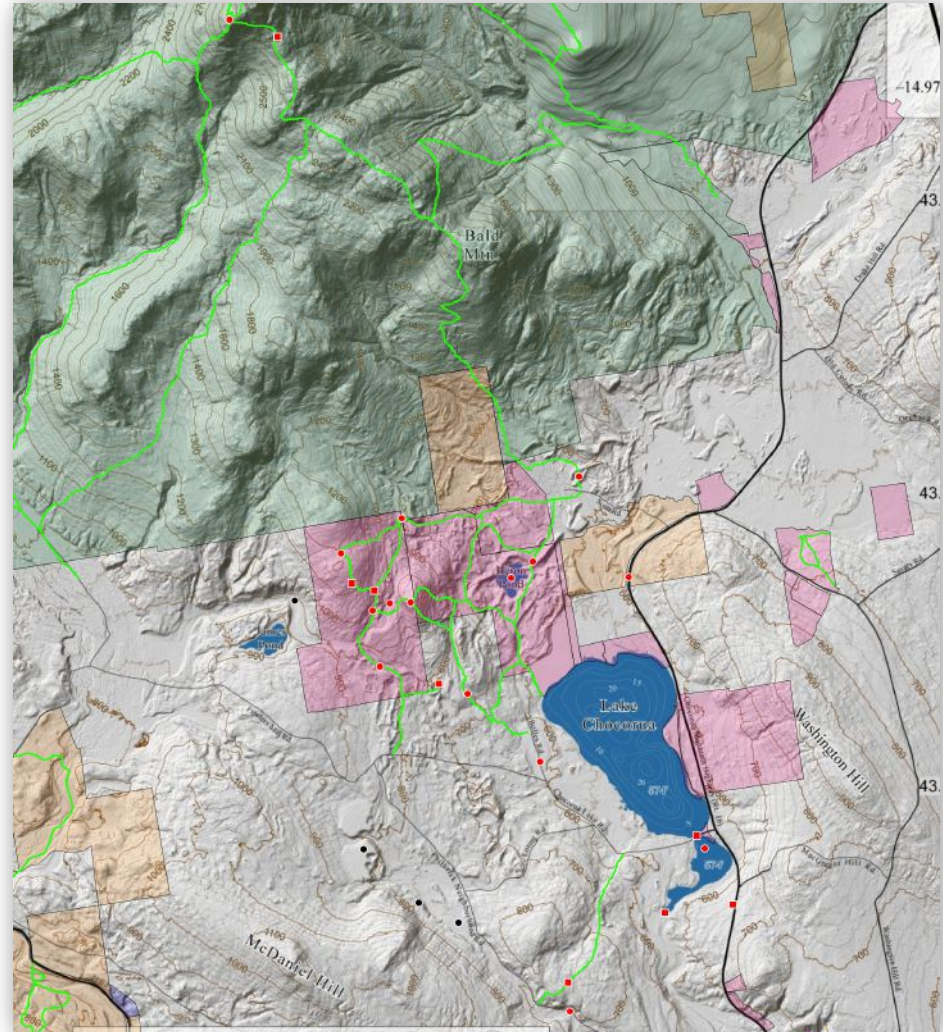


The Chocorua Map App

Explore the trails and points of interest associated with one of New Hampshire's most iconic views!

brought to you by...

**The Chocorua Lake Conservancy &
Rick Allmendinger © 2019-2020**



Chocorua Lake Conservancy

Why an app?

Mount Chocorua and its eponymous lake are one of the most iconic vistas of the northeastern United States, so much so that it figures on one of the America the Beautiful Quarters.

One of the missions of the CLC is to educate the public about this spectacular corner of New Hampshire. What better way to do so than a mobile app that shows the user's location in relation to points of interest, both historical and geological/ecological?

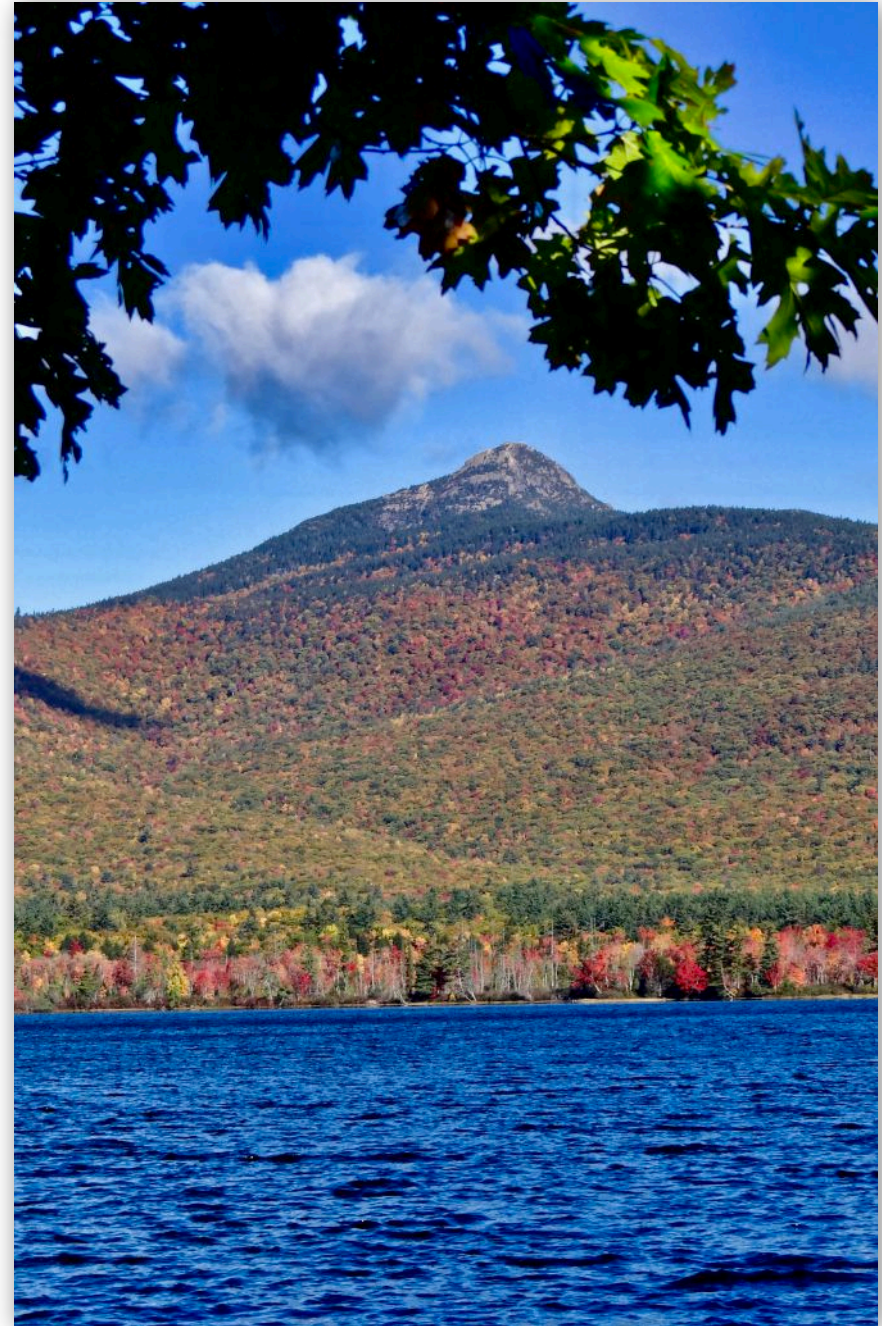


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How the app manages your data

because privacy has never been more important...

We'll get right to the point: ***The Chocorua Map app downloads no data from the Internet.*** All of the data necessary for the app to function — base map, descriptions of points of interest (POIs), trails, public lands, etc. — are all encapsulated within the app. If you do not have cellular coverage, no problem; The app has everything it needs to show your

position on the exquisitely detailed base map.

Likewise, the Chocorua Map app uploads NO data — location, photos, user points of interest — to the Internet automatically. You have complete control over whether, and how, that data is shared. You can, via the sharing panel in the user POI screen, choose to share your location, POI descriptions or photos using the iOS Messages or Mail app, etc., but only with people you explicitly select.

The Chocorua Map app NEVER sends your data to the app programmer, CLC, or any other third party. Really, never. The Chocorua Map app is not supported by advertising and will never display advertising that surreptitiously, or even overtly, tracks

you. We have absolutely no way of tracking your location, seeing your photos, etc. If you choose to save a user POI, the information is stored locally on your device and is not even available to any other program on your device.

The first time you use the app and turn on GPS, the app will ask your permission to use your location to show your position on the map. If you deny permission you can still use the app although it will be much less useful if it cannot show your location on the map. The first time you use the camera button in the User POI view, you will be asked for your permission to access the device camera and/or the Photos library on the device. If you refuse permission, you will not be able to attach photos to your own POIs. Remember, however,

when you grant permission for any of these functions, your data stays on your device and is never accessible by any third party unless you explicitly choose to share it with someone.

