A photograph of a serene forest scene. In the foreground, a dark lake reflects the surrounding environment. A small, rustic wooden cabin with a gabled roof sits on stilts in the water, its reflection clearly visible. The background is filled with dense evergreen trees, their green needles contrasting with a bright, cloudy sky.

Backpacking in the Digital Age

Joseph Zhang

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Free technologies which will further the planning and enjoyment of your next backpacking trip.

Joseph Zhang

About the Author



Joseph Zhang is an avid long-distance hiker from the Bay Area. As a Boy Scout since the sixth grade, he goes on regular camping and biking trips with his troop and friends. He first became fascinated with backpacking after he led a week-long backpacking trip in Yosemite's backcountry with a group of other scouts. Throughout the week of breathtaking views of the Sierras, he became motivated to streamline his pack weight to walk further with less fatigue and risk of injury. Since that trip, he has hiked on several local long-distance trails, including the John Muir Trail. He wishes to share the knowledge he picked up over the years about using technology to further the planning and enjoyments of trips.

Joseph has always been driven to help introduce technology to traditionally isolated demographics. He cofounded the nonprofit organization The Human Tech Project to further impact underprivileged children and the elderly in local communities through technology education. He has organized technology courses used across the world and is currently working with Assisting Children in Need to raise funds for computer resource centers in developing countries. He has witnessed technology's potential to bring immense efficiency and convenience to everyday life at a low cost.

Outside of backpacking, he enjoys exploring competitive programming, website design, and computer security. He conducts research in memory forensics and malware analysis, intending to specialize in this field. Beyond academics, he likes running cross-country and playing music with his chamber orchestra. After graduation, he strives to thru-hike the Pacific Crest Trail. Joseph can be contacted through his email at josephzhang999@gmail.com.

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Introduction

As we progress through the Digital Age, technology's rapid adoption brings unparalleled convenience to all aspects of life. Humans have access to an abundance of information, making education accessible by virtually anyone. Exploring activities and hobbies that were once obscure is now easier than ever as more and more people are joining and learning from online backpacking communities. Smartphones are now ubiquitous because these light, powerful devices possess high quality cameras, location tracking capabilities, and ample memories for numerous documents and pictures. Their ample battery lives make them perfect assistance on the trail. As there is a growing market for outdoor applications, I will present what I have learned about using these technologies to facilitate my trips. For each software recommended, I provide an introduction and a fundamental guide to get started. I made sure that all the technologies in this book are free, promoting the principle that just like technology, the outdoors should be accessible by all.

This eBook is broken down into three major parts. The first part presents technologies to facilitate the preparation for a trip, including resources used to organize gear which can also help in terms of mental preparation and streamlining your pack weight. It also contains navigation tools used to devise a route and calculate statistics, such as distance and elevation. The second section includes applications that are used while out on the trail, such as mobile maps and the highly informative but optional applications used to educate yourself about the outdoors. Finally, I cover advanced settings to minimize battery drain since I notice a lot of hikers pack unnecessarily bulky power banks to supply minimal phone use.

To explain more effectively and precisely, I include example screenshots labeled as figures enumerated with a chapter and sequence number for easy reference. Also, I try to detail some other common alternatives since I understand that people have different preferences. If you are open to spending a bit of money, I list some highly recommended software along with the costs. My personal advice is taken from my own tests out in the field, but feel free to contact me as I am always open to comments from people with more experience in using these free applications.

Despite all of its benefits, we should not solely depend on technology as it is never a replacement of knowledge and sufficient preparation. As the Boy Scout motto, *Be Prepared* suggests that all hikers must bring the ten essentials, notably including a paper map and a compass. One simply cannot rely on a phone for navigation since damage or battery depletion are common possibilities. Too often have hikers ruined their phones by leaving it charging at night out in the cold. Also, a phone is never a reliable source of communication to home, so always tell your friends and family where you will hike and when you plan on returning. Along with preparing your gear before your hike, please equip yourself with knowledge about staying safe and conducting yourself ethically in the outdoors.

1. Organizing Gear

A key part of trip preparation is formulating a thorough list of everything that you will bring. Not only is it easy to check if you are missing anything, you can also cut down on unnecessary items, streamlining your pack weight and maximizing efficiency. Thus, a good gear list is adjustable and updatable, recording weights for each item and categories dividing the gear i.e. (clothing, shelter, and food preparation). Also, it is valuable to have the ability to share your gear list for critique from different backpacking communities out there, especially r/Ultralight on Reddit. This chapter will cover the basics of using LighterPack, a free website that enables you to create and share comprehensive gear lists, as well as alternative applications that have mobile capabilities.

LighterPack

As an open source project led by Galen Maly, LighterPack proves to be a powerful technology for backpackers. It provides a simple way for hikers to clearly know what is on their back. It allows an unlimited amount of highly adjustable gear lists for your trips. Each list shows a nice amount of statistics, including prices and weight for each category as depicted in Figure 1-1. The pie chart provides a nice visual for the weight distribution, and in this case, it is evident that the “Big 4” and “Worn Clothing” constitutes most of the weight. You have the option to customize the units of weight.



Figure 1-1: Example gear list statistics

Consumable (in bold text) presents the sum of all the weight that varies throughout a trip, such as food and toothpaste. It is commonly used to subtly decrease your base weight in order to seem ultralight. The same thing can be said for the Worn category which describes the weight of items not in your pack, including your phone. Finally, Base Weight describes the total weight of gear that stays constant throughout a hike, like a shelter and a sleeping quilt.

Creating Your Gear List

After creating an account, [LighterPack](#) should bring you to an empty, unnamed list page, similar to Figure 1-2. I already named the gear list “PCT Gear List” and the first category “Big 4.” Note that the named list shows up on the sidebar section, “Lists,” so you can quickly access your other gear lists.

The screenshot shows the LighterPack beta interface. On the left, a sidebar has 'Lists' and 'Gear' sections. Under 'Lists', 'PCT Gear List' is selected. Under 'Gear', there's a search bar and two categories: '0 oz' and '0 oz'. The main content area is titled 'PCT Gear List' and displays a welcome message: 'Welcome to LighterPack! Here's what you need to get started: 1. Click on things to edit them. Give your list and category a name. 2. Add new categories and give items weights to start the visualization. 3. When you're done, share your list with others!' Below this is a table for 'Big 4' items:

Name	Description	Weight	qty
		0 oz	1
		0 oz	1

At the bottom, there are links for 'Site by Galen Maly and friends.' and 'Copyright LighterPack 2019 - Contact'.

Figure 1-2: Sample of a new gear list

You have the option to control what LighterPack shows by adjusting the settings on the top bar. For my demonstration purposes, I have selected all of them, so my list now records item prices and shows links and pictures of my gear.

Go ahead and populate your list categories with gear while using an accurate scale, so you know exactly where most of the weight is coming from and where you can better streamline your gear. As a side note, specifying the quantity of items will not multiply the weight, so if you have multiple items, please record the total sum along with the quantity. As shown in Figure 1-3, the website will automatically total your weights in the upper pie chart section and add your items into the shared “Gear” section of the sidebar. Also, by hovering over each entry, you can

choose to add links and pictures or mark the entry as desired. In my example, I have added pictures and links which would show up nicely in the public mode like in Figure 1-4. Finally, you can rearrange items by dragging the left icon of each entry.

PCT Gear List

Category	Price	Weight
Big 4	650.00	4.37 lb
Packed Clothing	80.00	1.25 lb
Worn Clothing	150.00	2.88 lb
Electronics	0.00	0.03 lb
Water Filtration	30.00	0.49 lb
Toiletries	0.00	0.25 lb
Food!	0.00	0.14 lb
Total	910.00	9.41 lb
Consumable	0.00	0.19 lb
Worn	2.88 lb	
Base Weight	6.34 lb	

List Description (Markdown supported)
Demonstration of LighterPack

Item	Description	Price	Weight	qty
5.8 x 9 Tarp	Borah	\$50.00	8.3 oz	1
Polycryo	Description	\$10.00	1 oz	1
Mini groundhogs	Description	\$15.00	2.1 oz	6
KS 50	KS ultralight is my favorite cottage pack maker!	\$250.00	15 oz	1
Nylofume Bag	waterproofing	\$10.00	1 oz	1
Quilt	20 degrees	\$220.00	22 oz	1
Sitpad	Description	\$20.00	10 oz	1

Figure 1-3: Example of a complete gear list in the create mode with images and links enabled

PCT Gear List

Category	Price	Weight
Big 4	\$650.00	4.37 lb
Packed Clothing	\$80.00	1.25 lb
Worn Clothing	\$150.00	2.88 lb
Electronics	\$0.00	0.03 lb
Water Filtration	\$30.00	0.49 lb
Toiletries	\$0.00	0.25 lb
Food!	\$0.00	0.14 lb
Total	\$910.00	9.41 lb
Consumable	0.19 lb	
Worn	2.88 lb	
Base Weight	6.34 lb	

Demonstration of LighterPack

Item	Description	Price	Weight	qty
5.8 x 9 Tarp	Borah	\$50.00	8.3 oz	1
Polycryo	Description	\$10.00	1 oz	1
Mini groundhogs	Description	\$15.00	2.1 oz	6
KS 50	KS ultralight is my favorite cottage pack maker!	\$250.00	15 oz	1
Nylofume Bag	waterproofing	\$10.00	1 oz	1
Quilt	20 degrees	\$220.00	22 oz	1
Sitpad	Description	\$20.00	10 oz	1
		\$650.00	4.37 lb	12

Category	Price	Weight
Fleece	\$20.00	8 oz
Rain Jacket	\$20.00	8 oz

Packed Clothing

Figure 1-4: Example of gear list in the public mode

In the public view of your gear list, notice how the links can be accessed by clicking on the item names in blue. This can be useful for curious gear list viewers who want to see where they can purchase your items.

Sharing Your Gear List for Critique

Now that your gear list is complete with alluring pictures and links, LighterPack offers a public link for you to anonymously share your list. It shows your gear list in the public mode like in Figure 1-4. To access the link, click Share on the top bar which will result in something similar to Figure 1-5. The first text box is your public link, and the second box contains code to embed your gear list within HTML. Export to CSV allows you to transfer the list to other spreadsheets like Microsoft Excel or Google Sheets.

