. Rd. is included in the recommendation section of this report.

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Figure 16. (above) Culvert array (left to right: 36" rd, 48" rd, 48" sq, 36" rd) view looking east in direction of travel to nesting dunes, visible as distant treeline. Plank gates limited access; note tarp covering far end of 48" rd vs. open 48" sq.

Figure 17. (below) Test culverts, looking west, showing traps and runways so culverts could be tested in different combinations. Plastic covers end of 48" rd Culverts shown are: (right to left) 48" squashed, 48" round, and 36" round.

Figure 18. (above) View of traps positioned at east end of culvert array. Planks used to direct turtles into "gangplank" traps, open to sky with water in bottom

Figure 19. (below) Turtles moving east and entering 36" round culvert during a daily trial. In this experiment, this culvert and the one adjacent (48" round) provided routes to the east side of the enclosure, in direction of nesting areas.

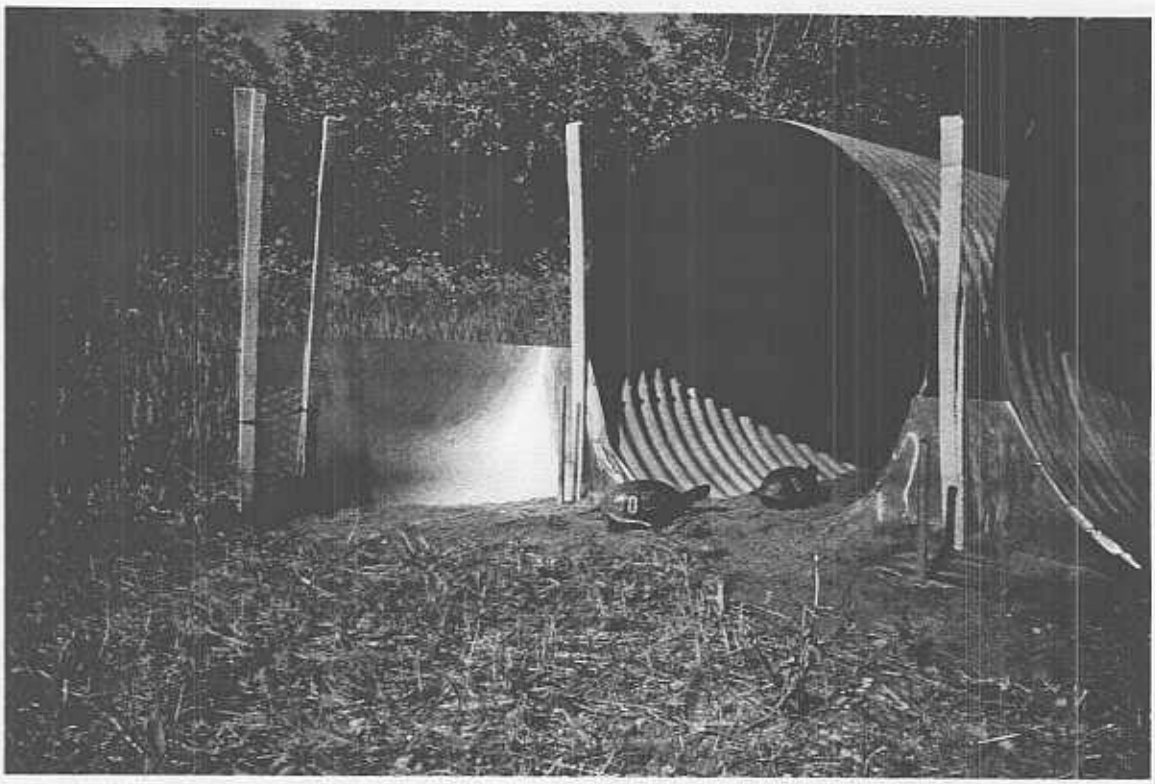


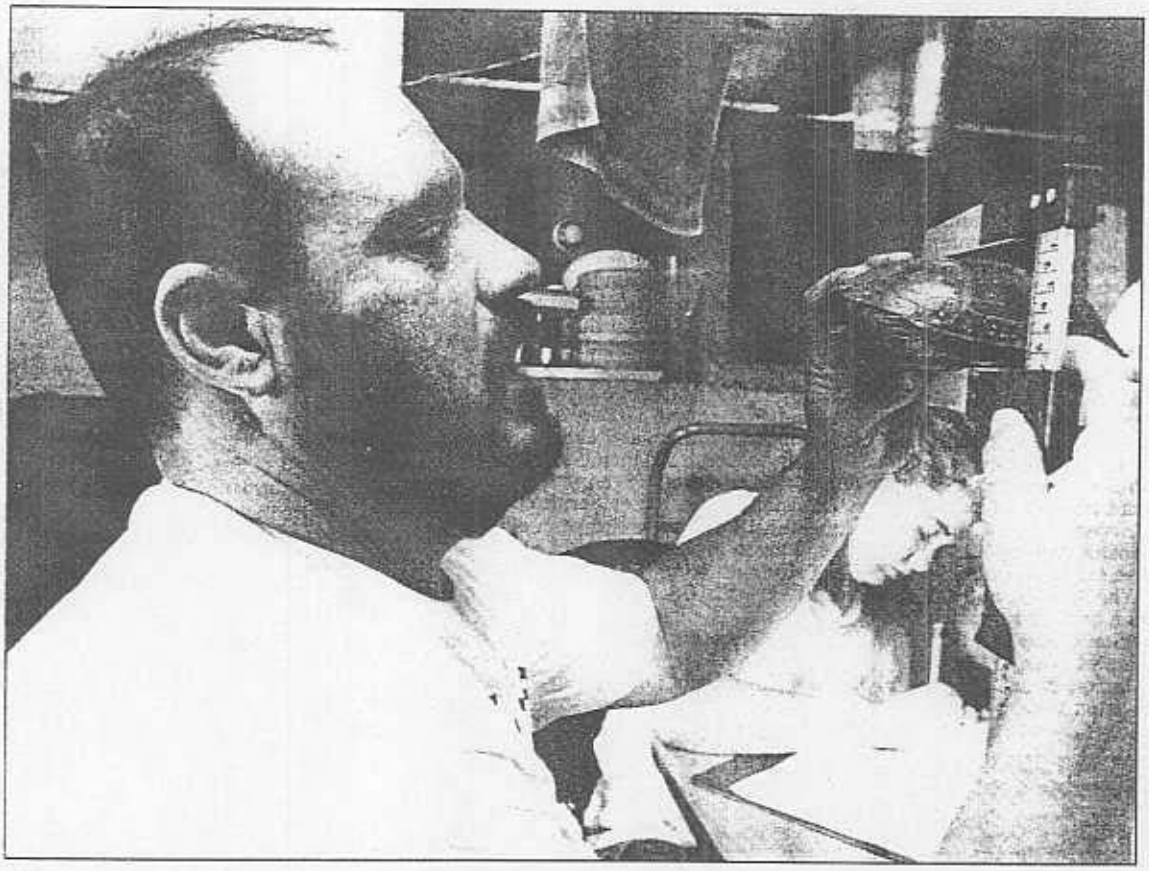
Table 4. Culvert Experiments--Daily Trials and Summaries
Results of 15 daily trials of directed movements by female turtles through culverts of different sizes and configurations.

culvert experiment--summary of daily trials with Blandings turtles

date	time	time	turtles tested	did not finish	round 36"	round 48"	squash 48"	direction	open=O vs. covered=C round 36"	round 48"	squash 48"
6-Jun	1630	1700	20	11		4	5	east		O	O
