

# The prey and foraging range of *Cerceris fumipennis* and its use for bio-surveillance of the Emerald Ash Borer (*Agrilus planipennis*)

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March 2014



- Tree host associations aid in determining prey selection within certain forest types
- *Cerceris fumipennis* seasonality overlaps with Buprestid prey allowing for documentation of seasonality of various secretive/difficult to survey species

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest states (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service.

<http://www.nsrcforest.org>

# Project Summary



- Ash trees are a prominent feature in the northern forest region and are important to the biodiversity of this 26 million acre landscape. Destruction of large populations of ash can have severe ecosystem-level consequences. Currently, the greatest threat to ash trees comes from extensive and serious infestations of the Emerald Ash Borer, EAB (*Agrilus planipennis*).
- Fortunately, *Cerceris fumipennis*, a predatory wasp, is recognized as presenting an extremely effective technique for locating and parasitizing adults of this serious pest recently introduced to New Hampshire (2013).

# Project Summary *continued*



- The NH Department of Agriculture and Division of Forests regard an understanding of the biology of this wasp as being critical in development of their plans for detecting low density populations of EAB.
- This project was to monitor two large colonies of this wasp. One at the Boscawen State Forest Nursery and another on private land in Epsom, NH. Incoming female wasps with prey were captured and their prey were collected and documented.

# Project Summary *continued*



- Beginning June 26<sup>th</sup> two-hundred female wasps emerged within 15 days of each other. The wasps continue to forage for beetle prey after Aug 22<sup>nd</sup> but become unproductive by the 31<sup>st</sup>. Thirty-four different prey species were collected and seasonality was studied for ten of the most common prey. No EAB was observed during the field season of 2014.
- Monitoring for EAB is a key step in keeping the forests of New England and New York healthy and productive. *C. fumipennis* is being utilized to help in the detection of low density populations of EAB so effective management in the Northern Forest region can be implemented early.

# Background and Justification: Ash Trees

- Ash trees are a prominent feature in the 26-million acre Northern Forest research region throughout many of our northern cities along with northern hardwood forests and associated aquatic ecosystems.
- Loss of this species may have dramatic effects on the carbon and nitrogen cycles within the affected areas.
- Ash trees are important both economically and culturally.



Baseball  
bats



Furniture



Native American baskets

# Background and Justification: Emerald Ash Borer (EAB)

- Currently, the greatest threat to Ash trees comes from extensive and serious infestations of *Agrilus planipennis*, or the Emerald Ash Borer (EAB).
- EAB originated from the Russian East and northeastern China where it is occasionally a minor pest of native ash tree species.
- It was first found in the United States in 2002 in Michigan, and is now known from 22 states, plus Quebec and Ontario, Canada.
- In Michigan, at least 15 million ash trees in urban and forested settings have been destroyed by the EAB.
- EAB has recently been discovered in Concord, NH, less than 75 km from the Northern Forest. This destructive beetle has also been found in the Montérégie region of Quebec, no more than 160 km from NH's northern border and only 64 km from the largest area of the Northern Forest of New England and New York.

Emerald Ash Borer



# Background and Justification: *Cerceris fumipennis*

- *Cerceris fumipennis* is a predatory wasp that specializes in catching, stinging, and paralyzing wood boring beetles including EAB.
- The wasp has outperformed all other current methods of detecting presence of wood boring beetles when in small and diffuse populations.
- Seasonality, prey selection and whether prey preferences are fixed or shift due to difference in tree communities must be better understood to determine if this wasp will be an efficient tool for bio-surveillance of native and non-native wood bring beetles.