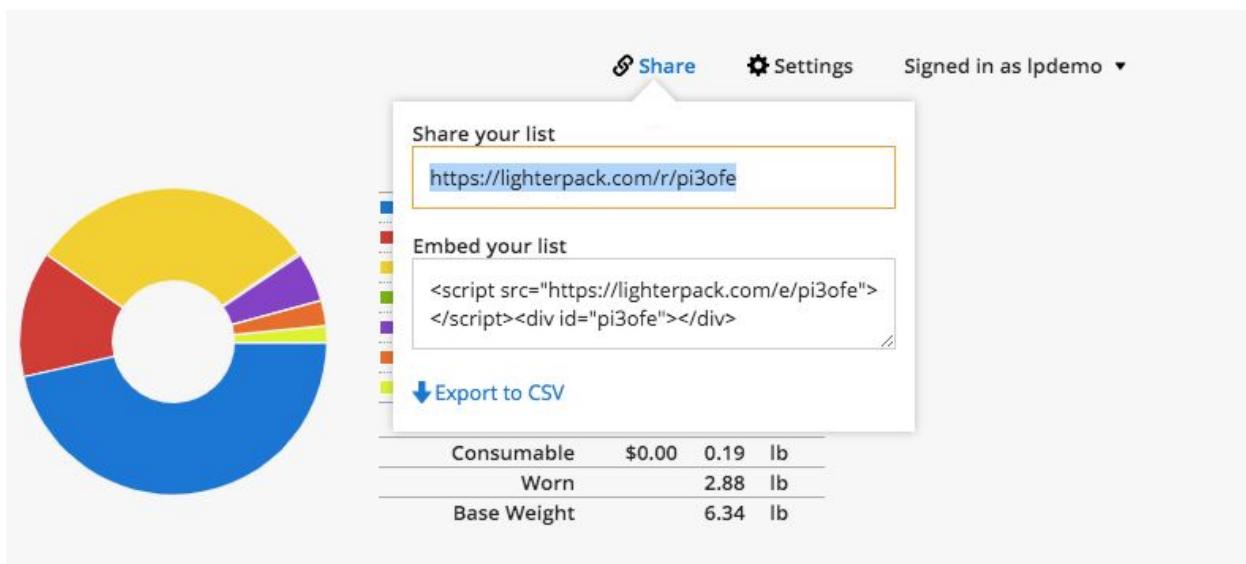


Figure 1-5: Retrieve the sharing link for your LighterPack gear list

With this link, I recommend sharing your gear list for others to critique. One great community is [Reddit r/Ultralight](#), which is populated with experienced backpackers that are collectively motivated to hike more efficiently through a minimalist mindset and lightweight gear loadout. The community offers pack shakedowns which are essentially advice about the suitability of your gear and ways to lighten it. Also, you can look at others' gear lists which are often shown in users' fairs. Gear advice from this amazing community is an added benefit for creating an online, shareable gear list. However, LighterPack does not pressure you to be an ultralight backpacker, but listing out all your items tends to compel you to lighten up.

Mobile-Friendly Alternatives

Although LighterPack has a straightforward user interface, a commonly cited drawback is its lack of a mobile-friendly interface since hikers often want to show off their gear lists on the trail. The next couple of mobile-friendly alternatives are considerably more clean and modern-looking. However, many people including me prefer LighterPack since it displays a lot of information on one page in a simple manner even if it does not adhere with current website UI trends.

Trailpost

A great alternative is TrailPost, which is a slightly more complicated application to use than LighterPack. Although not a dedicated iOS application, Trailpost on a mobile browser is a less cluttered and definitely a more pleasant mobile experience than LighterPack as indicated in Figure 1-6 and 1-7. Dan, the creator of the app, accounted for a mobile-friendly interface during the development, so your mobile Trailpost gear lists look really nice like in Figure 1-8.

The figure consists of three side-by-side screenshots of the Trailpost mobile application. The left screenshot shows the homepage with a green header containing 'JOIN' and 'SIGN IN' buttons, a banner for 'Plan for adventure', and a list of features: 'Store the gear you own', 'Quickly plan multiple packs', 'Track consumable usage over time', 'Analyze your pack weight breakdowns', 'Print packing checklists before you go', 'Search through your gear and packs', and 'Access your account on any device'. Below this is a 'JOIN NOW FOR FREE' button and a 'Track what you own' button. The middle screenshot shows the 'Sign in' page with a 'trailpost' logo, a 'Sign in' button, and fields for 'Your email address' and 'Your account password'. It also includes a 'Don't remember? Get help' link and a 'SIGN IN' button. The right screenshot shows a gear list for a trip named 'Yosemite'. At the top, it shows 'tpdemo' and the trip name 'Yosemite'. Below this is a summary of weights: Base 5.95 lbs + Worn 3 oz + Consumable 0 oz = Total 6.14 lbs. A 'Units' dropdown is set to 'US Customary'. Below the summary is a table with two rows. The first row shows 'Packing: 1 lb' with items '1 x KS 50' and '15 oz'. The second row shows 'Shelter: 10.45 oz' with item '1 x Polycryo' and '1 oz'. There are also 'ITEMS' and 'STATS' tabs at the bottom of the gear list screen.

Figure 1-6 to Figure 1-8: Trailpost pages on a mobile device

Google Sheets

Ahh yes, creating your own solution. Google Sheets has all the capabilities including displaying charts, creating unlimited amounts of categories, and sharing a mobile-friendly list to

others. Nearly everyone has a Google account, so anyone can access the list. A spreadsheet is definitely powerful enough to add up all your statistics, such as weight, food calories, and cost, with some equation tinkering. Unlike the other gear list applications shared here, if you go on a group hike, Google Sheets allows collaboration between multiple accounts, so it makes coordinating a shared gear list much easier. Figure 1-9 shows an example gear list on Google Sheets, and for its great customizability, it does not seem too uninviting if I do say so myself.

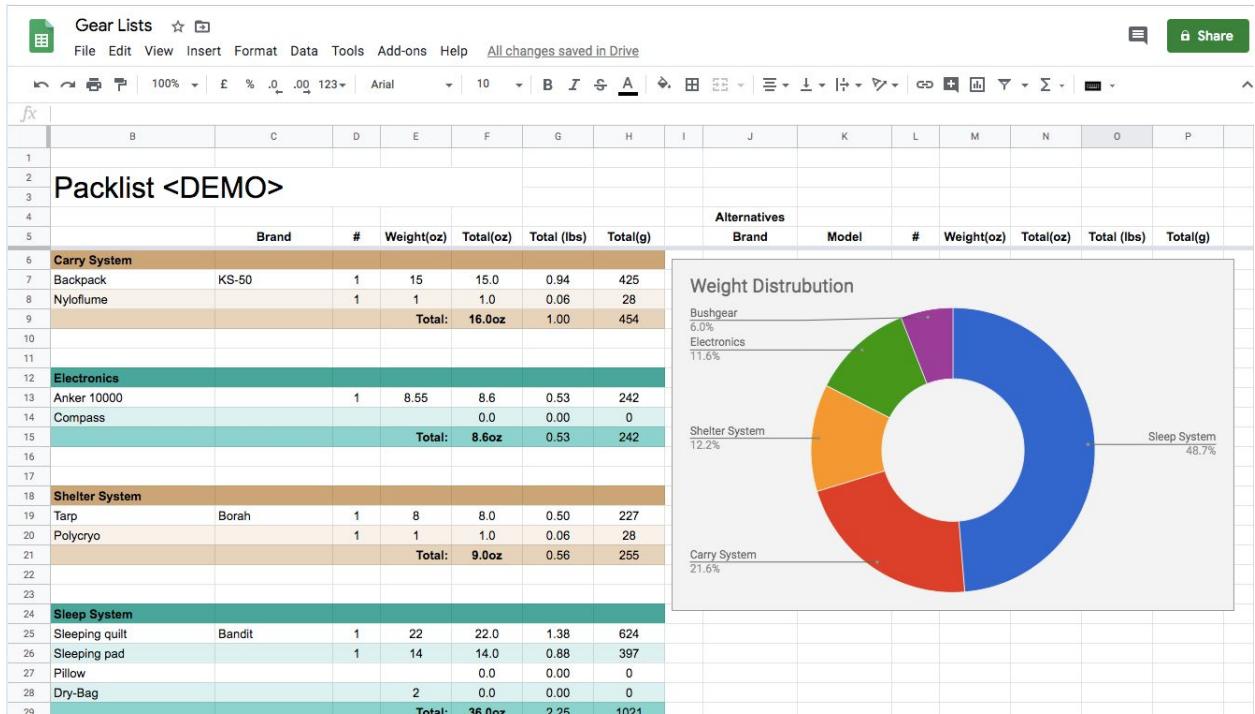


Figure 1-9: Gear list created on Google Sheets (template courtesy to [u/Lloldrin](#))

Through all the technologies covered in this chapter, it is clear that the ability to organize and share your gear digitally is extremely beneficial since it mentally prepares you for your next adventure, keeping you from forgetting necessary items or bringing unneeded ones. One of my favorite activities is listing all my dream gear in a LighterPack and marvelling at the base weight (but cringing at the price).

2. Route Planning

Make sure you do sufficient research on where you will hike. A lot of variables can be adjusted once the route information is set, such as the amount of food and duration of the trip. You could purchase maps from USGS or the ranger station, but online map services provide much more customizability and details about specific points on the map. This chapter presents an easy way to plan and print a route from CalTopo, but it also touches on Google Earth which is a popular planning tool for off trail hiking. If used in conjunction with chapter three, a mobile device with a CalTopo Geospatial PDF can pinpoint your location on a digital map without the Internet, keeping you on the trail and aware of where you are.

CalTopo

This free online mapping tool has an abundant amount of maps from USGS quadrangles to satellite imagery. Users can draw their own trails over a customized base layer. Terrain statistics can be gathered from the route, including an elevation profile, tree cover, overall slope, and land cover. The treasure trove of information provided by CalTopo makes it vastly more preferable than any other online route planner. I will guide you through drawing a route, viewing its statistics, and downloading a printable PDF version.

After logging in to [CalTopo](#), you will reach a screen similar to Figure 2-1.

