

FIRST YEAR REPORT: Assessment of the Current Distribution and
Abundance of the Wood Turtle (Clemmys
insculpta) in Minnesota and along the St.
Croix National Scenic Waterway in Wisconsin

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GENERAL INTRODUCTION

The following report gives the results of field work on wood turtles (Clemmys insculpta) conducted during 1984. PART ONE emphasizes work in Minnesota and PART TWO is restricted to work along the St. Croix National Scenic Waterway, which lies partly in Wisconsin. Most basic information is included in PART ONE, and little of this is repeated; hence, some information relevant to the St. Croix National Scenic Waterway appears in the general sections of PART ONE.

This report includes several exhibits, many of which are maps of very local areas. To facilitate use of these maps, Fig. 1 is provided as an index map. It shows the locations of USGS Quadrangle maps from which all of the detailed local site maps have been made. Locations of personal finds of wood turtles also have been recorded directly onto original Quadrangle maps and sent to the Nongame Wildlife Program of the Minnesota DNR. Some local regional maps are included to detail some of the broader areas that were searched without yielding wood turtles. These areas include the upper Cloquet River (Fig. 2, includes locations of two wood turtles that were not found personally), the St. Croix National Scenic Waterway near St. Croix Wild River State Park (Fig. 3), the St. Croix National Scenic Waterway, Trego to Danbury, Wisconsin (Fig. 4), and the St. Croix National Scenic Waterway, Hayward to Trego, Wisconsin (Fig. 5).

PART ONE: General Methods and Observations, and the Survey within Minnesota

1. General Field Procedures

The main objective was to locate as many wood turtles as possible during the period allotted to being in the field. Five days of field work were to be (and were) spent along the St. Croix National Scenic Waterway. However, little time was to be spent at any specific locality.

During preparations for the field, I studied maps (mostly USGS 7½ minute Quadrangles) and aerial photographs, and prepared maps for use in the field. Map and tentative site selections were based partly on existing records of wood turtle finds, partly on assigned areas to search, and partly on my background knowledge that wood turtles live along certain types of rivers.

Once in the field, I searched for natural open areas and manmade clearings adjacent to the rivers. Closer focus still was given to bare or partly barren sandy areas within these open areas, and to the vegetation close by. These areas were most likely to yield wood turtles.

I used two approaches to get to riverside lands. The most versatile approach was simply to drive to places where public roads closely approach or cross the rivers and then to walk in. Such activity resulted in numerous local accesses and yielded the most sightings of wood turtles. The other approach was to travel along a river in a canoe and to stop and search open areas spotted along the way. This latter approach may have been less than normally productive because natural open lands along rivers tend to be lowlands, whereas open uplands tend to be manmade,

hence, close to roads. High waters during the field season may have driven wood turtles from the lowlands farther inland, or may have caused the wood turtles to become more clustered than usual in the local uplands. However, this logic would not in itself explain the paucity of wood turtle signs in natural open uplands along the River.

As concerns which dates to search which rivers, weather conditions prevailed over other factors. High water levels and cold, windy, overcast weather render efforts to find wood turtles impractical. Such weather was not a serious problem during the field season. However, high water greatly delayed and otherwise inhibited field work in the central portion of my overall study area, that is, along the rivers of Pine and Chisago Counties, Minnesota, and throughout the St. Croix National Scenic Waterway.

Aside from weather conditions, past experience has shown that female wood turtles along the River become conspicuously active in their nesting activities from 9 to 12 June. Hence, it was logical to search along the River during this period.

At many sites where I was able to find a wood turtle or strong evidence of one, I tried to continue to search for additional specimens so as to get an indication of local abundance. Such effort was either in the form of intensified local searching during the same day as the first find or as a second (even third) visit on later dates. Due to logistics and time constraints, sites that were accessible only by canoe were not revisited.

For documentation, the most important fact was the location of a find, which I usually recorded immediately. Other details were recorded immediately or later during the same day. I usually did not carry a camera out of preference for traveling light and with nothing expensive that would be damaged by being wet.

2. General Field Conditions

River levels throughout most of the study area, including the central and northern parts, were normal to slightly below normal from my arrival on 4 June to 7 June, when heavy rains struck the St. Croix Valley. During this period, conditions were good to excellent for locating wood turtles. From 8 through 11 June waters along the River rose slightly and became muddier. However, conditions here remained fair for looking for wood turtles. From 12 through 14 June tributaries to the

River were unworkable due to high water, and the itself, was noted as seriously flooded on 15 June. Streams of the River drainage were in low flood and the smaller ones were unworkable. Most searching was restricted to road-accessed upland sites along these rivers, except for one unproductive (but enjoyable) canoe trip along the bank-full River. By 23 June, stream water levels throughout the study area had returned to normal (or just above normal on the

). By this time the wood turtle nesting season had ended, wood turtles appear to have dispersed away from their rivers (for summer foraging), and the riparian vegetation had become so rank as to hamper searching efforts. Details of day-to-day weather conditions are as follows:

