2020 Magicicada
Brood Mapping Project
Table of Contents

Table of Contents..................................................................................................................................................3

Species Information..............................................................................................................................................5

Magicicada cassini (Fisher 1851).......................................................................................................................5

Approximate range of M. cassini from verified records in the Cicada Central database as of February 2017. .........................................................................................................................................................6

Typical M. –cassini calling (Court I) song sonogram. .........................................................................................6

Typical M. –cassini “Court II” song sonogram....................................................................................................7

Typical M. –cassini “Court III” song sonogram..................................................................................................7

Magicicada septendecim (Linnaeus 1758).............................................................................................................8

Approximate range of M. septendecim from verified records in the Cicada Central database as of February 2017. .........................................................................................................................................................8

Typical M-decim Calling/ Court I song sonogram...............................................................................................9

Typical M-decim Court II song sonogram...........................................................................................................9

Typical M-decim Court III song sonogram .........................................................................................................10

Magicicada septendecula Alexander and Moore 1962.........................................................................................11

Approximate range of M. septendecula from verified records in the Cicada Central database as of February 2017. .........................................................................................................................................................12

Typical M. –decula calling song sonogram. ..........................................................................................................12

Typical M. –decula “Court III” song sonogram..................................................................................................13

Magicicada tredecassini Alexander and Moore 1962 .........................................................................................14

Approximate range of M. tredecassini from Cicada Central database records as of 31 December 2010. .........................................................................................................................................................14

Typical M. –cassini calling (Court I) song. ...........................................................................................................15

Typical M. –cassini “Court II” song....................................................................................................................15

Typical M. –cassini “Court III” song. ..................................................................................................................16

Magicicada neotredecim Marshall and Cooley 2000.............................................................................................17

Approximate range of M. neotredecim from Cicada Central database records as of 31 December 2010. .........................................................................................................................................................18

M. neotredecim calling and “Court I” song (undisplaced). .................................................................................20

M. neotredecim “Court II” song (undisplaced). ...................................................................................................20

M. neotredecim “Court III” song (undisplaced). .................................................................................................20

Magicicada tredecim (Walsh and Riley 1868).......................................................................................................21

Approximate range of M. tredecim from Cicada Central database records as of 31 December 2010. .........................................................................................................................................................21

Magicicada tredecula Alexander and Moore 1962...............................................................................................22

Approximate range of M. tredecula from Cicada Central database records as of 31 December 2010. .........................................................................................................................................................23

Typical M. –decula calling song..............................................................................................................................23

Typical M. –decula “Court III” call. ....................................................................................................................24

Brood Maps.........................................................................................................................................................25

Fig. 1. Verified, positive records for all broods in the Periodical Cicada Database as of 16 March 2015. Brood V is represented by gold stars.................................................................................................................25

Appendix 1: Planning a mapping route..............................................................................................................26
What to look for.................................................................27
Recording your data..........................................................29

Appendix 2: Standard Data Sheet..............................................33

Appendix 3: The GPS Datalogger .............................................36
  Fig. A3.1 GPS datalogger..................................................36
  Each kit consists of:..........................................................36
To use the Map-O-Matic device.............................................37
  Fig. A3.2 GPS Datalogger..................................................38
  Fig. A3.3. Asus eeePC home screen (Favorites).....................38
  Fig. A3.4. GPSRecorder2 Home screen................................39
  Fig. A3.4. Data collection..................................................40
  Fig. A3.6. Asus eeePC Home Screen (Files and Folders)...........41
  Fig. A3.7. Asus eeePC Files and Folders................................41
Troubleshooting the GPS datalogger.................................43
  Problem: The car adapter does not power the computer...........43
  In the type of adapter shown above, pry the purple fuse out using forceps, and
replace it with an automotive-type 3A fuse available at auto supply stores........43
  In the type of adapter shown above, unscrew the tip of the adapter and replace
the fuse with a 3A tubular fuse, available at auto supply stores......................43
  How to open a UNIX terminal window:..................................43
  How to test whether the GPS unit is finding satellites...............44
  Fig. A3.8. xgps Home Screen...........................................44

Appendix 4: GPS Navigator Devices .......................................45
  Database records as Points of Interest (POI)..........................45
  Figure A4.1. POI on a Nuvi 200 series navigator......................45
  Figure A4.2. POI on a Nuvi 1300 widescreen GPS navigator........46
  Loading points using POI Loader........................................47
  Loading points using a microSD card..................................47

Appendix 5: Locality Codes................................................48

Appendix 6: Labeling specimens and specimen preservation........50

Appendix 7: Practical Considerations.................................51
  Things to have in each vehicle........................................51
  Safety tips in the field....................................................51
  Places to get common items.............................................51
  Funding Sources..........................................................52