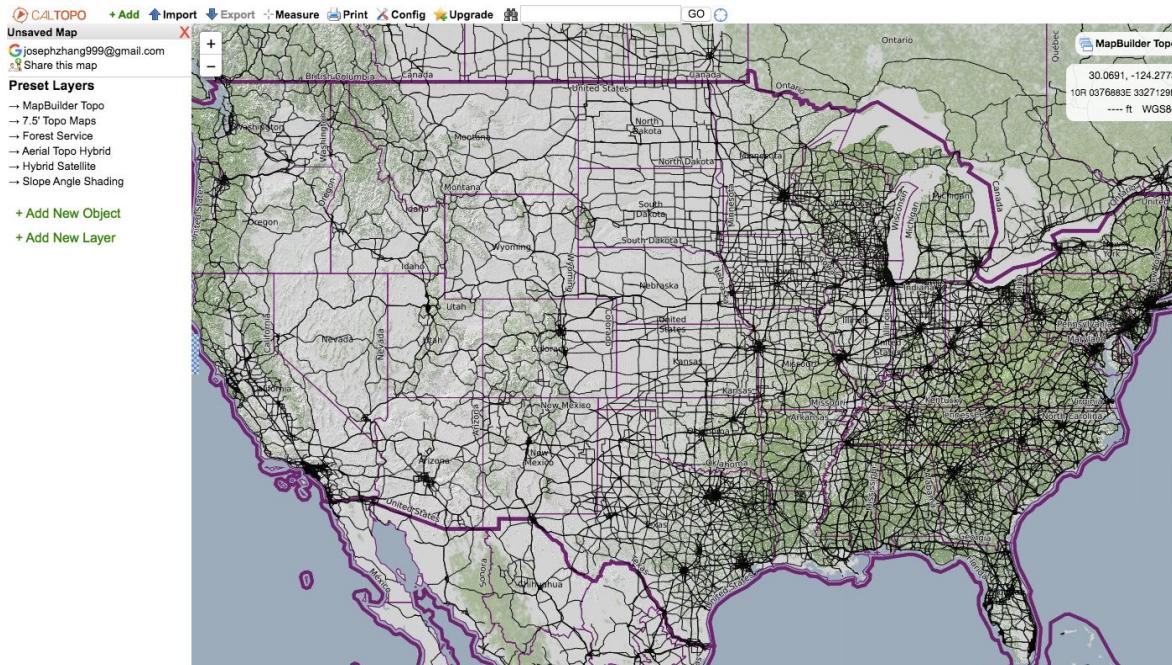


Figure 2-1: Typical new map screen after login

Start by selecting a base layer which will affect the look and details of the map. You can choose options by clicking “MapBuilder Topo” on the upper right corner. Next, click on the drop down the menu, and select your preferred layer as shown in Figure 2-2. I like the Scanned 7.5’ layer since I typically use a paper USGS quadrangle map which is identical.

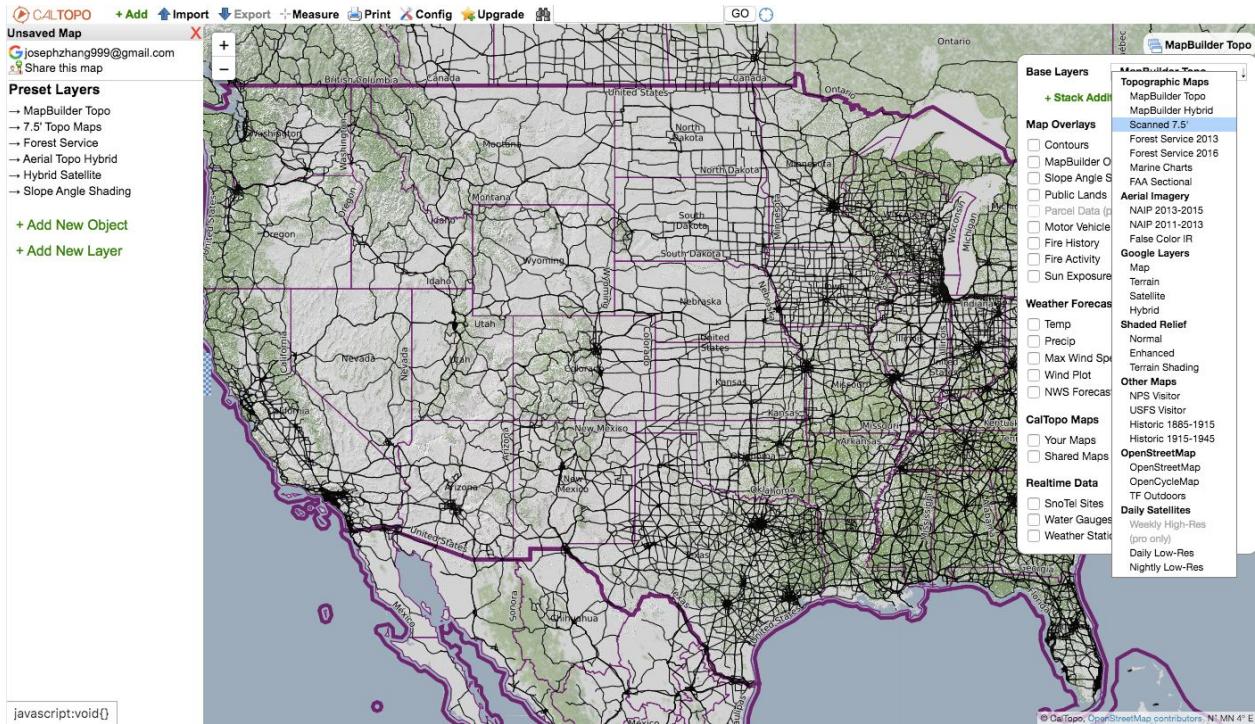


Figure 2-2: Select a base layer for your map (Scanned 7.5’ selected)

On the top search bar, enter the location you will hike at and press “GO.” As an example, I have chosen Yosemite National Park as my desired location. Note how the new layer differs from the original default layer. Start drawing a line from your trailhead by selecting “+ Add New Object” and “Line.” The starting point selected will have a ray emerging from it, and you can click to segment and elongate the current line, press escape to undo, and double click to end. After your line is drawn, note that you can go back to the layers button and select multiple other overlays. I find that “weather forecast” is the most useful as Temp, Precip, and Wind Plot are some of my most commonly used tools.

Figure 2-3 is from a 50-miler trek I led with a few other Boy Scouts in the Yosemite backcountry. We had to turn back at Sunrise Lakes due to too much snow, so note that a line can overlap over itself, for out-and-back trails for instance. Figure 2-4 shows the statistics I derived from my 50-Miler, including the elevation profile, overall elevation, slope, aspect, tree cover, and land cover. This wealth of information is what drew me to CalTopo since I can foresee how difficult my hike will be and plan my camps and backpacking duration accordingly.

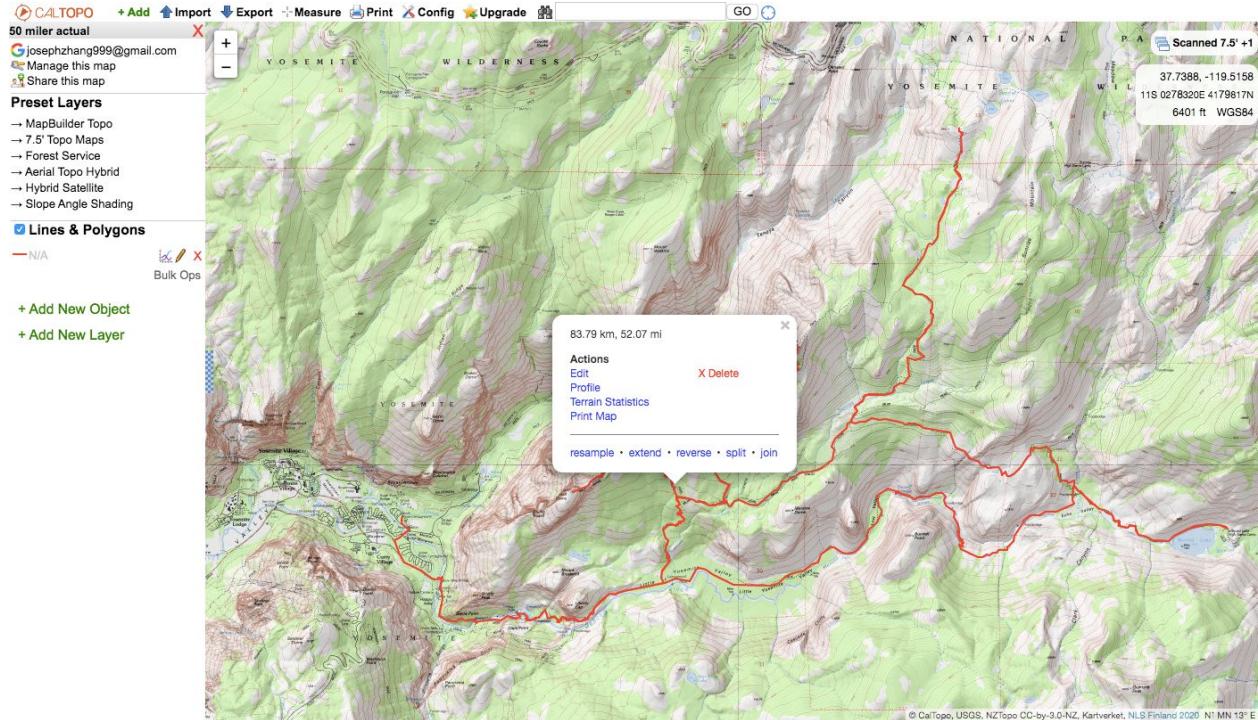


Figure 2-3: Example of a line drawn on a Scanned 7.5' layer

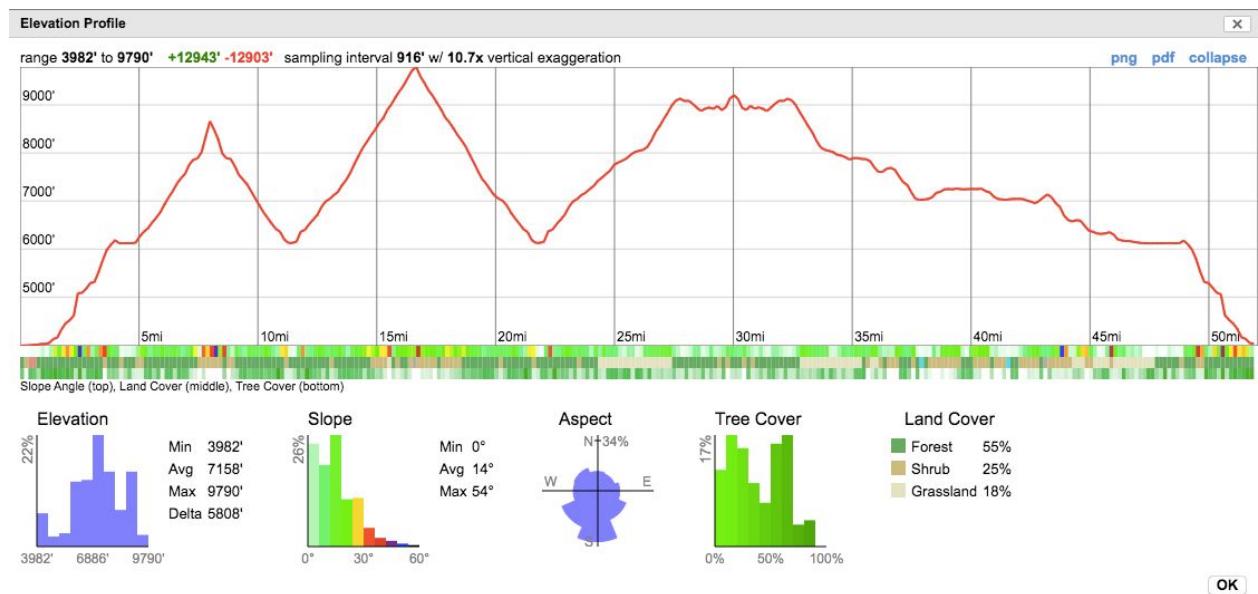


Figure 2-4: The terrain statistics for my 50-Miler example in Figure 2-3

In the pop-up window in Figure 2-3, you can quickly gain information about your line's length, and several other actions can be performed which are summarized in Table 2-1.