You have total control over your information, which is as it should be... [don't you wish more apps worked this way?]

Organization

The Chocorua Map app displays five basic types of information: (1) a high resolution base map rendered from LiDAR topography which has a resolution of 1 meter; (2) lands that are accessible to the public, including State and Federal lands as well as preserves maintained by nonprofit organizations for the public good; (3) publicly-accessible trails; (4) points of interest located throughout the region; and (5) bedrock geology. We expand on each of these in the following sections of this manual.

The Base Map and Topo

The base map for the Chocorua Map app displays the ground surface in unprece-

ented detail. It is based on LiDAR, which stands for “light detection and ranging”, a method of measuring topography using airborne lasers. The U.S. Geological Survey makes available to anyone digital elevation models (DEMs) based on LiDAR surveys. Topography is traditionally depicted using contour maps which have curves of equal elevation. The Chocorua Map app also shows contours at 20 foot intervals, with heavier contours every 100 ft. In addition, the author of the program has rendered as shaded relief image (sometimes known as a hill shade) where a virtual sun is positioned and shadows cast by the topography are calculated. The extraordinary detail that you observe in the base map is due to the resolution of the DEM and the hill-shading process. The LiDAR is so detailed that it can resolve stone walls and old cellar holes

in the woods. Natural features produced by surface processes are likewise illuminated with unmatched fidelity, enabling for the first time detailed interpretations for how the Chocorua landscape came to be.

The map will show your current position with a red circular cross-hair icon when you turn on the device GPS receiver. As you move across the topography, this icon will move with you over the map and your position in longitude and latitude will be displayed at the top of the map. If your longitude-latitude are shown in red text, it means that the app thinks that you are located outside of the map area and will not show the location icon. Note that ***continuous use of GPS can deplete the battery of your iPhone or iPad very***



quickly, sometimes in a couple of hours or less.

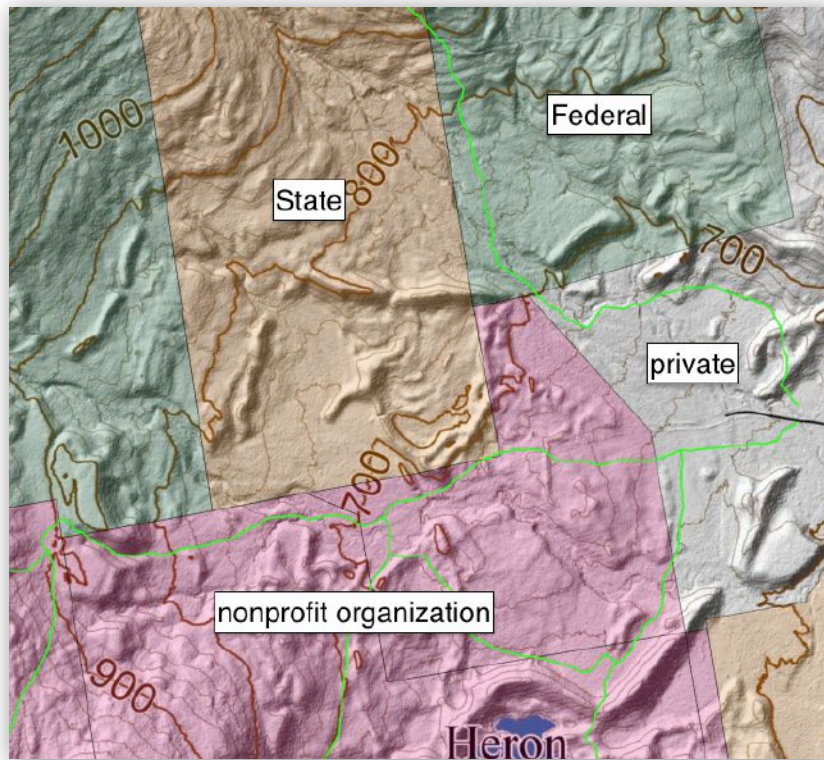
In addition to the static base map image, the app also has a built in digital elevation model (DEM), the U.S. Geological Survey $\frac{1}{3}$ arc second topography on a ~ 10 m grid

that is used to make the 7¹/₂ minute topo maps. Thus, you can find the elevation of any point on the map and the app can do things like generate topo profiles of trails.

This built in DEM is lower in resolution than that used to make the shaded relief and the contour lines. Thus you may notice a difference between the elevation reported when using the measure tool and the contours (the latter are actually more accurate). If that bothers you, there is a way to install the LiDAR DEM (see the appendix of this manual for instructions) which will provide the most accurate elevations short of hiring a surveyor. Be aware, though, that the LiDAR DEM is ~690 megabytes in size!

Lands Accessible to the Public

The app shows four types of lands that you can explore: (1) the White Mountain National Forest, Federally owned and managed, is shaded green and occupies the northern half of the map. (2) Forests owned and managed by the State of New Hampshire are shown in light orange. (3) Conservation lands and preserves owned and managed by private, non-profit organizations are shown in light pink. With the exception of the Bolles Preserve, which is owned by The Nature Conservancy, all of the plots of land in this category are owned and managed by the Chocorua Lake Conservancy. Finally, (4) there are a few small plots of public land that are maintained by local municipalities shown in blue. In the



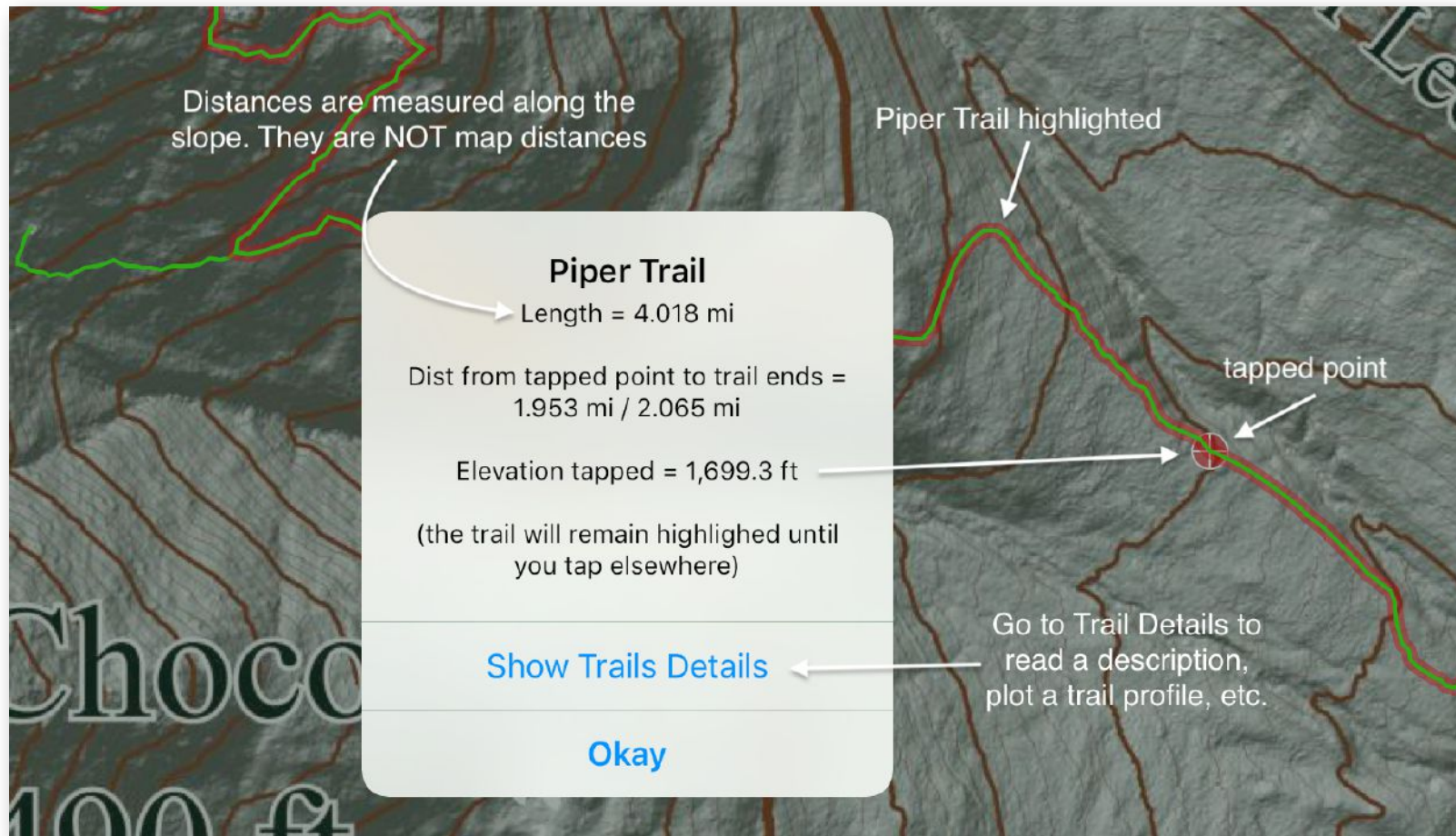
app, if you tap on a plot of publicly-accessible land, a message box will appear showing you the name of the plot and who maintains it.