Appendix 8: Important locations and contact information.........53

Literature........................................................................54
Species Information

*Magicicada cassini* (Fisher 1851)

A 17-year cicada, usually smaller than *M. septendecim*. No orange coloration in front of the wing insertion behind the eye. Abdomen entirely black except in some locations (especially towards the western part of the range) where individuals may have weak ventral yellow-orange marks; if present, these tend to be faded and rarely form complete stripes. Sometimes such individuals may be difficult to distinguish from *M. septendecula* if the calling song is not available. Calling song phrases consist of a series of ticks followed by a shrill buzz. Males of *M. cassini* and its close 13-year relative *M. tredecassini* sometimes synchronize their calls and flights all at once, a display that has been likened to a “giant game of musical chairs”. Scale is 1 cm long.
Approximate range of *M. cassini* from verified records in the Cicada Central database as of February 2017.

Typical *M. cassini* calling (Court I) song sonogram.
Typical *M. cassini* “Court II” song sonogram.

Typical *M. cassini* “Court III” song sonogram.
Magicicada septendecim (Linnaeus 1758)

A large 17-year periodical cicada with broad orange stripes on the underside of the abdomen, and with orange coloration on the sides of the thorax behind each eye and in front of the forewings (not visible in the photographs). The calling song phrases are said to resemble the word “Pharaoh.” Scale is 1 cm long.

Approximate range of M. septendecim from verified records in the Cicada Central database as of February 2017.
Typical M-decim Calling/ Court I song sonogram

Typical M-decim Court II song sonogram
Typical M-decim Court III song sonogram
Magicicada septendecula Alexander and Moore 1962

A 17-year cicada usually smaller than *M. septendecim* and similar to *M. cassini* in size, with narrow, well-defined orange stripes on the underside of the abdomen but no orange coloration in front of the wing insertion behind the eye. This species is often rarer or patchier than *M. septendecim* and *M. cassini*. The calling song of the -decula sibling species is rhythmically unlike those of the other two forms and consists of a series of short phrases lasting 15-30 seconds. The first two courtship songs have not been well characterized but may bear the same relationship to each other as the courtship songs of the other species. Scale is 1 cm long.
Approximate range of *M. septendecula* from verified records in the Cicada Central database as of February 2017.

Typical *M. decula* calling song sonogram.
Typical *M. ~decula* “Court III” song sonogram.
**Magicicada tredecassini** Alexander and Moore 1962

Usually smaller than *M. tredecim*. No orange coloration in front of the wing insertion behind the eye. Abdomen entirely black except in some locations where individuals may have weak ventral yellow-orange marks; if present, these tend to be faded and rarely form complete stripes. Sometimes such individuals may be difficult to distinguish from *M. tredecula* if the calling song is not available. Calling song phrases consist of a series of ticks followed by a shrill buzz. Males of *M. tredecassini* and its close 17-year relative *M. cassini* sometimes synchronize their calls and flights all at once.

Approximate range of *M. tredecassini* from Cicada Central database records as of 31 December 2010.
Typical M. – cassini calling (Court I) song.

Typical M. – cassini “Court II” song.
Typical *M. –cassini* “Court III” song.
*Magicicada neotredecim* Marshall and Cooley 2000

*M. neotredecim* was described in 2000 (Marshall and Cooley 2000). *M. neotredecim* and its closest relative, *M. septendecim*, are consistently distinguishable only in life cycle length. The new species is similar to 13-year *M. tredecim*, but distinguishable in male song pitch, female song pitch preferences (Marshall and Cooley 2000), abdomen color, and mitochondrial DNA (mtDNA) lineage (Martin and Simon 1988; Martin and Simon 1990; Simon et al. 2000). These findings are consistent with the theory that *M. neotredecim* evolved from populations of *M. septendecim* by a life cycle change (Martin and Simon 1988; Martin and Simon 1990; Marshall and Cooley 2000; Simon et al. 2000).

The photos show that *M. neotredecim* is extremely similar to 17-year *M. septendecim* in appearance. The dark bands on the underside of the abdomen are similar to those of *M. septendecim*. 
Approximate range of M. neotredecim from Cicada Central database records as of 31 December 2010.