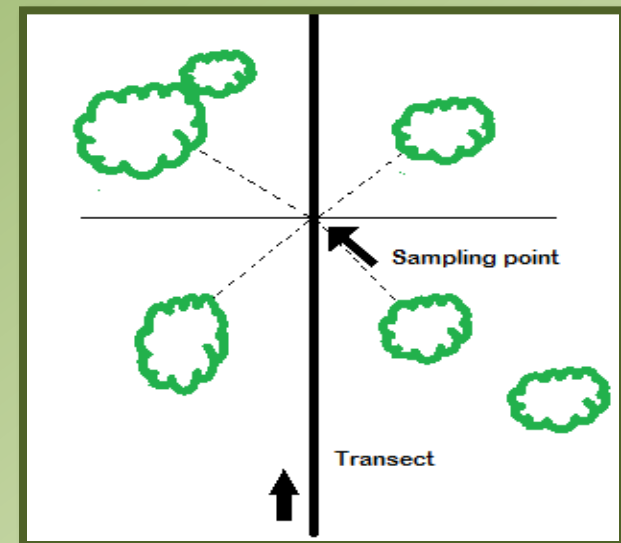
*Cerceris  
fumipennis*



# Methods

- Forest types determined by walking three 0.5 m transects away from each colony
- Tree sampling was done using a modified point-centered quarter density method
- 6-7 tree sampling points taken along each transect depending on terrain

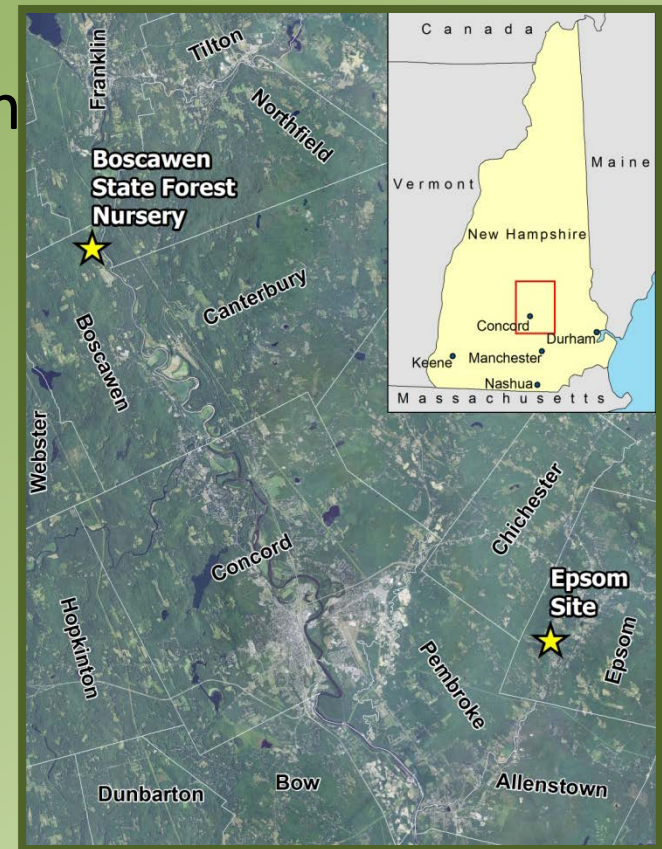
Point-centered quarter  
method





# Methods

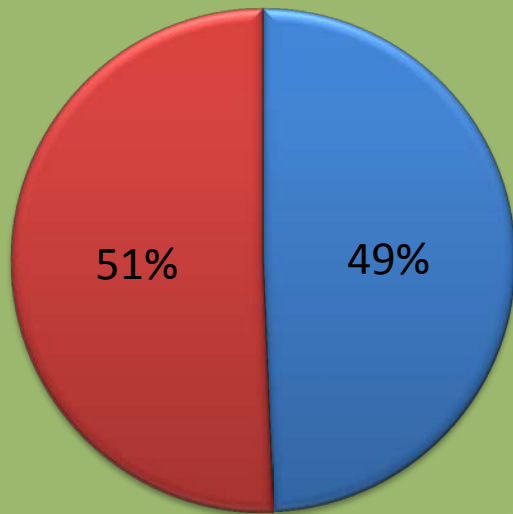
- 2 large colonies of +200 nests
  - Epsom American Legion parking lot, Epsom, NH
  - Boscawen State Forest Nursery, Boscawen, NH
- June 23<sup>rd</sup> – August 31<sup>st</sup> 2013
- 9-14 random nests monitored at each site twice a week for 6-8 hours
  - Vented plastic cup over nests to time females entering and exiting
- 3 hours per visit was to intercept females with prey in flight
- Minimum goal of 50 prey per week



