State Wildlife Grant Program
Final Report 2018

Smooth Green Snake Project

The purpose of this project was to expand our knowledge of the geographic locations of current Opheodrys vernalis populations on McHenry County Conservation District sites, determine the habitats that they seem to prefer, and to initiate an on-site head-starting program.

McHenry County Conservation District
Cindi Jablonski, Wildlife Ecologist

STATE OF ILLINOIS

DEPARTMENT OF NATURAL RESOURCES

PROJECT FINAL REPORT

Project Information:

Project Title: Smooth Green Snake Project

Project Number: T- 109- R- 1

Federal Program: SWG

Reporting Entity:

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Date Report Prepared: August 16, 2018

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Introduction

Historically, smooth green snakes (*Opheodrys vernalis*) were once a common species in the Illinois landscape. However, urban development, agricultural practices, pesticides, and habitat fragmentation have dramatically reduced their numbers. The Illinois Wildlife Action Plan has identified the smooth green snakes as a Species in Greatest Need of Conservation for Illinois. The criterion for the designation includes the small population size, the significant decline from historic levels, and that the species status is poorly understood from available information.

Currently, the distribution and geographic location of individual populations of *O. vernalis* is incomplete and sporadic. It is believed that their populations may be restricted to isolated, graminoid-dominated remnants. Although conservation efforts in Illinois have restored available habitat, smooth green snakes populations remain low. They have limited potential for natural recolonization due to habitat fragmentation and the small dispersal range of smooth green snakes, which may be less than 40 meters (Sacerdote-Velat, 2014).

The purpose of this project was to survey District sites to identify and map current populations, look at vegetation and habitat types where they were found and investigate land-use history to see if remnant populations are dispersing into reconstructed natural areas. Geographic information will be incorporated into future District site management plans and brought forth into any future discussions of site planning and development.

The District also wanted to establish a head-starting program at an on-site location, specifically their Wildlife Resource Center. Head-starting is a conservation technique that improves the survival rate of a species by accelerating growth rate and increasing body size of captive born young. Augmenting existing populations and reintroducing populations by head-starting young may increase and expand populations.

Methods

Field Surveys:

Fourteen sites with 250 cover boards in 50 transects (5 cover boards in each transect) were surveyed in 2015, the first field season of the grant. Each cover board had a discrete Id (image 1). Cover board placement was modified in 2016-2017 based on previous survey success and information such as incidental observations by staff that indicated potential smooth green snake populations. At a minimum, the data collected during cover board surveys included the snake species and number observed; if the sex was determined, it was recorded.

Captured *O. vernalis* were measured for length and mass (image 2). Whenever possible, all *O. vernalis*, including head-started juveniles, were individually marked with ventral scale cautery to monitor recapture rates and growth and survival of released head-started young. The ventral marking consisted of three small cautery marks representing a single 3-digit number (image 3). Diagram 1 shows an example of how #463 would be marked.

Image 1. Cover board #22

Image 2. Taking morphological data

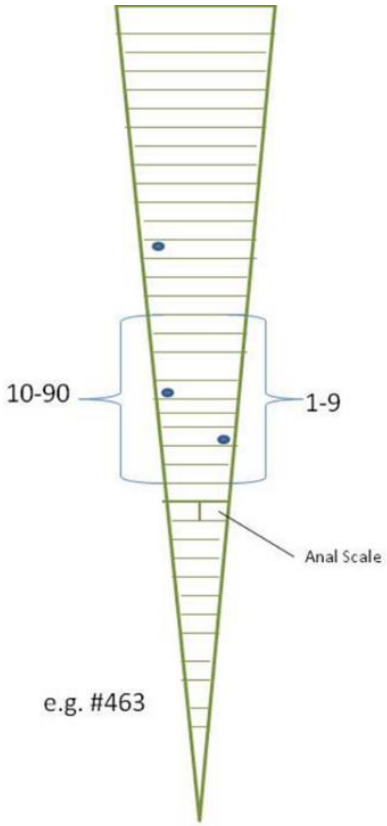

Diagram 1. Ventral cautery marking system

Image 3. Ventral Cautery marks.

All survey sites and transect locations were mapped in Arc GIS and the existing natural communities were documented. Transects that had *O. vernalis* captures had additional data recorded including a basic plant species list, site land use history, whether it is a remnant, old field, reconstructed natural community or other. Geographic locations of *O. vernalis* observed under cover boards or by visual observation were recorded at the time of discovery and mapped in Arc GIS.

Head Starting:

Captured gravid females were brought to the District's Wildlife Resource Center to lay their eggs. The females were placed in 15-gallon aquariums that contained at least three inches of sphagnum moss, some live plants, and a variety of branches and loose bark. Cages were misted daily with half of the cage kept moister than the other to allow the snake a choice of humidity levels. At the conclusion of oviposition, founder dams were returned to the capture location and their eggs were placed into containers filled with vermiculite (wetted at a 1:1 ratio) in a Hova-bator incubator. Eggs were incubated at 80F°.

Hatchlings were housed in 15 gallon glass aquariums, each with a secure, metal screened lid. In the beginning, an entire clutch went into one aquarium, housed together for a period. As they developed and grew, individuals were separated into different aquariums – smaller individuals in one tank and larger in another. Each tank had three inches of sphagnum moss as substrate, with a dry side and wet side, and pieces of bark, sticks, and live plants were placed in the tank to provide multiple habitat options. Tanks were misted daily and the substrate changed weekly when the tanks were cleaned and disinfected. Artificial lighting provided both heat and UV radiation. Heat strips were placed under the tanks to provide warmth. Lighting consisted of Sylvania black lights, fluorescent Reptisun 5.0 bulbs, and Eiko Supreme (EXT/SU 12V50W) halogen lights. Lights stayed on for 15 hours/day during the most active months of the year (Jun-Aug) and 11 hours/day from September to the end of December.

The protocol for head-starting young *O. vernalis* was modeled on protocol used at Lincoln Park Zoo with the exception of their brumation strategies. Instead of brumating in artificially cool temperatures from a refrigeration unit, the District's head-started young naturally brumated in a below ground cool environment located within the Wildlife Resource Center. The brumation period was scheduled to last 65-70 days with a week of cooling down and warming up at the start and end of this period. After brumation ended in late March, we began a light cycle of 11 hours/day increasing to 15 hours/day by late May.

Hatchling diet consisted of small (3/16-1/4") crickets and wax worms. Food items were dusted with a calcium supplement six days of the week and a 1:1 vitamin D/calcium supplement one day of the week. In addition, calcium was often added to the water dishes. Wellness assessment was done on a weekly basis.

All head-started young were used to augment local populations, specifically those of the founder dams; none were reintroduced into new areas.

Data Collection:

GPS coordinates were taken at the location of *O. vernalis* captures. For some staff or public sightings, the general location was noted in ArcMap. A GIS shapefile with the geographic locations of each *O. vernalis* observation was created. Locations of populations from all reliable past data was combined with current data to produce a comprehensive occurrence map.

Morphological data from field surveys and the head-starting project was recorded in excel. Recapture rates, if applicable, were also be recorded and mapped.

A general plant list was compiled at the site of each smooth green snake capture including descriptions of structure and composition. Recent management was also be noted.

In areas with confirmed *O. vernalis* observations, the past and current land-use was analyzed using historic aerial photos. Remnant communities versus reconstructed communities were identified and, if the area contained a reconstruction, planting records were consulted to determine the natural community and when reconstruction was initiated. If the occurrence was within a reconstructed natural community, the distance to the nearest remnant natural community was measured using GIS with the assumption that snakes from a remnant population most likely migrated over time from the remnant areas into suitable habitat in reconstructed communities.

Results: Cover Board Surveys

The data in this report includes survey data from 2013 & 2014, before the start of the grant but part of the total project.

Table 1. Cover Boards

Year	Total Number of Cover Boards	Number of Sites with Cover Boards
2013	275	14
2014	225	14
2015	250	18
2016	340	17
2017	280	12

All Snake Species:

Over the course of the project, seven different species of snakes were observed (table two; figure 1). Most snakes were found in remnant natural areas and reconstructed prairie habitat (figure 2). The greatest percentage of observations were in mesic prairie, both remnant and reconstruction (figure 3).

Table 2. Total # of Species Identified

Scientific Name	Common Name	# of occurrences	Percent of total occurrences
Lampropeltis triangulum	milk snake	0	0.0%
Opheodrys vernalis	smooth green snake	84	4.7%
Pantherophis gloydi	Eastern fox snake	69	3.9%
Regina septemvittata	queen snake	2	0.1%
Storeria dekayi	Dekay snake	262	14.6%
Storeria occipitomaculata	red-belly snake	191	10.7%
Thamnophis radix	plains garter	225	12.6%
Thamnophis sirtalis	common garter	959	53.5%
	Total:	**1792**	

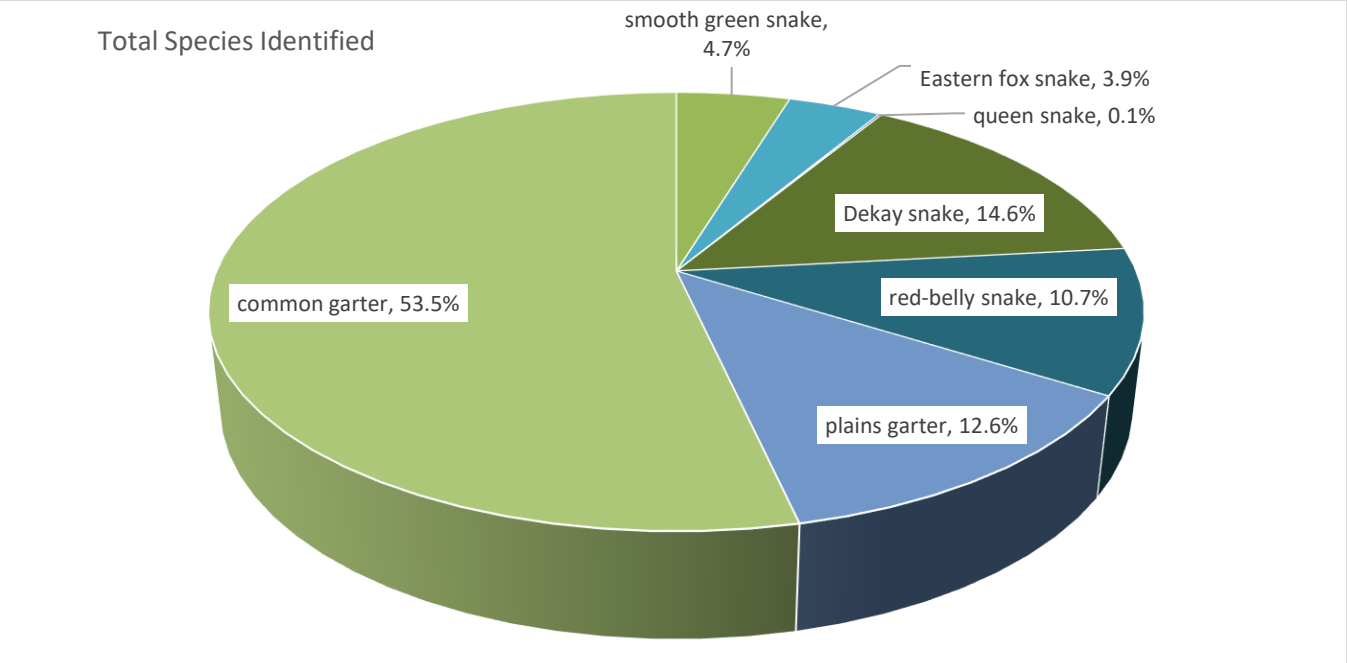

Figure 1. Percentage of all snake species observed.