The two 13-year -decim species have a special geographic relationship -- they are not sympatric (living together) across the entire 13-year range. *M. neotredecim* inhabits the midwestern part of the 13-year range, while *M. tredecim* inhabits the southern and southeastern part.
The two species overlap only along a narrow region in northern Arkansas, western Kentucky, and southern Missouri, Illinois, and Indiana. By comparison, the three 17-year species are found together from Connecticut to Kansas, and the remaining 13-year species together inhabit most 13-year populations. Where *M. neotredecim* and *M. tredecim* overlap, *M. neotredecim* songs are much higher-pitched, while *M. tredecim* songs are slightly lower-pitched. This pattern of reproductive character displacement suggests that the songs have evolved to reduce wasteful sexual interactions between the species.
M. neotredecim calling and "Court I" song (undisplaced).

M. neotredecim "Court II" song (undisplaced).

M. neotredecim "Court III" song (undisplaced).
**Magicicada tredecim** (Walsh and Riley 1868)

Generally similar to *M. septendecim* and *M. neotredecim* in appearance and behavior, but with lower pitched songs and lacking dark bands on underside of abdomen. Underside of abdomen varies from light orange to caramel color; sometimes light color extends up sides of abdomen above spiracles.

*Approximate range of M. tredecim from Cicada Central database records as of 31 December 2010.*
Magicicada tredecula Alexander and Moore 1962

Usually smaller than *M. tredecim* and similar to *M. tredecassini* in size, with narrow, well-defined orange stripes on the underside of the abdomen but no orange coloration in front of the wing insertion behind the eye. This species is often much more rare than *M. tredecim* and *M. tredecassini*. The calling song of the -decula sibling species is rhythmically unlike those of the other two forms, and consists of a series of short phrases lasting 15-30 seconds. The first two courtship songs have not been well characterized, but may bear the same relationship to each other as the courtship songs of the other species.
Approximate range of *M. tredecula* from *Cicada Central* database records as of 31 December 2010.

Typical *M. –decula* calling song.
Typical *M. decula* “Court III” call.
Fig. 1. Verified, positive records for all broods in the Periodical Cicada Database as of February 2017.
Appendix 1: Planning a mapping route

It is not always easy to know where to start, but existing maps are reasonable predictors. Note that M. –decim species choruses are strongest in the mornings, while M. –cassini species choruses are stronger in the afternoons. Weak M. –decim choruses can be difficult to hear from a moving car or if there is a lot of ambient noise (highways, construction, mowing, etc.). Take these factors into account—under poor conditions, you will need to think carefully about planning your route—and you’ll also need to be careful about estimating population densities or collecting negative records. If the weather cooperates, you can map from dawn until dusk.

Here are some suggestions for planning a mapping route. These suggestions are based on the methodology described in (Cooley et al. 2013).

1. Use the maps on www.magicicada.org, records in the Cicada Central database (see Appendix 8), or a GPS navigator (see Appendix 4) to find areas of emergence and to keep track of how long cicadas have been out in any given area.

2. **Begin and end each day with a positive record!** Each day, when you start mapping, you should go to an area where Magicicada are known to be present. Note the time, weather and temperature conditions, etc., and whether the cicadas are singing. You should return to known emergence locations (positive records) throughout each day (e.g., don’t spend an entire day just obtaining negative records), and you should end each day by visiting an area of emergence.

3. If the cicadas are not singing (e.g., it is raining, cold, etc.), you can still obtain records, though the process will be slow. Since negative records taken under poor conditions can be questionable, under poor conditions you should concentrate on visually locating areas of dense emergence (searching for adults, shed skins, etc.). You can also use periods of poor conditions to drive long distances to other mapping areas. Use the web to obtain current weather predictions.
4. If the cicadas are singing, then attempt to crisscross or “stitch” the brood boundary by driving slowly back and forth across the boundary, collecting both positive and negative records at 1/10 mile intervals (the trip odometer in some cars can be helpful here, as it may display 10ths even if the regular odometer does not). **Negative records are just as important as positives!** You can typically hear a *M. cassini* chorus from a closed vehicle at highway speeds, and extremely dense *M. decula* choruses can also be heard at speed. However, *M. septendecim* choruses have a pitch that is closely imitated by the tread patterns on some car tires or by the alternators of some cars. For all but the strongest *M. septendecim* choruses, or when mapping in the afternoon, you may need to stop your vehicle and turn off the engine. You don’t need to fully stop the car or turn off the engine for every record, but you will need to do so periodically just to be certain.

5. You should also consider stopping occasionally to take voucher photographs, recordings, and specimens. If you are collecting for genetic studies, plan to make at least a few large (ca. 100+ *M. septendecim* and other spp. if possible) collections stored frozen (dry ice or nitrogen) or in 95% ethanol for later genetic analysis. Clearly label all vouchers!