- 4 June Overcast, cool - spot visits along the River
 Drizzle. cool - spot visits along the River
 Drizzle ends, hazy warm - hike in along Creek
 Overcast - River at
 Light drizzle. dusk - hike in along River
- 5 June Partly cloudy, fairly warm - hike along the River
 Same - hike along the River
- 6 June Sunny, warm - hike along Creek and along the River at
- 7 June Overcast, muggy, then very heavy rain - canoed the St. Croix River
- 8 June Partly cloudy, windy, cool - visit Creek and the River at
- 9 June Warm, overcast. then drizzle - canoed the River
- 10 June Cool, mostly overcast, briefly partly cloudy - canoed the River
- 11 June Light overcast - visit the River
 Same - visit Creeks
- 12 June Drizzle. cool - visit the River at
 Partly cloudy, warm - visit the River
- 13 June Cool, overcast - hike along the River
 Partly cloudy, dusk - visit the River
- 14 June Sunny at first, then overcast & cool, then partly cloudy - visit the River then canoe from
 (Fig. 2)
 Partly cloudy at dusk - hike into the River sand mine
- 15 June Sunny, warm - visit Creek and the River along
- 16 June Overcast. warm - visit the River at

- 22 June Thunderstorm, warm - visit the River
- 23 June Overcast, then partly cloudy - Group and later personal visit to the River
- 24 June Overcast, dusk - visit Creek
- 25 June Sunny and hot - visit the River, hike, make spot checks farther up river, spot checks also at River tributaries
- 26 June Sunny, hot most of day - many spot checks along the River
- 27 June Sunny, warm - canoe the River to
- Warm, evening - several spot visits along the River,
- 28 June Sunny, hot - canoe the River
- 29 June Sunny, warm - canoe the River, then the to

3. Wood Turtles Observed During 1984

Table 1 summarizes personal finds of wood turtles and confirmed wood turtle nests during 1984. The Minnesota observations are described in detail in Section 4; the Wisconsin find is treated in Section 9. In Minnesota, I found wood turtles in four rather widely separated locations.

During 1984, the Nongame Wildlife Program of the Minnesota DNR received three records of wood turtle sightings from state laypersons. One of these records is from the near in Rice County. Another record is from Washington County about a mile inland from the St. Croix River (Fig. 6). The third record is from ~~the~~ near the River (St. Louis County) at a location within three miles of an

TABLE 1. Personal Finds of Wood Turtles and Their Nests During This Survey

River	Males	Females	Juveniles	Nests
Creek	0	3	0	0
River	2	1	0	0
River	3	9	0	1
Creek	0	1	0	0 (+2?)
River	0	4	0	3 (+2?)
River	2	2	2	4 (+36?)
River	0	1	0	0 (+2??)
TOTAL	7	21	2	8 (+42?)

older record along the _____ River (in the DNR files) near the _____ (Fig. 2). In addition, there are unconfirmed reports of wood turtles in the Boundary Waters Canoe Area (from Bill Teft of the USFS Voyager Visitor Center, Ely, as communicated by J.H. Harding), and confirmed reports of wood turtles in Iowa (Butler County, R. K. Loraine, 1984, Program of the 1984 ASIH, HL, SSAR Herpetological Meetings, Oklahoma City) about 40 miles south of the Minnesota border. The last record is relevant to the possible presence of wood turtles in the intermediately located _____ River system, which remains unconfirmed.

Collectively, the records suggest that the wood turtle still is about as widely distributed in Minnesota as in the past and that the full geographic distribution is not yet known. Only the record from Washington County is suspect. The putative sighting is fully a mile (perhaps a little over a mile) from the nearest stream. Further, the Scandia Topographic Quadrangle (Fig. 6) and an aerial photograph (supplied by the USF & WS) show local ponds and small marshes that look suitable for habitation by blanding's turtles (Emydoidea blandingii), one of which might have been mistaken for a wood turtle.

4. Detail of Minnesota Wood Turtle Sites and of their Wood Turtles

Descriptions of nine sites are presented generally in the same chronological order as they were first visited during 1984. Coordinate listings are centered on one or more wood turtles.

4a. _____ Creek

At this site _____ Creek is a moderately small stream (easily wadable in normal water) that flows on a narrow floodplain between high to moderately high uplands. The creek has moderately well developed pool and riffle zones, and snags are present in some places. The creek bed consists mostly of sand and gravel, but modest-sized stones are present in several riffle zones. In the immediate vicinity of where I found wood turtles, there are several tight meanders with gravelly sandbars on their insides. The adjacent floodplain is wooded and often brushy, with only a few grassy clearings. The upland rises are wooded.

On the afternoon of 4 June toward the end of a drizzle but warming up, I found two moderately old, gravid female wood turtles making trial nest holes in a gravelly sandbar on the east side of the creek (SW exposure). This sandbar is visible looking north from _____. Just across the creek from this sandbar, there is a private residence with a small lawn extending to the bank of the creek. A third wood turtle, an old female (gravid) was located in herbaceous vegetation at the top of a sandbar about 200 yds upstream (North) from the two other wood turtles. No other wood turtles were observed during additional searching of over half a mile of stream banks upstream from the finds.

On 11 June I stopped by this site and found it flooded and unworkable. On 24 June I stopped again at this site near dusk. There were several incomplete nest excavations on the sandbar formerly occupied by the two wood turtles. In talking with the resident who lives across the creek, it became evident that

spiny softshell turtles (Trionyx spiniferus), not wood turtles, had made these holes. Two snapping turtle (Chelydra serpentina) nests were located in soft earth on the south side of the bridge.

4b. River

The stream flowing south from is moderate (wadable) with numerous broad meanders, a sandy bed, modest current, and only relatively slight differentiation into pool and riffle zones. The stream has a well-developed floodplain supporting mostly hardwood forest (rather few conifers) but with small open areas associated with oxbows, marshes, and sandbars. Uplands adjoin the floodplain and support mixed coniferous forest in most places but a hayfield/oldfield about 200 yds east of where I found wood turtles. The trees were only about three quarters leafed out during my visit on 5 June and the herbaceous ground cover, particularly fern (Matteuccia?) fiddle heads, was sparse because it was early in the season.