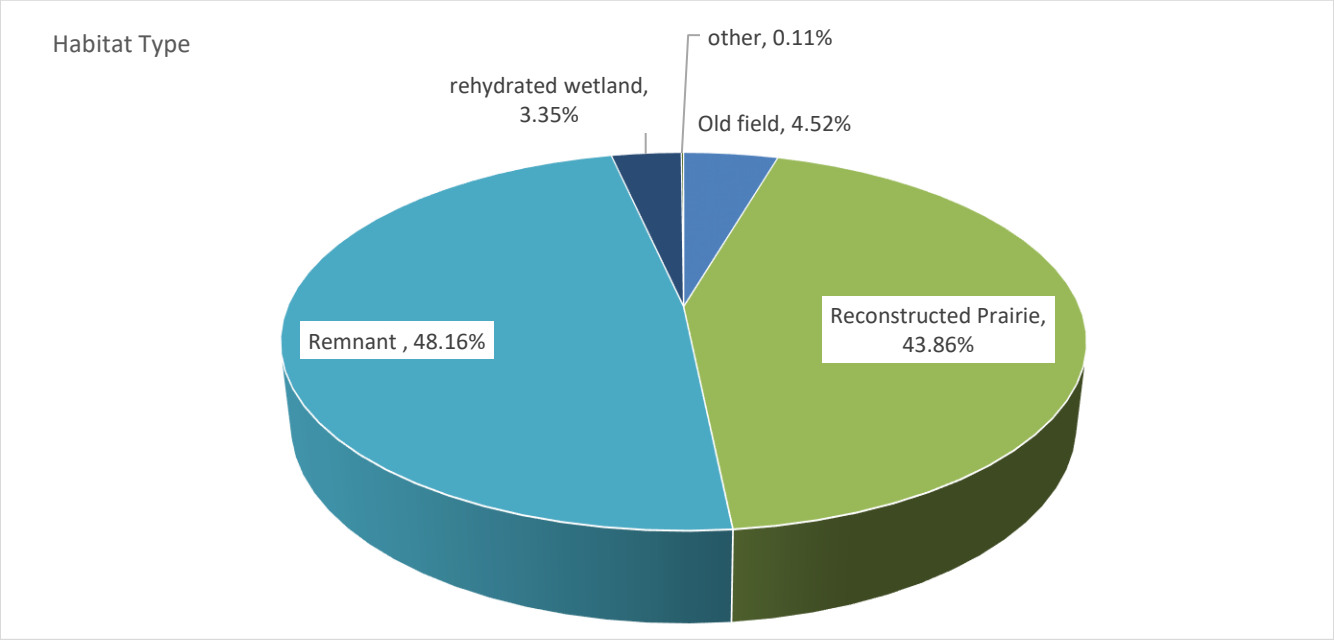

Figure 2. Habitat type and the percentage of snakes observed in each.

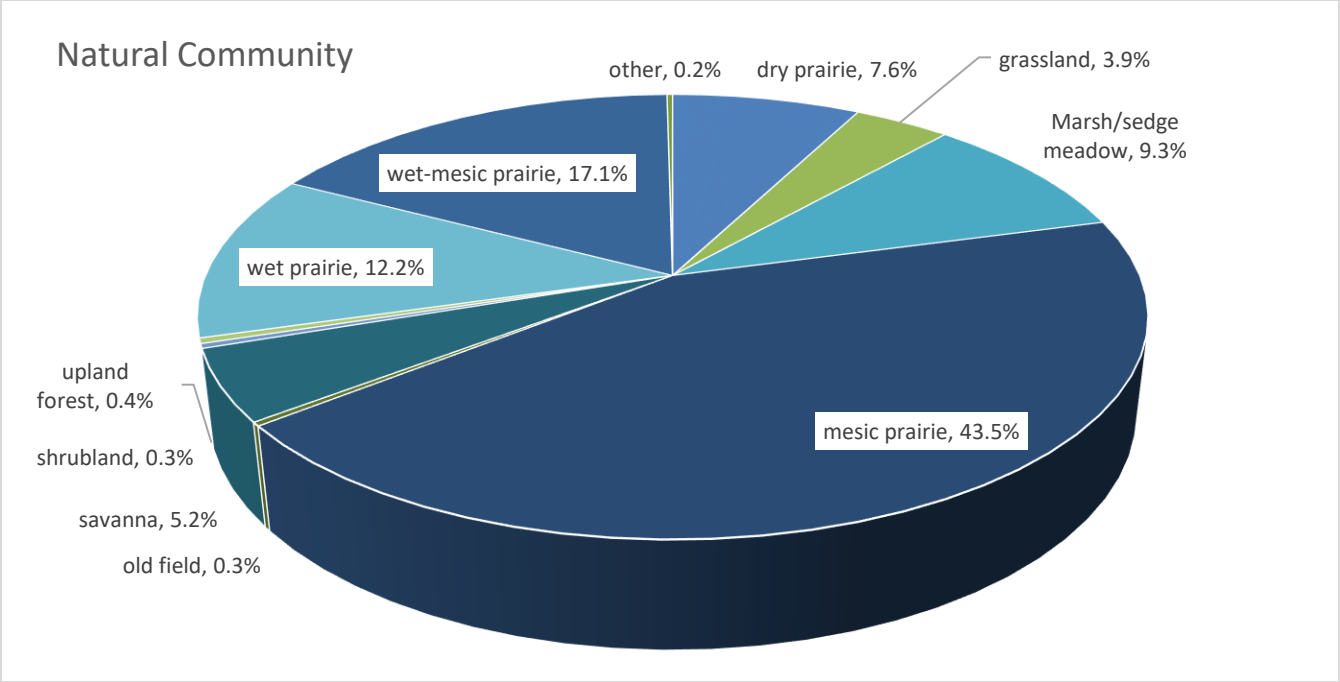

Figure 3. Habitat type and the percentage of snakes observed in each.

Opheodrys vernalis

Habitat Survey Data

O. vernalis comprised 4.67% (n=84) of the total snake observations from 2013-2017. Seventy-five occurrences were new and nine were recaptures. Nine sites during the five year project had *O. vernalis* observations (table 3). While only 40.5% (n=34) of the occurrences were in remnant communities (figure 4), each of the District sites with *O. vernalis* occurrences had at least one remnant community within its boundaries. Almost all occurrences were in some type of prairie or graminoid-dominated community (figure 5).

Table 3. Sites with *O. vernalis*

Site Name	Number found	Percent of total
Alden Sedge Meadow	1	1.19%
Fel-pro	5	5.95%
Glacial Park	40	47.62%
Goose Lake	1	1.19%
Hickory Grove	2	2.38%
Larsen Prairie	2	2.38%
Lake in the Hills Fen	28	33.33%
Pleasant Valley	3	3.57%
Stickney Run	2	2.38%
total:	84	

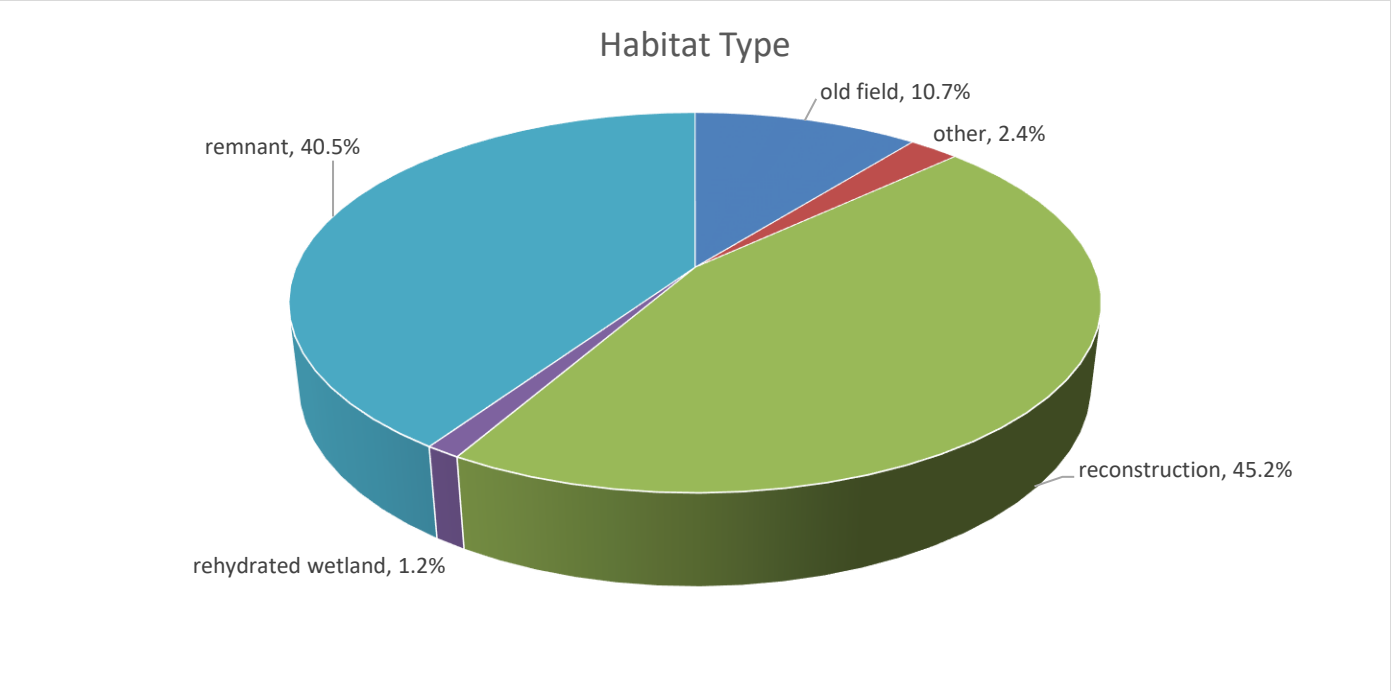

Figure 4. Percentage of *O. vernalis* found in each habitat type.