**What to look for**

Most literature makes note of the extreme densities typical of *Magicicada* (e.g., Dybas and Davis 1962). In reality there are shades of gray—periodical cicadas emerge as single individuals, light density choruses, and full choruses. These kinds of emergences are qualitatively different; single individuals seem to be stragglers, or off-cycle cicadas; low-density emergences may occur because of extinction or straggling, and high density emergences seem to have shaped much of cicada biology and behavior. Mixing these types of records is one reason that older emergence maps often suggest that the geographic extent of certain broods was once much larger than at present—stragglers or off-cycle emergences adjacent to an emergence tend to give an inflated impression of a brood’s geographic extent (Marshall 2001).
Periodical cicadas accidentally accelerate, or “straggle.” The straggling phenomenon may be a source of confusion about brood boundaries, since stragglers from one brood may be mistaken for low-density populations of another. **Thus, it is especially important to collect density information, especially where broods are in close proximity.** It is also important to collect any “stragglers” found for genetic analysis.

Therefore, if at all possible, when mapping you should note whether cicada densities meet any of the following criteria (these correspond to criteria listed in the instructions for the “Map-O-Matic” device). Beware that the timing of the emergence may affect your perceptions—choruses develop after adults emerge in large numbers, and choruses eventually die out, though individuals dwindle on.

The information below can help guide you in categorizing an emergence. As with any attempt to come up with simple categories, there will be situations that don’t seem to fit well into this scheme. That’s OK—take notes as you go, and if you find a situation that doesn’t seem to fit, take especially detailed notes, photographs, recordings, etc.

1. **No cicadas present.** No physical evidence of cicadas, and no songs heard. Negative records based on lack of songs must be taken under appropriate conditions in quiet surroundings.

2. **Stragglers.** A single individual (“straggler cicada”), or a very small number of highly localized cicadas. You may find physical evidence of a straggler, such as a single adult, nymph, shed nymphal skin, fragment of an adult (often a wing). More likely, you will hear a single adult singing, or widely scattered adults singing. The individual songs will be clearly audible, and there will be no perceptible background chorus.

3. **Low-density populations.** This category is difficult to define—it’s more than a handful of cicadas (category #2), and less than a full emergence (category #4). Low-density populations may consist of a few widely scattered individuals. You may find physical evidence of cicadas such as nymphs, skins, adults, or body parts. If you hear cicadas, you will be able to clearly distinguish individual calls, and there may be periods of silence between
calls. As you back away from an area of calling, the calls will not blend together into a uniform chorus, though you may hear more or less continuous, weak sound. Note that in the absence of other evidence, holes in the ground—even seemingly large numbers of holes—or even turrets—are not reliable evidence for *Magicicada* (though if you find suspicious holes, you should note that you found them).

4. **Full emergence.** Large numbers of nymphs, cast skins, or adults. If you are not at the very beginning or end of the emergence, you should also hear choruses. Large numbers of holes—of a size that you could insert you pinky into—and perhaps even turrets might be visible on patches of open ground. In extreme cases (or on open lawns), there may be piles of dead or rotting cicadas under trees, and the smell might be noticeable. Under appropriate weather conditions (warm, humid, sunny days) singing and flying cicadas will be clearly audible and visible. A full *M. tredecim* chorus will have a constant, tonal drone of about 1.1 kHz; a displaced *M neotredecim* chorus about 1.7 kHz, and an undisplaced *M. neotredecim* chorus about 1.3 or 1.4 kHz. You will be able to hear the individual songs of cicadas that are very close to you, but as you back away from the woods edge, the individual songs will blend together. A full *M. cassini* chorus may include synchronized calling and flying, which will be evident by intense waves of sound and periods of movement. A full *M. decula* chorus will have a metallic “beat” to it. Note that the relative densities of the species in a chorus will vary significantly, and over surprisingly short distances. An emergence is considered to be a full emergence if at least one species is dense.

**Recording your data**

**Using the website “www.magicicada.org.”** Project principals should avoid reporting records over the website. Principals’ records are considered “verified” and are classified as such in the Cicada Central database. **Records submitted over the website are considered “unverified” and are classified as such.**

**Using paper maps.** If you are marking records using paper maps, please use DeLorme state atlases. Inside the front cover, please write in indelible ink your name and “2017 Magicicada.” Either hand-deliver or mail the maps to John Cooley at the end of mapping. To note records on
the pages, mark positive records in pencil as dark circles and negative records as open circles, using landmarks and your car odometer to accurately place the circles. It is also extremely helpful if you trace your route lightly in pencil, using arrows to indicate direction of travel and occasionally noting time, temperature, and weather conditions. You may also wish to note chorus densities and species present. Pencil is an excellent choice for record keeping because it is erasable yet it will not be damaged by water or alcohol. **Advantages: Can be geocoded later, permanent hard copy may be archived. Disadvantages: Requires expertise and accuracy in map reading, and geocoding requires specialized software and may be tedious.**