7-Jun	1700	1715	36	12		14	10	east		O	O
8-Jun	1715	1900	49	8	17		24	east	O		O
10-Jun	1730	1700	78	27	29		22	east	O		O
11-Jun	1700	2030	62	14	26		22	east	O		O
12-Jun	2030	1130	23	8	8		7	east	O		O
13-Jun	1130	1030	33	0	14		19	west	O		O
14-Jun	1030	1400	14	3		6	5	east		O	O
15-Jun	1400	1100	*19	5		1	13	east		C	O
16-Jun	1100	1200	*19	4		11	4	east		O	C
17-Jun	1200	1500	*19	8		3	8	east		C	O
19-Jun	1700	1630	7	0		4	3	east		C	O
20-Jun	1630	1600	31	14		8	9	east		C	O
23-Jun	1600	900	9	0		4	5	east		C	O
24-Jun	900	1200	19	5		7	7	east		O	O
	individuals		400								
	retrials		38								
	total turtles tested		438		* =same individuals tested repeatedly on successive days						
	summary of combined trials		89	31		31	27	east			
			212	57	80	75		east			
			33	0	14	19		west			
			66	22		19	25	east	48" round closed		
			19	4		11	4	east	48" squash closed		

Figure 20. News article about turtle project
Rochester POST-BULLETIN, 14 June 2000

Figure 21. News article about turtle project
Wabasha County Herald, 28 June 2000



John Levell of Lanesboro measures a Blanding's turtle and gives the information to Mindy Dornbusch who was recording the turtle's size, gender and if it had eggs. This turtle did have eggs.

John Weiss/The Post-Bulletin

Rerouting detours traveling turtles

▶ Research examines migration patterns

By John Weiss
The Post-Bulletin

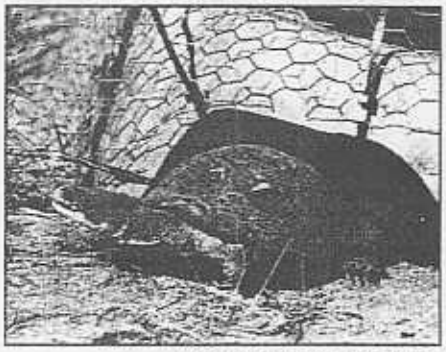
KELLOGG — Even rare Blanding's turtles are running into detours in their summer travel.

It's all for the sake of science and the turtles' future.