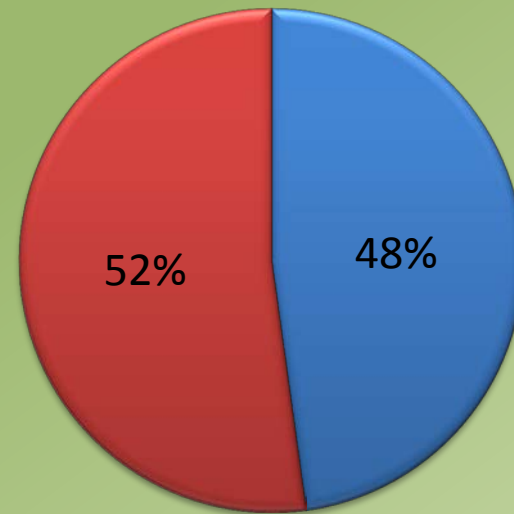
Map of colonies

# Results – Forest types

Boscawen trees



Boscawen prey

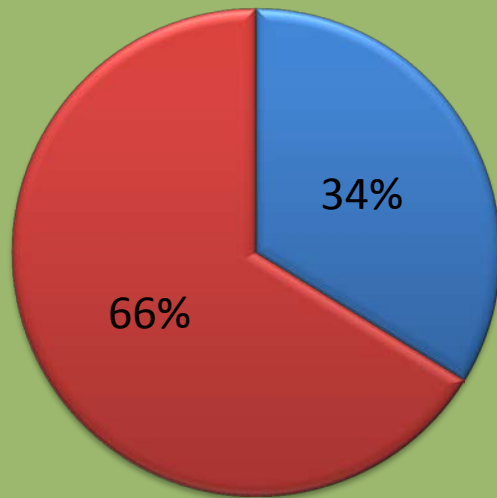


■ coniferous  
■ deciduous

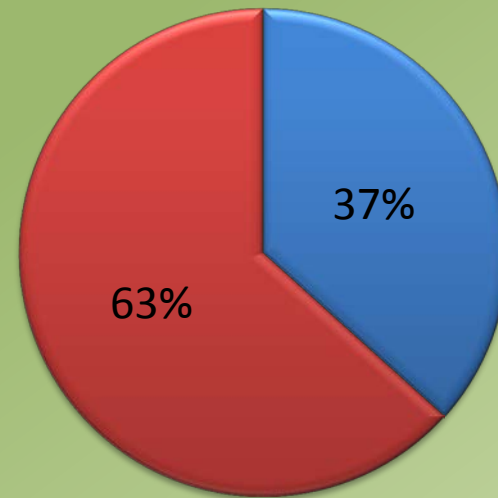


# Results – Forest types

Epsom trees



Epsom prey



■ coniferous  
■ deciduous



# Results – seasonality of SWBB

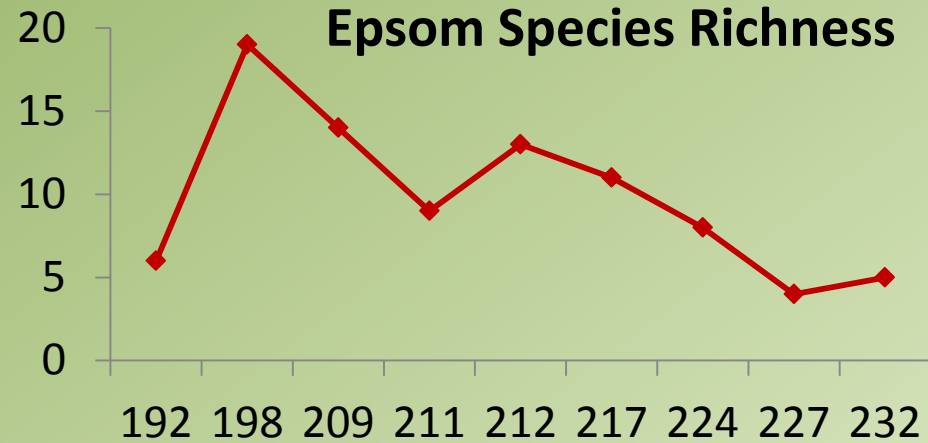
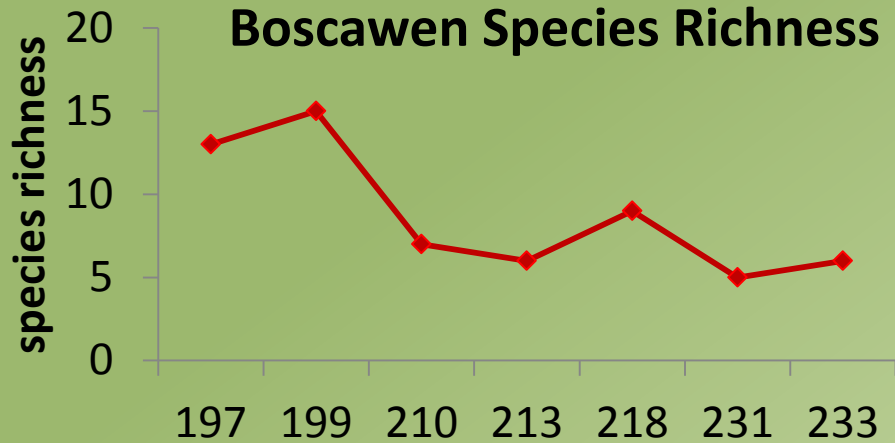