All other land shown in the Chocorua Map app is privately owned with most of the private property in the lake basin under a

conservation covenant governed by the CLC. ***Please respect private property and do not trespass.*** Obtain permission before proceeding onto private lands, even those not marked with no trespassing signs.

Trails

Only publicly-accessible trails are marked in bright green lines on the map in the app. These trails are maintained by a variety of organizations including the US Forest Service (within the White Mountain National Forest, WMNF), the Chocorua Mountain Club (CMC), and the Wonalancet Out Door Club (WODC). Many of the trails shown in the app were initially digitized by the WODC and are used in the app with permission (and gratitude!). In the app, the



trails have been subsampled to a 25 m spacing and spurious points edited out by hand to enable efficient display.

The trails shown on the map are “live” objects. When you tap on one, a message box will appear showing you the name of the trail and its total length (above graphic).

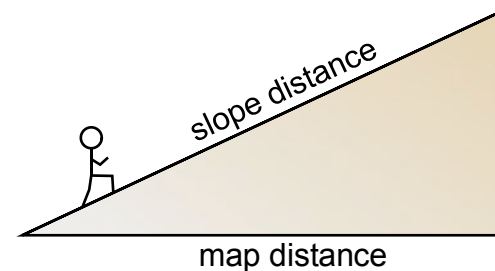
The trail will also be highlighted with a reddish halo so you can easily identify the beginning and end of the trail. Also, when you tap a trail, the app will calculate how far the tapped point is from the two ends of the trail so you can answer that age-old question “how much farther...?”

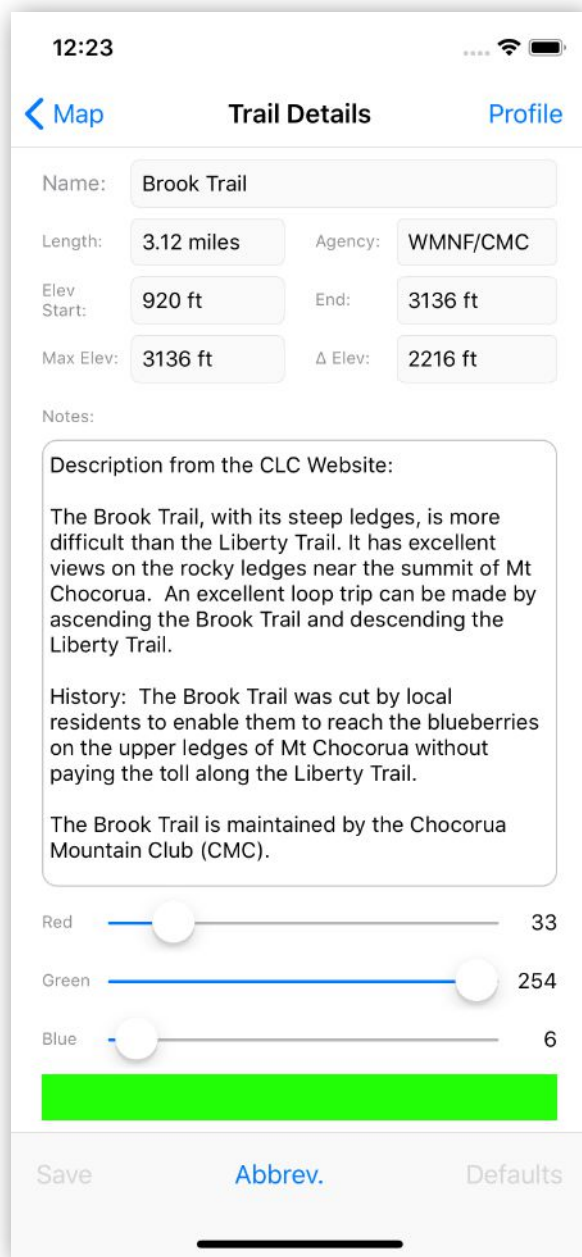
While the trails are located reasonably accurately, ***you should never depend on the app for your sole source of navigational information.*** Your device battery can run down, you can drop and break your device, and trail locations may change over time, become washed out, etc. You should always carry a paper map and compass and know how to use them! We recommend the [Map of the Sandwich Range](#) published by the WODC.

With the high resolution LiDAR topography, you can see many old logging roads and other paths that are NOT official trails. The fact that you can see these paths in the topography does not mean that they are approved, or appropriate, for hiking and

Map distance vs. Slope distance

Maps are projections onto a horizontal surface so, when you measure a distance on a map, it is always a horizontal distance. The distance along the slope is how far you actually walk. Because GMDE has elevations, it calculates and reports the slope distances:





many are on private property and not open to the public at all. Please stick to the trails shown as green lines on the topography.

Trail Details

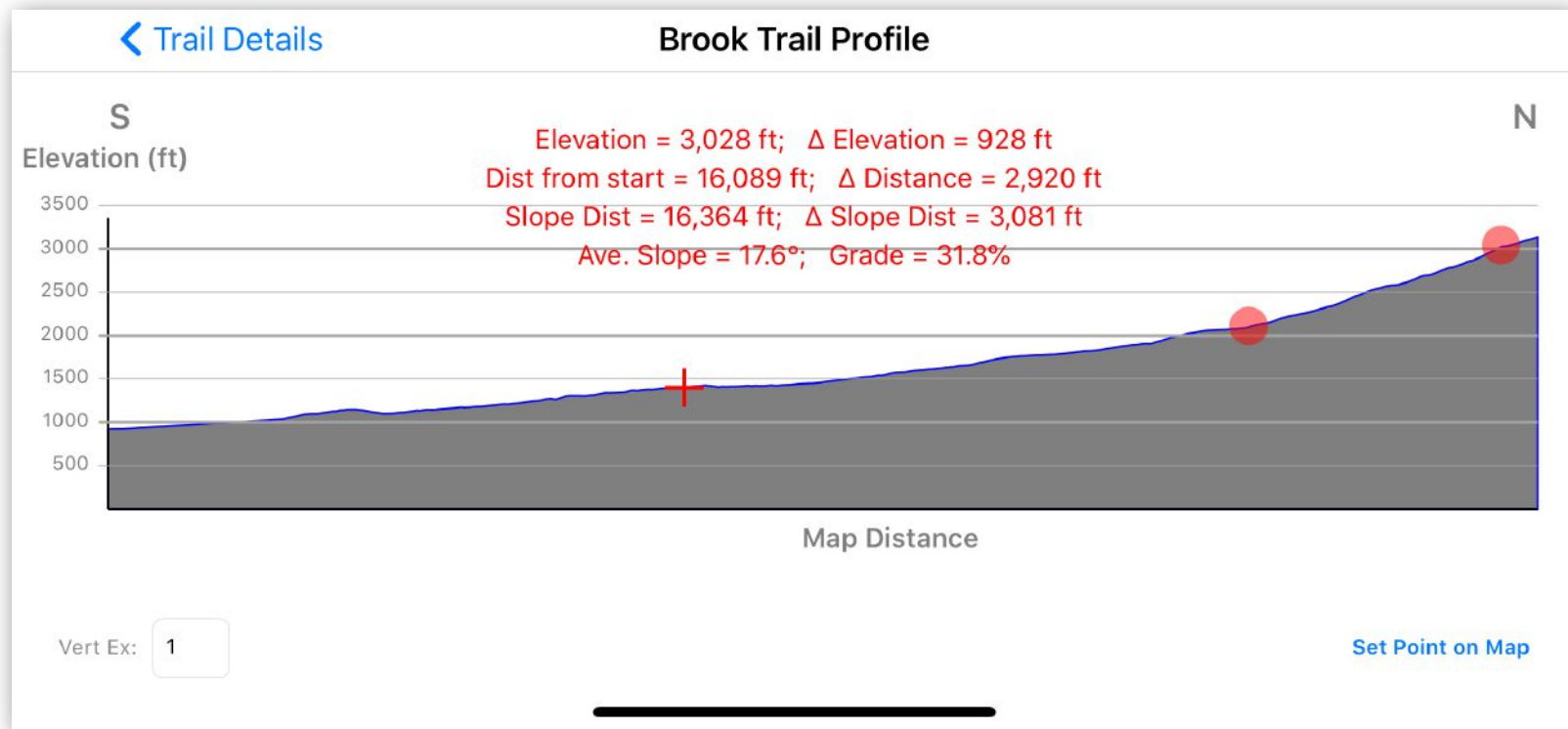
When you tap “Show Trail Details”, or tap on a specific trail in the Trail List, you are taken to the Trail Details screen where you can find a written description and some trail metrics such as total length, elevation change, and who maintains the trail.