Edit

Changes the name, color, or description of the path.

Profile	A detailed chart of the elevation profile will pop up at the bottom.
Terrain Statistics	Plots similar to Figure 2-4 will show.
Print Map	Converts the route to a printable PDF version.
Delete	Deletes the entire line.
Resample	Simplifies the route by reducing the number of points along the route.
Split	Splits the route into two individual segments.
Join	Combines two named lines.

Table 2-1: Possible operations that can be performed on a line through the pop-up window

Now that your route looks nice and shiny, you have the option to share the map online to your friends for recommendations and critique using the link. Note that you must grant permission in the sharing settings. Print the map by either clicking on “Print Map” from the pop-up window of your line (detailed in Table 2-1) or selecting “Print to PDF or JPG” from the “Print” icon on the top bar. The former option simply prints out your route on one page, so if the scale is too small, the latter option is more customizable. Like in Figure 2-5, you will be able divide your map into individual pages, so you effectively increase the scale.

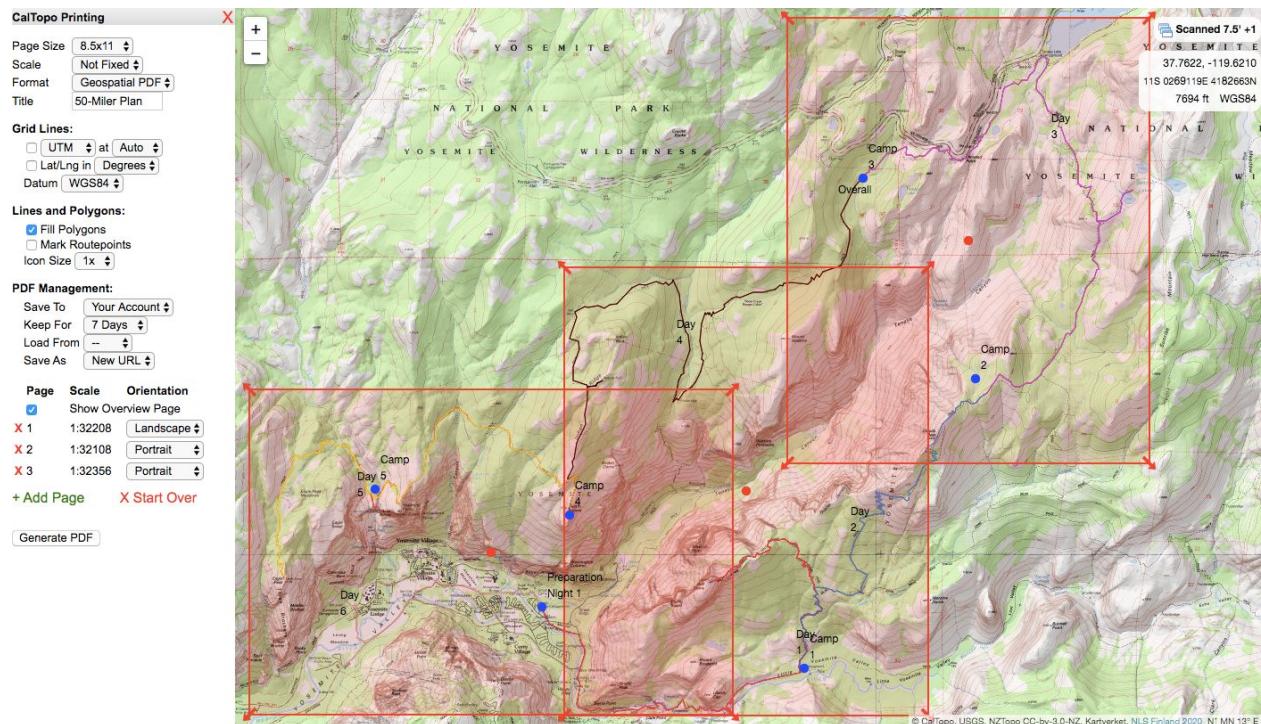


Figure 2-5: Dividing a sample route into multiple pages of roughly the scale for printing

By clicking “Generate PDF,” you will have a compiled set of all your pages in addition to a distance scale, the magnetic declination, and a map scale for each page. Upon printing, all of this information will be useful for navigation with a paper map and a compass. The next chapter will cover using GeoPDFs for mobile digital navigation in the backcountry.

Google Earth

Although CalTopo is a solid choice for most, if not all, backpacking adventures, sometimes you will have to venture off trail. Since CalTopo only provides lines that trace over current trails, it is not suitable for off-trail hiking. On the other hand, Google Earth uses satellite imagery to render a 3D representation of the world, so it is useful to have a birds-eye view of the terrain while mapping a route. The detail offered by Google is not paralleled by a USGS 7.5' map. My guide solely covers the more limited online version of Google Earth since it is more accessible for backpackers. The downloadable Pro version provides vastly more resources than the online version, notably including the ability to take terrain statistics from your route. However, with the online version, it is still possible to export a .KML file which can be printed or imported on a GPS through numerous online convertors.

To use the free online service, go to [Google Earth](#) and wait for the software to load. On the sidebar, choose the “Projects” icon and make a new “line or shape” as shown in Figure 2-6.

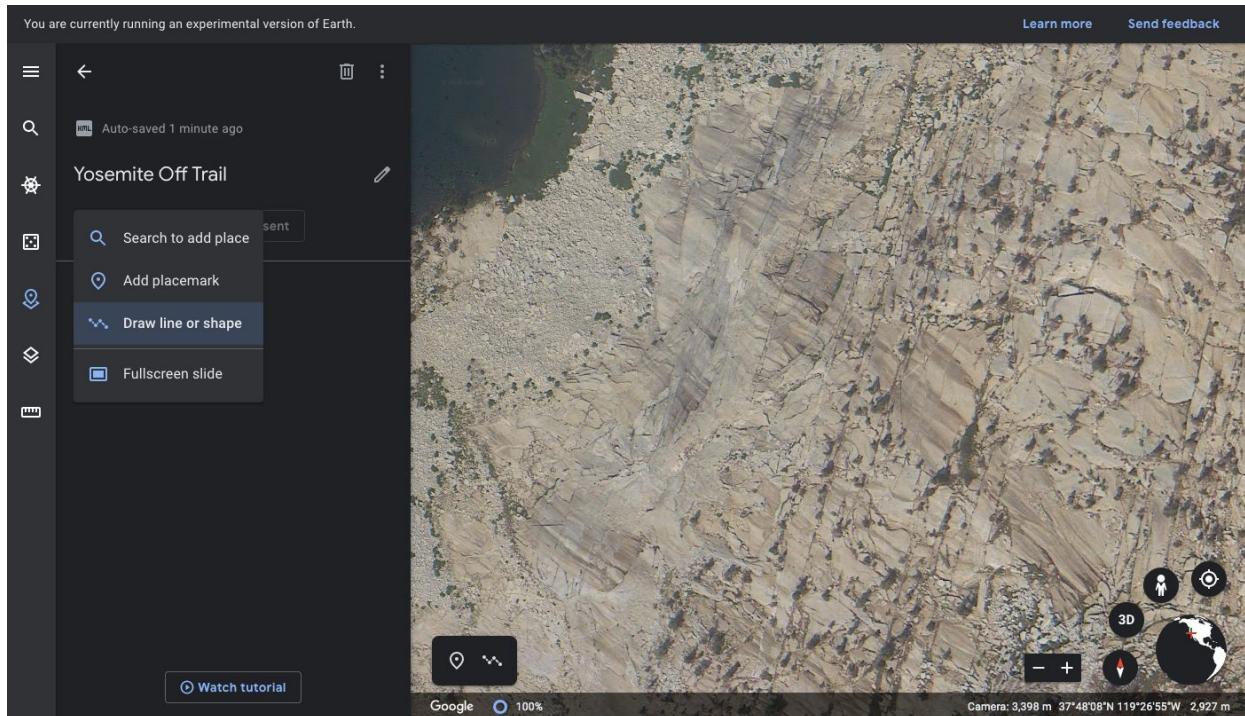


Figure 2-6: Example of the Google Earth imaging to draw your route over

The precise quality of the imagery demonstrates that this is clearly preferred for off-trail route planning over CalTopo since you can see real-life representations of the landmarks and terrain. You can zoom in even closer to scope out particular sections of your hike. By hovering my mouse over specific points, Google offers elevation and coordinate data points on the bottom right, giving indicators on how steep the terrain is.

To draw a line in the general direction you want to hike, follow Google's directions and simply click to segment and extend the line like in Figure 2-7.