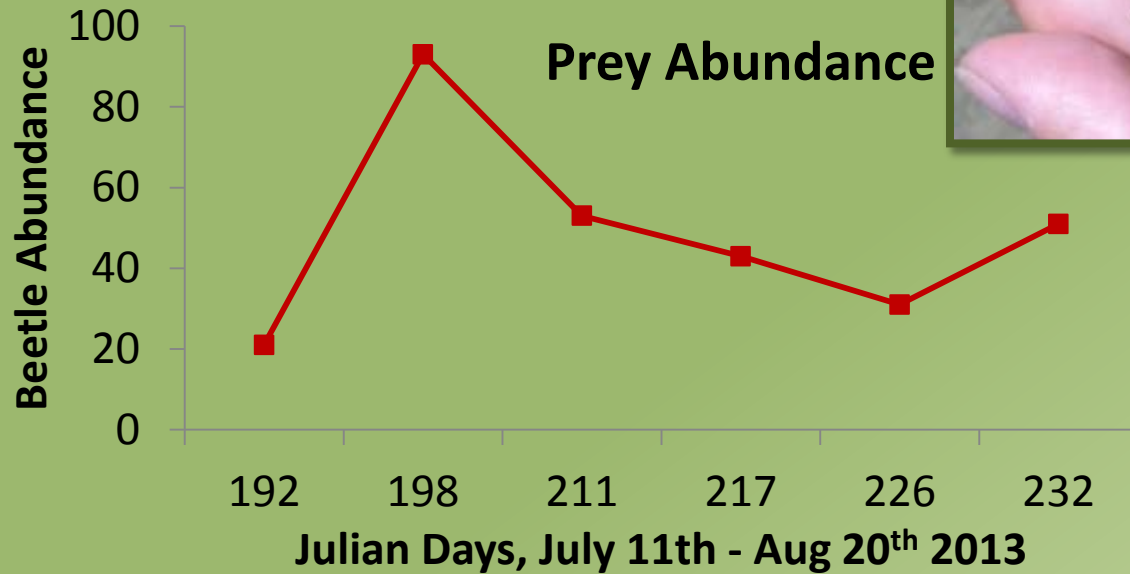
- Single male was first to emerge – June 26<sup>th</sup>
- July 9<sup>th</sup>, 150 nests were opened but no females were observed returning with prey
- July 11<sup>th</sup>, +200 nests at each site and females were observed with prey
  - 21 individuals of 6 different species (Epsom)
- July 16<sup>th</sup>
  - 70 individuals of 13 different species (Boscawen)