You can modify or completely rewrite the Notes section, and you can change the color used to plot the trail on the map by adjusting the slider bars at the bottom. When you make changes, the Save button on the toolbar becomes active. When you save the changes, they will be used the next time you use the app. To return to the built-in values, tap the Defaults button.

Trail Profile

To see a profile of the trail, tap the Profile button in the upper right corner. If you are using a phone, you will probably want to rotate it to landscape orientation to see more detail. In this view, you can change the vertical exaggeration in the lower left. The red + shows the selected point on the

map. You can measure segments of the trail by tapping and dragging horizontally; the first red dot shows where you tapped initial and the second the horizontal position of your finger now. In the screen shot, you can see that the upper part of the Brook trail, for example, has an average slope of

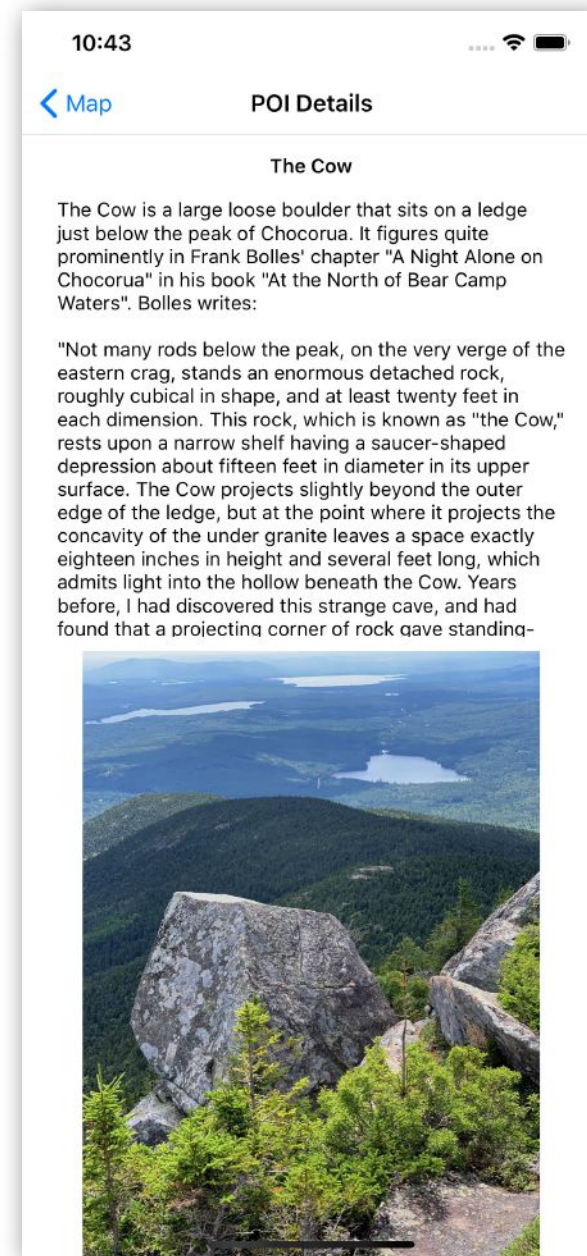


almost 18° for more than half a mile (i.e., very steep!)

Points of Interest

The Chocorua region is rich in both natural and human history. Understanding how the landscape formed and how early settlers and subsequent occupants have interacted with that landscape can enrich your visit to this beautiful part of the world. The Chocorua Map app introduces you to some of the special features of this region using small circle, square, and diamond shaped icons that mark specific points of interest (POIs).

public	private	
●	●	geological
■	■	historical
◆	◆	ecological



Tap on a POI icon on the map — you will probably have to zoom in to select a POI — and a new screen will slide in with a description of the POI and either a photo or a diagram illustrating the feature. Note that, if the text exceeds the space available for it, the text field with the description can be scrolled by swiping up or down. You can tap on the photo or diagram to see it on a screen by itself, where you zoom and pan it with standard iOS gestures such as pinching and dragging.

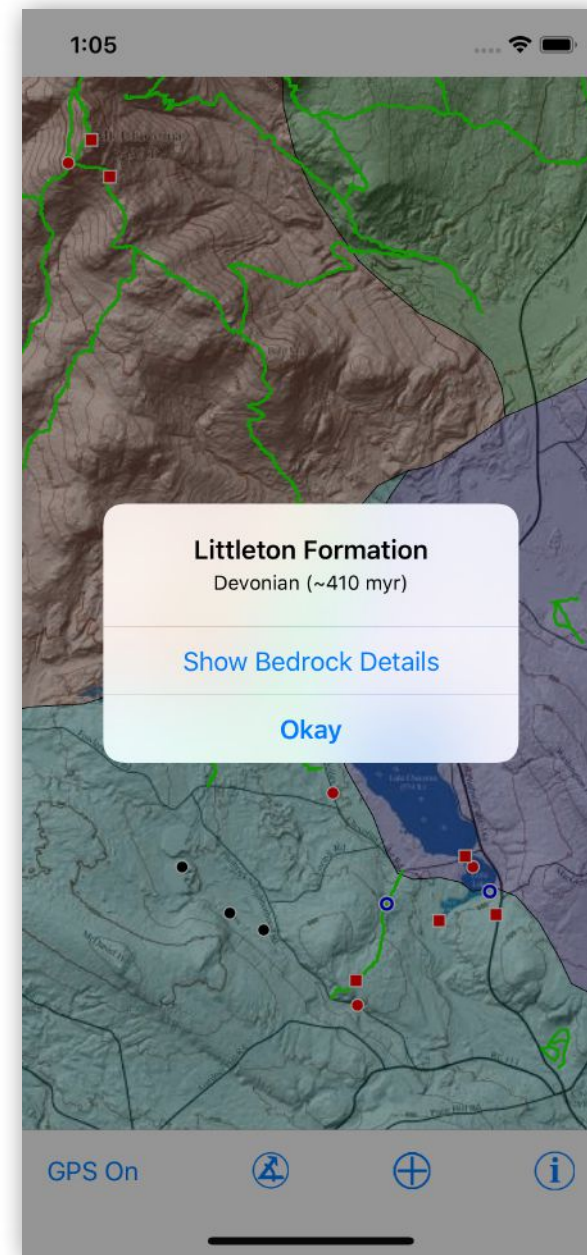
A few POIs of geological interest are located on private property (black dots) and should not be visited without explicit permission of the landowner. We show these features because they help to tell the story of how the Chocorua landscape developed. In many

cases, the shape of the feature seen on the LiDAR topography map is more interesting than the feature, itself, in the middle of the woods. That is, you will get more out of it by gazing at the map rather than visiting it in person!

As described, below, you can define your own POIs (“user POIs”) which are stored directly on your device and are only available to you. User POIs are marked with a small, blue open circle. You can set a user POI either at your current location or by tapping on the map. Each user POI is automatically stamped with the location and the date and time the POI was set. You can use User POIs as your own digital diary of your explorations of the region.

Bedrock Geology

If you want to see what rock units underlie different parts of the map area, go to the Info Screen and toggle on the “Show bedrock geol.” switch. When you return to the map, you’ll see a colored overlay representing the different rock units from the Geologic Map of New Hampshire by Lyons et al (1997). When you tap on one, a message will appear showing you the unit name and how old it is (“myr” = millions of years). You can read more about the unit and see a picture by tapping “Show Bedrock Details” if you are interested. Showing bedrock geology turns off the publicly accessible lands layer. The bedrock layer is turned off by default.