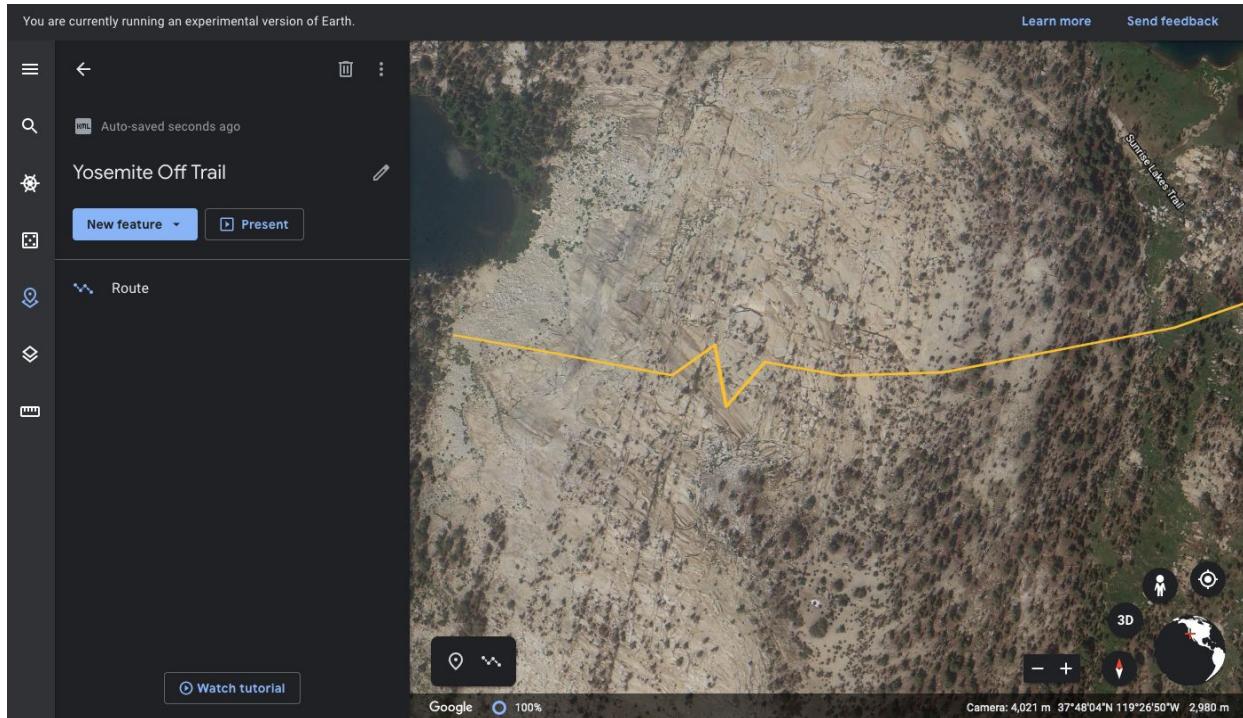


Figure 2-7: Sample off-trail route over the Google Earth

Once the final project is finished, you can export the .KML file by clicking on the vertical ellipses on the top right of your project section. This file can then be printed or converted to a GPS processable file through numerous online services.

This summary of Google Earth is not comprehensive since an online search will yield even more detailed documentation. I personally do not use the downloadable Pro version since I very rarely hike off-trail, and when I do it is only over a short distance, so the online Google Earth version suffices. However, by all means, try out the Pro version if you want a greater amount of features or are simply curious.

3. Smartphone Navigation

Imagine being able to track your location on your phone's digital map while hiking. Say hello to Geospatial PDF (GeoPDF), an electronic map which relates its images to coordinates. Now, all a hiker needs is his phone with downloaded GeoPDFs to surpass the efficiency and usability of a map and compass. Contrary to popular thought, mobile devices do not need an internet connection since they contain built-in chips that can communicate with satellites to retrieve coordinates. However, having only a smartphone for navigation is ill-advised. Despite their inefficiency, a map and a compass are considered one of the ten essentials. No matter how advanced navigation technology becomes, this duo will remain a reliable backup, so brush up on the Orienteering Merit Badge.

In this chapter, I focus on Avenza Maps, a useful free iOS and Android mobile application that supports mapping GeoPDFs. It works perfectly with CalTopo, the incredibly powerful route-creating tool discussed in chapter two. If you are willing to spend money, I would recommend exploring Gaia GPS, Guthooks, or All Trails Pro, all of which are highly recommended by experienced hikers.

Avenza Maps

As a free application with in-app purchases, Avenza Maps allows users to download maps for offline use. Note that it is not free to purchase maps from their store and only three GeoPDF maps are allowed with the free version, which are enough for my shorter trips. If you are open to paying money, the Pro version allows unlimited map imports for 30 dollars a year. I have heard that OruxMaps, a similar application available only for Android, is free and allows an unlimited amount of GeoPDFs.

Now that you have finished mapping a CalTopo route as shown in chapter two, download Avenza Maps from the App Store or Google Play Store. Upon opening the application, go to the bottom bar and tap on My Maps. This is the only part of the application I use. To import maps, first go to CalTopo Printing like in Figure 3-1. Notice that I have selected the default "Geospatial PDF" on the upper left, so Avenza Maps will use my phone's GPS capabilities for navigation while on the map. Make sure to form a single page for each download since Avenza only supports importing single-paged GeoPDFs.

After perfecting the page and clicking Generate PDF, as in Figure 3-2, CalTopo will produce a QR code on the bottom right side of the GeoPDF. Avenza has a QR code reader which can be accessed by clicking the "+" indicated in Figure 3-3. Although this method for sending the GeoPDF to your phone is convenient enough, an alternative option is to send via an email

attachment. Once you open your inbox on your phone, choose to copy the attachment to Avenza Maps.

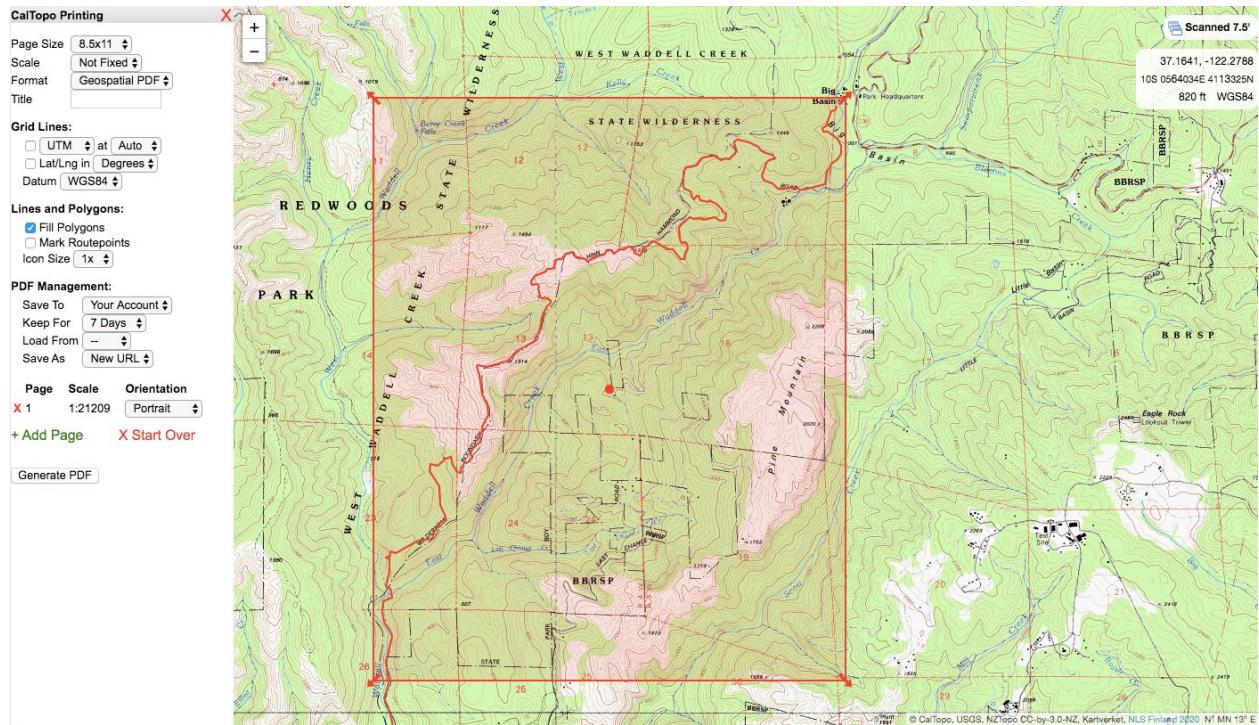


Figure 3-1: Producing a Geospatial PDF from CalTopo

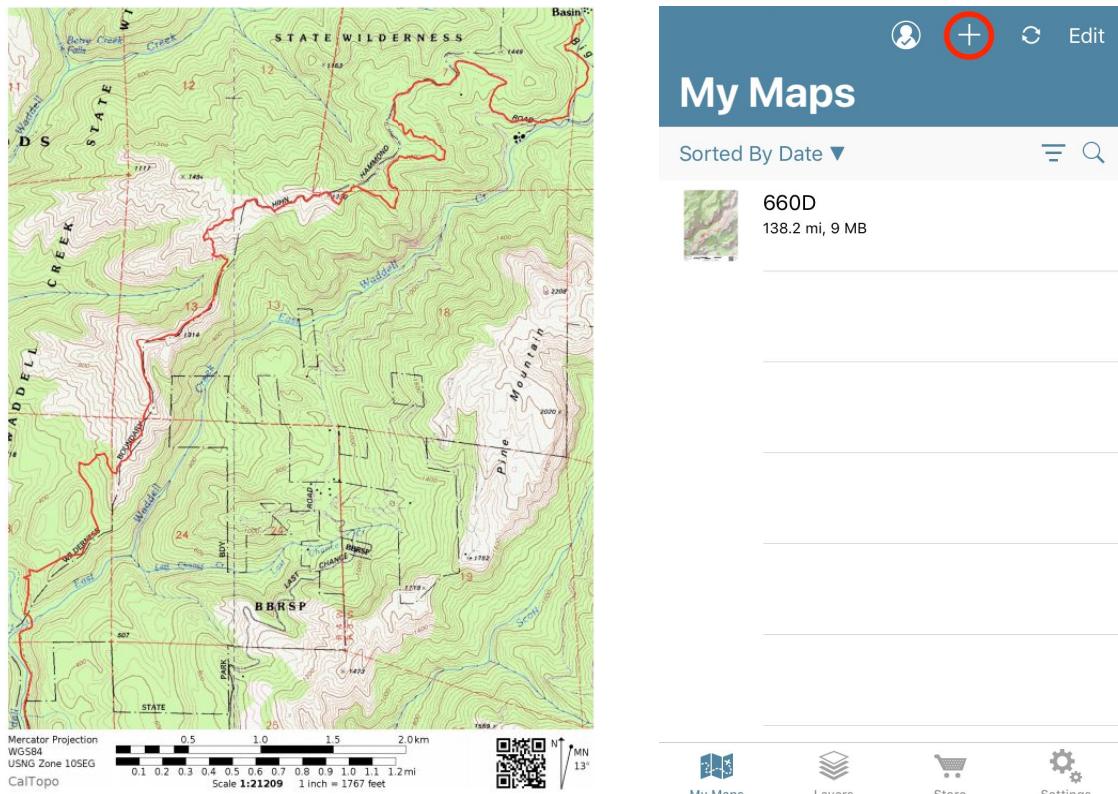


Figure 3-2: GeoPDF produced from CalTopo which is shareable using the bottom right QR code

Figure 3-3: Import your GeoPDF using circled “+” icon

Once you scan the QR code, the map should appear and download in My Maps. This may take a few seconds depending on the file size. Once you open the file, it will look similar to Figure 3-4.