# Results – seasonality



Prey



# Results – seasonality of prey

- Greatest species richness – July 17<sup>th</sup>
  - 19 species (Epsom)
- Prey foraging continued past Aug 22<sup>nd</sup> when regular sampling ended
- Aug 31<sup>st</sup>
  - 62 open nests – Boscawen
  - 41 open nests – Epsom
  - Females observed in flight but none with prey



Nest

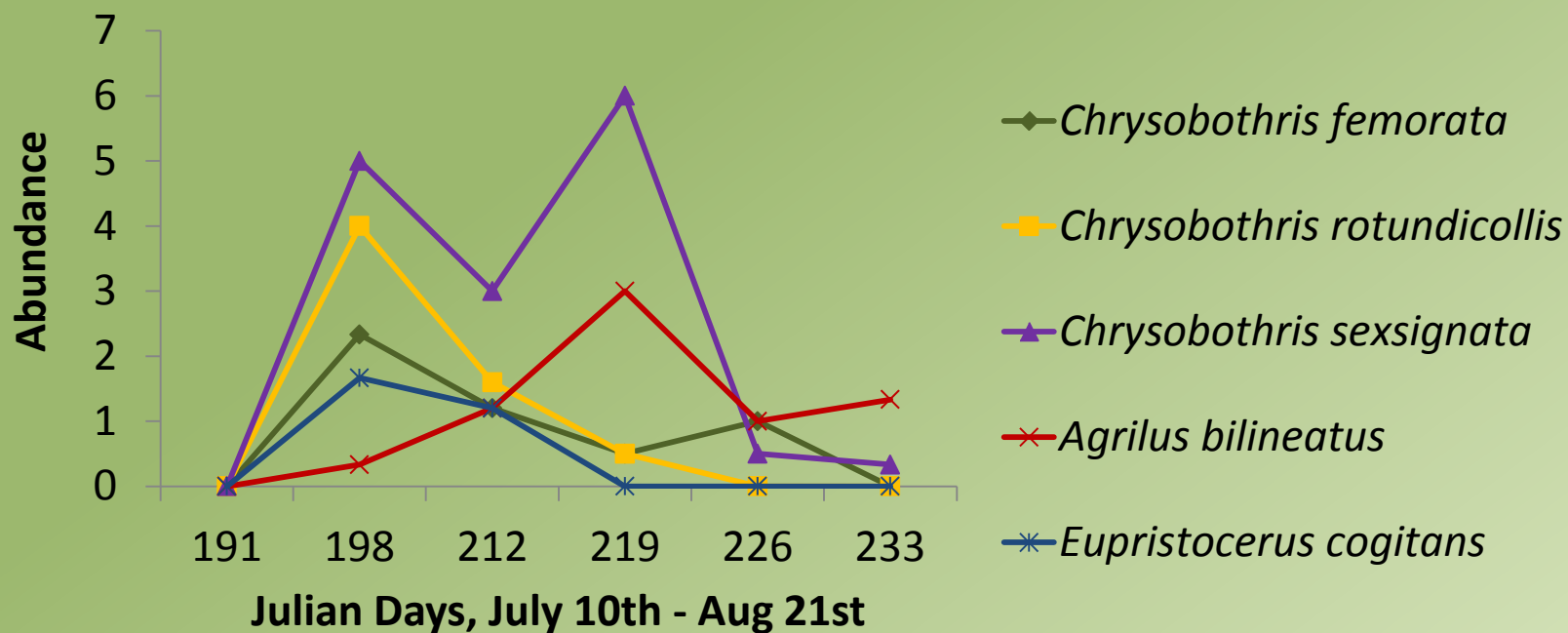
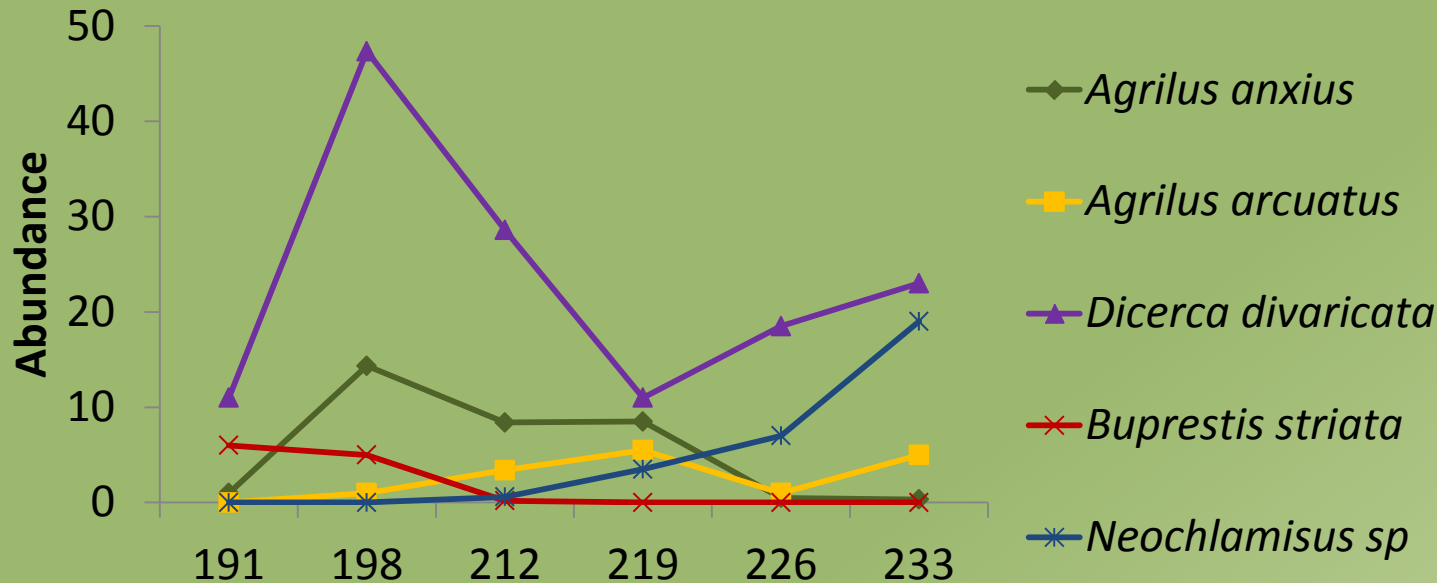