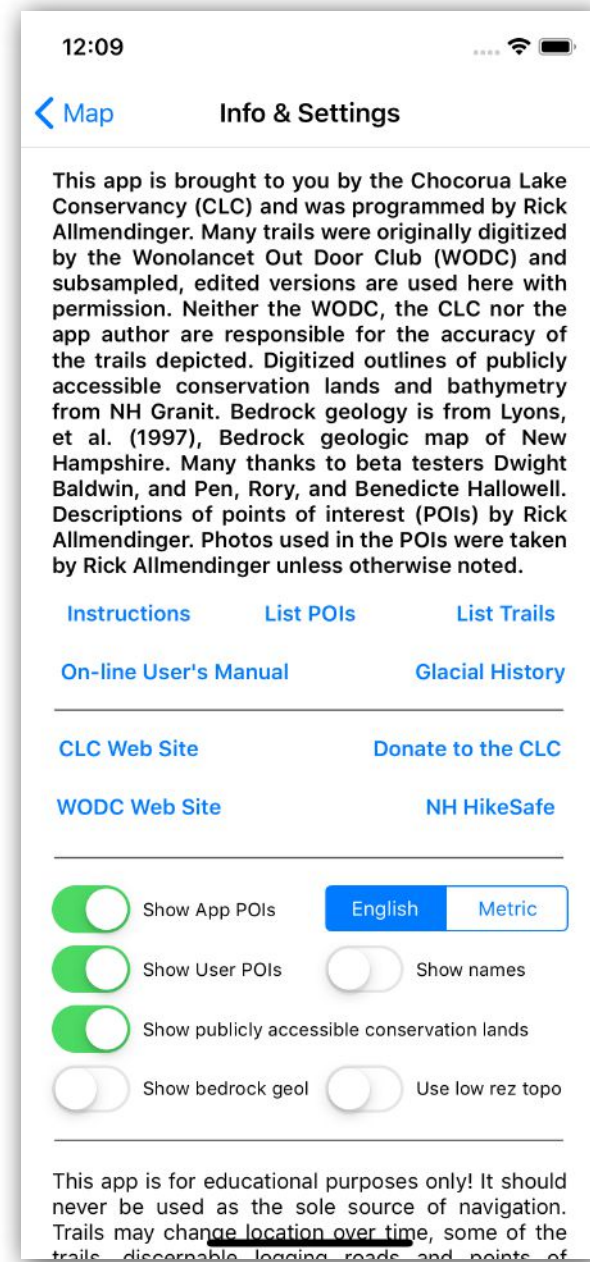


App Functions

Get Info ⓘ

The Info screen provides a variety of useful information including credits for the app, access the useful web pages, and basic settings to control what you see on the map screen. This screen scrolls by swiping up or down.

The **Instructions** link will take you to a page of brief, in-app instructions on how to use the app. **List POIs** will give you a scrolling list of all User and in-app POIs. tapping on that list will take you directly to that POI details view. Likewise, **List Trails** will access a scrolling list of all trails mapped by the app. **Glacial History** will



give you a brief synopsis of how the Chocorua landscape was shaped by the last continental ice sheet to move over this region. **On-line User's Manual** will launch your web browser and open the PDF document you are reading now.

The **CLC Web Site** has lots of useful information about the conservation efforts in the region. After using this free app, you will surely want to **Donate to the CLC** so that it can continue its conservation and educational missions. You should visit the **WODC Web Site** to find out where their wonderful map of the Sandwich Range is sold. Finally, you should always obtain a **NH Hike Safe** card before setting out on a hike in the White Mountains or anywhere else in New Hampshire. If you have signed up for this program, you will not have to

pay the cost of rescue in the unfortunate event that your hike goes badly wrong.

The next section allows you to customize the appearance of your map in various ways. You can turn on or off app and user POIs, hide publicly accessible land, show the titles of POIs right on the map, show or hide the bedrock geology layer, and even have distances reported to you using English or metric units. Note that the “Use low rez topo” switch only appears if you have the LiDAR DEM loaded on your device.

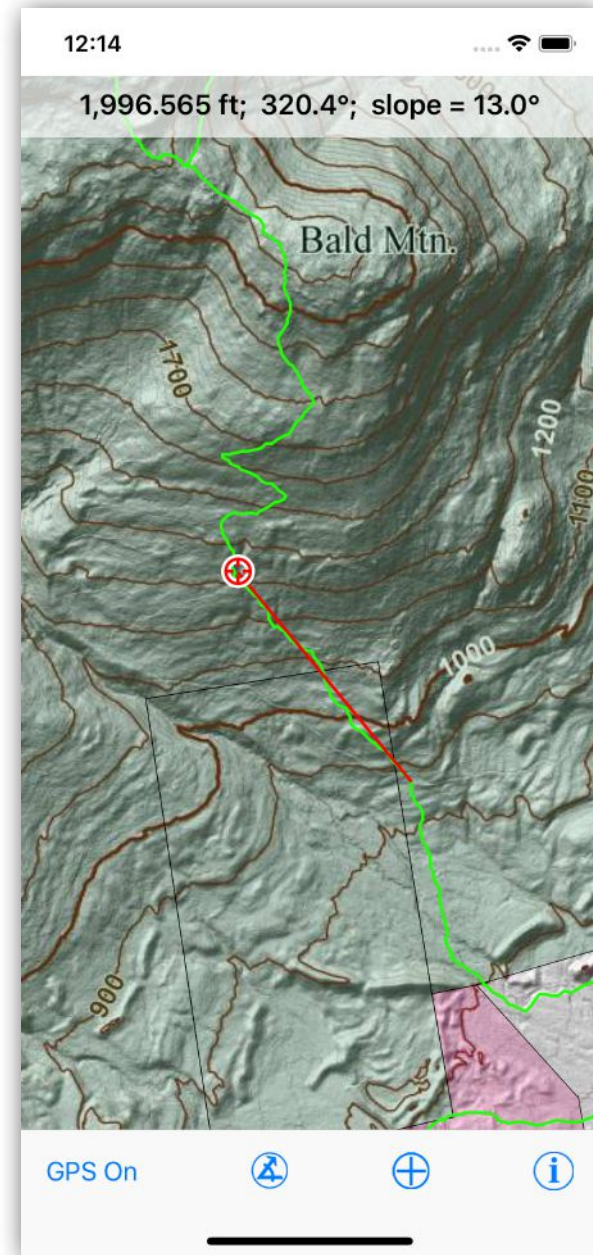
Measure Distance & Bearing



You can measure the distance and compass bearing anywhere simply by tapping and dragging your finger on the map. Tap the

arrow-angle icon, then tap to set the first point. The tap target is offset above your finger, and the first point set when you lift your finger from the screen, so that you can set the point accurately. Now, tap and drag your finger on the screen to set the second point. While dragging, the distance, compass bearing, and slope from the first point to the second point is displayed at the top of the screen.

You can also capture the location of any point on the screen. Tap the arrow-angle icon and set the first point as before. Now, instead of tapping and dragging on the screen, tap the arrow-angle icon again. The iOS sharing panel will appear, allowing you to send a message or email, or simply copy to the system clipboard, the precise location of the tapped point. Location is

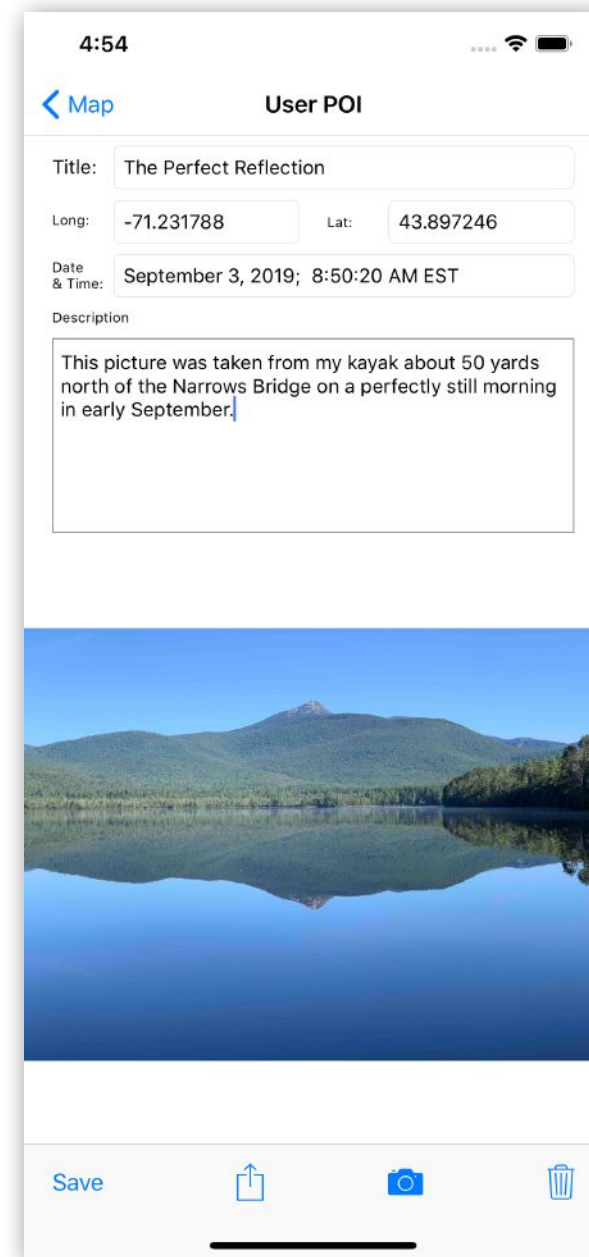


recorded in both Latitude and Longitude and in Universal Transverse Mercator (UTM) coordinates.