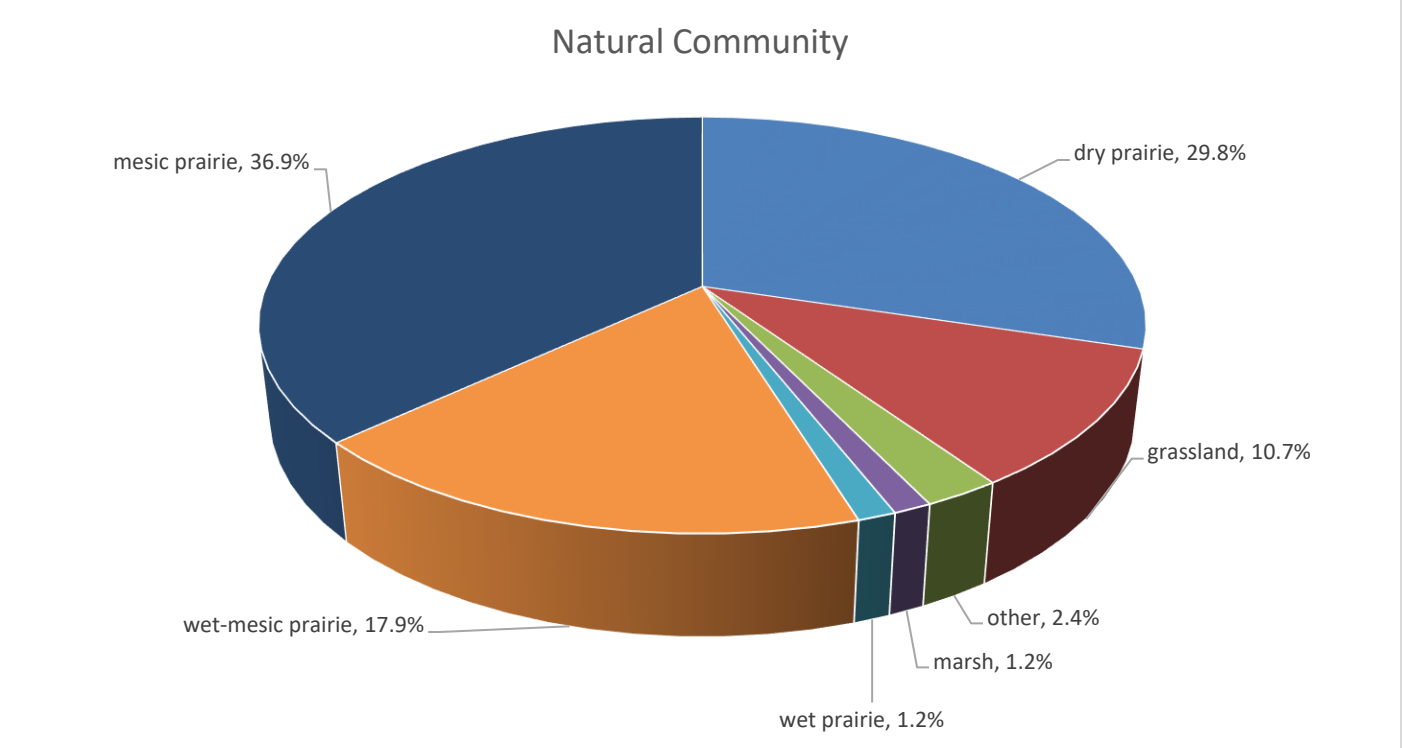

Figure 5. Percentage of *O. vernalis* found in each natural community type.

Age Class and Gender Survey Data:

Of the 84 occurrences, 32 were male, 30 were female, and 22 the gender was undetermined. The age classes were divided into three classifications: adult (n=50), juvenile first year (n=22), and sub-adult or juvenile after second year (asy) (n=12) (figure 6). Table 4 shows the age classes and the habitat types where they were found. Table 5 shows the age classes and the habitat communities where they were found.

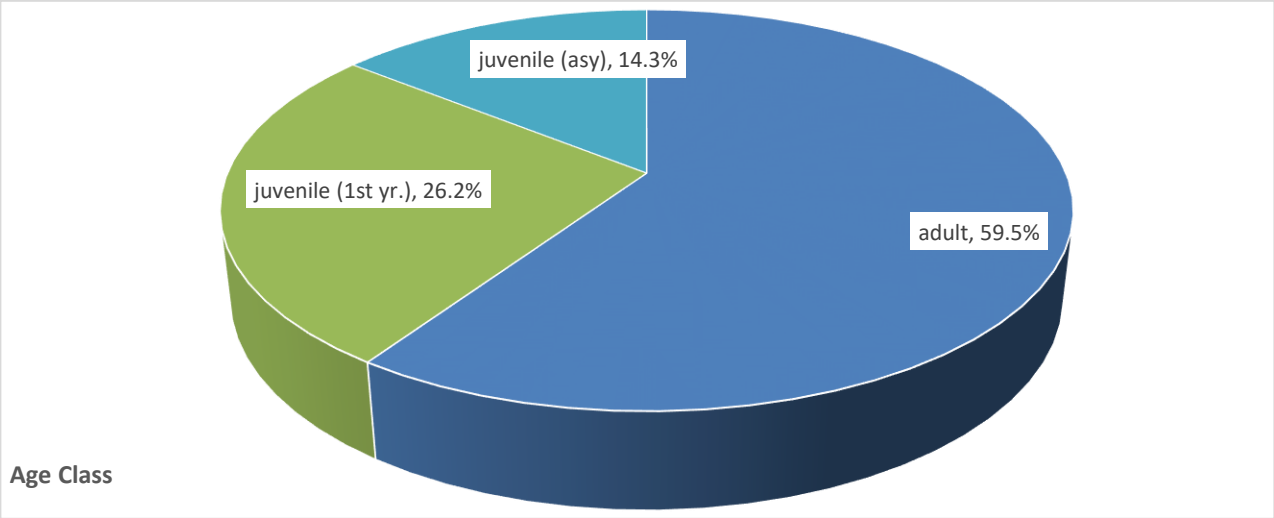

Figure 6. Age Classes of *O. vernalis* occurrences.

Table 4. Habitat Type & Age Class			
Adult	old field	7	14.0%
	reconstruction	23	46.0%
	rehydrated wetland	1	2.0%
	remnant	17	34.0%
	other	2	4.0%
Juvenile (1st yr.)	old field	2	9.1%
	reconstruction	9	40.9%
	rehydrated wetland	0	0.0%
	remnant	11	50.0%
	other	0	0.0%
Juvenile (asy)	old field	0	0.0%
	reconstruction	6	50.0%
	rehydrated wetland	0	0.0%
	remnant	6	50.0%
	other	0	0.0%

Table 5. Natural Community & Age Class			
Adult	dry prairie	5	10.0%
	grassland	7	14.0%
	marsh	1	2.0%
	wet prairie	0	0.0%
	wet-mesic prairie	10	20.0%
	mesic prairie	25	50.0%
	other	2	4.0%
Juvenile (1st yr.)	dry prairie	13	59.1%
	grassland	2	9.1%
	marsh	0	0.0%
	wet prairie	0	0.0%
	wet-mesic prairie	4	18.2%
	mesic prairie	3	13.6%
	other	0	0.0%
Juvenile (asy)	dry prairie	7	58.3%
	grassland	0	0.0%
	marsh	0	0.0%
	wet prairie	1	8.3%
	wet-mesic prairie	1	8.3%
	mesic prairie	3	25.0%
	other	0	0.0%

Population Distribution:

The geographical location of each observation was mapped in Arc GIS. Image 4 shows the general locations where there were confirmed *O. vernalis* observations.

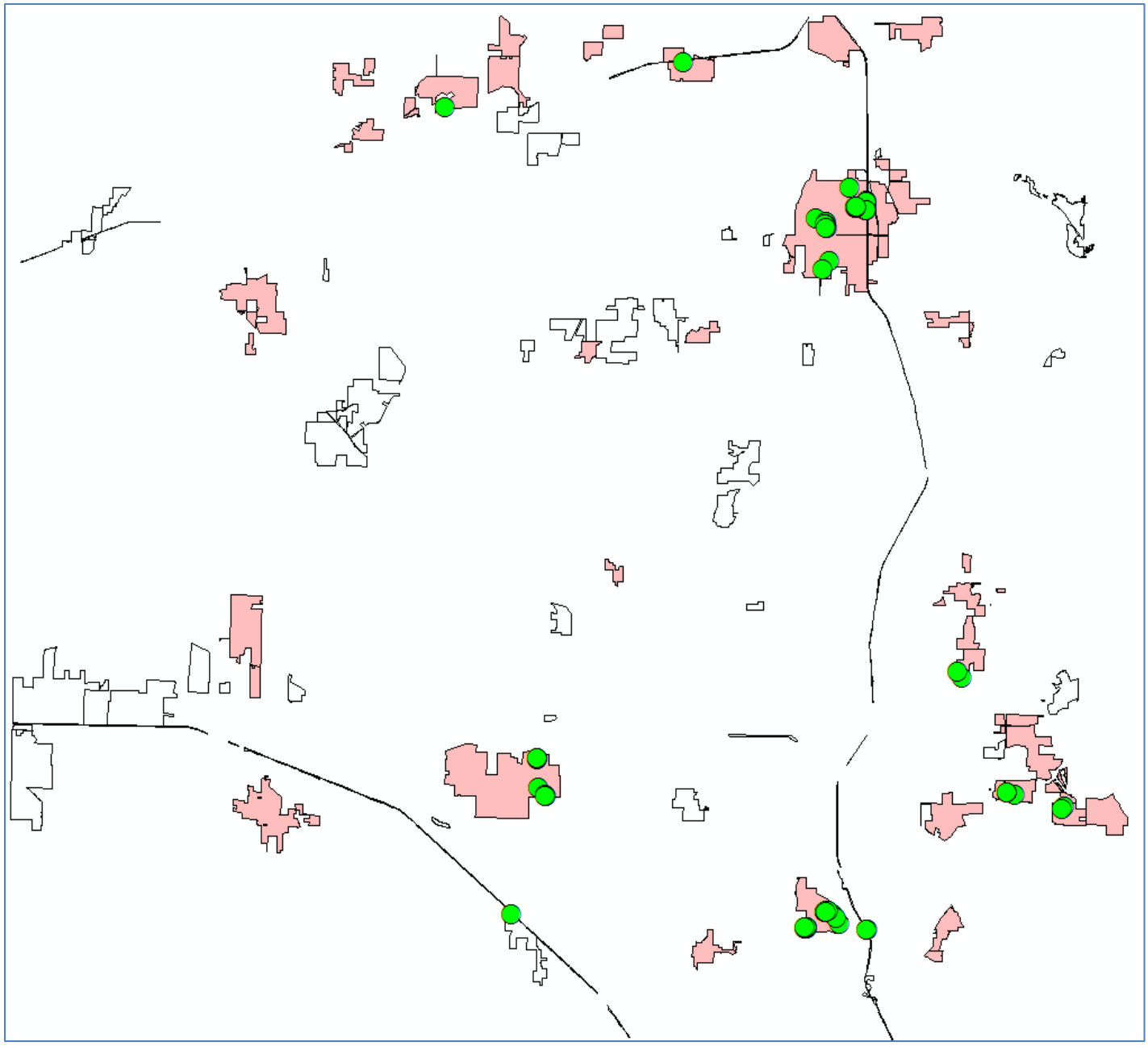

Image 4. Geographic locations of all confirmed *O. vernalis* observations (green dots). District sites are outlined in black and District sites that had cover boards placed within their boundaries at some point 2013-2017 are rose colored.

Morphological Data:

The gender of *O. vernalis* can often be determined by tail: body length ratio. Males generally have longer tales than females. Other, more obvious, gender indications included observed hemipenes in males and gravidity in females. We took snout to vent measurements and tail measurements whenever possible. Based on our data, we found that tail lengths for adult females were often less than 28% of the total body length and adult males often had tail lengths greater than 28% of the total body length. We used these guidelines when determining the gender of first year juveniles and sub-adults, which can be more challenging to sex.

The mean mass for adult *O. vernalis* was 21.57 grams (n=27), juvenile (1st yr.) mean mass was 3.57 g. (n=22), sub-adult (juvenile asy) mean mass was 9.03 g. (n=11). Figure 7 breaks it down further by age class and gender. The largest smooth green snake captured was a gravid female (#516) that was 42.44 g. and 550 mm in length; she was 25.99 g. after oviposition. Thirty-three individual smooth green snakes were marked with ventral cautery; their numbers and associated data is in Table 6.