Each of three wood turtles, an old female (gravid), an old male, and a very old male, was in a locally exposed situation within a few yards of the stream, where sunlight could reach the ground. Despite two-to-three more hours of extensive searching downstream from these turtles, and along the near the , I could find no other wood turtles.

4c. River

At this site, the River flows rather slowly, and

the channel meanders broadly between steep, mostly sandy banks. Sandbars are steep-sided and fairly small. The floodplain and adjacent slopes are wooded except for fields located east of Rd (on moderately raised lands on both sides of the river). One of these fields (north side of river) lies in a large meander and is cultivated. Beyond this field lies a grassy oldfield that includes raspberry patches (a source of wood turtle food) and extends to the raw edge of a cutbank of the river, where turtles might nest. Elsewhere, most of the river banks support trees and hazel brush leading down to natural grasses and sedges near the water. Southwest of there is a partly forested, partly barren, west-facing high bank that forms the outside of a meander of the river.

During the afternoon of 5 June, I found three wood turtles at this site. An old male was in a sunlit deer trail in bankside woods and brush between the river and the cultivated field in the meander. A moderately old male was in sedges on low sunlit ground on the inside of a meander. A moderately old female (gravid) crawled out onto Rd as I was leaving the site. This female was next to the aforementioned highbank, which suggests that the latter might be attractive for nesting. I also observed probable wood turtle tracks on a sandbar about a quarter of a mile NE of the nearest observed specimen.

On 5 June, a gravid painted turtle was out in the cultivated field. On 26 June I found two snapping turtle nests near the Rd, but no nests of any kind on the aforementioned highbank.

4d.

River

This site is the roadway and the adjacent grassy embankments leading to the bridge. These features appear new, as if the roadway had been redone during the previous year. Ground cover on the embankments was incomplete and the latter eroded considerably just during the study. The River flows rather slowly in large broad meanders. The banks are sandy and fairly steep. Thickly wooded floodplain extends away from the highway on both sides.

During light rain late in the morning on 12 June, I found three wood turtles on the pavement and one on the embankment close to the road. The specimens included three moderately old (2 living, 1 road-killed) gravid females and one very old gravid female (road-killed). Probably, these turtles were seeking nesting sites and mistakenly perceived the open road and its embankments as suitable habitat. As such, the road serves as a population sink because it attracts wood turtles that subsequently get run over.

On a return visit on 26 June, no wood turtles or wood turtle nests were observed. There were four snapping turtle nests fairly low to midway up the embankments. (Snappers tend to nest from dusk to dawn, particularly during rains. For most of the night, Hwy traffic would be expected to be light, hence less hazardous than during the day.)

4e.

&

This site is a large but shallow, mostly well-drained borrow pit located south of the river and east of the highway. The excavated area extends 100 yds east from the highway and begins 5 to 10 yds from the river and extends back 50 - 100 yds. The bottom of the borrow pit is flat to gently sloping and supports mostly grasses, but also sedges and alders where least well drained and pines and aspens on the slopes. Most important, there is an extensive raspberry patch on a SW facing slope about 80 yds east of the highway (two wood turtles found here) and a partially barren sandy area (with a few l^hickens and low herbs) about 50 - 60 yds east of the highway (~~a wood turtle nest here - eggs subsequently hatched~~). The borrow pit is bordered by forest on the east and a road, then a field on the south. This road leads to scattered residences both east and west of the area. Across Hwy 100 to the west, there is more borrow pit terrain but with numerous scattered pines, hence less open than to the east. During high water, the river has distinct zones of rapids both up and down river from the site, but these zones become much less evident at normal water levels.

The wood turtles, found on 12 June, included an old adult female, a middle-aged adult female, a young adult female, and a very young (barely?) adult male. None of the females were gravid on 12 June. On 26 June I could not locate any wood turtles. There was a snapping turtle nest about 80 yds east of the highway (on the SSW facing edge of the borrow pit), two snapper nests on the embankment of the highway bridge, and a painted turtle nest

in the borrow pit across the highway.

4f. Creek

At this site, Creek is a moderately small stream (easily wadable during flow) running in a steep-sided valley between 250 foot-high bluffs. The creek lacks a floodplain or has only a poorly developed one in some places. Pools and riffles are excellently differentiated and the stream bed varies from small boulders, stones, and gravel in the riffles to silt on the bottoms of the larger pools. Some of the landscape still reflects a flood that occurred 13 - 14 years ago, when waters tore topsoil from the stream banks and adjacent fields and replaced it with boulders, stones, and gravel. Some of the high sandbars that developed at this time retain bare areas that turtles use for nesting. Lower, but still fairly extensive sand and gravel bars subsequently have developed closer to the normal flows. Otherwise, low stream banks support reed canary grass and young willows, whereas high banks tend to be forested or sometimes have oldfield vegetation including raspberry patches. Back from the creek, the valley floor supports a mixture of cultivated fields, oldfields, and woodlots, with each category well represented. Close to the sighting of the wood turtle (Table 1), lands to the east are wooded (riparian hardwood forest with openings associated with oxbow-alternate channel development, and upland hardwood forest on the slopes of the bluff). West of the creek, lies a mix of advanced oldfield and small patches of dense, brushy lowland woods.