Females go from the marshes on the west side of Wabasha County Road 84 in the Weaver Dunes area south of Kellogg to sand dunes on the east side each June, and the females lay their eggs. Then they return to the marshes. The peak movement is this time of the month.

This year, the turtles, with their buttery yellow chin and throat, are finding fences, children's wading pools and culverts, besides road traffic, blocking their route. Scientists and volunteers are placing those fences, pools and culverts in the turtles' path. Once volunteers check, measure and perhaps mark them, the turtles are sent on their way. The new impediments are part of studies to determine the turtles' numbers and how to make it easier for them to cross the road. Detours delay the turtles a day at most.

The Weaver Dunes area has the world's largest number of Blanding's turtles, which are a threatened species in Minnesota and endangered in other states. The newest estimate of the overall number of turtles at Weaver is now about 5,000, said Jeffrey Lang, a University of North Dakota biology professor who is again studying the turtles.



John Weiss/The Post-Bulletin

A Blanding's turtle steps out of an opening in a chicken wire fence that was put up to capture it and hundreds of other turtles south of Kellogg.

That is based on the number of marked turtles found in proportion to those unmarked, he said.

Lang said he is donating his time for the work because "I want to do it, and the easiest way to do it is just do it." Many other people from the Rochester area and the Twin Cities are volunteering their time to capture, measure and care for the turtles. The Nature Conservancy is the umbrella organization sponsoring the work and is helping pay for it, he said. The Department of Natural Resources is helping with the study.

The major part of the study this year has been capturing turtles that move in the cool of the morning or evening but not at night or heat of the day, he said. A fence of chicken wire or rolls of metal was put around a pond the turtles use as a staging area before moving to the dunes, he said. When turtles hit the fence, they move until they find holes in it. Those holes, however, lead to small water-filled wading pools where researchers capture them.

Some turtles get a dot of temporary paint sprayed on them, others have their shells permanently marked so they can be identified 30 years from now, Lang said.

The second part of the study gives turtles a choice of two or three sizes of culverts to see if they will go through any of them, and if so, which size they like, he said. The county road is expected to be improved next year and maybe culverts can be installed to make it safer for them to cross, he said. It is known that Blanding's turtles will avoid small culverts because they can't see light at the end.

Lang hopes work done last year and this year will prove fruitful and lead to "serious funding" in the future. The ultimate goal is to find out exactly what habitat turtles need for their life cycle and protect that land, he said. Turtles can adapt to losses of some parts but not to too many, he said.

Herding Turtles

Latest project in ongoing study at Weaver Dunes hopes to help Blanding's, bureaucracy co-exist

by Michael Smith

Why did the turtle cross the road?

Or better yet, the more appropriate, localized version of that age-old question usually attributed to chickens, could be, "*How* did the turtle cross the road?"

Dr. Jeff Lang hopes he and his work partners with the Nature Conservancy can answer that and other questions about the familiar and threatened Blanding's Turtle that is present in abundance on Lower Sand Prairie. As we reported last summer, Dr. Lang, a Professor of Biology at the University of North Dakota in Grand Forks, is in the midst of an ongoing study that he hopes will, in short, help assure the longevity of the Blanding's Turtle species, as well as make future planning easier for agencies building or changing roads in populated areas where the turtles may be present.

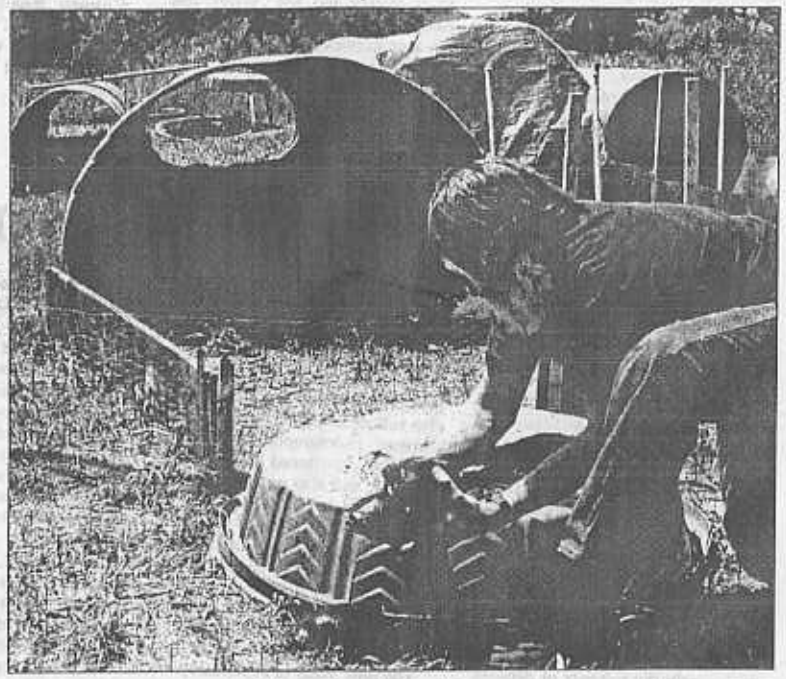
The center of the current research revolves around the Blanding's Turtle's—in this case the female's—natural movement from its wetland habitat to its dry land nesting area. In this case, that means from the wetlands west of County 84 on Lower Sand Prairie (primarily on the DNR's McCarthy Lake Wildlife Management Area) and the Dunes area east of the highway (much of which is on Nature Conservancy land).