Boscawen  
colony



wasp with  
prey

## Weekly Average Prey Abundances





		Bosc	Epsom	total			Bosc	Epsom	total
Actenodes	simi*†	0	1	1	Chrysobothris	neopusilla*	1	0	1
Agrilus	anxius	44	61	105	Chrysobothris	rotundicollis*	9	13	22
Agrilus	arcuatus*	27	21	48	Chrysobothris	scabripennis	2	2	4
Agrilus	bilineatus	10	9	19	Chrysobothris	sexsignata	25	18	43
Agrilus	carpini*†	0	4	4	Chrysobothris	verdigrispennis*†	5	4	9
Agrilus	corylicola*	0	1	1	Dicerca	asperata*	4	3	7
Agrilus	politus	5	3	8	Dicerca	caudata*	0	5	5
Agrilus	pseudocoryli	1	3	4	Dicerca	divaricata	187	245	432
Agrilus	ruficollis	0	1	1	Dicerca	pugionata*	0	3	3
Brachys	aerosus	0	1	1	Dicerca	punctulata	0	5	5
Brachys	ovatus	0	5	5	Dicerca	tenebrica	1	1	2
Buprestis	consularis*	0	4	4	Dicerca	tuberculata*	4	3	7
Buprestis	maculativentris	1	0	1	Eupristocerus	cogitans	0	14	14
Buprestis	striata	12	10	22	Neochlamisus	bebbianae	53	31	84
Chrysobothris	dentipes	2	2	4	Phaenops	aeneola*	2	1	3
Chrysobothris	femorata	9	7	16	Phaenops	fulvoguttata	5	4	9
Chrysobothris	harrisi	2	1	3	Poecilonata	cyanipes*	4	1	5
<b>abundances</b>		<b>415</b>	<b>487</b>	<b>902</b>	<b>species</b>	<b>richness</b>	<b>23</b>	<b>32</b>	<b>34</b>