**Using a handheld GPS unit.** Make sure your GPS unit is set to use the WGS 84 map datum. If you are using a handheld GPS unit, you can either note the Lat/Lon of data points and copy them into a field notebook, or you can make “waypoints” that will be downloaded later. In either case, note in your field notebook (use pencil) things such as time, temperature, weather conditions, chorus densities, and species present. **Advantages: Geocoding is rapid and instant, and some GPS devices can download waypoints directly into a computer. Disadvantages: Data must be downloaded or backed up frequently, which requires a laptop and special cables and software.** If you are marking waypoints, unless you also make notes in a field book (which must later be transcribed), you will not collect data on density or species present. Beware that some GPS units purge their waypoints if you change the batteries. **You should submit all records on the standard datasheet reproduced in Appendix 2.**

**Using the laptop datalogger (“Map-O-Matic”).** If you are using the laptop datalogger, then each time you start along a new road or enter a new region, start the logger (see detailed instructions in Appendix 3).
Then, as you drive along, use the keypad to enter data according to the following schemes:

For 17-year broods:

<table>
<thead>
<tr>
<th>M. septendecim</th>
<th>M. cassini</th>
<th>M. septendecula</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>4</td>
<td>1</td>
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<td>8</td>
<td>5</td>
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<td>9</td>
<td>6</td>
<td>3</td>
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</table>

The datalogger will automatically record the time, latitude, and longitude of each keystroke. However, you should occasionally make notes about temperature and weather conditions. To quit the program, type “q”. If you pass a chorus in which there are multiple species, make a separate record for each species in quick succession. They won’t have the exact same coordinates, but they will be extremely close. When using this device, you should try to collect records on 1/10 mile intervals. Hand-deliver or ship the datalogger to John Cooley at the end of the project.

Advantages: Allows rapid acquisition of locality, density, and species data.
Disadvantages: Must be backed up frequently and requires some familiarity with UNIX operating systems.

Written descriptions of record localities. As you collect records, write in your field notebook a written description of the locality, noting date, time, weather, etc. Try to record street addresses or intersections, and if a street has two identifiers (e.g., a name and a highway number), record both. You should submit all records on the standard datasheet reproduced in Appendix 2. Advantages: Requires no special equipment.
Disadvantages: Extremely difficult to geocode. Street signs may not match databases of street names used to geocode, so these sorts of records must often be geocoded by hand.
Appendix 2: Standard Data Sheet

The mapping project will generate a lot of data, and in the past, data have been submitted in a variety of formats, which has greatly complicated and delayed their integration into the database. In order to streamline this process, please follow a few simple rules and use the standard data sheet to report data (electronic copies available at: http://magicicada.org/magicicada/datasheet/). The standard data sheet is an Excel-compatible spreadsheet with the following column headings, in order:

A. **Latitude.** Latitude North should be included in decimal (dd.dddd”) format only, WGS 84 map datum. Most GPS units can easily be set to display this format. Degrees, minutes, and seconds format (dd°mm’ss”) or decimal minute format (dd°mm.mmm’) are difficult for computers to parse.

B. **Longitude.** Longitude West should be included in decimal (dd.dddd”) format only, WGS 84 map datum. Most GPS units can easily be set to display this format. Degrees, minutes, and seconds format (dd°mm’ss”) or decimal minute format (dd°mm.mmm’) are difficult for computers to parse. **Note that Longitude West does not have a negative sign for any location in North America.**

C. **Date.** Dates should be recorded in dd/mm/yyyy format.

D. **Time.** Local time should be recorded using a 24-hour clock.

E. **Elevation.** Elevation should be given in meters (m).

F. **Temperature.** Temperature should be given in Fahrenheit (°F).

G. **Species.** Use full species epithets (skip the genus name, *Magicicada*) when reporting species identities. Do not use abbreviations (-decim, -decula, etc.), and use “unknown” when the species is not known or when you are recording a negative record.

H. **Density.** Use the four categories defined in Appendix 1 to record density.

I. **State.** States should be given as 2-letter postal state abbreviations.

J. **Collector.** The last name or names of collectors should be recorded in this column.

K. **Locality Code.** Any locality codes assigned must use the format given in Appendix 5 and are to be considered provisional until incorporated into the database.

L. **Locality.** A brief description of the locality.

M. **Notes.** Any notes about the collection site, the cicadas there, etc.,
N. **Other.** Once you have added columns A-M to your datasheet, you may add as many additional columns as you see fit. Remember to clearly label them.
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<th>Lat</th>
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<th>Date</th>
<th>Time</th>
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Appendix 3: The GPS Datalogger

The “Map-O-Matic” datalogging GPS is constructed of off-the-shelf components.