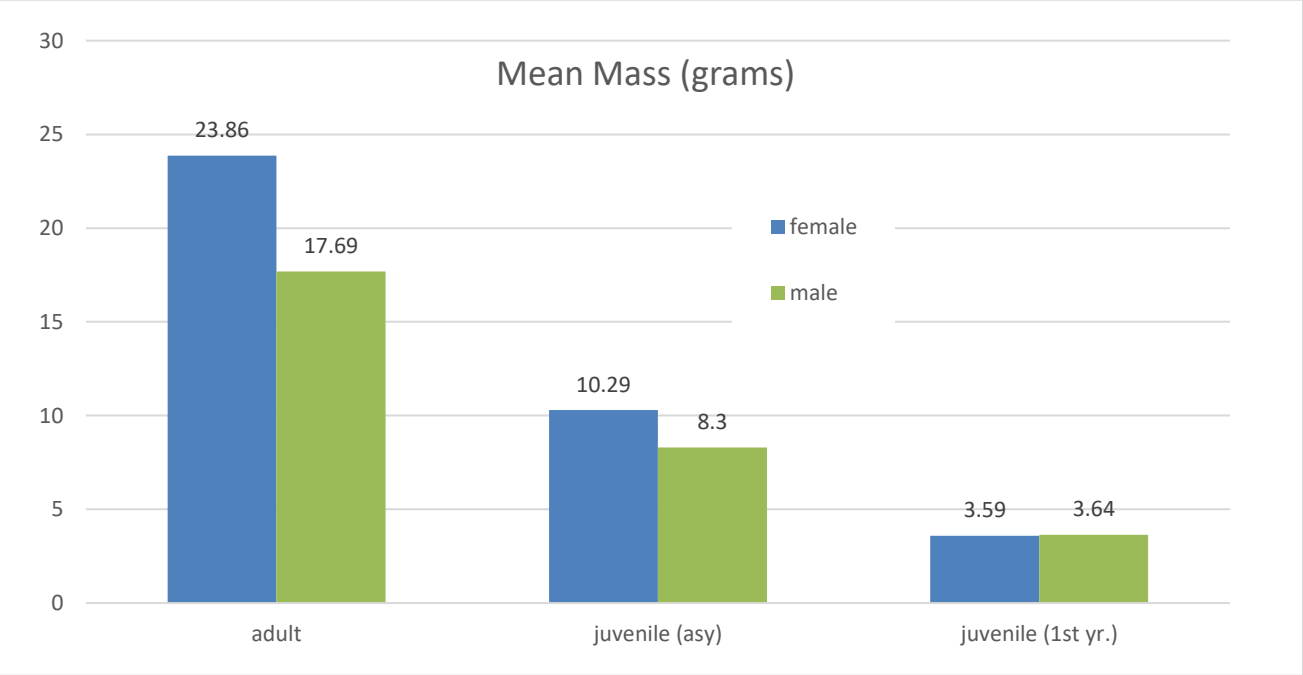

Figure 7. Mean mass in grams by age class and gender.

The mean body length for adult *O. vernalis* was 453.05 mm (n=27), juvenile (1st yr.) mean body length was 248.95 mm. (n=22), sub-adult (juvenile asy) mean body length was 354.80 mm. (n=10). Figure 8 breaks it down further by age class and gender.

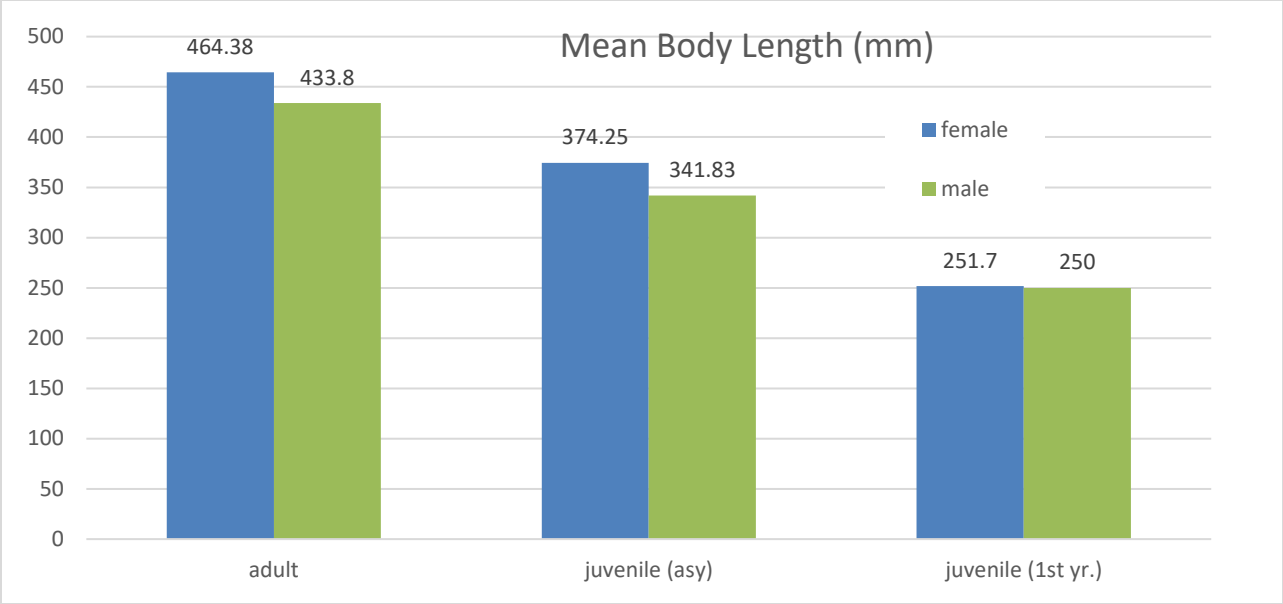

Figure 8. Mean Body Length by age class and gender.

Table 6. Ventral cautery marked *O. vernalis* and associated data.

Site	Date	SVL (mm)	Tail Length (mm)	Total length	tail:body ratio	Mass (g)	Mark	Sex	Age Class
GLP	14-May-13	240	110	350	31.4%	17.2	**102**	M	adult
FEP	10-Jun-13	320	165	485	34.0%	22.1	**130**	M	adult
PLV	18-Jun-13	235	110	345	31.9%	8	**147**	M	juvenile (asy)
LHF	30-Jun-14	170	73	243	30.0%	3.3	**303**	M	juvenile (1st yr.)
LHF	30-Jun-14	155	62	217	28.6%	2.4	**304**	M	juvenile (1st yr.)
LHF	28-May-14	148	72	220	32.7%	2.5	**306**	F	juvenile (1st yr.)
LHF	2-Jun-14	166	70	236	29.7%	1.7	**307**	M	juvenile (1st yr.)
LHF	9-Jun-14	154	65	219	29.7%	2.4	**308**	F	juvenile (1st yr.)
FEP	10-Jun-14	235	111	346	32.1%	8.5	**309**	M	juvenile (asy)
GLP	20-Jun-14	330	120	450	26.7%	24	**310**	F	adult
LHF	23-Jun-14	325	125	450	27.8%	19.1	**311**	F	adult
LHF	21-Jul-14	156	63	219	28.8%	2.5	**313**	F	juvenile (1st yr.)
LHF	7-Jul-14	190	80	270	29.6%	3.5	**314**	F	juvenile (1st yr.)
LHF	7-Jul-14	190	90	280	32.1%	4.5	**315**	M	juvenile (1st yr.)
FEP	7-Jul-14	195	82	277	29.6%	3.8	**316**	M	juvenile (1st yr.)
GLP	15-Jul-14	180	75	255	29.4%	3.6	**317**	M	juvenile (1st yr.)
LHF	21-Jul-14	195	80	275	29.1%	4.1	**318**	M	juvenile (1st yr.)
LAP	25-Jul-14	270	110	380	28.9%	11.5	**319**	F	juvenile (asy)
GLP	29-Jul-14	195	100	295	33.9%	5	**320**	M	juvenile (1st yr.)
GLP	30-Jul-14	342	136	478	28.5%	18.6	**321**	F	adult

Table 6. cont.

Site	Date	SVL (mm)	Tail Length (mm)	Total length	tail:body ratio	Mass (g)	Mark	Sex	Age Class
GLP	22-May-15	216	83	299	27.8%	5.5	**322**	F	juvenile (1st yr.)
GLP	22-May-15	300	115	415	27.7%	16.4	**325**	F	adult
GLP	22-May-15	285	160	445	36.0%	14.37	**326**	M	adult
GLP	9-Jun-15	370	140.5	510.5	27.5%	24.67	**340**	F	adult
GLP	10-Jun-15	310.5	119.5	430	27.8%	20.38	**341**	F	adult
LHF	12-Jun-15	270.5	109.5	380	28.8%	14.66	**342**	M	adult
LHF	24-Jun-15	340.5	149.5	490	30.5%	30.48	**343**	F	adult
LHF	6-Jul-15	170.5	79.5	250	31.8%	4.31	**344**	M	juvenile (1st yr.)
GLP	10-Aug-15	210	100	310	32.3%	6.58	**346**	M	juvenile (asy)
GLP	6-Jun-16	342	116	458	25.3%	27.07	**419**	F	adult
GLP	7-Jun-16	210	115	325	35.4%	7.22	**420**	M	juvenile (asy)
GLP	9-Jun-16	251	120	371	32.3%	19.19	**421**	M	adult
GLP	13-Jun-16	351	120	471	25.5%	28.92	**422**	F	adult
GLP	15-Jun-16	351	135	486	27.8%	21.76	**425**	M	adult
GLP	15-Jun-16	305	151	456	33.1%	19.39	**426**	M	adult
GLP	15-Jun-16	346	120	466	25.8%	26.43	**427**	F	adult
GLP	7-Jul-16	316	105	421	24.9%	19.5	**429**	F	adult
LHF	19-Jul-16	355	140	495	28.3%	16.38	**430**	M	adult
GLP	26-Apr-17	290	120	410	29.3%	17.95	**501**	M	adult
GLP	4-May-17	300	160	460	34.8%	13.86	**509**	M	adult
GLP	4-May-17	370	160	530	30.2%	29.18	**510**	F	adult
GLP	4-May-17	315	105	420	25.0%	17.38	**511**	F	adult
GLP	15-May-17	250	110	360	30.6%	9.63	**512**	M	juvenile (asy)
GLP	16-May-17	310	120	430	27.9%	15.47	**513**	F	adult
LHF	19-May-17	270	100	370	27.0%	10	**514**	F	juvenile (asy)
LHF	19-May-17	150	65	215	30.2%	3.75	**515**	M	juvenile (1st yr.)
LHF	19-May-17	405	145	550	26.4%	42.44	**516**	F	adult
PLV	20-Jun-17	175	65	240	27.1%	3	**518**	F	juvenile (1st yr.)
GLP	28-Jun-17	245	120	365	32.9%	10.77	**525**	M	juvenile (asy)
PLV	7-Aug-17	395	100	495	20.2%	25.17	**542**	F	adult

Miscellaneous Field Data:

In addition to snakes observed under cover boards, several *O. vernalis* nests were found under cover boards. Often there were several communal nests under one cover board. The first nest was discovered in Glacial Park, July 27, 2015 (image 5). A protective cage was placed around the cover

board (GP20) with the nest of five eggs underneath; they were allowed to hatch ex-situ. Only two of the five successfully hatched.

Image 5. Single nest found under cover board GP20 in Glacial Park, 27-JUL-2015

Another nest was discovered under a different cover board (GP11) in Glacial Park in 2016. This nest with eight eggs was carefully transported to the Wildlife Resource Center for incubation in the controlled environment of a herptile incubator. All eight eggs successfully hatched.