This is a major management concern with the Blanding's. As Dr. Lang summarized in his overview of this particular two-year study, road crossing has been identified as a critical threat, especially when populations are fragmented, resulting in mortality and injury of all ages, but particularly adults. However, he says, there is little information at present on how to design structures that allow turtles to move back and forth across roadways between the wetlands and into the uplands when they nest.

"This isn't a critical problem at the present time at the Dunes," Dr. Lang assured us. "We've only had two cases reported thus far of turtles being run over on the highway. However, we'd like to learn if we can manage the turtle populations that may be in jeopardy elsewhere."

Why here?

"We can do the study because of



Dr. Jeff Lang pulls out a trio of Blanding's turtles from the collection pond (plastic wading pool) at the end of the culverts used in his study on the turtle's migration habits from habitat area to nesting area.

turtle's migration habits. They, essentially, wanted to learn what made the turtle tick—and what was so right about this area that made the turtles congregate here in abundance.

"One of the reasons the turtles are doing so well," Dr. Lang noted, "is the agricultural impact here is minimal and the area residents are very supportive."

The data they collected helped determine the status of the population and provided a baseline for assessing the impact of potentially detrimental activities, such as wetland and upland habitat alteration, roadway maintenance and/or construction and other development-related environmental changes that may directly or indirectly affect the turtles.

Now this year, as part of of the multiple-year study, Dr. Lang and the Nature Conservancy, as the "umbrella agency" and sponsor, and other agencies are partnering in a subproject to provide information for road management for the species constructed along the west side of County 84 near the intersection of Pritchard's Road where the wetlands are closest to the highway. The fence is designed to stop the turtles exiting the wetland and funnel them to catch basins—experimental substitutes for culverts that would be placed under the roadway—to determine how many are crossing the highway and the timing of the movements into and out of the uplands to the east of the road.

"By marking the turtles, we can learn if they naturally use the same route in both directions, as well as what time of day and year their travel is heaviest, and so forth."

While Dr. Lang understands that not all turtles will use culverts to get to the other side of the road if they are able to cross the highway instead, his studies last year have found that the Blanding's uses only three or four corridors to travel between the wetlands and their nesting sites, so if they build the drift fences where the turtles naturally travel, they can and ment laying eggs within one to two days."

Shade, provided by small, plastic wading pools, is often set up over we are using and the volunteer help in putting the fence up."

The other half of the present study is the culvert experiment itself, with additional funds for this individual sub-research provided by the DNR. A variety of metal culverts—36" round, 48" and 42" "squashed" culvert—have been lined up to determine which size the turtles prefer. The far end is often covered with tarp to determine if, given a choice, the turtle tends to go through the culvert that it can see light through, or the darker one—as well as the larger or smaller ones. Twelve-inch culverts tried earlier achieved only "moderate success," he noted.

The culverts, on loan from MnDOT in Rochester thanks to the efforts of former County Highway Engineer Craig Falkum and others, as well as Whitewater Management Area, are in place near the same location as the drift fence and work in the same manner. The turtles enter the culvert of choice—positioned as they are in a row and opened or closed depending on the specific choice being tested—and are caught in a pool at the other end...and of course, released a short time later.

"To date, we are finding they prefer the larger culverts, though light seems not to be a big factor." Between 200 and 300 turtles have been trapped, marked and released to date, Dr. Lang said.

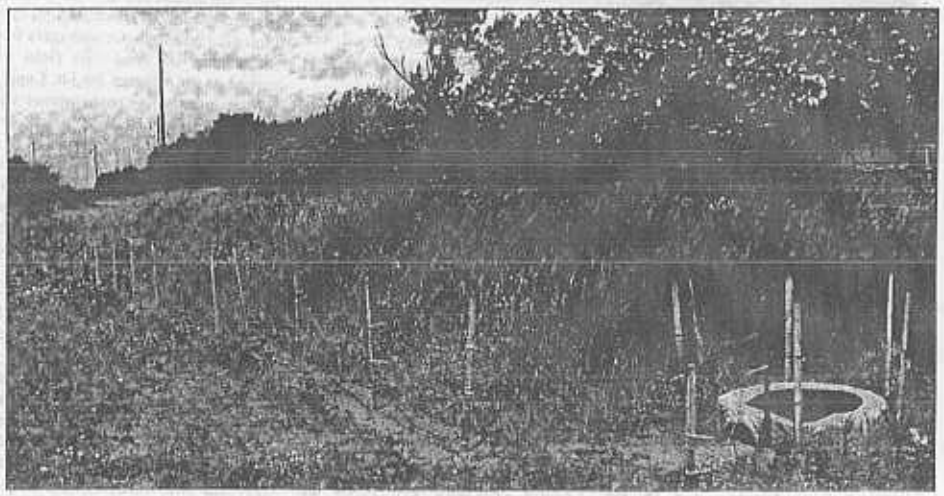
"We are starting to feel now as though we've answered all the most pertinent questions," Dr. Lang concluded.