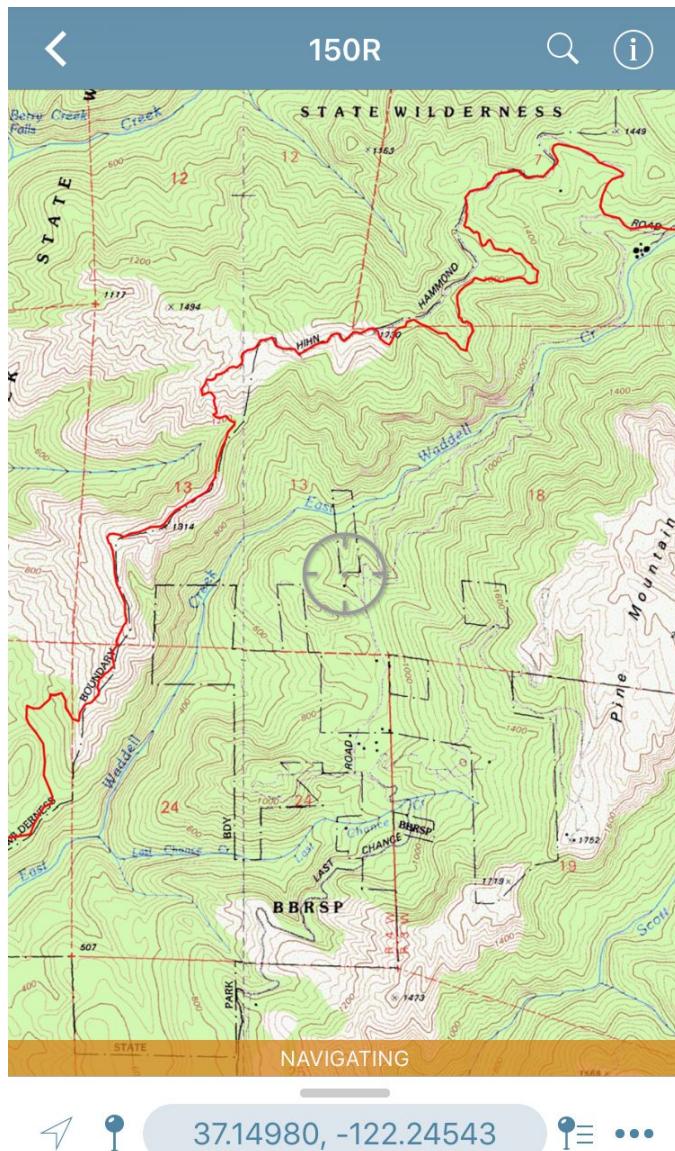


Figure 3-4: A finished GeoPDF loaded on Avenza Maps

There are a whole slew of options available from the bottom bar and under the ellipses icon. A few notable ones follow:

- **Map Arrow Icon:** Pinpoint your current location (you have to be located on the map)

- **Map Pin Icon:** Add a place marker to where the crosshairs are pointing
- **Draw and Measure:** Form a segmented line and measure its length on the map
- **Record GPS Tracks:** Presents your hiking statistics such as speed, distance, and duration
- **Navigate to a Destination:** Indicates how to travel to a specified destination on the map

Avenza Maps provides an easy method to import your GeoPDF and powerful interactive GPS tracking tools for using it out in the field as well. With its compatibility with CalTopo, you can also import multiple other overlays (snow, rain, wind, etc.) on top of your original GeoPDF, providing you with considerably more information. In Figure 3-5, I have added the slope angle shading, wind plot, and NWS Forecast Grid overlays over the original map and imported it to Avenza Maps. Ultimately, the combination of CalTopo and Avenza Maps provides countless options and features that will improve your preparation and ease your hike.

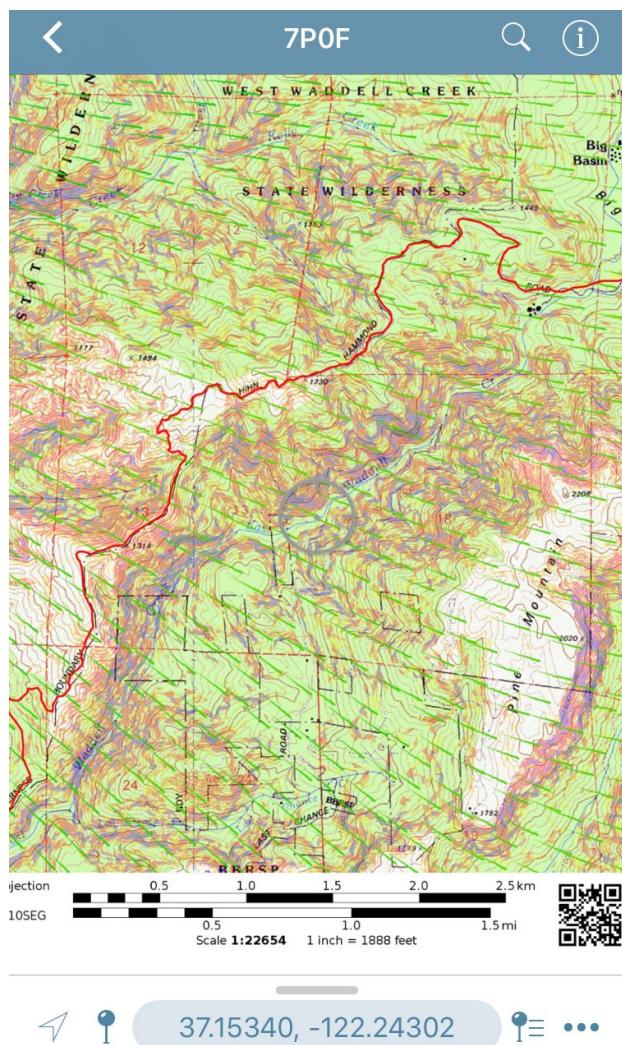


Figure 3-5: Avenza Maps GeoPDF with CalTopo weather and slope angle shading overlays

4. Other Cool Applications

Although the next couple of mobile applications are not necessary for your trip to succeed, they have greatly increased my enjoyment of hiking. Unlike the more essential applications listed previously, these exist purely for pleasure and personal education. It is understandable that unnecessary technology is discouraged in nature since many people wish to isolate and rejuvenate themselves away from distractions. Therefore, the decision to download the following is purely yours. As long as you follow Leave No Trace and outdoor ethics principles, hike your own hike.

However, personally, these educational mobile applications enhance my experience in nature since in addition to marvelling at its beauty, I can learn names and information about organisms in the natural world around me. By identifying the plants I encounter, I can now accurately distinguish between poison oak and blackberry vines! Technology is not only making hiking more convenient and enjoyable, it is fueling an increasing interest in nature, which in my eyes will lead to more greater environmental conservation and protection.

iNaturalist

Already a very popular mobile application, iNaturalist boasts more than a million users across the world. The 12-year old platform uses crowdsourced data and artificial intelligence to accurately identify plant and animal species, like the mushroom in Figure 4-1.



Figure 4-1: Observing a mushroom on iNaturalist's mobile application

The app also uses your smartphone's GPS, clock, and calendar technologies to narrow down the list of possible species and publically post what you identified on the Explore page as in Figure 4-2. This application requires an internet connection for most of its features, including the Explore and Observe pages.