Results: Head-starting

This section includes head-starting data from when the young were transported to Lincoln Park Zoo's head-starting facility in 2014 and 2015 (table 7 & 8). The head-starting program at the District's Wildlife Resource Center began in 2016 (table 9 & 10).

The over-all hatching success for in-situ incubation from 2014-2017 was 92.3% (72/78). When the eggs were left in the field to hatch the success rate was only 40%. Personal communications with Allison Sacerdote-Valet, research biologist with Peggy Notebart Museum, provided additional information on low hatching rates of *O. vernalis* eggs in the wild.

The original head-starting protocols were based on those used by Lincoln Park Zoo with the exception of the brumation set-up. The District had the tanks located in a closed room within the basement of their facility with open windows to the outdoors instead of an artificial refrigeration unit. The winter of 2016-17 was unusually warm which created a situation in which the snakes were more active than if they had gone into full diapause. The following year, the young snakes were not gaining weight as hoped for and two died in late fall. Consequently, a decision was made to omit brumation that winter in an attempt to give them more opportunity to gain additional weight before their scheduled time of release the following summer.

Although their enclosures were cleaned weekly, some of the young snakes developed bacterial infections that presented as lumps near their vents (Image 6). A veterinary doctor that specializes in wildlife was consulted and he suggested that the cause was improperly discharged fecal matter. All young *O. vernalis* were subsequently medicated with prescribed antibiotics prophylactically and/or for existing infections, Amikacin, 0.05 ml/snake once daily for 2 weeks.

Image 6. Infectious lump near vent from fecal matter, May 19, 2017, clutch #429

Table 7. 2014 Data (LPZ)	# eggs	# hatched	mortality	# released	%hatched	% released
#310	8	8	3	5	100.0%	**62.5%**
#311	7	5	2	3	71.4%	**42.9%**
Totals:	**15**	**13**	**5**	**8**	**86.7%**	**53.3%**

Table 8. 2015 Data (LPZ)	# eggs	# hatched	mortality	# released	%hatched	% released
GP20 nest (ex-situ)	5	2	0	0	40.0%	**0.0%**
#343	10	10	3	0	100.0%	**0.0%**
Totals:	**15**	**12**	**3**	**0**	**80.0%**	**0.0%**

Table 9. 2016 Data (MCCD)	# eggs	# hatched	mortality	# released	%hatched	% released
GP11 nest (in-situ)	8	8	3	5	100.0%	**62.5%**
419	7	7	2	5	100.0%	**71.4%**
422	9	9	3	6	100.0%	**66.7%**
427	8	8	4	4	100.0%	**50.0%**
429	6	6	6	0	100.0%	**0.0%**
Totals:	**38**	**38**	**18**	**20**	**100.0%**	**52.6%**

Table 10. 2017 Data (MCCD)	# eggs	# hatched	mortality	# released	%hatched	% released
#510	7	3	0	3	42.9%	**42.9%**
#516	8	8	3	4	100.0%	**50.0%**
Totals:	**15**	**11**	**3**	**7**	**73.3%**	**46.7%**

Table 11. Summary 2014-2017

# eggs	# hatched	mortality	# released	%hatched	% released
83	74	29	35	89.2%	42.2%

Image 7. Incubated in-situ eggs hatching, July 26, 2016

Image 8. Hatched young, July 26, 2016, approximately 1 g. each

Image 9. Released head-start, June 29, 2018, #521, male, 7.07 g.

Table 12. Marking and morphological data for individual released head-started *O. vernalis*.

Site	Release Date	SVL (mm)	Tail Length (mm)	Total length	tail:body ratio	Mass (g)	Mark	Sex
GLP	22-Jun-17	180	75	255	29.4%	5.85	**519**	F
GLP	22-Jun-17	180	85	265	32.1%	6.79	**520**	M
GLP	22-Jun-17	185	85	270	31.5%	7.07	**521**	M
GLP	22-Jun-17	155	90	245	36.7%	4.43	**522**	M
GLP	14-Jul-17	155	60	215	27.9%	4.55	**528**	F
GLP	14-Jul-17	180	85	265	32.1%	4.92	**527**	M
GLP	14-Jul-17	-	-	-	-	4.92	**526**	U
GLP	1-Aug-17	145	40	185	21.6%	2.78	**530**	F
GLP	1-Aug-17	160	45	205	22.0%	2.39	**533**	F
GLP	1-Aug-17	150	50	200	25.0%	2.41	**534**	F
GLP	1-Aug-17	150	50	200	25.0%	2.79	**535**	F
GLP	1-Aug-17	150	50	200	25.0%	2.77	**537**	F
GLP	1-Aug-17	190	80	270	29.6%	3.1	**529**	M
GLP	1-Aug-17	150	65	215	30.2%	2.19	**531**	M
GLP	1-Aug-17	140	60	200	30.0%	2.43	**532**	M
GLP	1-Aug-17	135	65	200	32.5%	2.42	**536**	M
GLP	2-Aug-17	140	50	190	26.3%	2.97	**539**	F
GLP	2-Aug-17	135	65	200	32.5%	2.23	**538**	M
GLP	2-Aug-17	135	65	200	32.5%	2.21	**540**	M
GLP	2-Aug-17	140	70	210	33.3%	2.8	**541**	M
GLP	7-May-18	-	-	-	-	3.05	**542**	U
GLP	7-May-18	-	-	-	-	3.66	**543**	U
GLP	7-May-18	-	-	-	-	6.08	**544**	U
LHF	15-May-18	275	90	365	24.7%	5.01	**545**	F
LHF	15-May-18	210	60	270	22.2%	2.58	**547**	F
LHF	15-May-18	130	45	175	25.7%	2.31	**548**	F
LHF	15-May-18	160	68	228	29.8%	3.86	**546**	M

Land-use and Plant Community Data

While not all the observations occurred in remnant areas, all the sites that had *O.vernalis* observations had at least one remnant community within its boundaries.

Fel-pro Conservation Area:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
FP05	10-Jun-13	old field	grassland	Wood	130	male	adult
FP02	10-Jun-14	old field	grassland	Wood	309	male	juvenile (asy)
FP04	10-Jul-14	old field	grassland	Wood	316	male	juvenile (1st yr.)

Land Use Summary: 1872 plat map shows that the area where there are current *O.vernalis* populations was once a savanna. After that, 1939-1954 aerial photos indicate the land was in pasture. From 1961 to the present, the land has been idle with no restoration activities. The nearest remnant community to

cover boards with *O.vernalis* observations is 50 to 80 meters away and that remnant community is a woodland.

Unfortunately, this heavily used recreational site had cover boards routinely tampered with. All the cover boards were eventually removed for the safety of the snakes that used them.

Plant Summary: Non-native grasses heavily dominated the survey area (image 10). Litter and duff covered 75-100% of the ground and the vegetation was thick with 75-100% cover.

Soils: Hooppole loam, poorly drained, fine-loamy mixed (calcareous) mesic typic endoaquolls, hydric soil

Image 10. Typical ground cover at survey site.

Table 13. Fel-pro plant data for cover boards with O. vernalis.

Cover Boards*	**Plant List**	**Abundance**	**Date**
FP 1, 2, 3, 4 & 5	Asclepias syriaca	rare	8-Aug-16
FP 1, 2, 3, 4 & 5	Cirsium arvense	common	8-Aug-16
FP 1, 2, 3, 4 & 5	Physalis heterophylla	occasional	8-Aug-16
FP 1, 2, 3, 4 & 5	Daucus carota	locally occasional	8-Aug-16
FP 1, 2, 3, 4 & 5	Lotus corniculatus	common	8-Aug-16
FP 1, 2, 3, 4 & 5	Cichorium intybu	locally occasional	8-Aug-16
FP 1, 2, 3, 4 & 5	Solidago canadensis	locally abundant	8-Aug-16
FP 1, 2, 3, 4 & 5	Poa pratensis	very common	8-Aug-16
FP 1, 2, 3, 4 & 5	Bromus inermis	abundant	8-Aug-16
FP 1, 2, 3, 4 & 5	Rhamnus cathartica	locally occasional	8-Aug-16
FP 1, 2, 3, 4 & 5	Acer negundo	locally occasional	8-Aug-16

Cover Class Ranges		
1 = 0-25%	**Vegetation height:**	**.5 to 3 feet**
2 = 25-50%	**litter class:**	**4**
3 = 50-75%	**cover class:**	**4**
4 = 75-100%		

Goose Lake:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
GL10	14-May-14	rehydrated wetland	Marsh/Sedge Meadow	Wood	**n/a**	Unknown	adult

Land Use Summary: In the 1872 plat map, this area appeared to be a prairie next to railroad tracks and wetlands; it remained that way in aerial photos until 1961 when it looks like the marshes were drained and the entire site was in row crops until 2005 when it was left fallow. Currently, there is a bike trail of crushed limestone along the RR tracks, restored wetlands, and a prairie reconstruction.

A very small (<.25 acres) remnant prairie north of the wetland and next to the bike path escaped being plowed into row crops with the rest of the site. It is possible that snakes retreated to the railroad ballast and this small remnant prairie during the decades when the marsh was drained and the site was in row crops. The one green snake observation under a cover board was less than 20 meters from this small remnant prairie.

Plant Summary: The entire site is in early stages of prairie reconstruction. The one green snake observation, however, was in old-field dominated by Bromus inermis and non-native *Solidago canadensis* near the main marsh (image 11).

Soils: Lorenzo loam, well drained, 4 to 6 percent slopes eroded, highly erodible land, not hydric. However, the cover boards are only 13 m. from Pella silty clay loam, a wetland soil.

Image 11. Cover board GL10

Larson Prairie:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
LP08	5-May-17	remnant	mesic prairie	rubber	**n/a**	unknown	juvenile (1st yr.)
LP09	25-Jul-14	remnant	dry prairie	wood	**319**	female	juvenile (asy)

Land Use Summary: This small remnant prairie provides ideal snake habitat. However, it is surrounded by infrastructure and industrial development (image 12).

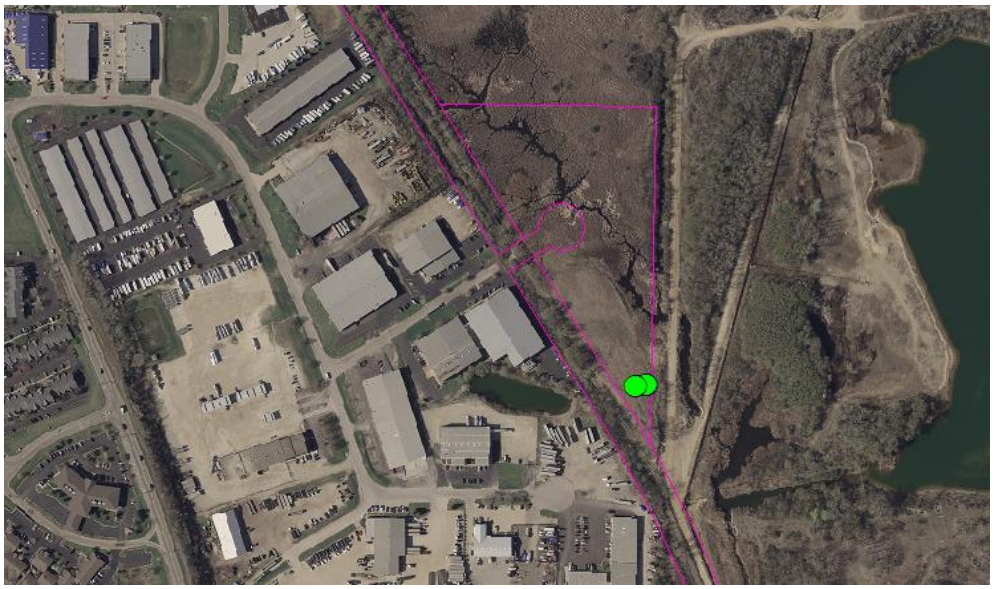

Image 12. Larson Prairie, an industrial park to the west and an active gravel pit to the east.