With all these answers, the study team hopes they can develop specific recommendations for roadway designs in the Weaver Dunes area to augment safe passage of turtles, particularly during nesting; and make general recommendations for the species elsewhere in Minnesota, based on their findings. The combination of culverts and drift fence could make the turtle migration a safer journey and provide fewer headaches for highway or sub-division construction, for example.

Development in many of these locations may encounter interference from turtle migrations—or vice versa, and any information gathered here could prove very helpful in dealing with that.

Showing us a map of locations from where turtles enter the Lower Sand Prairie, he adds, "This truly is one of the turtle hot spots of the world. We hope that our work here will help this species and others in many areas."

From Nick Gulden, to Mark Hamernick, to Mike Pappas, to Michelle, Rachel and Jeff and all the others: this can be called a total turtle—and team—effort.



the abundance of the Blanding's Turtle here, which we now feel is well over 1,000, making it easy for us to locate and track them." The Weaver Dunes area is often considered to quite possibly hold the largest concentration of the Blanding's in the world.

Studies have been underway since 1974 on this turtle species, with much of the early work being undertaken by DNR Area Conservationist Nick Gulden, who Dr. Lang credits with making the McCarthy Lake Wildlife Area what it is. Literally hundreds of of turtles were marked and studied by volunteers in the 70's, providing invaluable data on overwintering, nesting, habitat selection and population dynamics.

Last year we reported how Dr. Lang and others were researching the "We want to do a much more complete census," he said.

Assisting Jeff in the project are Michelle Anderson and Rachel Palmersheim, two W-K graduates. Michelle also directs the county's Sentence-to-Serve program and Rachel is a Biology student at Luther College.

Also helping out is John LaVelle, who owns and operates a living museum in Lanesboro.

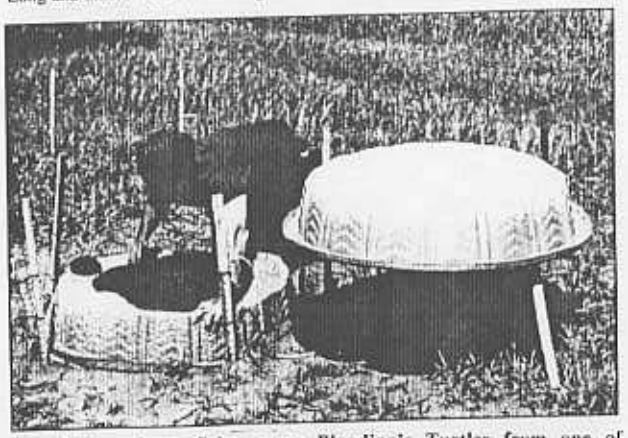
Dr. Lang explained that these experiments are being done now because the county plans on re-paving County 84 in 2002, so results of the studies might be incorporated into that project, saving the county money.

What they've done is set up two experiments.

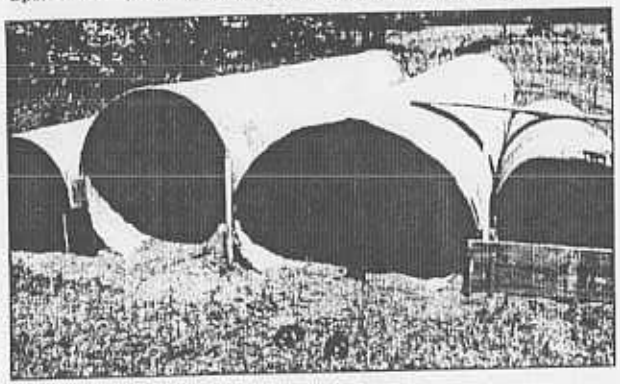
In one, a 1500-foot drift fence was will, it appears, use the accompanying culverts.

The turtles hit the fence and then proceed along it to one in a series of openings. They go through the openings and are "caught" in shallow pools for a short holding period.

"We measure and mark them within 12 hours," Dr. Lang explained. "We then release them on the opposite side of the road in the direction of their natural movement and they are back in their environ-



Dr. Jeffrey Lang fishes some Blanding's Turtles from one of the plastic wading pools used to collect them as they head for County Road 84. By his side is another of the pools, turned upside down, used to shade the water-filled pool at left.



The four culverts used in Dr. Lang's research are lined up between the wetland area and County 84 near Pritchard's Road. The turtles are given a choice of which of the four different-sized culverts they prefer to use. Usually, they have a choice of two at any given time.

A portion of the 1500 feet of Drift Fence is shown here along County Road 84 near Pritchard's Road that helps turn the Blanding's Turtles toward the wading pool at right. If the experiment works, the wading pools will be replaced by culverts that will help get the turtles safely across this and other roads.