![Fig. A3.1 GPS datalogger.](image)

Each kit consists of:

1. Asus eee surf computer (2G or 4G models), or similar.
2. Garmin GPS receiver (GPS 18 USB or GPS 18x USB models)
3. Keypad (Various models)
4. 110v charger/adapter
5. 12v Car charger/adapter
6. Carry case

As with any electronic device, avoid exposure to moisture, direct sunlight, high temperatures, or shocks, and allow air to circulate around the vents. The device costs approximately $400, and if it is lost or damaged, you are responsible for replacing it.

The Map-O-Matic device runs Ubuntu Netbook Remix OS. This OS is extremely stripped down, though files are organized in a manner similar to Mac OS 10.6 or Windows 7. You may find that the built-in trackpad on the ASUS eeePC is difficult to use; any USB mouse can be plugged in and used instead. All of these units have limited memory and hard drive...
space, and it is suggested that you periodically back your files up to a USB thumb drive and use another computer to email them to John Cooley.

Please do not replace, add, or modify any of the software on the computer. The software has been optimized for use in the datalogger. All units were tested before shipping.

**To use the Map-O-Matic device**

1. Plug the car charger into the power socket of the computer and plug the other end into the cigarette lighter of your car. Be aware that in some cars, the lighter has no power unless the ignition is on, and that in most cars, if you start the car, power to the lighter may be interrupted. If the computer’s battery is charged, it will ignore these power interruptions, but if the computer’s battery is discharged, it will crash if power is interrupted. **Most likely, the computer you are using will have a weak or damaged battery, and it will need to be plugged in because of extremely limited battery capacity. Letting the battery run down or keeping the computer in a state with a dead battery will lead to problems—see “Troubleshooting” section.**

2. Stick the GPS antenna “puck” to the outside of your car (it is magnetic). Run the cable inside the door, and avoid slamming it in the door or pinching it in the window. The antenna is moisture-resistant. You can also put it on the dashboard; however, if your car’s windshield has a metallic coating, the antenna will not work.

3. Plug the GPS antenna into one of the USB ports on the Asus eee. Plug the keypad into another port. The image below shows a typical setup.
4. Start the computer by pressing the power button. The keypad and mouse button work as in most laptops; however, the mouse button below the keypad is actually divided into right and left sides. These work like right and left mouse buttons.

5. Once the computer has booted, in the “Favorites” menu along the left side of the screen (see image below), choose “GPSRecorder2.” Each time you launch GPSRecorder2, a new file will be created.

6. Start a new file whenever you move to a new drainage, county, highway, etc.—look for natural breaks in your mapping route.
7. Wait for the GPS antenna to get a satellite “fix.” While this is happening, the screen should appear as below:

![GPS Recorder Home Screen](image)

*Fig. A3.4. GPSRecorder2 Home screen.*

*Note that most dataloggers will also give you a message about “GoTemp Cli not ready.” The dataloggers are also designed to record temperature, but if the temperature probe is not installed, you will receive this message, which may safely be ignored.*

8. Once the satellites have been located, move along your mapping route and press single keys according to the scheme in Appendix 1.
9. The computer will log the latitude, longitude, and the key you pressed. As you gather data, your screen should look like this, with your key in the left column, and GPS data in the other columns (the rightmost column indicates how strong the satellite “fix” is):

```
# | lat       | lng       | alt  | status
---|-----------|-----------|------|-------
 8 | 41.7381194| -72.199354| -9.43| 3D-0  
 6 | 41.7381194| -72.199354| -9.43| 3D-1  
 0 | 41.7381196| -72.199352| -9.48| 3D-0  
 9 | 41.7381196| -72.199352| -9.48| 3D-1  
 4 | 41.7381196| -72.199351| -9.52| 3D-0  
 2 | 41.7381196| -72.199351| -9.52| 3D-1  
 7 | 41.7381197| -72.199350| -9.59| 3D-0  
 5 | 41.7381197| -72.199350| -9.59| 3D-1  
 4 | 41.7381193| -72.199348| -9.61| 3D-0  
```

*Fig. A3.4. Data collection.*

10. When you are done mapping run, press “q” to quit the program. GPS recorder will quit.

11. To start another mapping run, re-launch **GPSRecorder2**.
12. Data files will be saved in your root folder, which you can access by clicking the “Files & folders” tab (see image below). The root folder is named “cicada.”

![Fig. A3.6. Asus eeePC Home Screen (Files and Folders).](image1)

13. Double-click on the icon for the root folder to open it. You will see a number of icons in it (see image below). The data files are named according to the convention “yyyymmdd_tttttt.csv”.