On 8 June, I saw (with binoculars) an adult female wood turtle (tail end toward me, moderately well-domed shell as the diagnosis of sex) on a log just above the creek. The log forms part of a small beaver lodge, and locally, the water was over a foot deep and very muddy. The wood turtle dove into the water and disappeared before I could get to it. On 6 June, I had found two apparant wood turtle nests about 500 yds downstream from the subsequent sighting. Both nests had been robbed, hence the diagnosis was made as follows: nest cavity too small and the eggshells too few, too thin, and the wrong shape to be those of snapping turtles; eggshells too large to be those of painted turtles; nests made too early in the season and in the wrong place to be those of northern map turtles (Graptemys geographica), a species that could be present in Creek but I have not seen there; eggshells not thickly calcareous as those of spiny softshell turtles. The putative wood turtle nests were on a sandbar that also did contain nests of snapping turtles and spiny softshells. During June 1971, I had observed wood turtle tracks on the fresh sand and gravel left by the momentous flood. On my last visit to Creek, 15 June 1984, I found no additional evidence of wood turtles.

In the same general area as the signs of wood turtle occupancy, spiny softshells are common during June. I saw at least four adult females and found half a dozen nests. Snapping turtles are also common - 5 nests and one near hatchling-sized juvenile. Snappers and softshells may migrate up the River to nest along Creek.

48.

River

To the present author, this site is the longest and most well-known. Over a 16-year period including the springs of 1969, 1970, 1971, 1973, and 1984, I have found wood turtles along a 5½-mile stretch of the River valley extending ENE to E from the mouth of Creek onto the River floodplain. The River floodplain, for the most part, is low and silty. The river normally flows through two channels for much of the distance, and there are additional marshy backwaters and partial oxbows. Much of the floodplain normally is flooded during the early spring and during wet spells in the summer. From the edges of these bottomlands, bluffs rise 300 feet, often steeply. Manmade features include the abandoned roadbed of a single track rail line, US Hwy , and two gravel roads located downstream . (These roads are crossing the valley and a county road running along north side of the valley.) Less than a dozen home or vacation residences presently exist at the bases of the bluffs or within 100 yds of the river. Many years ago, railroading was conspicuous in the valley and a triangular 3-way junction for turning trains around occupied the valley where it opens onto the floodplain of the River (Frank & Jean Chesley, personal communication). This feature persists as overgrown embankments and flooded borrow pits.

Vegetation of the bottomland is a mixture of mediocre

riparian forest (silver maples common with nettles as ground cover) and floodplain grassland (reed canary grass or like morphotypes common). Sagittaria spp. are the most conspicuous plants in the marshes. Formerly, the River coursed more deeply through its floodplain than it does today, and the bottomlands were widely used as hay pastures and occasionally for row cropping. But allegedly, siltation has filled the river channel and raised it such that nowadays the whole floodplain floods easily (Frank & Jean Chesley, personal communication). Most important for wood turtles, there are large sandbars that lie exposed at normal low water. These sandbars include large deposits of fine sand as well as medium-to-coarse gravel. High ground adjacent to the floodplain is mostly forested (upland hardwoods) but includes small oldfields in several places. The bluffs are mostly forested but include small patches of hill prairie and occasional bedrock outcrops.

Waters of the River are silt-laden from early spring through the summer (perhaps all year), hence cloudy. During the summer, waters of the assume a greenish cast from suspended algae.

Over the 16-year period the River has yielded 32 different evidences for wood turtles as follows: 2 females, 1 nest in 1969; 7 females, 1970; 3 females, 1 male, 1971; 11 females, 1973 (deposited at the Carnegie Museum, Pittsburgh, as CM 87441 - CM 87451); 4 females, 3 nests, 1984. Analysis of growth annuli indicates that all but one of the wood turtles taken subsequent to 1969 had to have been living in 1969. The

exception, a young adult female found in 1984, had 14 growth annuli but had not grown recently. Hence, it could have hatched in 1969 and ceased growing in 1983. Given that some of the 32 different evidences do not represent separate wood turtles (e.g., nests found first, females that made them later; females recaptured), still, 22 females and 1 male were living in 1969. Given further, that the sex ratio in populations of western wood turtles is nearly even (Harding and Bloomer, 1979), 44 wood turtles is a conservative low estimate of the population of adults for 1969. Most of the wood turtles taken in 1973 and earlier years were not returned; however, 90 hatchlings were released into the river in 1973. The population in 1984 could be lower than in 1969 (due to the loss of the females and low replacement, and high mortality of hatchlings), but moderately high water hampered the search effort (1984 was closer to 1969 and 1970 than to 1971 and 1973). The yield at one local site () was much as in previous years (1 in 1969; 3-4, 1970; 0, 1971; 2-3, 1973; 2 + a nest, 1984).

The sightings during 1984 came partially while canoeing on 9 June . An adult female (gravid) was found on a mud bank at the mouth of Creek. Small grassy flats and riparian forest were close by. Across the River and about 200 yds downstream, there was a large sandbar containing one confirmed wood turtle nest (eggs subsequently hatched) and two probable nests (eggs destroyed by predators). The robbed nests appeared to be those of wood turtles on the basis of the criteria given in Section 4f,

the fact that northern map turtles (the only local species whose nests and eggs look like those of wood turtles) have never been seen to nest on sandbars of the River, and the close likeness to the intact nest.