\* Ten most abundant species

† New state record (NH)

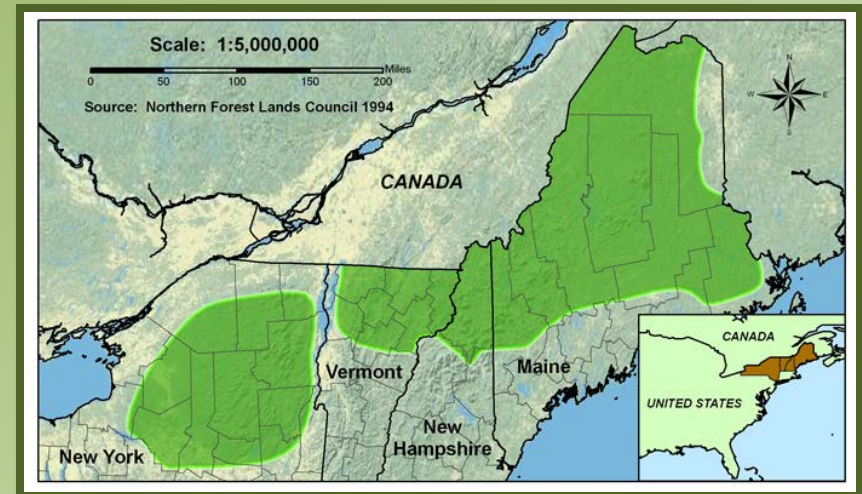
- Mean successful foraging time was 47 min, shortest – 6 min, longest – 217 min
- No Emerald Ash Borer were documented
- 890 individual beetles from 30 different species were collected from July 11<sup>th</sup> – Aug 21<sup>st</sup>



# Implications and Applications in the Northern Forest region

- Ash trees are a prominent feature in the Northern Forest research region
- Line streets in many northern cities
- In northern hardwood forests and associated aquatic ecosystems
- Destruction of large populations would have severe ecosystem-level consequences
- Economic and cultural loss

Northern  
Forest



# Implications and Applications in the Northern Forest region

- Detection of low density populations of EAB is necessary so effective management in the Northern Forest region can be implemented early
- *C. fumipennis* is being utilized to help in the detection of low density populations of the invasive beetle so effective management in the Northern Forest region can be implemented early.



SWBB



EAB

# Future Directions

- Does prey selectivity change over the foraging season?
- Accurate seasonality of *C. fumipennis*
  - Emergence
  - Decline in productivity
  - Demise of colony
- Actual foraging distance?
  - Foraging times
  - Distance traveled
- Productivity based on volume of prey
  - Individual
  - Colonial

Epsom colony



Letting female  
wasp into nest



# List of Products



- Conference presentations
  - Dube, M. C. 2014. The biology and prey of the predatory wasp *Cerceris fumipennis* and its use for bio-surveillance of the Emerald Ash Borer. Poster presented at the Northeastern Forest Pest Council, Quebec City, Quebec, CA.
  - Dube, M. C. 2014. The biology and prey of the predatory wasp *Cerceris fumipennis* and its use for bio-surveillance of the Emerald Ash Borer. Presentation at the New England Society of American Foresters, Nashua, NH, USA.

This project was supported by the Northeastern States Research Cooperative through funding made available by the USDA Forest Service. The conclusions and opinions in this paper are those of the authors and not the NSRC, the Forest Service, or the USDA

THANK YOU!