Blanding's Turtle Research at Dunes - an overview

A pilot study of the Blandings turtle population at Weaver Dunes was initiated in spring 1999 by Dr. Jeffrey W. Lang, Biology Department, University of North Dakota in Grand Forks. Jeff was instrumental in guiding a comprehensive field study of this species, threatened in Minnesota, at Camp Ripley and in Brainerd/Baxter during the previous three summers. The studies were carried out by two graduate students and an undergraduate assistant, Mark Hamernick, and were supported by the Minnesota DNR and DOT. The population status and critical habitats of the Blandings turtle and the management guidelines for the species were the subjects of detailed reports. This work was summarized at the Blandings Turtle Workshop, at the Bell Museum, U. of Minnesota, in May 1998. As part of the Workshop, there was a field trip to Weaver Dunes in the company of more than 60 turtle biologists and resource managers from across the US, and this field trip served as the impetus for Dr. Lang to initiate a study this past summer with the help of TNC staff members Garth Fuller and Nancy Lee Falkum.

Mark Hamernick has been supported as a research intern funded thru a small grants program reestablished by the Minnesota Chapter of the Nature Conservancy, for the summer, fall, and winter to monitor turtle movements. Mark will use this information as part of his MS program in Resource Analysis at nearby St. Mary's University in Winona. In addition, various volunteers have contributed many hours to the Weaver Dunes turtle project throughout the first season of fieldwork. Mike Pappas, a Rochester resident who initiated the original mark-recapture study of the turtles at Weaver Dunes in the late 1970s, and who has been a tireless advocate for preserving the turtles and their habitats during the past two decades, participated this past summer as an integral member of the research team. Mike continues to be an active collaborator with Dr. Lang on the ongoing project. Gretchen Chesley Lang also volunteered her expertise as field assistant, photographer, and support staff. Jeff contributed his experience and time, and also provided most of the financial and logistic support for the project. The estimated direct cost of the project to date, not including compensation for time contributed and not including the component provided by the TNC, is $15,000. The Mn DNR provided scientific permits for the turtle work and use of the SNA.

The pilot study is exploratory, but a number of objectives were identified:

1) What habitats and associated corridors are utilized by individual turtles throughout the year at Weaver Dunes? How much do turtles move annually?

2) Are these habitats and avenues used by the different size-age classes of turtles in the population? Are there sex-specific usage and movement patterns?

3) How are the turtles affected by human activities? Is survival threatened?

4) Is the turtle population at Weaver Dunes viable? Is breeding successful? What is the survivorship of eggs, hatchlings, juveniles, and adults?

5) What is the approximate size of the turtle population? Is it isolated or is it contiguous with other populations?

Spring fieldwork was initiated in late March by Mike Pappas who located groups of turtles as they were emerging in small ponds and pools where they had overwintered. Turtles were active at the water surface as the ice melted around the margins of these wetlands, located near the Mississippi bottomlands and adjacent to the McCarthy WMA and the old channel of the Zumbro River. By mid April, 14 adult turtles were radio tagged in order to follow spring movements, and these were also fitted with temperature loggers that recorded ambient temperatures near the turtles. In early May, an additional 8 turtles, including several juveniles and sub adults, were telemetered to provide additional information on pre-nesting movements.

In mid-May, trapping with aquatic hoop traps was begun, and produced within several weeks, over 200 turtles. All turtles captured by net were permanently marked and released with visual tags for recognition, if recovered during the nesting period or afterwards. Female turtles were also routinely x-rayed to determine if the turtle was gravid, and to monitor the number of eggs per clutch. Trapping was suspended in late May, to avoid disturbing turtles preparing to nest. Trapping was attempted intermittently throughout July and August, but was markedly unsuccessful relative to efforts earlier in the season. Fewer than 25 turtles were captured in traps during the remainder of the active season.

During nesting (early to mid June), field work focused on 1) monitoring nesting movements of females across Cty Rd 84 and Pritchard Road near the TNC Dubray property, 2) following the nesting movements of radio-tagged females from various spring wetlands surrounding the dunes, and 3) locating nesting females in the centrally-located dune fields north and south of Pritchard Road on TNC as well as other properties, and following these females back to their wetlands when nesting was completed. Efforts to accomplish these objectives were largely successful. Most of the radio-tagged females (-15 individuals) were located during nesting and important details of nesting behavior and movements noted. Movements of nesting females to and from the dunes were tracked in detail on a daily basis in the vicinity of the Dubray property near Cty Rd 84 and Pritchard Road. Up to 50 animals per hour were observed crossing stretches of road adjacent to the Dubray tract on peak days during the 10-12 day nesting period. And finally, more than 20 females not previously captured earlier in the season were located nesting in and around the central dunes, and all were marked and - or radio-tagged before they returned to wetlands after nesting.