A second intact nest (eggs subsequently hatched) was located on another sandbar about $1\frac{1}{2}$ miles down river from the preceeding one. Here and for the next mile or two, there were several sandbars in tight meanders, where the river changes direction quickly and the current is relatively swift. A second adult female wood turtle (gravid) was found crawling on one of the last of these sandbars. The sandbars normally have sand at their highest levels but gravel lower down. The sandbars change into grassy flats, often muddy ones, as one moves away from the river. Two snapping turtle nests and the tracks of spiny softshell turtles were also present on the sandbars.

After canoeing (9 June), I visited (a raw sand and gravel bank that rises from the river to an oldfield, Fig. 12) and found a gravid wood turtle atop her partly dug nest. Two snapping turtles were also present laying their eggs in this bank. About 2 PM, CDT, 11 June, I found another wood turtle (gravid) resting in the grass at the top of this bank. On 15 June I found a wood turtle nest (eggs subsequently hatched) in the bank; the female of 11 June could have made this nest. I found no additional evidence of wood turtles after 15 June.

Over the years the accumulated records of dates of wood turtle nesting are as follows: a little before 12 June - 15 June 1969, 9 - 10 June 1970, 12 - 13 June 1971, 9 - 10 June 1973 (entire

period), before 9 June (possibly pre-6 June as on Creek?)
 - 9 June - a little after 11 June 1984.

Other species of turtles that appeared numerous in the
 River valley in 1984, especially near
 include snapping turtles, northern map turtles, painted
 turtles, and spiny softshell turtles.

4h. River &

This site is located a mile SW of the larger site at the
 River (Fig. 13) and may be an extension of
 the latter from the perspective of wood turtle movements and
 population dynamics. The present site is located just west of
 the bridge on the River, where the river is
 gravelly and includes two small, low, gravelly sandbars that
 are exposed during normal flows. Just north of the river,
 across a narrow, sedgy and brushy floodplain, there is a well-
 drained borrow pit cutting into the uplands. Its floor is
 sandy and nearly completely barren. Between the borrow pit
 and the highway, there is a narrow stand of pine trees and a
 few aspens. The highway has a grassy embankment leading to
 the bridge. Just south of the river, there is the embankment
 of an old sandy road bed that terminates at the river.

On 13 June, I found fresh wood turtle tracks on the Hwy
 embankment, and here also, pieces of shell from a wood turtle
 killed at least a year ago. Early on 14 June, I found a juvenile
 wood turtle (6 growth annuli) in the pine stand between the
 highway and the borrow pit. The latter site was found to contain
 a fresh wood turtle nest (eggs subsequently hatched). A very

old female wood turtle (gravid) was located in an area of brush and sedges adjacent to the river. The river was bank full at this time. On 25 June, the water level had dropped and the two sandbars had become exposed. In one of them, I found a fresh wood turtle nest (eggs subsequently hatched). No additional wood turtle nests were present in the borrow pit or along the highway embankment. A snapping turtle nest was present in the old road bed south of the river.

4i. River

This site provided evidence of the largest concentration of wood turtles observed during the study. The site is part of an old sand and gravel mining operation that appears to have been abandoned for 6 - 10 years. The sand mine lies NW of the River and extends to the river's edge where I encountered the wood turtles and signs of their activities. For the most part, the sand mine is surrounded by upland mixed coniferous/ hardwood forest with jackpines quite common. The mine itself consists of various sandy mounds, ridges, and banks with ditches and ponds inbetween. The portion of the mine used by the wood turtles includes a series of ridges and ravines that form topography similar to that of 40⁺-year-old coal strip mine topography in the Illinois Coal Basin (Fig. 14a). The bottoms of the ravines are ponded with standing water or just damp with marsh vegetation - sedges, cattails, alders. The ridges in the NE part of the site are partly barren with coarse sand and partly vegetated with alders, aspens, silver maples, and low ground cover including raspberry patches. The

ridges in the SW portion of the site used by the wood turtles appear older and are nearly completely vegetated, especially with large maples, alders, and aspens but also with a few willows and diverse low brush and herbaceous cover including raspberries and strawberries (i.e., wood turtle food plants).

I first visited this site at dusk on 14 June and found 31 recently made wood turtle nests (and hundreds of tracks) on the barren ridges. Topography where the nests occurred varies from the River inland as follows: first, a narrow ridge with original vegetation between the river and the mined land (Fig. 14b), then three 50 - 60-yd-wide ponds on mined land parallel to the river (one pond shown in Fig. 14c), then a series of three parallel ridges (Figs. 14c & 14d), and lastly a raised barren flat leading to a grove of pines. Most of the nests were on the first and second ridges across the ponds from the River. Only a few nests were on the ridge next to the river or ~~on~~ the ridge farthest inland. All but two of the nests had been destroyed by predators (eggshells strewn about), but still were unmistakably those of wood turtles. (Snapping and painted turtles are the only other local turtles.) One of the two intact nests was very fresh with a young adult female wood turtle still sitting on it. Eggs from both nests subsequently yielded wood turtles. Late morning on 25 June, I revisited the site and found five more wood turtle nests, ^{all ?} old robbed. I also found three wood turtles (an old male, a young adult male, and a juvenile with 7 growth annuli) in the extensively vegetated ridge and ravine area in the SW portion of the site. ~~All of~~ All of these turtles were located within 25 yds of the

River. One turtle had leeches on it suggesting that the turtle had been spending much of its time in water.