Plant Summary: Larson Prairie is a small, high quality remnant prairie with conservative plant species (Table 14).

Soils: Casco clay loam, somewhat excessively drained, highly erodible. Cover boards are 32 m. away from Houghton muck, a hydric, wetland soil.

Image 13. Cover board LP06

Table 14. Larsen Prairie Plant List- survey date 8-AUG-2016	Abundance	Cover Boards
Achillea millefolium	occasional	LP 6, 7, 8, 9 & 10
Allium cernuum	common	LP 6, 7, 8, 9 & 10
Amorpha canescens	occasional	LP 6, 7, 8, 9 & 10
Andropogon gerardii	common	LP 6, 7, 8, 9 & 10
Anemone cylindrica	locally occasional	LP 6, 7, 8, 9 & 10
Bouteloua curtipendula	rare	LP 6, 7, 8, 9 & 10
Bromus ciliatus	rare	LP 6, 7, 8, 9 & 10
Cirsium discolor	rare	LP 6, 7, 8, 9 & 10
Comandra umbellata	common	LP 6, 7, 8, 9 & 10
Coreopsis palmata	locally occasional	LP 6, 7, 8, 9 & 10
Daucus carota	occasional	LP 6, 7, 8, 9 & 10
Dichanthelium oligosanthes var. scribnerianum	common	LP 6, 7, 8, 9 & 10
Erechtites hieracifolia	occasional	LP 6, 7, 8, 9 & 10
Eryngium yuccifolium	occasional	LP 6, 7, 8, 9 & 10
Euphorbia corollata	common	LP 6, 7, 8, 9 & 10
Fragaria virginiana	rare	LP 6, 7, 8, 9 & 10
Geum canadense	locally occasional	LP 6, 7, 8, 9 & 10
Helianthus rigidus	occasional	LP 6, 7, 8, 9 & 10
Hypericum perforatum	occasional	LP 6, 7, 8, 9 & 10
Kuhnia eupatorioides corymbulosa	occasional	LP 6, 7, 8, 9 & 10
Lespedeza capitata	locally common	LP 6, 7, 8, 9 & 10
Liatris aspera	occasional	LP 6, 7, 8, 9 & 10
Lithospermum canescens	rare	LP 6, 7, 8, 9 & 10
Monarda fistulosa	occasional	LP 6, 7, 8, 9 & 10
Oenothera biennis	rare	LP 6, 7, 8, 9 & 10
Oligoneuron rigidum	common	LP 6, 7, 8, 9 & 10
Pastinaca sativa	locally common	LP 6, 7, 8, 9 & 10
Phalaris aruninacea	locally common	LP 6, 7, 8, 9 & 10
Physalis heterophylla	rare	LP 6, 7, 8, 9 & 10
Physalis subglabrata	rare	LP 6, 7, 8, 9 & 10
Poa compressa	occasional	LP 6, 7, 8, 9 & 10
Polygonatum canaliculatum	rare	LP 6, 7, 8, 9 & 10
Potentilla simplex	rare	LP 6, 7, 8, 9 & 10
Pycnanthemum virginianum	rare	LP 6, 7, 8, 9 & 10
Ratibida pinnata	occasional	LP 6, 7, 8, 9 & 10
Rhamnus cathartica	locally common	LP 6, 7, 8, 9 & 10
Rosa carolina	common	LP 6, 7, 8, 9 & 10
Rubus occidentalis	occasional	LP 6, 7, 8, 9 & 10
Rudbeckia hirta	occasional	LP 6, 7, 8, 9 & 10
Schizachyrium scoparium	common	LP 6, 7, 8, 9 & 10
Silphium integrifolium deamii	common	LP 6, 7, 8, 9 & 10
Silphium terebinthinaceum	occasional	LP 6, 7, 8, 9 & 10
Solanum dulcamara	locally occasional	LP 6, 7, 8, 9 & 10
Solidago altissima	locally occasional	LP 6, 7, 8, 9 & 10
Solidago graminifolia	occasional	LP 6, 7, 8, 9 & 10
Solidago juncea	occasional	LP 6, 7, 8, 9 & 10
Solidago nemoralis	common	LP 6, 7, 8, 9 & 10
Solidago speciosa	rare	LP 6, 7, 8, 9 & 10
Sorghastrum nutans	occasional	LP 6, 7, 8, 9 & 10
Sporobolus asper	rare	LP 6, 7, 8, 9 & 10
Sporobolus heterolepis	locally occasional	LP 6, 7, 8, 9 & 10
Stipa spartea	occasional	LP 6, 7, 8, 9 & 10
Verbascumthapsus	rare	LP 6, 7, 8, 9 & 10
Verbena stricta	occasional	LP 6, 7, 8, 9 & 10

Cover Class Ranges		
1 = 0-25%	Vegetation height:	.5 to 3 feet
2 = 25-50%	litter class:	3
3 = 50-75%	cover class:	4
4 = 75-100%		

Glacial Park Berry Parcel, Mgt. Unit 12:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
GP11	9-Jul-16	recreation	wet-mesic prairie	wood	**Nest**	n/a	n/a
GP12	6-Jun-16	recreation	wet-mesic prairie	wood	**419**	female	adult
GP21	10-Jun-15	recreation	wet-mesic prairie	wood	**341**	female	adult
GP22	22-May-15	recreation	wet-mesic prairie	wood	**322**	female	juvenile (1st yr.)
GP22	19-May-15	recreation	wet-mesic prairie	wood	**n/a**	male	adult
GP23	22-May-15	recreation	wet-mesic prairie	wood	**325**	female	adult
GP23	22-May-15	recreation	wet-mesic prairie	rubber	**326**	male	adult
GP24	11-Jun-15	recreation	wet-mesic prairie	wood	**341**	female	adult
GP24	10-Aug-15	recreation	wet-mesic prairie	wood	**346**	male	juvenile (asy)
GP25	20-Jun-14	recreation	wet-mesic prairie	wood	**310**	female	adult
GP25	29-Jul-14	recreation	wet-mesic prairie	wood	**320**	male	juvenile (1st yr.)
GP25	9-Jun-15	recreation	wet-mesic prairie	wood	**340**	female	adult

Land Use Summary: This survey area was originally prairie according to 1872 plats maps and 1939 aerial photos. Row crops appear in the 1961 aerial photos. From 1998 aerial photos to 2015, the land appears to be old field with no recorded planting or seeding.

Because the area is so close to the Lost Valley Marsh water control structure drainage ditch, it occasionally floods. This can create a precarious condition for nests of green snake eggs as was observed in 2017 when a communal nest with more than 17 eggs completely washed away in a flooding event. Crayfish burrows, which can be used as snake hibernaculum, are common in this transect survey area, as are garter snakes (image 14).

Image 14. Crayfish burrows and garter snakes under a cover board in one of the Berry parcel transects.

Plant Summary: The area where these cover boards transects were placed is a prairie reconstruction, close to a marsh drainage ditch, that floods during high water events. Image 15 shows the vegetation at GP22, which was typical for both cover board transects in this parcel.

Soils: Grundelein silt loam, 0 to 2 percent slopes, somewhat poorly drained, not hydric. Cover boards are 12 m. from Comfrey loam, a wetland soil.

Table 15. Glacial Park, Berry Parcel, Unit 12 Plant List

Plant List	Abundance	Cover Boards	Date
Achillea millefolium	occasional	GP21-25 & GP11-15	16-Aug-16
Anemone cylindrica	common	GP21-25 & GP11-15	16-Aug-16
Asclepias syriaca	rare	GP21-25 & GP11-15	16-Aug-16
Daucus carota	locally abundant	GP21-25 & GP11-15	16-Aug-16
Desmodium canadense	occasional	GP21-25 & GP11-15	16-Aug-16
Lotus corniculatus	occasional	GP21-25 & GP11-15	16-Aug-16
Lycopus americanus	occasional	GP21-25 & GP11-15	16-Aug-16
Solidago altissima	occasional	GP21-25 & GP11-15	16-Aug-16
Solidago canadensis	abundant	GP21-25 & GP11-15	16-Aug-16
Thalictrum dasycarpum	occasional	GP21-25 & GP11-15	16-Aug-16
Vernonia fasiculata	occasional	GP21-25 & GP11-15	16-Aug-16
Andropogon gerardii	occasional	GP21-25 & GP11-15	16-Aug-16
Carex sp.	occasional	GP21-25 & GP11-15	16-Aug-16
Phalaris arundinacea	occasional	GP21-25 & GP11-15	16-Aug-16
Poa pratensis	common	GP21-25 & GP11-15	16-Aug-16
Cornus racemosa	abundant	GP21-25 & GP11-15	16-Aug-16
Vitus riparia	occasional	GP21-25 & GP11-15	16-Aug-16
Equisetum hyemale	occasional	GP21-25 & GP11-15	16-Aug-16
		Cover Class Ranges	
Vegetation height:	**1-3 feet**	**1 = 0-25%**	
litter class:	**4**	**2 = 25-50%**	
cover class:	**4**	**3 = 50-75%**	
		4 = 75-100%	

Image 15. Cover board GP22 and the surrounding vegetation

Glacial Park DeRose Parcel, Mgt. Unit 12:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
GP06	9-Jun-16	remnant	mesic prairie	wood	421	male	adult
GP08	7-Jun-16	remnant	mesic prairie	wood	420	male	juvenile (asy)
GP09	15-Jun-16	remnant	mesic prairie	wood	426	male	adult
GP18	14-Sep-14	remnant	mesic prairie	rubber	n/a	unknown	adult
GP18	13-Jun-16	remnant	mesic prairie	rubber	422	female	adult
GP19	15-Jul-14	remnant	mesic prairie	wood	317	male	juvenile (1st yr.)
GP19	15-Jun-16	remnant	mesic prairie	wood	425	male	adult
GP19	15-Jun-16	remnant	mesic prairie	wood	427	female	adult
GP20	27-Jul-15	remnant	mesic prairie	wood	NEST	N/A	N/A
GP38	28-Jun-17	remnant	mesic prairie	wood	525	male	juvenile (asy)
GP43	26-Apr-17	remnant	mesic prairie	wood	501	male	adult

Land Use Summary: The DeRose parcel is a remnant dry-mesic to wet-mesic prairie that is relatively undisturbed except perhaps by encroaching shrubs and introduced non-natives plant species dispersed by wildlife or the elements. The location next to an old railroad bed, now used as a walking and bike path, provides hibernaculum opportunities for snake brumation.

Plant Summary Cover Boards 6-10 & 16-20: The plant community is highly diverse with many conservative native species. The structure is that of a long established, high quality prairie, evenly distributed and short to moderate in overall plant heights.

Plant Summary Cover Boards 38 & 43: These cover boards are on the northern portion of the DeRose parcel. The plant community is more adapted to wetter conditions and occasionally, with heavy rain events, will flood. These transects are placed in close proximity to and parallel with the old railroad bed.

Soils: Millstream silt loam, 0–2 percent slopes, somewhat poorly drained, not hydric; Grundelein silt loam, 0 to 2 percent slopes, somewhat poorly drained, not hydric; Dunham silty clay, hydric, wetland soil.