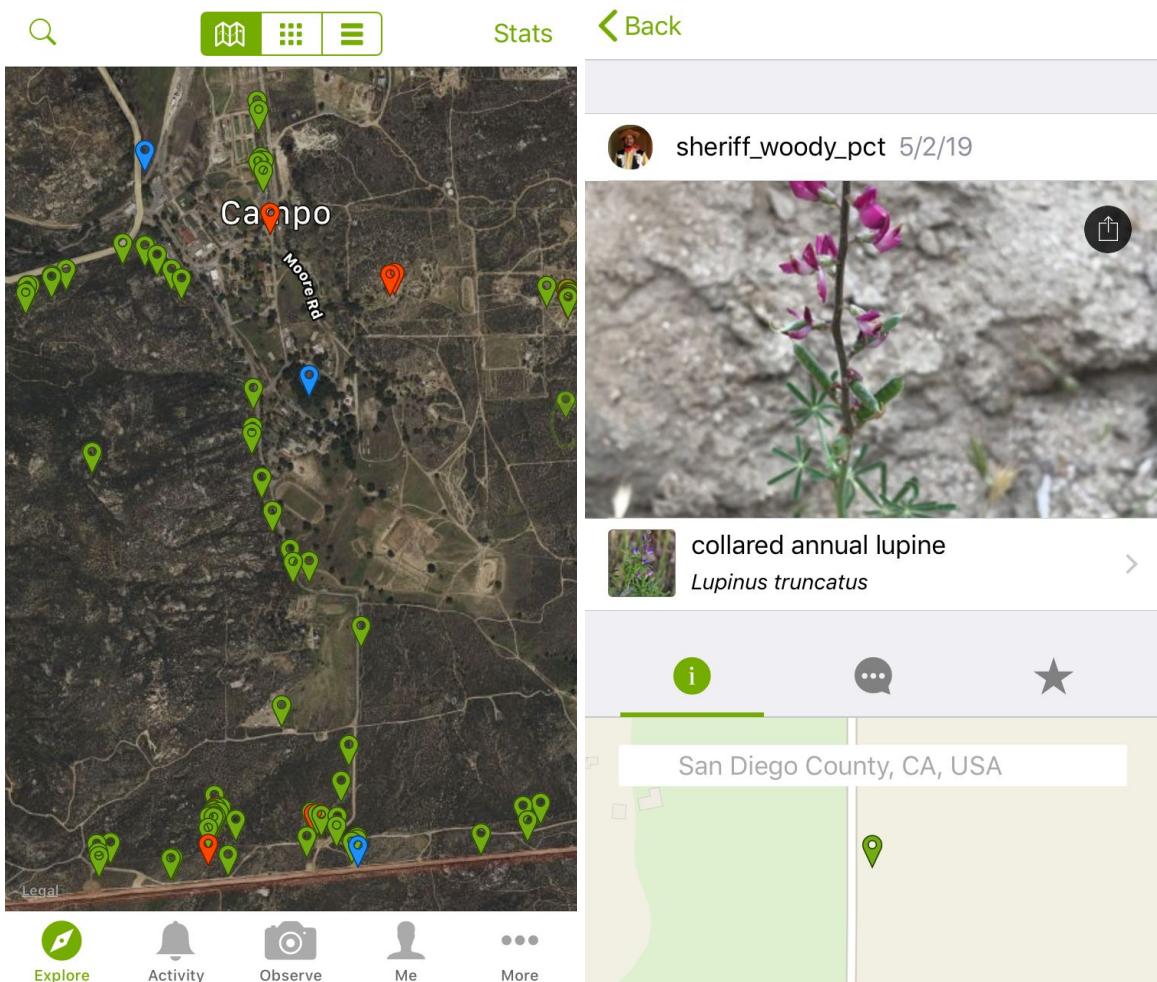


Figure 4-2: Example of observations made near Campo, like from this PCT hiker

A look at any neighborhood on the Explore page confirms the million plus user figure. It is entertaining to virtually visit a region and discover the wildlife that people found there. This application definitely encourages me to visit the outdoors since it helps identify what I see around me and it is satisfying to watch artificial intelligence doing its magic out in the field.

To make your observation of an organism, go to the Observe page marked by the camera icon on the bottom bar. It will result in something similar to Figure 4-3 where I am taking a picture of a pheasant. Note that any pictures you take using iNaturalist will also be automatically loaded onto your camera roll. After processing the photo, select the question mark icon next to

“What did you see?” to identify the organism resulting in Figure 4-4. If you are too remote for a cellular connection, save the picture for identification later.



Details

WE'RE PRETTY SURE THIS IS IN THE GENUS PHASIANUS.

Phasianus (i)

HERE ARE OUR TOP TEN SPECIES SUGGESTIONS:

- Ring-necked Pheasant**
Phasianus colchicus (i)
Visually Similar / Seen Nearby
- Long-tailed Pheasant**
Syrmaticus (i)
Visually Similar
- Golden Pheasant**
Chrysolophus pictus (i)

Figure 4-3: Taking a picture using iNaturalist

Figure 4-4: iNaturalist guesses possibilities

The application guesses the possible species of your observation, surprisingly quickly and accurately. It first presents the genus, the overall umbrella of the organism species. Then, the software classifies possible species ranked by its confidence. Notice how the application also factors in your location, so if an animal is known not to be native to your local area, it would likely rank lower on the list.

You can click on the information icon for each entry to look at pictures, a basic Wikipedia description, and a map of all the observations of this specific organism across the world like in Figure 4-5. I enjoy looking through the interesting and detailed information the

application conveniently presents, especially the map feature since I can gather about how common my observation is and where it normally can be found.



Northern Bobwhite

Colinus virginianus

The northern bobwhite, Virginia quail or (in its home range) bobwhite quail (*Colinus virginianus*) is a ground-dwelling bird native to the United States, Mexico, and the Caribbean. It is a member of the group of species known as New World quails (Odontophoridae). They were initially placed with the Old World quails in the pheasant family (Phasianidae), but are not particularly closely related. The name "bobwhite" derives from its characteristic whistling call. Despite its secretive nature, the... (Source: Wikipedia, [Northern bobwhite, CC BY-SA 3.0](#))

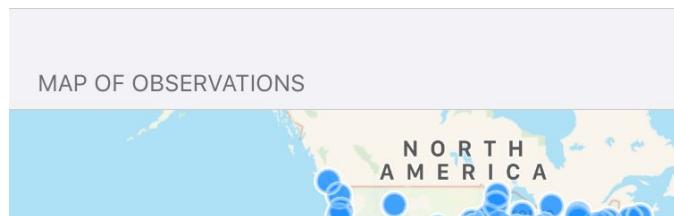


Figure 4-5: iNaturalist presents pictures, a description, and a map of the species.

From the sheer amount of data taken from its nature-oriented community to its powerful organism identifier, iNaturalist provides a wealth of information for the casual hiker that is inquisitive about the outdoors. As an additional bonus, the application works to make nature more accessible through its Explore page where anyone can virtually take a hike and see others' observations. Understand that by publicizing observations, iNaturalist increases the biodiversity data available for scientists and conservationists, and the application even found a new poison frog species, *Andinobates cassidyhornae*. It definitely spiked my curiosity about the random animals and plants I found on the trail and motivated me to discover more about them.

Night Sky

While cowboy camping, I have always been curious about the names of stars and constellations in the night sky. Before downloading Night Sky, I only knew the basics: Orion, Big Dipper, and the North Star. This application has greatly improved my knowledge, and like iNaturalist, I am now curious about learning more. With your location, time, and gyroscope data, it uses augmented reality to calculate which part of the night sky your phone is pointed at. The free version of the application is sufficient for casual use as it provides information about each star or constellation and even assesses stargazing conditions. Surprisingly, Night Sky mostly does not require an internet connection, making it a very good choice to have in the remote backcountry.

After installing and configuring the application, you will see an interactive picture like Figure 4-6 with many stars and constellations that shift as you rotate your phone or zoom in.

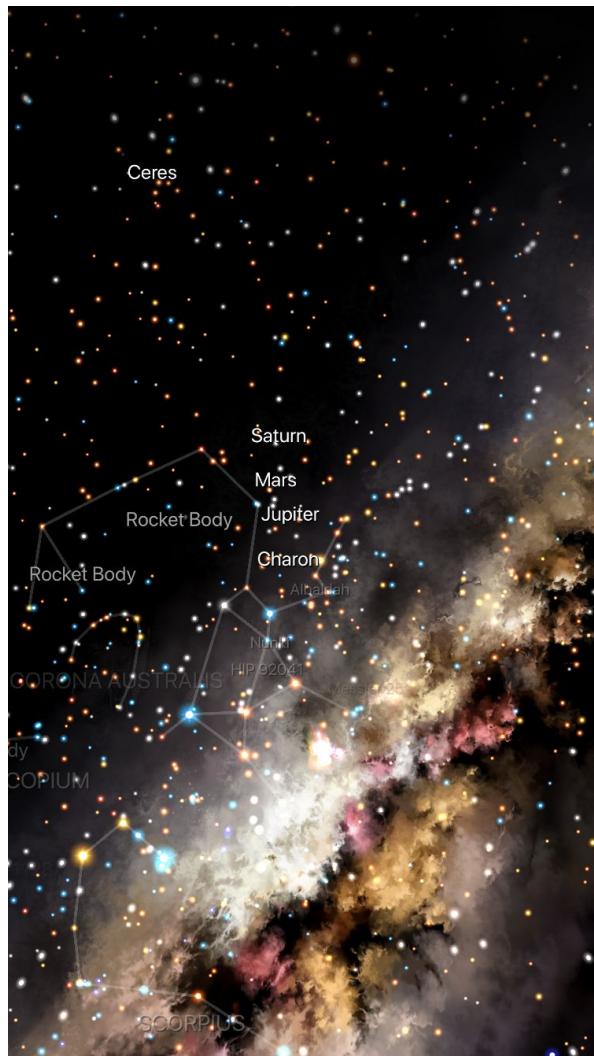


Figure 4-6: Interactive view of the sky taken produced from smartphone sensor data

If you click on a constellation or a star, it offers very detailed information, such as about Bootes in Figure 4-7, notably without requiring an internet connection. I find that the descriptions are almost always long and interesting, detailing everything from history to etymology.

Night Sky also provides some useful information to maximize your viewing experience. As shown in Figure 4-8, from your location and weather data, it projects the temperature at night along with the sun and moon's rise and set times which is helpful for scheduling wake-up times and aesthetic sunset pictures.