![Fig. A3.7. Asus eeePC Files and Folders.](image2)
14. Periodically e-mail these files to cicada@magicicada.org. Doing so will effectively back up these files. You can use the webmail on the Asus eee, accessible through a browser (provided you have an internet connection), or you can remove the files from the computer using a USB drive and email them from another computer. If you generate a lot of files, you may want to consider organizing them in folders by date.

15. In the event that the computer malfunctions or the hard drive fills up, contact John Cooley.
Troubleshooting the GPS datalogger

Problem: The car adapter does not power the computer.
Check the fuse. There are several types of adapter; typical ones are shown below:

In the type of adapter shown above, pry the purple fuse out using forceps, and replace it with an automotive-type 3A fuse available at auto supply stores.

In the type of adapter shown above, unscrew the tip of the adapter and replace the fuse with a 3A tubular fuse, available at auto supply stores.

How to open a UNIX terminal window:
1) Start the computer and wait for it to finish booting.
2) Under the “internet” tab, choose “terminal”
3) Alternatively, from the home screen, type “CTRL-ALT-T”
**How to test whether the GPS unit is finding satellites**

1) Start the computer and wait for it to finish booting.

2) Place the GPS unit where it can “see” satellites (e.g., outdoors, away from trees)

3) Plug the GPS18 unit in and wait 30 seconds.

4) In a UNIX terminal window, type the command `xgps`

   This command will bring up a window much like the screen on a standard GPS, as shown below:

![XGPS Home Screen](image)

*Fig. A3.8. xgps Home Screen.*

Available satellites are listed in the table on the left, while the graphic on the right shows their predicted locations in the sky. **If no satellites appear in the table or in the graphic**, then the computer is not communicating properly with the GPS unit. **If this happens**, close xgps and unplug the GPS18 “puck.” Then plug the GPS18 back in, and from the terminal window, restart xgps. Often, “cycling” the GPS18 unit in this manner seems to fix the problem of no satellite lock. **If you can see satellites in xgps, then GPSRecorder2 should work correctly.**  

*Tip: Hold down the “alt” key to drag the XGPS window up so that you can see lat/lon, and the GPS18’s USB address.*
Appendix 4: GPS Navigator Devices

Database records as Points of Interest (POI)

Data points from the Cicada Central database have been provided as “points of interest” (POI) for loading onto Garmin automotive navigation devices. POI are point data analogous to GIS shapefiles. Garmin Nuvi automotive navigation devices (and some other brands) can display such data, under certain conditions. The advantage of displaying data points as POI is that the required files are very small and display quickly. The disadvantage of displaying data points as POI is that they are displayed only at 300ft resolution (standard screen models) or 200ft resolution (widescreen models). Remember to turn off “proximity alerts” for these points of interest, or an alert will sound each time you approach a record!

Figure A4.1. POI on a Nuvi 200 series navigator.
Figure A4.2. POI on a Nuvi 1300 widescreen GPS navigator.

The *Magicicada* POI dataset has been designed with distinctive icons. 17-year broods have a cicada icon with the head facing up, and 13-year broods have an icon with the head facing down. Adjacent broods also have different colored icons, and moving the cursor onto an icon causes the brood number to be displayed. As an example, Figures A6.1-A6.2 show an area near Siloam Springs State Park, IL, where Brood III (brown icons) and Brood XIX (yellow icons) are in close proximity.

To use this dataset, obtain the file “magi_poi_v4.zip” from [http://magicicada.org/about/poi.php](http://magicicada.org/about/poi.php). This file will unzip to a folder named “POI_III”. By downloading this dataset, you agree to several conditions:

- No warranty is made as to the accuracy or compatibility of these data
- Only experienced GPS users should attempt to program or modify GPS units, and by downloading this data set, you accept all responsibility for any damage to your GPS unit.
- You agree that these data are the property of Cicada Central and you agree not to distribute or republish these data without express written permission.
- These data are not to be used for scientific research purposes, as their accuracy has not been checked.
Loading points using POI Loader

1. Go to the Garmin Website and download POI loader (http://www8.garmin.com/products/poiloader/).
2. Connect your GPS unit to your computer using a USB cable.
4. At the “save options” screen, choose “Garmin Device” and click “Next”. On the next screen, you will see your device; if it shows up properly, click “Next”.
5. You now have the option to “Install new custom POI’s...”. Choose this option and click “Next”.
6. You will now see a screen where you can navigate on your computer to find and select the “Magicicada_POI” folder. Do this, and choose “Feet and MPH” as the units. Also, choose the “Express” option for installation, and click “Next.”
7. Your data points are loaded.