Table 15. Glacial Park, DeRose Parcel, Unit 12 Plant List

Cover Boards	Plant List- survey dates 6-Oct-2015 & 28-JUL-2016	Abundance	Cover Boards	Plant List survey date 28-JUL-2016	Abundance
GP16 - 20	Achillea millefolium	occasional	GP6 - 10	Achillea millefolium	occasional
GP16 - 20	Amorpha canescens	occasional	GP6 - 10	Amorpha canescens	common
GP16 - 20	Andropogon gerardii	occasional	GP6 - 10	Andropogon gerardii	occasional
GP16 - 20	Anemone cylindrica	occasional	GP6 - 10	Anemone cylindrica	common
GP16 - 20	Antennaria neglecta	occasional	GP6 - 10	Antennaria neglecta	occasional
GP16 - 20	Aster azureus	occasional	GP6 - 10	Aster azureus	occasional
GP16 - 20	Aster ericoides	occasional	GP6 - 10	Aster ericoides	common
GP16 - 20	Aster laevis	occasional	GP6 - 10	Aster laevis	occasional
GP16 - 20	Comandra umbellata	common	GP6 - 10	Comandra umbellata	occasional
GP16 - 20	Cornus racemosa	rare	GP6 - 10	Cornus racemosa	occasional
GP16 - 20	Dalea candida	occasional	GP6 - 10	Dalea candida	occasional
GP16 - 20	Dalea purpurea	common	GP6 - 10	Dalea purpurea	occasional
GP16 - 20	Desmodium canadense	occasional	GP6 - 10	Desmodium canadense	common
GP16 - 20	Dichanthelium oligosanthes	common	GP6 - 10	Dichanthelium oligosanthes	common
GP16 - 20	Echinacea pallida	occasional	GP6 - 10	Echinacea pallida	occasional
GP16 - 20	Erigeron strigosus	rare	GP6 - 10	Elaeagnus umbellata	rare
GP16 - 20	Eryngium yuccifolium	occasional	GP6 - 10	Eryngium yuccifolium	occasional
GP16 - 20	Fragaria virginiana	occasional	GP6 - 10	Fragaria virginiana	occasional
GP16 - 20	Helianthus grossesettarus	occasional	GP6 - 10	Helianthus grossesettarus	occasional
GP16 - 20	Lactuca candensis	rare	GP6 - 10	Lactuca candensis	rare
GP16 - 20	Lespedeza capitata	common	GP6 - 10	Lespedeza capitata	occasional
GP16 - 20	Liatris aspera	occasional	GP6 - 10	Liatris aspera	occasional
GP16 - 20	Liatris spicata	rare	GP6 - 10	Lithospermum canescens	common
GP16 - 20	Lithospermum canescens	common	GP6 - 10	Monarda fistulosa	occasional
GP16 - 20	Monarda fistulosa	occasional	GP6 - 10	Oligoneuron rigidum	common
GP16 - 20	Oligoneuron rigidum	common	GP6 - 10	Parthenium integrifolium	occasional
GP16 - 20	Parthenium integrifolium	occasional	GP6 - 10	Phlox pilosa var. fulgida	occasional
GP16 - 20	Phlox pilosa var. fulgida	occasional	GP6 - 10	Poa compressa*	occasional
GP16 - 20	Poa compressa*	occasional	GP6 - 10	Poa pratensis*	common
GP16 - 20	Poa pratensis*	common	GP6 - 10	Polygala senega	occasional
GP16 - 20	Polygala senega	occasional	GP6 - 10	Potentilla simplex	rare
GP16 - 20	Pycnanthemum virginianum	occasional	GP6 - 10	Pycnanthemum virginianum	occasional
GP16 - 20	Ratibida pinnata	occasional	GP6 - 10	Ratibida pinnata	occasional
GP16 - 20	Rosa carolina	occasional	GP6 - 10	Rosa carolina	occasional
GP16 - 20	Rudbeckia hirta	common	GP6 - 10	Rudbeckia hirta	common
GP16 - 20	Schizachyrium scoparium	occasional	GP6 - 10	Schizachyrium scoparium	occasional
GP16 - 20	Silphium integrifolium	occasional	GP6 - 10	Silphium integrifolium	occasional
GP16 - 20	Silphium laciniatum	rare	GP6 - 10	Silphium laciniatum	rare
GP16 - 20	Silphium terebinthinaceum	occasional	GP6 - 10	Silphium terebinthinaceum	occasional
GP16 - 20	Solidago canadensis	occasional	GP6 - 10	Solidago canadensis	occasional
GP16 - 20	Solidago nemoralis	occasional	GP6 - 10	Solidago graminifolia	rare

Table 15.	Continued				
GP16 - 20	Solidago speciosa	occasional	GP6 - 10	Solidago nemoralis	occasional
GP16 - 20	Sorghastrum nutans	common	GP6 - 10	Solidago speciosa	occasional
GP16 - 20	Tradescantia ohiensis	rare	GP6 - 10	Sorghastrum nutans	occasional
GP16 - 20	Veronicastrum virginicum	occasional	GP6 - 10	Tradescantia ohiensis	rare
GP16 - 20	Viola pedatifida	occasional	GP6 - 10	Veronicastrum virginicum	occasional
Cover Class Ranges	**Vegetation height:**	**.5 to 2 feet**	GP6 - 10	Viola pedatifida	occasional
1 = 0-25%	**litter class:**	**2**		**Vegetation height:**	**.5 to 2 feet**
2 = 25-50%	**cover class:**	**3**		**litter class:**	**2**
3 = 50-75%				**cover class:**	**3**
4 = 75-100%					

Image 16. Cover Board GP06 in the DeRose Parcel.

Image 17. Cover Board GP38 in the North DeRose Parcel.

Glacial Park Weidrich & Lodge parcels, Mgt. Unit 09:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
GP29	16-May-17	recreation	mesic prairie	wood	**513**	female	adult
GP31	4-May-17	recreation	mesic prairie	wood	**510**	female	adult
GP32	4-May-17	recreation	mesic prairie	wood	**511**	female	adult
GP33	15-May-17	recreation	mesic prairie	rubber	**512**	male	juvenile (asy)
GP53	4-May-17	recreation	mesic prairie	rubber	**509**	male	adult

Land Use Summary: The 1872 plat map shows the cover board area to be a large wooded area. Aerial photos from 1939 show a dissected woodland and row crops until the 1988 aerial photo where the row crops are gone and old-field takes its place; a small remnant woodland is still present. Over-seeding in the field began in 2010. Some infrastructure and building appears in 1954 aerial photos. The cover boards with green snake observations are very close to the remnant woodland, some less than 10 meters.

Plant Summary: Both of these survey areas are early prairie reconstructions with low diversity, tall vegetation and patchy structure (image 18 & 19).

Soils: Kidder loam, well drained, 6-12 percent sloped, highly erodible, not hydric. Cover boards are 150 m. to the nearest hydric soil.

Image 18. Cover board GP53 in the Weidrich parcel.

Image 19. Cover board GP29 in the Lodge parcel.

Table 16. Glacial Park, Weidrich & Lodge Parcels, Unit 09 Plant List

Cover Boards	Plant List survey 17-OCT-2017	Abundance
GP31, 32, 33 & 53	Acer negunda	rare
GP31, 32, 33 & 53	Agrimonia grypsosepala	rare
GP31, 32, 33 & 53	Aster ericoides	occasional
GP31, 32, 33 & 53	Bromus inermus	abundant
GP31, 32, 33 & 53	Daucus carota	occasional
GP31, 32, 33 & 53	Monarda fistulosa	occasional
GP31, 32, 33 & 53	Poa pratensis	abundant
GP31, 32, 33 & 53	Ratibida pinnata	occasional
GP31, 32, 33 & 53	Rhamnus cathartica	rare
GP31, 32, 33 & 53	Rosa multiflora	rare
GP31, 32, 33 & 53	Solidago altissima	abundant
GP31, 32, 33 & 53	Sorghastrum nutans	common
GP31, 32, 33 & 53	Spartina pectinata	occasional
GP31, 32, 33 & 53	Triosteum perfoliatum	occasional
	Vegetation height:	>1.5 m
	litter class:	4
	cover class:	4
	Cover Class Ranges	
	1 = 0-25%	
	2 = 25-50%	
	3 = 50-75%	
	4 = 75-100%	

Cover Boards	Plant List survey 19-OCT-2017	Abundance
GP29	Amorpha canescens	rare
GP29	Anemone cylindrica	common
GP29	Artium minus	rare
GP29	Baptisia alba v. macrophylla	occasional
GP29	Baptisia leuphaea	occasional
GP29	Cirsium arvense	common
GP29	Dalea candida	occasional
GP29	Dalea purpurea	occasional
GP29	Daucus carota	very common
GP29	Desmanthus illinoensis	common
GP29	Echinacea purpurea	occasional
GP29	Lactuca canadensis	occasional
GP29	Lespedeza capitata	rare
GP29	Monarda fistulosa	occasional
GP29	Euthamia graminifolia	abundant
GP29	Securigera varia	abundant
GP29	Silphium laciniatum	common
GP29	Solidago altissima	very common
GP29	Solidago speciosa	occasional
GP29	Trifolium pratense	occasional
GP29	Zizia aurea	occasional
GP29	Andropogon gerardii	occasional
GP29	Bromus inermus	common
GP29	Elymus canadensis	common
GP29	Bouteloua curtependula	rare
GP29	Poa pratensis	common
GP29	Schizachyrium scoparium	occasional
GP29	Sorghastrum nutans	very common
GP29	Sporobolus heterolepsis	occasional
GP29	Lonicera mackii	occasional
GP29	Morus alba	rare
	Vegetation height:	>1.5 m
	litter class:	4
	cover class:	4

Pleasant Valley CRS3 parcel, Mgt. Unit 4:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
PV24	7-Aug-17	reconstruction	mesic prairie	wood	**542**	female	adult

Land Use Summary: There is a homestead in the 1872 plat map. The house remains in aerial photos through 1988 but the surrounding the house was plowed, disced, and seeded with a prairie mix. The house was removed somewhere between 1988 and 1999. The closest remnant, a wet prairie/sedge meadow complex, is approximately 150 meters east.

Plant Summary: Tall grasses and forbs dominate the area (image 20).

Soils: Harpster silt loam, 0-2 percent sloped, undrained, hydric wetland soil.

Table 17.Pleasant Valley CRS3 parcel, Unit 04, Plant List

Cover Boards	Plant List - survey 20-OCT-2017	Abundance
PV24	Daucus carota	common
PV24	Melilotus altissimus	abundant
PV24	Siphium integrifolium	rare
PV24	Solidago altissima	common
PV24	Solidago canadensis	abundant
PV24	Andropogon gerardii	locally common
PV24	Bromus inermis	abundant
PV24	Sorghastrum nutans	locally abundant
	Vegetation height:	**1-1.5 meters**
	litter class:	**4**
	cover class:	**4**

Image 20. Cover board PV24 in Pleasant Valley

Pleasant Valley CRS4 parcel, Mgt. Unit 2:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
PV16	5-Jul-17	reconstruction	mesic prairie	wood	**n/a**	nest	nest
PV17	5-Jul-17	reconstruction	mesic prairie	wood	**n/a**	nest	nest
PV18	20-Jun-17	reconstruction	mesic prairie	rubber	**518**	female	juvenile (1st yr.)

Land Use Summary: The transect area appears to be in pasture in 1872 plat maps to 1954 when aerial photos show it in row crops. The area was planted in dry prairie in 2003. The nearest remnant, a woodland, is over 300 meters to the east.