Snapping turtles appear to be common in and about the sand mine. I found three intact and several robbed nests. I also saw a few painted turtles in ponds at the sand mine.

5. Wood Turtle Populations and Habitat Considerations

The following discussion is intended to provide background from which one can turn to consideration of habitat preservation and management. The material is partly speculative, but the reasons why are indicated and the "soft" facts definitely are better than no facts.

No one really knows how many wood turtles constitute either large populations or minimally sustainable ones. Large local concentrations in the eastern United States appear to be close to 500 individuals (judging from Harding and Bloomer, 1979). The largest shipment to animal dealers that I have heard mentioned was one of about 100 females collected where railroad tracks run along a river in Pennsylvania in 1971 (L. A. Lantz, personal communication). In the Western Great Lakes Region, there is no evidence that local populations ever reach these sizes (either absolutely or to permit moderately easy collecting of 100 females). In personal experience in northern Michigan and Wisconsin during 1969 - 1971, I found that a half a day of intensive searching of the banks along 1 - 1½ miles of river yields 4 - 10 wood turtles when conditions for searching are good. Comparable search effort under comparable conditions seems to yield the same ^{to} ~~of~~ slightly fewer individuals in NE Minnesota, both along small creeks (Cr.,)

and rivers (). With the assumption of a 1:1 sex ratio, there appears to have been at least 6 adult wood turtles per river mile along the River in 1969. This estimate compares well with others of 5 - 13/ mile for one river in northern Michigan (derived from Harding and Bloomer, 1979; Harding, personal communication) and 6 - 10 per mile for another river (personal observations).

Dissections of dead female wood turtles show conclusively that these specimens would never lay more than one clutch of eggs per female per season along the River (personal observations) or in eastern Canada (Powell, 1967). Hence, each wood turtle nest with eggs (intact or robbed) indicates the presence of a separate adult. Accordingly, the 36 nests found at the River may be used as evidence for the largest known nesting aggregation in the Western Great Lakes Region. Fifteen to 20 nesting wood turtles were observed at a local site in County, Wisconsin (Vogt, 1981) and similarly about 25 females in County, Wisconsin (Vogt, personal communication).

Wood Turtle Habitat: The core of the wood turtle's habitat is a river, typically, a swiftly to moderately swiftly flowing one. Wood turtle rivers normally have fairly narrow floodplains with distinct rises to uplands close by. Much of the floodplain and most of the uplands are wooded. Wood turtles appear to use their space and time in alternation between the river and the floodplain and very likely the uplands as well.

The river serves as a winter retreat and as a place where

males and females find each other.

Wood turtles obtain most if not practically all of their nutrition on land. Captives usually refuse to eat fish and free-living specimens are not known to eat bivalve molluscs. Local substrates in some wood turtle rivers support few snails, insects, or plants. These rivers may have backwaters or oxbows with such life but wood turtles seldom enter them. That reaches of rivers occupied by wood turtles tend to have poor fish populations (e.g., Thorn and Sogla, 1977 on the River; Peterson, 1979 on the River) is another indication that aquatic forage may be poor. Terrestrial foods of a wide variety, including small invertebrates, raspberries and strawberries, and succulent leaves are common in wood turtle diets (Harding and Bloomer, 1979; personal observations).

With the onset of summer, wood turtles appear to disperse away from their rivers, but just how far remains speculative. The recent record from D. P. Petry suggests movement of at least 1000 feet away from the (Fig. 2). Also, there appear to be movements of similar distance away from the River (secondhand information from the Oxbow Nature Center by way of Mike Pappas). In western Pennsylvania, wood turtles supposedly wander half way up Appalachian hillsides (M. G. Netting, personal communication). Wood turtles of the Western Great Lakes Region may be more aquatic than their eastern counterparts (Harding and Bloomer, 1979; Vogt, 1981), but this premise needs further substantiation. In both the west (Harding and Bloomer, 1979) and the east (Carroll and Ehrenfeld,

1978), wood turtles have a strong perception of space that enables them to "home" after being displaced one to several miles.

Even though it is most productive to search for wood turtles in open areas, such areas nearly always are "islands" in extensively forested regions. Wood turtles seem never to wander far out in large open areas, nor to spend long periods at local spots in small open areas. The species seems to require the shade and/or the dampness that forests provide. It is likely that droughts restrict overland movements. Such a restriction would explain why fisheries crews working along the River were able to see many wood turtles during the dry summers of 1976 and 1977 (Peterson, 1979).

Late in the summer, wood turtles begin moving back to their rivers (Harding and Bloomer, 1979).

6. Habitat Preservation

From the foregoing information on wood turtle habitat, it is premature to define more than very approximate boundaries to known wood turtle habitats. It is reasonable to speculate that wood turtle habitat extends no farther than 400 yds inland from the home river and no farther than 100 yds into any large field, mesic savanna, or xeric woodland. I doubt that wood turtles ever move higher than 50 vertical feet up the sides of bluffs bordering on the valley of the River or that of Creek. However, knowledge of the mid-summer movements of wood turtles remains the weakest link in the natural history of the species. Since wood turtles that have moved away from their rivers are very

difficult to locate systematically, research involving radio-tracking would be required to define the inland limits of their home ranges.

Tentatively, outer boundaries can be assigned to some of the known wood turtle areas. A suitable refuge along the River would extend from the western edge of Section 35 (N of Creek) ENE to Hwy 61 and include the valley bottom from bluff to bluff (Fig. 11).