The majority of nests were protected to permit an accurate assessment of how nest and other reproductive parameters varied with individual females, as a function of size and - or age. During this nesting season, over 500 viable eggs produced more than 450 hatchlings which were marked and released. Initial observations indicated very high levels of egg predation at unprotected nests, primarily by mammals, especially skunks. Preliminary surveys, including turtles observed nesting (-40 nests) as well as predated nests (-60 nests), indicate that turtles nest throughout the entire dune complex, usually singly or closely spaced groups of 2-3 nearby nests. Turtles often nested in disturbed sites, including soybean fields and plowed areas, as well as along roadsides, near shrubs and - or woods, as well as out in cleared areas. Nests were usually located in sparse ground vegetation, at high points in the dune terrain. Females were observed to nest at night, typically at dusk or after dark, following movements to nesting areas over a period of 1-8 days in the late afternoon and early evening as weather permitted.

RECOMMENDATIONS

Regional Context: The following recommendations are preliminary, and should be viewed as provisional, pending further research, analyses, and discussions. Earlier in this report, I have summarized what was previously known and what we have recently learned about relevant features of the Weaver Dunes population of Blandings turtles. The focus of the report is to document turtle movements across roads into upland habitats in time and space, and to evaluate how roads and related activities affect these movements now and in the future. Ultimately, these activities may either jeopardize or ensure the continued survival of this unique population of turtles. This population is the largest concentration of this species anywhere in its range; and from all indications, it is healthy and thriving.

It is useful to view the status of the population in a historical and ecological context. To date, the Weaver Dunes turtle population has survived several hundred years of recent settlement; this entailed primarily low impact agriculture practiced by a low density human population. Importantly, these activities have been carried out within a complex mosaic of upland and wetland habitats which have proven resistant to large-scale, irreversible alteration. Both upland and wetland habitats in the area are diverse, and have maintained their distinctive ecological integrities in the face of human activities, past and present. In particular, sections of undulating dunes have remained intact; and likewise, shallow marsh wetlands have persisted in the extensive surrounding river bottom lands. The uninterrupted presence of both habitats in the Weaver Dunes area has undoubtably been critical to the continued survival of Blandings turtles at this location.

These turtles live most of their lives in aquatic habitats; in wetlands, they feed, grow, find mates, and overwinter. Overland movements are limited to occasional trips between wetlands, except for the annual movement by reproductive females to and from upland nesting areas, and the later movements of hatchlings from upland nest sites to the surrounding wetlands. Thus, the turtles' upland activities are restricted in time and space, and for the most part, very predictable.

Critical Times: At Weaver Dunes, nesting and hatching and associated movements are restricted to two separate six week periods, in early and late summer respectively. Specifically, most nesting occurs during the first two weeks of June, and most hatching/emergence occurs during the last two weeks of August. The addition of one week before and three weeks after these periods essentially covers all year-to-year variations in the timing of these critical annual activities by Blandings turtles in uplands.

It is also important to note that during the intervening period, for late June to early August, eggs in upland nests are incubating and subject to changes in vegetation and soil as well as associated environmental influences, particularly in thermal and moisture regimes. For example, egg temperature in this species determines hatchlings sex. The life history of Blandings turtles, particularly their late-maturing, long-lived strategy, dictates management decisions which give priority to protecting adults. Consequently, the early summer nesting activities of

reproductive females deserve the highest level of accommodation and protection, relative to the concerns about the eggs and/or hatchlings.

Critical Locations: At Weaver Dunes, the dunes and associated uplands provide extensive areas for nesting by Blandings turtles. These dunes are bounded by roads ( ) that are encountered by turtles moving back and forth from surrounding wetlands. Of these perimeter roads, the section of Cty. Rd. from the Rd. to the Bridge is clearly the most critical location for turtle crossings. Our work this season indicated in excess of 2000 road crossings by reproductive females from late May through June on this section of roadway. More than 80% of these were centered in sections (denoted as a dashed line in Figure 1; details in Figure 7). Previous studies indicate that this section of Cty. Rd. has been the major corridor for turtle movements, both by nesting adults and hatching young, and our studies in 1999 and 2000 serve to reinforce this conclusion.

By combining available information on critical time with critical location, it is clear that all activities occurring along the roadway and/or within the main movement corridor ( ) from late May through mid September should be evaluated and planned to minimize detrimental effects on nesting adults, hatching young, and/or incubating eggs. The following recommendations are made in light of the comments above.

Maintenance of Existing Roads

Mowing: Mowing in the right-of-way along Cty. Rd. (between) should be done as early as possible in the season. It should be timed to occur at midday rather than in early morning or late afternoon. Typically, the first mowing occurs in late May. Mowing should be avoided throughout the month of June. At present, no mowing is done by the township along Rd., but the same restrictions should apply if it is done in the future.

Grading: Grading along Rd and other local township roads should be avoided during the nesting and hatching time periods delineated above. Grading could be done in mid July when turtle activity on the roads is minimal.