Set a User POI ⊕

Tap the ⊕ icon to set a User POI. If GPS has been turned on, you will be given the choice of whether to set the point at your current location or if you prefer to tap elsewhere on the map. If GPS is off, your only choice is to tap on the map (or cancel).

Once you have set the location, the User POI screen will appear with the Latitude and longitude, as well as date and time, filled in automatically. To **add a photo**, tap the camera icon. You will be asked whether you want to take a picture with the device camera or whether you want to use



an existing picture in the Photos Library on the device. To take a picture, you will get the standard camera interface; for an existing photo, you will see the standard library browser. Select or take the photo and it will appear automatically below the Description field. A POI can have only one photo associated with it. If you tap on the photo, it will appear by itself on the screen and you can zoom and pan using standard iOS gestures.

To **share your POI** with another app on the device or to send to someone else, tap the sharing icon (box with arrow) on the toolbar. You must select either text or photo; if you want both, you must share twice, once for each type. You can also use the sharing panel for moving a photo that you took in the app to your Photos Library.

In Case of Emergency

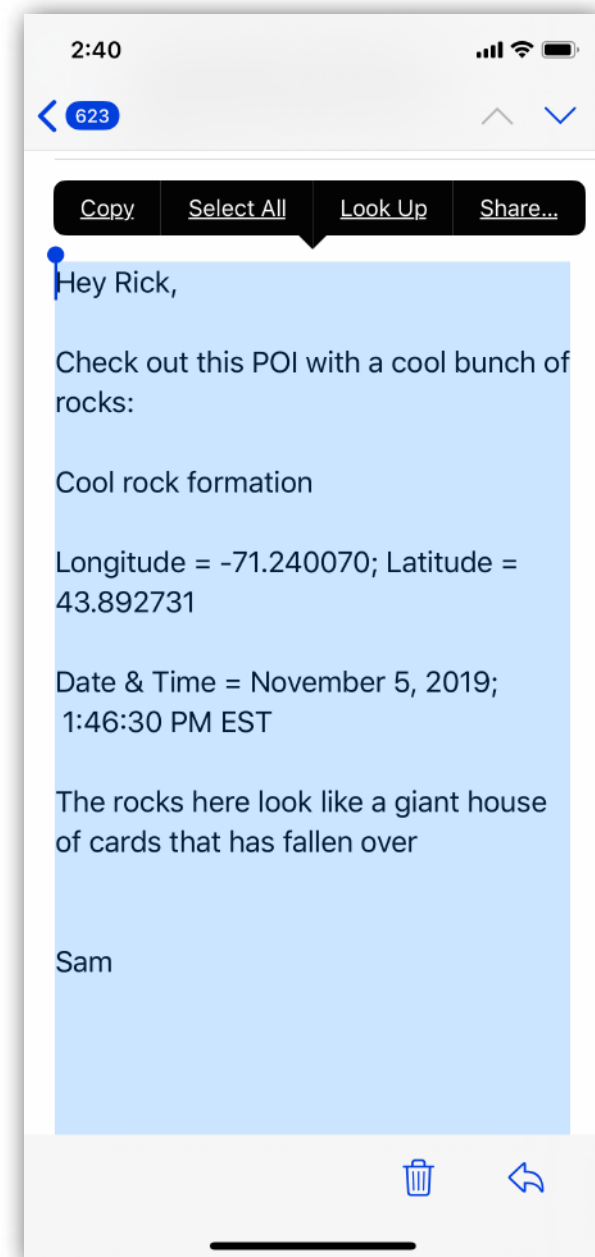
If you need to send someone your location **and** you are fortunate enough to have a cellular data connection, set a User POI at your current location and then use the Sharing Panel to email or message the POI to the person. The message will include your location as well as the time and date and any description you care to include.

When you are done entering info about the User POI, tap the **Save** button on the toolbar. If you leave the POI without saving it, a message box will appear asking if you want to save your changes. The **trash icon** on the toolbar will delete the POI but you will be asked if you are sure, and have a chance to cancel, first.

To **return to an existing User POI**, just tap the open blue circle on the map that represents the POI, or find the POI in the POI list accessed from the Info Screen. The same User POI screen as above will appear with all your information for the POI filled in. You can edit any of the fields, add a different picture, etc. Before leaving the screen, to record any changes tap the **Save** button on the toolbar. To return to the map without making any changes, tap the Map back arrow at the top left of the screen.

Import a User POI

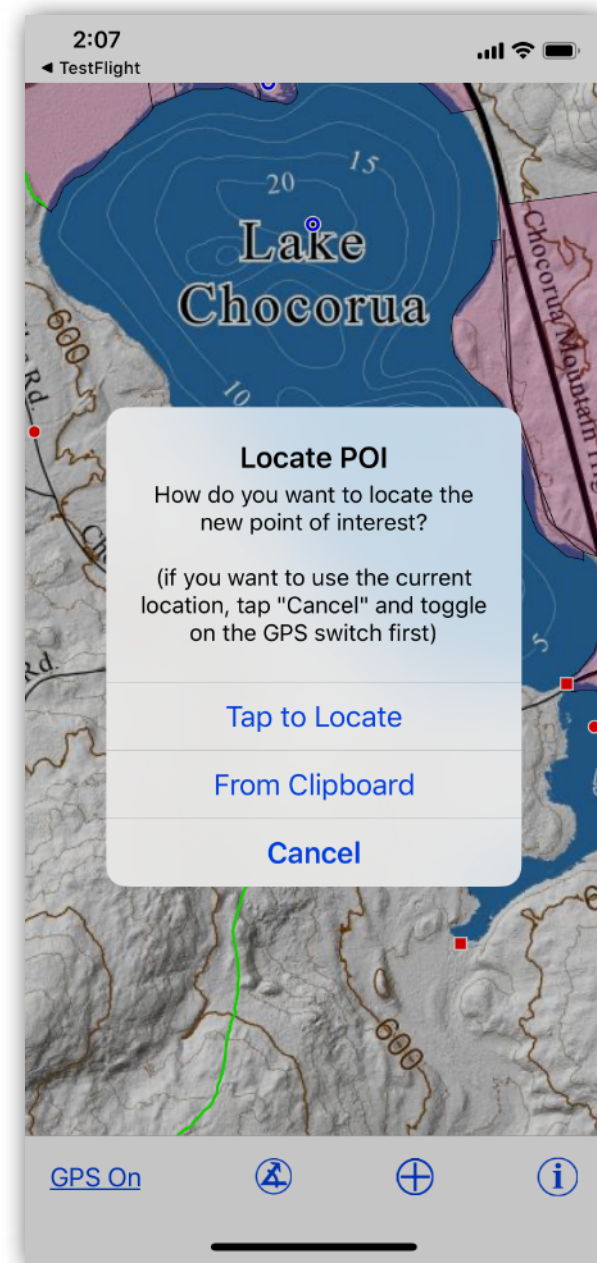
You can also easily import the text of a POI from another user. To begin, go to the message or email that you received from the other user in the Messages or Mail app. Select and copy the text of the message (e.g.,



as shown in the screen shot from the Mail to the right). Note that you can copy the entire message and the app will extract the pertinent parts, ignoring the rest.

Return to the Chocorua Map app and tap the Add POI button, ⊕, on the toolbar of the Map view. The app will recognize the location data on the system clipboard (which Apple like to call a pasteboard) and will give you the option of using clipboard data as show to the right. Tap the “From Clipboard” button and a new POI will be created from the text that you copied to the clipboard.

This also works if just the line with the Longitude and Latitude is copied, but not the descriptions. In that case, a new User POI will be created at that location but the other fields left blank for you to fill in.