Advantages: Allows removal of points later. Disadvantages: Complex, and requires software and cables. May not be Macintosh compatible.

Loading points using a microSD card

1. Obtain a blank microSD card (small size will work).
2. Using your computer, place the file “Magicicada_POI” on the microSD card.
3. Insert the microSD card into the expansion slot of your Garmin device.
4. Start the Garmin Device.
5. When prompted to install the data on the device’s memory, click “OK”.
6. Your data points are loaded, and you may remove the microSD card.

Advantages: Fast and simple. Disadvantages: Without POI loader, you cannot remove the data points.
Appendix 5: Locality Codes

The periodical cicada database makes use of site codes to tie specimens to locality data. These codes follow certain conventions that are designed to keep the database organized and to eliminate ambiguity. These codes contain four fields in the following format:

YY.SS.XXX.NN

These fields are defined as:

1) **YY** 2-digit year code. For this project, the year code will be 15.

2) **SS** 2-letter state code. This is the 2-letter US postal service state abbreviation.

3) **XXX** 3-character site code. This code consists of three alphanumeric (numbers or letters) characters. The three characters may be arbitrary, but they are typically chosen because they have some relationship to the site description. For example, specimens collected on “Rabbit Island” might be given the three-letter code “RAB”.

4) **NN** 2-letter initials. This character is the first letter of the first name and the first letter of the last name of the person assigning the code.

Note that you are not required to put full locality labels into each specimen container, although it never hurts to do so. Instead, you can place a label in each container that consists of the site code *as long as a standard data sheet (Appendix 2) providing full locality information for each site code is also filled out.*
Because of the possibility of accidental duplication of site codes, all site codes that are assigned in the field are to be considered provisional until all records are incorporated into the database.
Appendix 6: Labeling specimens and specimen preservation

Specimens should be clearly labeled. The labels should contain the date, a description of the site, the names of the collectors, and the latitude and longitude, if available. Alternatively, specimen labels can consist of the locality code, as long as a standard data sheet providing full locality information for each locality code is also filled out.

Specimen labels should be clearly written in pencil on both sides of a small slip of white paper. Do not use pen to write labels.

Specimens for genetic analysis should be stored individually in small vials or in large Ball jars filled with 95% Ethanol. A paper label should be included inside the container, and the outside of the container should be labeled as well. Specimen containers should be kept cool and out of sunlight.
Appendix 7: Practical Considerations

Things to have in each vehicle

1. Cell phone
2. Road maps
3. Field notebook, pencils, etc.
4. Extra batteries for GPS, camera, etc.
5. Water, food etc.
6. Maps of existing records
7. Jumper cables, functional spare tire, emergency kit
8. Camping gear (incl. cookware, clothesline, etc.)

Safety tips in the field

1. When you stop by the side of the road, pull all the way off the road. If you cannot do so, it is not safe to stop.
2. Avoid stopping on busy roads.
3. Beware of roadside ditches, which may be hidden by weeds or grass.
4. Beware of roadside grass and weeds, which may hide sharp objects.
5. Keep valuables (computers, GPS units, etc.) out of sight. This includes cases, battery chargers, and suction mounts for devices such as GPS units.
6. Take frequent rest breaks.
7. Keep in touch with the group and let others know where you are.
8. Check all fluids in your car. This kind of work is hard on a car, and continual stop-and-go driving can cause your car to overheat.
9. Carry a piece of plywood roughly twice the size of the base of your jack, in case you need to change a tire on a soft surface.
10. It is a good idea to carry a set of jumper cables.
11. Try to stay away from busy roads, but also don’t get bogged down on very poor quality dirt or gravel roads. If a road deteriorates to the point that you start to wonder seriously about it, it’s time to turn back and try another route.

Places to get common items

1. Wal-Mart usually stocks computer flash drives, disk drives, De Lorme maps, white cooking gas, gas canisters, clothespins, batteries, etc. Sometimes Wal-Mart also has dry ice.
2. Barnes and Noble usually has a good selection of DeLorme maps.
**Funding Sources**

While in previous years, research expenses for mapping periodical cicadas were underwritten by NSF or by the National Geographic Society, there is no additional research funding for the 2014 emergence. Plan accordingly.
Appendix 8: Important locations and contact information

1) Project homepage: www.magicicada.org


3) Simon Lab, Department of Ecology and Evolutionary Biology, The University of Connecticut, 75 N. Eagleville Road, Storrs, CT 06269-3043. (860) 486-3947. The closest commercial airport is Hartford (BDL).

4) Totoket Partners LLC, P. O. Box 822, Storrs, CT 06268.
Literature