Wood turtles in the River valley would be reasonably safe under existing conditions; that is, with curtailment of any further residential development within 1000 feet of the river (basically, the floodplain plus 500 feet of adjacent uplands) along the reach extending from Co. Hwy to the mouth of the River. Hwy remains a serious hazard within this area.

Along the River (Fig. 13), preservation of current conditions in part of the sand mine () and perhaps one river mile (and adjacent valley) above and below the sand mine (about $1\frac{1}{2}$ sections in total area) should provide substantial protection for the local population. The most significant unknown, here, is the distance of seasonal movements by wood turtles traveling along the river. Such movements could be a mile or so (cf. Harding and Bloomer, 1979), and again, radio-tracking would be the most efficient means of confirmation. The 1984 year, with its high water, may not have been an ideal year for wood turtles, as well as for looking for them. It is interesting that a good wood turtle production period, as indicated by the ages of the two 6-7-year-old juveniles found

in the region, corresponds to the 1976 - 1977 drought period on the River (cf. Peterson, 1979). This period would have been the best one to survey for ideal nesting habitat.

7. Overall Management Strategies

This subject will be treated only briefly in this report.

Habitat preservation and people management are, of course, the two major approaches to overall management. Both approaches probably will need development in the long run. As concerns preservation, we seem to be still in the early stages of learning that the wood turtle is fairly widely distributed in eastern Minnesota, even if nowhere in very large numbers. New information on the wood turtle in the sub-boreal forest N and NE of Duluth is coming at a quickening pace. This is a major range extension, perhaps the largest for any turtle in the United States in recent years. Hence, we still may be looking for the best populations to preserve, although the one at the sand mine does appear to be a good one.

In selecting lands to preserve, one must be careful to understand the role of the wood turtle in the selection process. One must understand whether land is being selected in its own right with the wood turtle as just one of several very desirable faunal elements, or if the literal intention is to enhance very significantly the potential for the long range survival of the wood turtle, itself. Either way the wood turtle may gain at least slightly. However, in our bureaucratic way of doing things, the drive to protect wood turtle habitat could fizzle with people having spent too much time and money protecting the wrong land. The public could feel tricked if the wood

turtle is "overmarketed" as rare and oversold as protected, and later on, new large populations, ones on land that should have been protected in the first place, turn up after the "preserving" has been done.

As for people management, commercial collectors and herpetologists will be quickest to understand a law against taking. However, the current impact of these groups on Minnesota wood turtles remains unknown. Education of more casually interested outdoor recreationists (who may take wood turtles casually, who use them for target practice, who may feel that wood turtles harm fishing, who trample on wood turtle sandbars) could do more to reduce the direct impact of people on wood turtles. Since both canoeists and wood turtles tend to seek out sandy areas along rivers, an increase in the volume of canoeing is more likely to harm than to benefit wood turtles. Further, revegetation of degraded lands along scenic rivers will only worsen the conflict between wood turtles and canoeists. Wood turtles will become increasingly attracted to the few areas that remain disturbed and open to service canoeists; and even may become attracted to new service areas as they open up.

It is obvious that motorized land vehicles (except for trains) are serious threats to wood turtles locally. The intersection of Co. Hwy and the River probably functions as a population sink, that is, gravid female wood turtles are attracted to it and then get killed. Depending on how far wood turtles travel to reach dangerous roads (hence, the size of unsafe borderlands), it may be necessary to consider constructing

low, turtle-proof fences near the most hazardous intersections.

8. Recommendations for Further Study in Minnesota

- A) Start field work just after mid-May. Long spells of cold, overcast weather can seriously affect the efficiency of field work; however, the intermittent warm, sunny days can give excellent results because the vegetation is low and the wood turtles are near their rivers.
- B) Survey the _____ and/or the _____ Rivers for range extensions that are likely to include large populations.
- C) Conduct spot shecks at non-navigable creeks because these areas represent ultimate refuges for wood turtles in the event of greatly increased riverine recreation.
- D) Survey along the _____ River system as time permits and as weather elsewhere in Minnesota dictates.
- E) Continue work in the _____ River valley and at the _____ River sand mine with the prospect of setting up wood turtle preserves at these locations. This work should include evaluation of a radiotracking study to assess the tradeoff between natural and economically feasible preserve boundaries, as necessary.

PART TWO: Work within the St. Croix National Scenic Waterway

9. Detail of Field Observations

High water in the Waterway greatly affected the timing of field work. I was able to canoe one stretch of the river before the waters began to rise. The remainder of my canoeing had to be delayed until after the nesting season (prime time for finding turtles) had passed, and even then, lower water levels would have enhanced searching. The following text details search activities by dates.

4 June - along the River on foot. I hiked a combined distance of about a mile near Crossing, near , and around (Fig. 4). Weather was overcast and cool, but not too cool for turtle activity. Habitat near looked suitable for wood turtle foraging and nesting, but only painted turtles (Chrysemys picta) were seen.

7 June - canoed the River from (Fig. 3). The weather began warm and overcast. Then, with two-thirds of the distance covered, heavy rains began and at least 4" fell before the end of the trip. Several low to moderately high sandbars were present along this stretch. All were separated from the inland shore by small-to-medium-sized channels. Wood turtles seldom use such sandbars and no specimens or signs of them were seen. There were also a few raw cutbanks without evidence of wood turtles.

Searches of field margins and grassy flats near the river did not yield wood turtles. The only turtles seen were spiny softshells (Trionyx spiniferus), including two females on sandbars nesting just in advance of the storm. Tracks of this species were common.