Glacial History

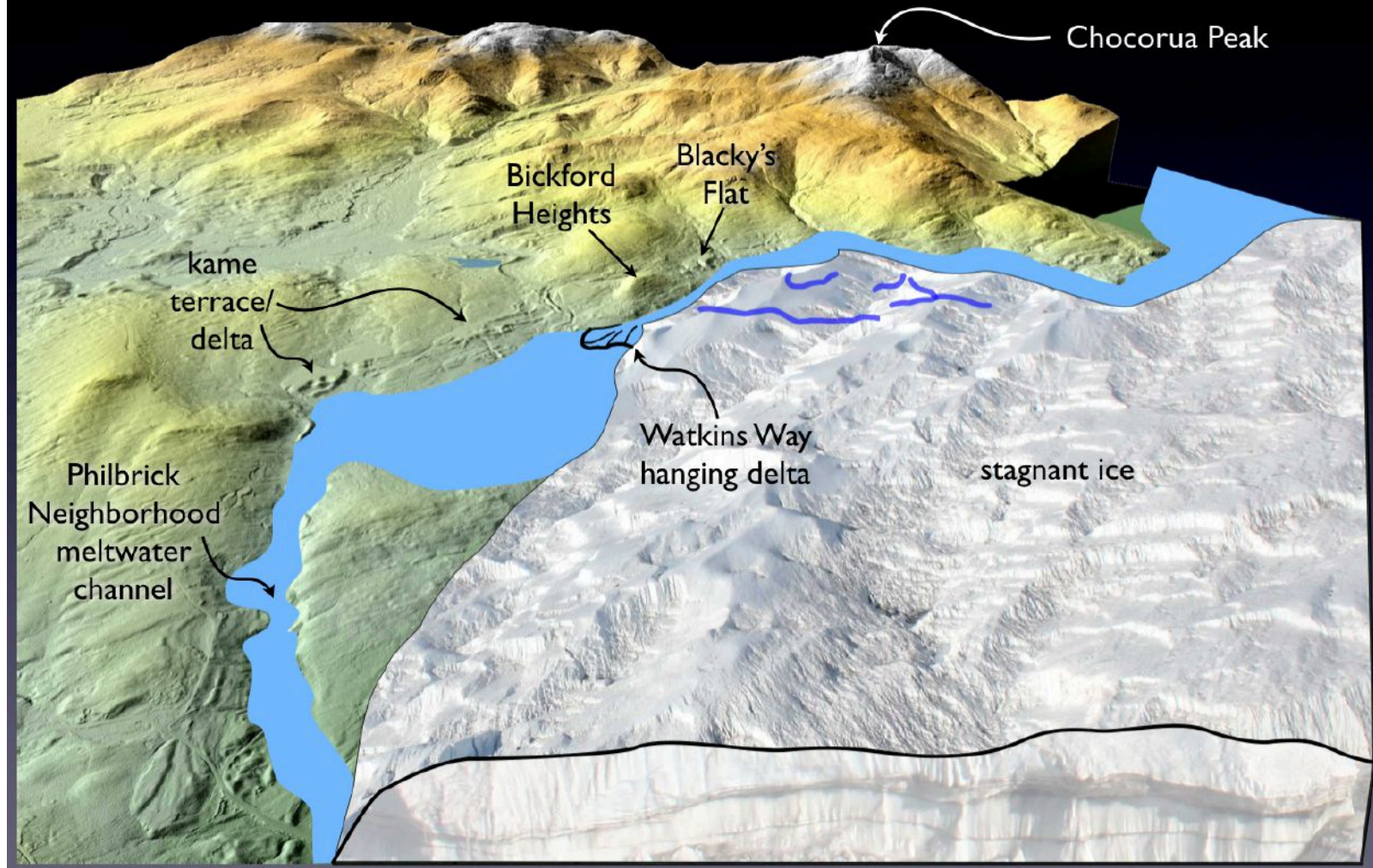
The Chocorua landscape is largely a product of the last continental glaciation, which reached its maximum extent about 25,000 years ago. At that time, the southern end of Laurentide ice sheet coincided with Long Island, New York and Cape Cod. Since 25,000 years ago, the southern margin of the ice sheet has retreated northward and, by about 14,500 years ago was located in the New Hampshire Lakes Region and the Ossipee Mountains just south of Chocorua.

Many of the huge boulders that can be seen in this area were removed from the ledges on Chocorua and neighboring mountains and were carried southward and south-eastward by the glacier before being

dropped in random spots as the ice became stagnant and began to melt away.

Melting ice produces huge amounts of meltwater and many of the detailed topographic features of the Chocorua basin were formed by water from the melting ice sheet. Eskers -- narrow sinuous ridges -- are thought to form by water moving in tunnels beneath the ice but may also form when streams flow on top of the ice or in crevasses in the stagnant ice. Kame terraces and deltas form when debris is deposited on the margin of the ice mass by streams or in lakes on top of the ice. Kettle holes -- enclosed topographic depressions -- form when ice blocks become isolated and surrounded by debris. When the ice block later melts, it leaves behind a depression that frequently fills with water to form

760 ft Lake ("Glacial Lake Watkins")



small lakes such as Heron Pond.

As the meltwater drains away, it erodes large channels and valleys. One sign of a meltwater channel is a large valley in the topography that today either doesn't have a stream at all or the stream is too small to have carved the valley (a so-called "underfit stream"). The valley that Philbrick Neighborhood road runs in and the valley to the north of James Pond are both excellent examples of underfit streams flowing in former glacial meltwater channels.

Proglacial lakes form at the margins of the melting ice cap and the Chocorua Basin has excellent examples of such lakes which were once as high as 840 ft in elevation. A small delta into such a lake at about 760 ft. can be found along Watkins way and another at 680 ft. in the Bolles Preserve. The

proto-Lake Chocorua had shorelines on both sides of the basin at ~610 ft (unlike earlier and higher lakes that had preserved shorelines only on the west side of the basin). The Chocorua River south of the Little Lake has terraces as high as about 680 ft which suggests that the modern valley of the river became exposed at the time of the 680 ft proglacial lake level.

The continental ice sheet had retreated to completely north of the White Mountains by 13,900 years ago and early humans entered this part of New Hampshire shortly thereafter.

Credits

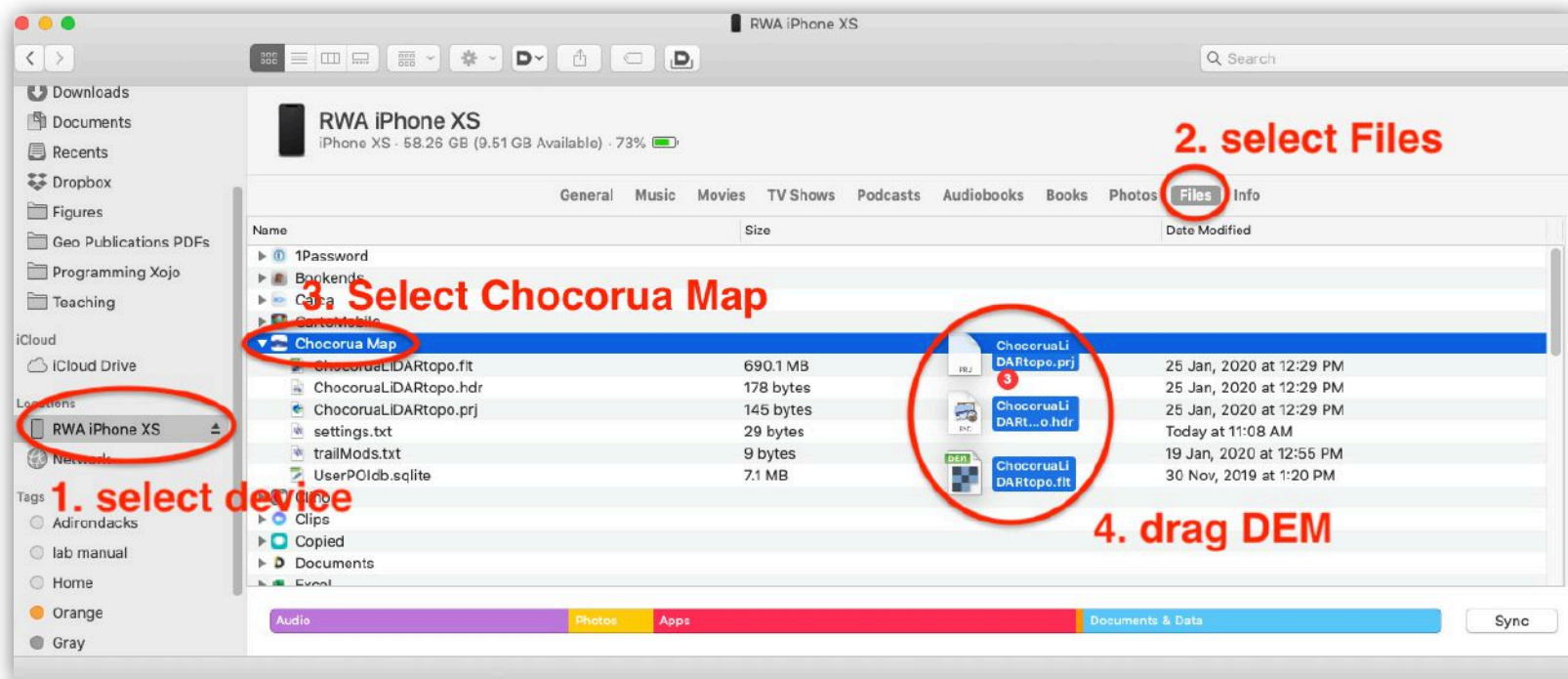
The Chocorua Map app was programmed by Richard W. Allmendinger. Many trails were originally digitized by the Wonolancet Out Door Club (WODC) and subsampled, edited versions are used here with permission. Lynne Flaccus of the CLC provided the digitized trails for the C. C. Browne Memorial Woods. Neither the WODC, the CLC nor the app author are responsible for the accuracy of the trails depicted. Digitized outlines of publicly accessible conservation lands and bathymetry from NH Granit. Many thanks to beta testers Dwight Baldwin, and Pen, Rory, and Benedicte Hallowell. Descriptions of points of interest (POIs) by Rick Allmendinger. Photos and diagrams used in the POIs were taken/

drawn by Rick Allmendinger unless otherwise noted.