Plant Summary: The transect area is dominated by short native grasses and forbs with some smooth brome scattered about (image 21).

Soils: Elliot silt loam, 2-4 percent slope, somewhat poorly drained, not hydric. Cover boards are 25 m. from Ashkum silty loam, a hydric wetland soil.

Image 21. Cover board PV18 in Pleasant Valley

Table 17.Pleasant Valley CRS4 parcel, Unit 02, Plant List

Cover Boards	Plant List - survey 20-OCT-2017	Abundance
PV16, 17, 18	Aster pilosus	occasional
PV16, 17, 18	Dalea purpurea	rare
PV16, 17, 18	Daucus carota	occasional
PV16, 17, 18	Echinacea purpurea	occasional
PV16, 17, 18	Eryngium yuccifolium	occasional
PV16, 17, 18	Helianthus grossesettarus	occasional
PV16, 17, 18	Rhamnus cathartica	occasional
PV16, 17, 18	Cornus sp.	rare
PV16, 17, 18	Ratibida pinnata	common
PV16, 17, 18	Silphium laciniatum	occasional
PV16, 17, 18	Solidago altissima	occasional
PV16, 17, 18	Solidago nemoralis	occasional
PV16, 17, 18	Solidago speciosa	occasional
PV16, 17, 18	Boutelous curtipendula	occasional
PV16, 17, 18	Bromus inermis	occasional
PV16, 17, 18	Schizachyrium scoparium	common
PV16, 17, 18	Sorghastrum nutans	common
	Vegetation height:	**.3 m with sporadic clumps of >1.5 m**
	litter class:	**4**
	cover class:	**4**

Lake in the Hills Fen, IDNR Parcel:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
LIH04	9-Jun-14	remnant	dry prairie	wood	**307**	male	juvenile (1st yr.)
LIH05	28-May-14	remnant	dry prairie	wood	**306**	female	juvenile (1st yr.)
LIH05	30-Jun-14	remnant	dry prairie	wood	**304**	male	juvenile (1st yr.)
LIH06	9-Jun-14	remnant	dry prairie	wood	**308**	female	juvenile (1st yr.)
LIH06	21-Jul-14	remnant	dry prairie	wood	**313**	female	juvenile (1st yr.)
LIH06	7-Jul-14	remnant	dry prairie	wood	**314**	female	juvenile (1st yr.)
LIH06	7-Jul-14	remnant	dry prairie	wood	**315**	male	juvenile (1st yr.)
LIH07	6-Jul-15	remnant	dry prairie	tin	**344**	male	juvenile (1st yr.)
LIH08	30-Jun-14	remnant	dry prairie	rubber	**303**	male	juvenile (1st yr.)
LIH08	21-Jul-14	remnant	dry prairie	rubber	**318**	male	juvenile (1st yr.)
LIH08	5-May-17	remnant	dry prairie	rubber	**n/a**	unknown	juvenile (1st yr.)
LIH08	12-Jun-15	remnant	dry prairie	rubber	**342**	male	adult
LIH09	25-Jul-14	remnant	dry prairie	wood	**319**	female	juvenile (asy)
LIH09	24-Jun-15	remnant	dry prairie	wood	**343**	female	adult
LIH09	21-May-15	remnant	dry prairie	wood	**n/a**	male	juvenile (asy)
LIH37	19-May-17	remnant	mesic prairie	wood	**516**	female	adult

Land Use Summary: This is a remnant prairie.

Plant Summary: The species list is indicative of a remnant dry prairie, lower diversity and short in stature. Several non-native species are also common (image 23). The shorter stature is perfect for basking

snakes. The vegetation surrounding LIH37 is taller, less diverse, with fewer native species (image 23). It is also farther downhill and in a moister area.

Soils: Lorenzo loam, well drained, not hydric; Casco-Rodman complex, somewhat excessively drained, not hydric. Cover boards are 30-60 m. from the nearest hydric soil, Houghton muck.

Image 22. LIH09 cover board in Lake in the Hills.

Image 23. LIH37 cover board in Lake in the Hills.

Table 18. Lake in the Hills Fen, IDNR parcel, Plant List

Cover Boards	Plant List survey date 25-AUG-2016	Abundance
LH 6, 7, 8, 9 & 10	Anemone cylindrica	occasional
LH 6, 7, 8, 9 & 10	Aster ericoides	occasional
LH 6, 7, 8, 9 & 10	Convolvulus arvensis	occasional
LH 6, 7, 8, 9 & 10	Daucus carota	occasional
LH 6, 7, 8, 9 & 10	Silene cserei	occasional
LH 6, 7, 8, 9 & 10	Physalis virginiana	occasional
LH 6, 7, 8, 9 & 10	Rosa carolina	common
LH 6, 7, 8, 9 & 10	Ratibida pinnata	rare
LH 6, 7, 8, 9 & 10	Verbena stricta	occasional
LH 6, 7, 8, 9 & 10	Andropogon gerardii	common
LH 6, 7, 8, 9 & 10	Bouteloua curtipendula	occasional
LH 6, 7, 8, 9 & 10	Bromus inermis	very common
LH 6, 7, 8, 9 & 10	Poa compressa	common
LH 6, 7, 8, 9 & 10	Poa pratensis	abundant
LH 6, 7, 8, 9 & 10	Schizachyrium scoparium	common
LH 6, 7, 8, 9 & 10	Sorghastrum nutans	common
	Vegetation height:	**1 ft**
	litter class:	**4**
	cover class:	**4**

Cover Class Ranges
1 = 0-25%
2 = 25-50%
3 = 50-75%
4 = 75-100%

Cover Boards	Plant List survey date 25-AUG-2016	Abundance
LH 1,2,3,4 & 5	Asclepias syriaca	occasional
LH 1,2,3,4 & 5	Cirsium arvense	occasional
LH 1,2,3,4 & 5	Daucus carota	abundant
LH 1,2,3,4 & 5	Helianthus grosseserratus	occasional
LH 1,2,3,4 & 5	Eupatorium altissimum	common
LH 1,2,3,4 & 5	Monarda fistulosa	occasional
LH 1,2,3,4 & 5	Phlox glaberrima	occasional
LH 1,2,3,4 & 5	Ratibida pinnata	occasional
LH 1,2,3,4 & 5	Solidago altissima	very common
LH 1,2,3,4 & 5	Verbena stricta	occasional
LH 1,2,3,4 & 5	Andropogon gerardii	occasional
LH 1,2,3,4 & 5	Bromus inermis	very common
LH 1,2,3,4 & 5	Phalaris arundinacea	locally abundant
LH 1,2,3,4 & 5	Poa pratensis	abundant
LH 1,2,3,4 & 5	Sorghastrum nutans	occasional
	Vegetation height:	**2 ft.**
	litter class:	**4**
	cover class:	**4**

Lake in the Hills Fen, Village of Lake in the Hills, Rothschild parcel:

CB ID	Date	Community Type	Natural Community	CB material	Mark	Sex	Age
LIH17	23-May-17	reconstruction	dry prairie	wood	**514**	female	juvenile (asy)
LIH18		reconstruction	dry prairie	wood	**515**	male	juvenile (1st yr.)

Land Use Summary: From 1872 plat maps to 2009 this area was in pasture that turned into old-field once the grazing cattle were removed. After 2009, brush was removed and the area was over-seeded with a dry prairie mix. The cover boards are located less than 10 meters from a remnant prairie.

Plant Summary: The transect area is dominated by thick brome with a few forbs and a few native grasses (image 24).

Soils: Lorenzo loam, well drained, highly erodible, not hydric. Cover boards are 100 m. from the nearest hydric soil, Houghton muck.

Image 24. LIH18 cover board in Lake in the Hills.

Discussion

Cover Board Surveys

The comprehensive species data is biased due to the fact that cover board placement was based on the goal of locating O. *vernalis* populations; most of the boards were placed in open grasslands, prairies and savannas, particularly in areas with a history of O. *vernalis* observations. Although 25 different sites were actively surveyed with cover boards at some point between 2014 and 2017, only nine sites had O. *vernalis* occurrences and only 6 sites had O. *vernalis* occurrences under cover boards. A commonality among these nine sites was the presence of at least one remnant natural community within their boundaries. The fact that 45% of the occurrences were in reconstructed natural areas shows that O. *vernalis* will migrate out of remnant areas into suitable reconstructed habitat when it is provided.

Adult O. *vernalis* were found more often but not significantly more often than the two juvenile classes combined. The three different age classes, adult, sub-adult (juvenile asy), and juvenile (1st yr.), were found relatively equally in similar habitat types, approximately half in remnant communities, half in reconstructed communities. The age classes differed in preferred natural communities, however. The majority of adults were found in mesic prairie and both juveniles and asy juveniles were found more often in dry prairies.

Geographically, the known populations of O. *vernalis* were more concentrated on the eastern half of the county. This is probably because the western half of the county is heavily dominated by agriculture. The size of the site did not seem to be a factor in the presence or absence of O. *vernalis*, one of the smallest sites, Larson Prairie, a nine acre prairie remnant surrounded by infrastructure and industry, had two occurrences in two different years.

The actual plant lists that were compiled for transects with O. *vernalis* occurrences were quite varied in the amount of native and non-native species and the over-all diversity. A common theme was varied heights of the vegetation. Each transect with occurrences had some shorter grasses and forbs. Some areas also contained some taller forbs, but not all occurrence areas had taller species (up to 3 feet). The shorter patches are likely chosen for basking.

Although many of the cover board locations were on or near hydric soils, some were not. The hydric soils may offer hibernaculum opportunities in the form of crayfish burrows. But given the limited scope of this aspect within this research project, no conclusions can be drawn. A more in-depth study would need to be done to see if there is any link between soil type and O. *vernalis* occurrences.

Head-starting

The challenges of rearing young O. *vernalis* proved to be many. There was a great deal of disparity in individual weight gains, even within clutches. The young were eventually divided into different tanks based on weight to try to ensure that feeding opportunities were equal. Their food was dusted with a vitamin D, calcium powder but we couldn't verify that this made it into the snake's diet or if it came off before the snake ate the invertebrates. Water dishes were provided with added calcium but we couldn't verify that they were seeking out this additional source of hydration. Some young developed kinks in their skeletal structure indicating a possible lack of calcium intake and some appeared dehydrated at times.

Whether a diet that can easily be provided to captive *O. vernalis* (i.e. crickets and waxworms) is adequate for survival during the head-starting period is unknown. Small invertebrates that are easily obtained year-round often have hard exoskeletons, which may lead to digestive issues such as impactions. It is possible that these feeder animals, individually or in combination, do not provide an optimal diet for *O. vernalis* even with the addition of vitamin/mineral supplements. In addition, handling the snakes to assess weight and health and cleaning their enclosures, while necessary, may stress the young snakes and possibly lead to reduced fitness. The hatching rate of in-situ incubated eggs (92.3%) was high but the mortality rate for captive reared young was not what we had hoped for; 39.6% of all hatched individuals did not survive to be released in the following summer.

After two years of head-starting young *O. vernalis,* our conclusion is that they do not respond well to captivity and the activities necessary to head-start the young. However, our in-situ hatching rate of 92.3% compared to the ex-situ hatching rate of 40% may suggest another possible means of supplementing current populations. Perhaps increasing hatching success with in-situ incubation and then releasing the neonates directly back into the wild where the eggs were found may also be a means to supplement existing populations. This approach to supplementing populations may be more practical for an institution with limited resources. The head-starting program proved to be time consuming and costly.