27 June - canoed the River from (Fig. 4). The weather was sunny, humid and hot. The channels were a little below bank full. Basking northern map turtles (Graptemys geographica) and spiny softshells were common, and a snapping turtle (Chelydra serpentina) nest was located on bare ground created by campers on an island.

27 June, evening - along the River on foot. During the evening I visited several river access points between (Fig. 5). Close to sunset, a road-killed and somewhat fragmented old adult female wood turtle was found in a driveway along close to its bridge over the river (Fig. 15). The flows swiftly here - a long rapids above the bridge and riffles and swirls down river. There was a small sandbar near the bridge with old evidences of turtle nesting. An oldfield borders the field on the same side as the road kill. A low wooded hillside extends to the river from the other side. Several residences are located close by, and the topographic map (but not the aerial photograph) indicates a gravel pit that was not seen during my visit.

Other sites visited on foot (Fig. 5) lacked signs of wood turtles.

28 June - canoed the River from to (Fig. 4). The weather was sunny and hot. Throughout this stretch the flows swiftly but without large boulder bed rapids. The water level was average - neither high nor low. The shoreline includes several sandy cutbank high banks and floodplain flats covered with grasses, sedges, and low bushes. Both features are suitable wood turtle habitat, but no specimens were seen, either from the canoe or during frequent stops to search on foot. Most of the sand banks had been trampled by humans, some banks so severely that signs of prior use by turtles would have been obliterated. Below , I began to find some sand banks with little human disturbance; however, a very large one at river mile was extensively disturbed. A good sand bank with several turtle nests is located just across from the mouth of Creek (at river mile).

Turtles seen between and the mouth of Creek included snapping turtles, painted turtles, and spiny softshells. Robbed nests of the spiny softshell were the most commonly observed turtle nests --- e.g., near State Hwy bridge, at , and along the large sand bank at river mile . Painted turtle nests were in the sand bank at ; otherwise, emydid nests were very few. Two robbed nests (but with eggshells strewn about) in the sand bank across from the mouth of Creek could have been wood turtle nests, but the state of deterioration of the eggshells rendered

them indistinguishable from those of northern map turtles. However, no map turtles were seen until river mile (down river from).

A blanding's turtle (Emydoidea blandingii), an adult male was seen on a log close to river mile , a little above the mouth of the River. No turtles were seen during about a half a mile of Canoeing up the River, which was bank full and deeply stained.

29 June - canoed the the River from Bridge to its mouth and then the River to (Fig. 4). The weather was sunny and warm. The large sand bars that show up on topographic quadrangles were almost entirely submerged and sand banks were absent along the River. The first sightings of northern map turtles, first an adult female, then both sexes, occurred at about river mile 154.3, soon after starting out. There were numerous sightings from here on. Snappers, painteds, and spiny softshells continued to be seen regularly.

10. Discussion of Field Observations

Weather had an adverse affect on field observations by delaying most of the work until after the nesting season. Rains also may have prompted wood turtles to wander inland away from their rivers. Such an effect would render searching along the River especially difficult because so many small side channels are involved. Between , where the single wood turtle was found, my observations were too few to form a conclusion as to the size of the local population.

The portion of the _____ that I did canoe, however, showed very little evidence of wood turtles. I had expected to find more, at least in the form of repeated finds of robbed nests along sand banks. Yet despite frequent findings of robbed nests of snapping turtles and spiny softshells, which confirm the presence of predators, perhaps three nests had even a chance of being wood turtle nests. Thus, the wood turtle appears to be uncommon along the _____ River, although suitable habitat for them is present.

11. General Discussion and Recommendations

Although I failed to locate any wood turtles along the _____ River, records of other workers indicate reliably that the species is present (e.g., Vogt, 1981), even if in very low numbers. However, as mentioned earlier (Section 3), I doubt that the new layperson's record of a putative wood turtle in _____ Washington County, MN does, in fact, represent a wood turtle. The wood turtles along _____ Creek are located just over two miles north of the _____ River.

In absence of actually finding wood turtles, one can still plan development cautiously. The first assumption is that gravid female wood turtles will be attracted to areas that are cleared for camp or launch sites. The river bank access to such areas is always barren, which makes them attractive for nesting. However, the attractiveness can be minimized. Choice sand banks for nesting have southerly or westerly exposures.

*Plan accesses to campsites so that they have N or NE exposures.

Further, to minimize the attractiveness of a particular

existing sand bank as a rest stop put in a rest stop/campsite just in advance of the sand bank, say 200 yds, and on the opposite side of the river.

If one assumes that wood turtles cannot be avoided, make the public more aware that wood turtles may be encountered but may not be molested. At major access points to the Waterway, include signs that warn against molesting endangered species. Selectively illustrate wood turtles (and a couple of the other most easily molested species), because even the most casually interested person may have the opportunity to step on one, or on its nest.

12. Continuation of this Survey

Now that I am a little more familiar with wood turtles in Minnesota and am aware of dates when other people have found them, my survey should benefit from starting earlier in the season, that is, during May. Wood turtles are certain to be located close to their rivers, and the bankside vegetation will be low rendering searching easier than during the summer. The risk is spells of cold spring weather that keep wood turtles in their rivers and out of sight. Also, high waters from snow melt and early spring rains may still be present. However, a few good days for searching may offset the disadvantages. The search effort should be focussed farther up the and Rivers that the portions canoed during the past year. The area where the single wood turtle was found should be examined more closely.

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