Appendix: Load the LiDAR DEM

If you want the most accurate possible elevation data on your device and you don't mind dedicating ~690 megabytes to get it, you can download and install a zip archive from the CLC web site. Here's how:

1. On your desktop computer, go to <https://www.dropbox.com/s/hdnbvf9ga7sk31/ChocoruaLidarDEM.zip?dl=0> to download all three files. They all have the root name "Chocorua LiDAR topo" but with the different suffixes: ".flt", ".hdr", and ".prj". ***You will need all three files.***
2. Connect your iPhone or iPad to your computer USB port using the cable that came with your phone. Be sure that your device is unlocked.
3. If your computer is running Mac OS 10.15 (Catalina), do the following steps:
 - 3.1. Open a new Finder Window and click on your device name in the side bar (see screen shot).
 - 3.2. Click on the Files Tab. You will see a list of all of your apps with a disclosure triangle next to each.
 - 3.3. Find "Chocorua Map" in the file list and select it.
 - 3.4. Drag the three DEM files onto it as shown in the graphic. The files are



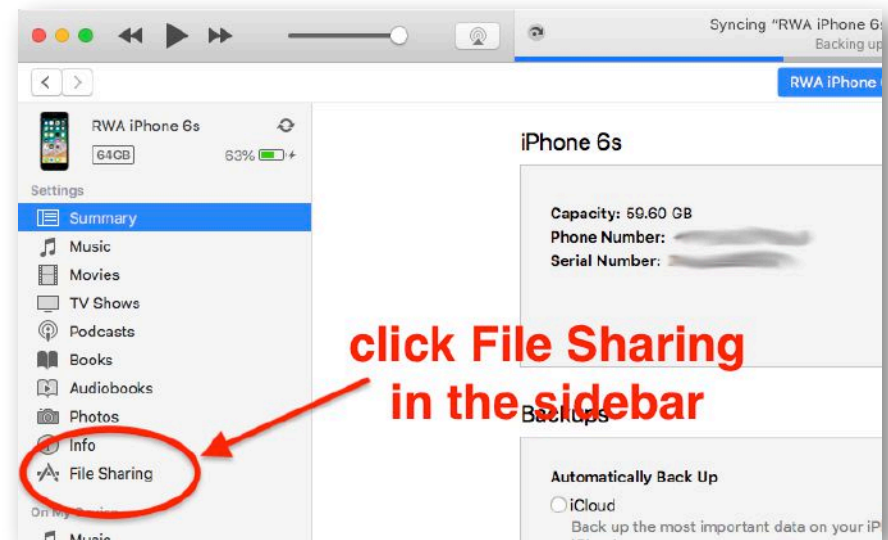
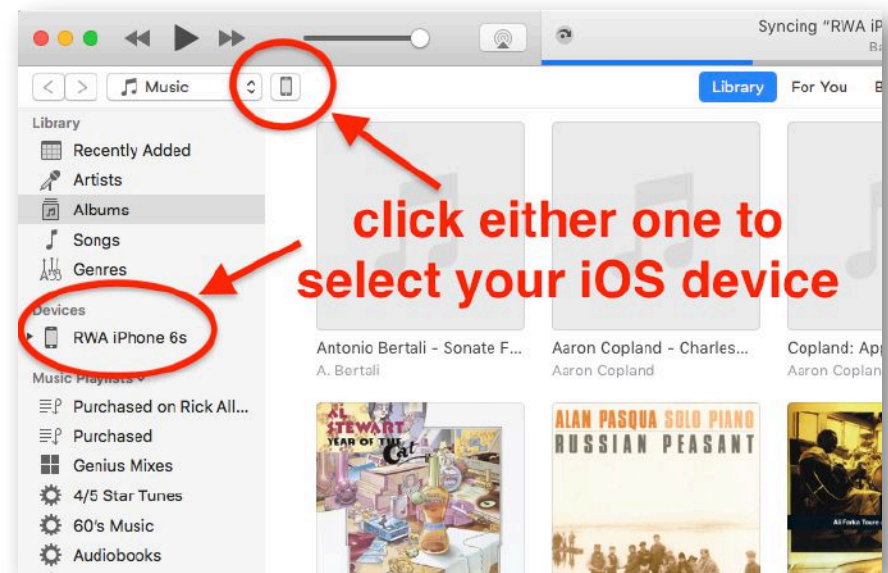
large so it will take a while to copy them. Do not disconnect your phone until you verify that the three files are all listed beneath the Chocorua Map app when you toggle the disclosure triangle.

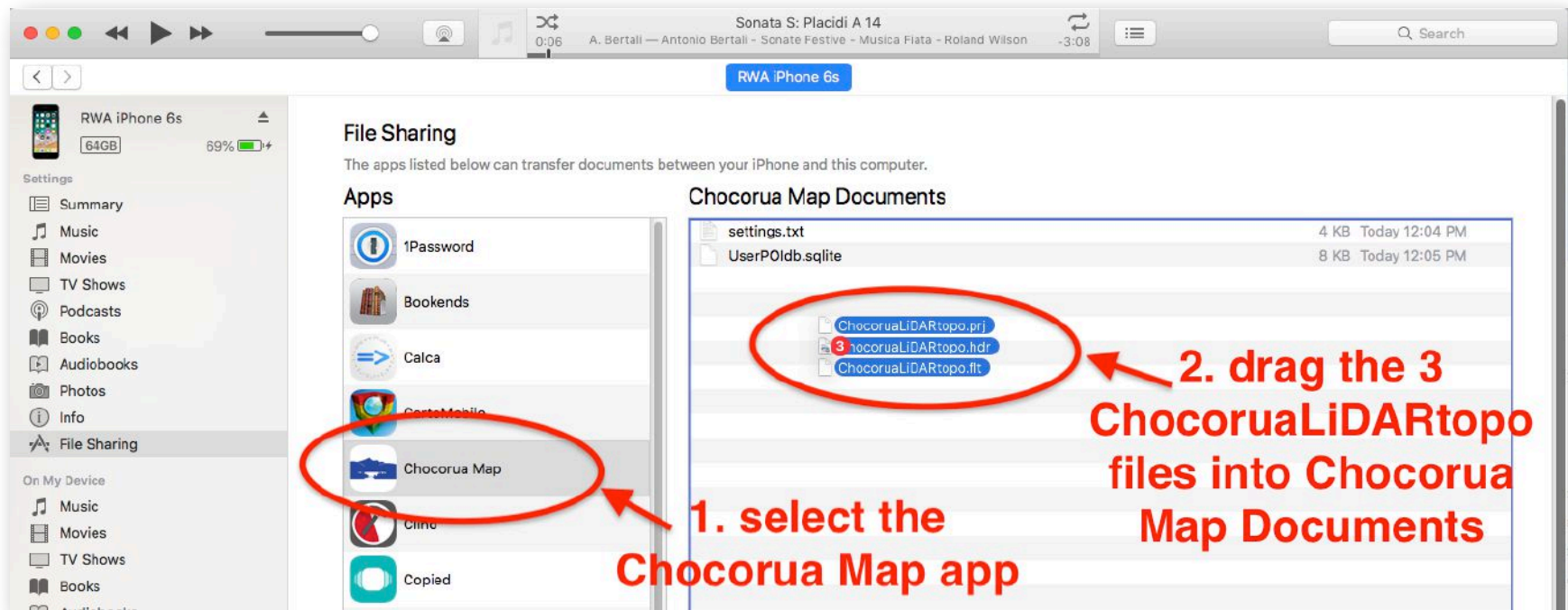
4. If you are on Windows or using an older version of the Mac OS, you will need to follow the same procedure but using iTunes:

4.1. Launch iTunes. A small, unlabeled icon in the toolbar represents the iPhone or iPad.

Click on it which will bring you to the device summary screen:

4.2. Click on “File Sharing” in the sidebar. This will bring up the File Sharing panel on the right hand side which lists all of the apps on the device.





4.3. Find and click Chocorua Map in the list of apps and drag the three DEM files onto Chocorua Map Documents panel. Verify that they have been copied before disconnecting your device from the computer.

Once you have copied the three DEM files (the files are large so be patient), the

Chocorua Map app will find them the next time that you start the program and will use the high resolution DEM rather than the built-in lower resolution DEM. If, for some reason, you want to use the lower resolution DEM, a new switch in the Info View will allow you to switch between the two