Signage: The present locations of the three "rare turtle" signs should be reevaluated. The north sign along Cty. Rd. should be repositioned at the intersection because turtles cross the road from that point south along Cty. Rd. . Additional signs might be located in north and south directions along Cty. Rd. closer to the . intersection. The "rare" designation on the signs should be deleted and the word "caution" used to replace it. The "rare" designation is a misnomer, given the abundance of the turtles locally, and some visitors might misread the signs to indicate that the turtles are valuable and hence "collectable."

Signs should be displayed from the last week in May through the month of June, and then removed until the next nesting season. A secure system should be used to prevent sign theft. TNC staff in residence at Weaver Dunes should be responsible for turtle signage. This would ensure that signs are put up and taken down at the appropriate times, as well as increase surveillance to deter sign disappearance.

Speed limits: At present, typical driving speed along Cty. Rd. is 45-55 mph and along Rd, 30-50 mph. If there were evidence of an increase in traffic-related turtle mortality on roads, it might be feasible to post slower speed limits on specific section only, and only during the nesting season.

Improvements to Existing Roads

Resurfacing: All road work should be timed and sited to minimize possible effects on turtles, especially any work along the sections of Cty. Rd. , between Township Rds. . The TNC should be consulted about any planned roadwork well in advance, so accommodation can be made for turtles.

Paving: The township roads in the area, particularly Rd, should remain gravel, and not be paved. Paving would likely increase speeds and possibly lead to increased local, as well as visitor traffic. These changes, in turn, would likely increase road injury/mortality of turtles.

Rebuilding: Any major road work, especially along the section noted above, should be designed, scheduled, and executed in close consultation with TNC staff and associates to ensure minimal impact on the Blanding turtle population. The several "dips" along the designated sections ( ) should be elevated and/or leveled, if possible in conjunction with scheduled resurfacing, to increase sighting distance, and to reduce the likelihood of road injury/mortality of turtles.

New roads/increased traffic: Proposals to build new roads anywhere in the Weaver Dunes area (Figures 1 and 7) should be reviewed for potentially detrimental effects on turtles. Likewise, any increases in traffic on existing roads may have adverse effects, and the effects on turtles should be evaluated before plans are approved.

Culverts/Underpasses for Turtles

Justification: At present, road mortality of adult Blandings turtles is judged to be minimal, and not likely to have appreciable effects on the turtle population. Nevertheless, suggestions are included here should the road risk situation change.

Location: The most likely placement for a culvert/underpass is the low "dip" in Cty. Rd. , just north of the . intersection (Figures 8-15). This location is directly east of the mid-point in the drift fence, in which more than 500 were collected during nesting in 2000. The land on either side of the right-of-way is owned by TNC.

Design: The culvert experiments described in this report indicated that nesting Blandings turtles will move through road-width lengths of large diameter (36-48") metal culvert. Thus, an underpass beneath the road might be a possible design solution.

Placement: Considerable landscaping would be required to position an underpass for turtle movements under the road. Extending the marsh eastward to join the underpass route, and/or possibly redirecting a "finger" of the marsh across the roadway through a culvert/underpass would be the most effective, "turtle friendly" solution. If properly aligned, the underpass would redirect nesting females to

emerge from the marsh on the east side of the road, having crossed the road through the underpass by simply swimming to the "edge" of the marsh.

Land Use/Development

Significant changes in land use and/or major development of existing facilities would likely lead to changes in roads and traffic patterns in the Weaver Dunes area. Such changes, in turn, may adversely affect the turtle population. Alternatively, there may be opportunities to augment existing corridors and connections between upland and wetland habitats in the area, and strategies should be developed for prioritizing such opportunities in light of the long-term conservation of this turtle population.

Main Movement Corridor

Habitat management: Although the major focus of this report has been on roads, the entire movement corridor should be properly managed according to these guidelines. In particular, the information about the critical times and locations of turtle movements in upland habitats should play a central role in habitat management. Routine as well as more extensive management initiatives, e.g., restoration projects, should be justified, designed, and carried out with reference to the potential impact of these activities on the resident turtle population. For example, prescribed burns within the movement corridor would likely have very different effects on turtles in August-September (when hatchlings emerge and move to wetlands by the the hundreds) in contrast to March-April (when few turtles move overland). At present, much of the uplands in the major movement corridor (identified in this report) is managed by the TNC and MnDNR (Lake McCarthy WMA). Additional initiatives to involve local landowners in beneficial land management strategies may significantly enhance the existing corridor habitats, and may be an attractive alternative to acquisition.

Interpretive activities: There is no question that interpretive activities centered on the turtles this year and last year by TNC staff at Weaver Dunes have been beneficial to the overall goals and objectives of TNC. In the same way in which local habitat management strategies should accommodate turtle movements and utilization of uplands, interpretive programs should be designed to highlight the unique features of the Weaver Dunes turtles while minimizing any negative disturbances. In particular, there should be careful consideration of how visitorship is likely to impact overall human activity in the main movement corridor. For example, increased vehicle traffic on Cty. Rd. , if only during the nesting period, would likely result in increased road injury/mortality for nesting turtles. Siting of driveways, turnarounds, and parking areas are also likely to have predictably negative effects on turtles, if located within the main movement corridor.