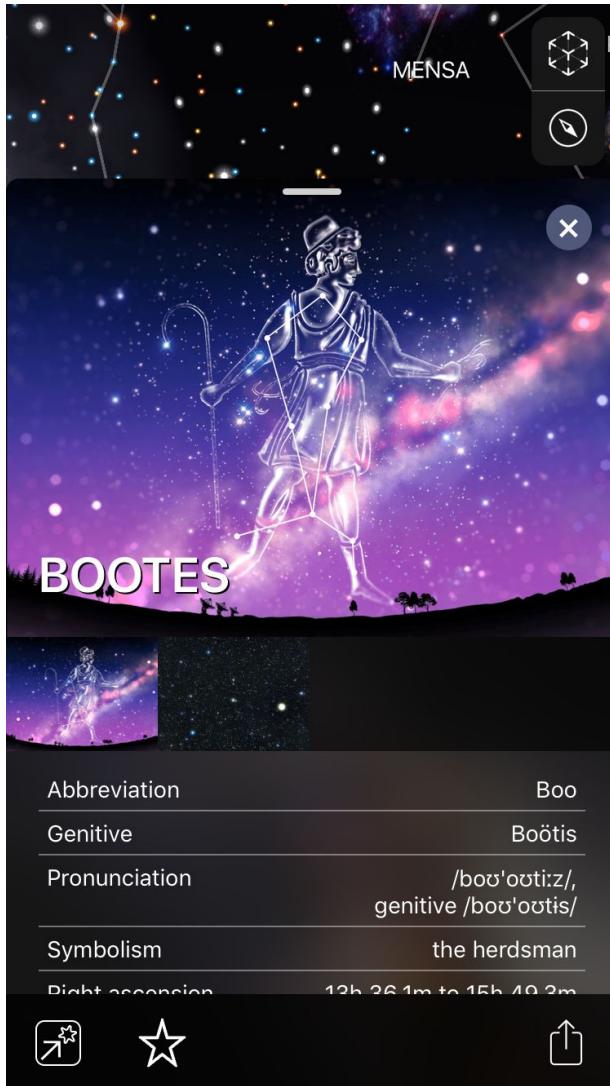


Figure 4-7: Night Sky presents information about the constellation Bootes

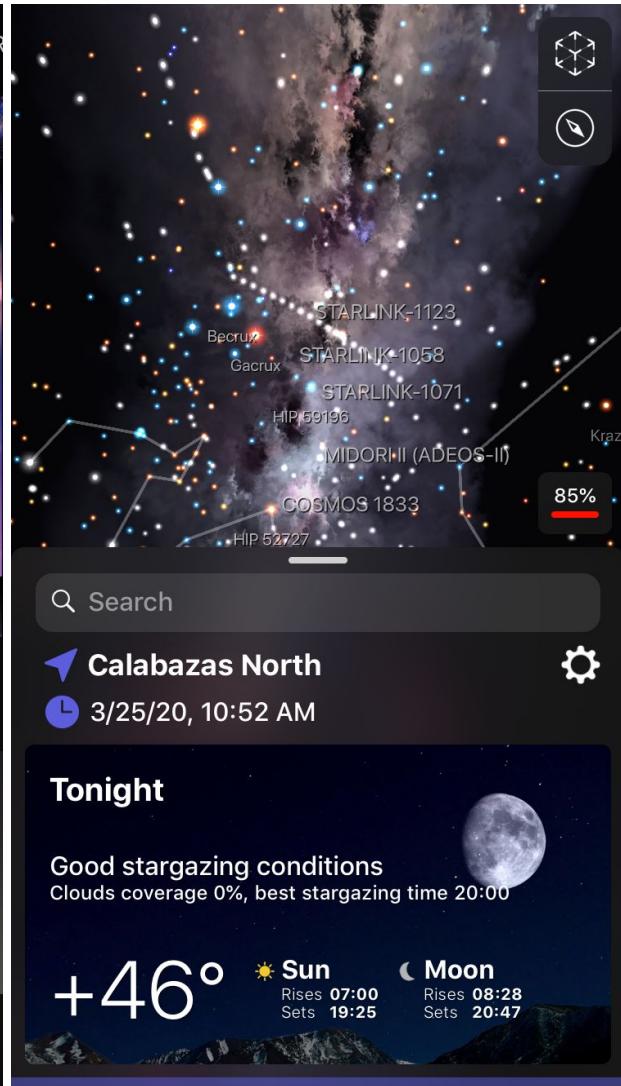


Figure 4-8: Projects stargazing conditions calculated from weather information

Besides putting together an accurate augmented reality interactive sky view, the makers of Night Sky also took the time to add detailed information about many major stars and

constellations in a usable and simple interface. I have stayed up many nights reading up on astronomical facts and fascinating myths.

5. Battery Saving Tips

All these applications would be useless if your phone quickly runs out of battery. In this chapter, I will cover some settings you can adjust to maximize your phone's battery life aside from the obvious airplane mode, low power mode, and low brightness. Also, a cellular connection drains battery faster than WiFi. After changing these settings, my iPhone 6 will last about four or more days of mostly taking pictures and checking my maps. Since it is impossible to last weeks without charge, I recommend these power banks: the lightweight and efficient Anker PowerCore II 10000 (6.3 oz) for longer trips and a Ravpower Luster Mini 3350 (2.6 oz) for shorter ones. Also, it is a good idea to replace the battery if your phone is older than two years as battery health deteriorates significantly over time. Note that you should sleep with your electronics since charging your devices in the cold will permanently reduce the battery capacity.

iOS

Apple's default iPhone settings tend to prioritize performance and user experience over battery life. Also, if you have recently updated your iPhone software, you may notice that your battery drains unusually quickly. Before purchasing a power bank, try these tips! They can do wonders for improving your battery life. The following adjustments cover all iPhone models and operating system versions. If you have an earlier version, the directions still apply, but some settings may be under a different name or have to be modified in a different place. Remember that using Low Power Mode and low brightness are good places to start.

iOS 13: Check Battery Health Suggestions

Apple's newest iOS 13 recommends specific adjustments to improve battery life. To access iPhone's tips, do the following:

1. Open the Settings app.
2. Scroll and tap Battery.
3. Go to Battery Health.

Tapping a proposed modification will automatically jump to the setting. If no recommendations show up, your iPhone cannot find any improvements, but this does not mean you are done.

Reduce Notifications

Cutting down on excessive notifications is a great way to save a bit of battery. Every time your phone receives something, it lights up the screen and makes a connection. Adjust your notifications by doing the following as guided by Figure 5-1:

1. Open the Settings app.
2. Tap Notifications.
3. Take a look at how each app notifies you and toggle the desired modifications.

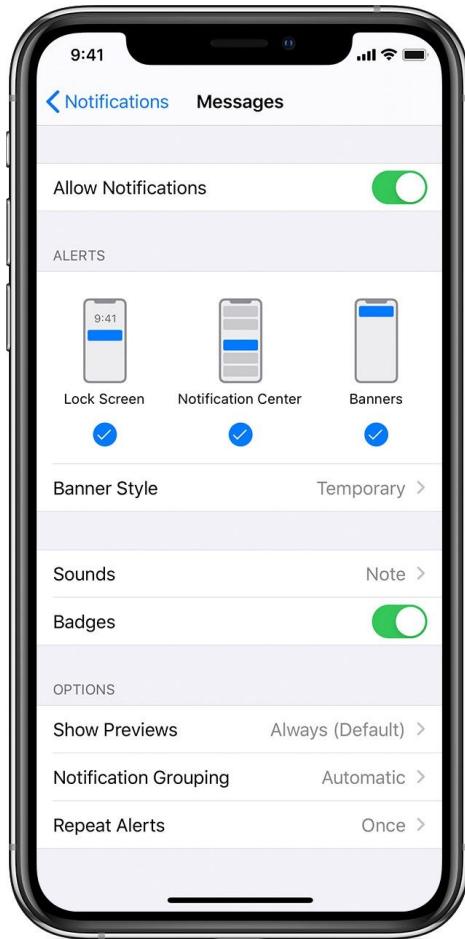


Figure 5-1: Specific notification settings that can be adjusted for each app

Disable Raise to Wake

This feature is enabled by default on iOS 10.3 or later. If you pick up your phone a lot or walk while holding it, the screen constantly turning on could be part of the problem. To turn off Raise to Wake:

1. Open the Settings app.
2. Scroll down and tap Displays & Brightness.
3. Toggle off Raise to Wake.

Reduce the Amount of Widgets

You can find widgets in the Today View which is accessed by swiping right until the last screen. Widgets provide quick updates on information like weather and calendar events for the

day. Consider removing them since they use a lot of battery to refresh their data. Remove widgets by doing the following:

1. At the bottom of Today View, tap on the circular Edit button.
2. Tap the red circle on the left of a selected widget as shown in Figure 5-2.
3. Confirm by tapping Remove.
4. To finish, tap Done on the upper right.

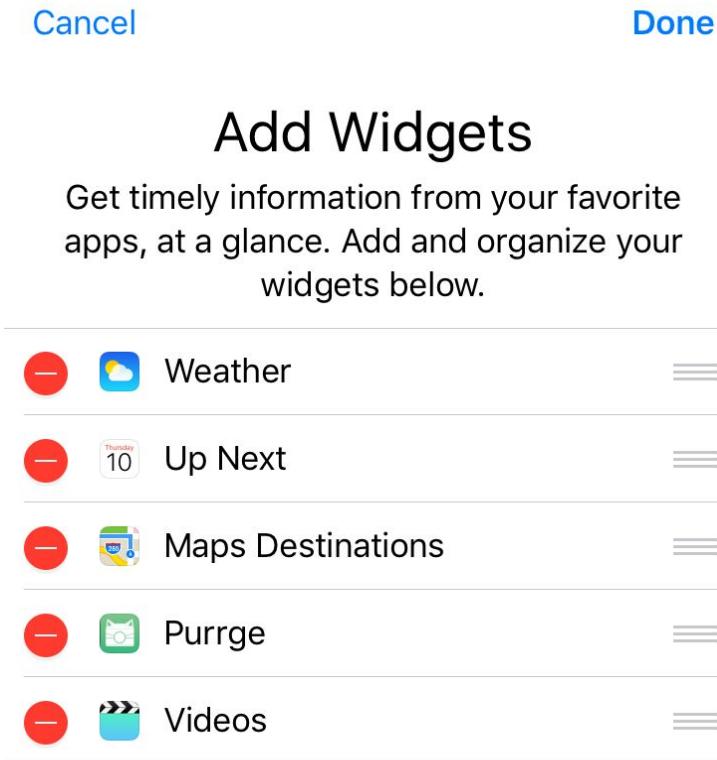


Figure 5-2: Removing widgets from the Today View screen

Disable Automatic Downloads and App Updates

By only explicitly allowing your phone to download software, you limit the amount of battery used covertly. Apple has an option that syncs downloads across all of your devices, so if you download a book on your iPad, for instance, it will automatically download it in iBooks on your phone. If you do not want apps to update on their own, also toggle off App Updates. Follow these steps to disable the feature as illustrated in Figure 5-3:

1. Open the Settings app.
2. Tap on your profile picture which takes you to your Apple ID.
3. Tap on iTunes & App Store.
4. Turn off automatic downloads and application updates by toggling off Music, Apps, Books & Audiobooks, and App Updates.



Figure 5-3: Page to disable all automatic downloads which are synced across your devices

Turn Off Background App Refresh

Background App Refresh allows your apps to check for new content without you using them. Apple intends this feature to optimize opening up an app since it will reduce loading time and have your updated information ready. However, the constant refreshing will drain your iPhone battery. Disable Background App Refresh by doing the following:

1. Open the Settings app.
2. Tap General.
3. Select Background App Refresh.
4. Select off from the list as in Figure 5-4.



Figure 5-4: Turn off Background App Refresh from the table

Limit Location Tracking

Your iPhone's location service allows apps to track you, but most of the time, this is not necessary when you are not using the app. You can go through your apps and choose whether you want them to see your location Always, While Using the App, or Never. Repeatedly sending your location data to apps or Apple developers takes a significant amount of battery power, so I recommend sticking to Never or While Using the App. To do this:

1. Open the Settings app.
2. Scroll and tap Privacy.
3. Tap Location Services on the top of the list.
4. Go through the list and adjust their permissions like in Figure 5-5.
5. Select the bottom option, System Services.
6. Toggle off any unnecessary system options, such as Location Based Apple Ads. Don't forget to look at the Product Improvement section as indicated in Figure 5-6.

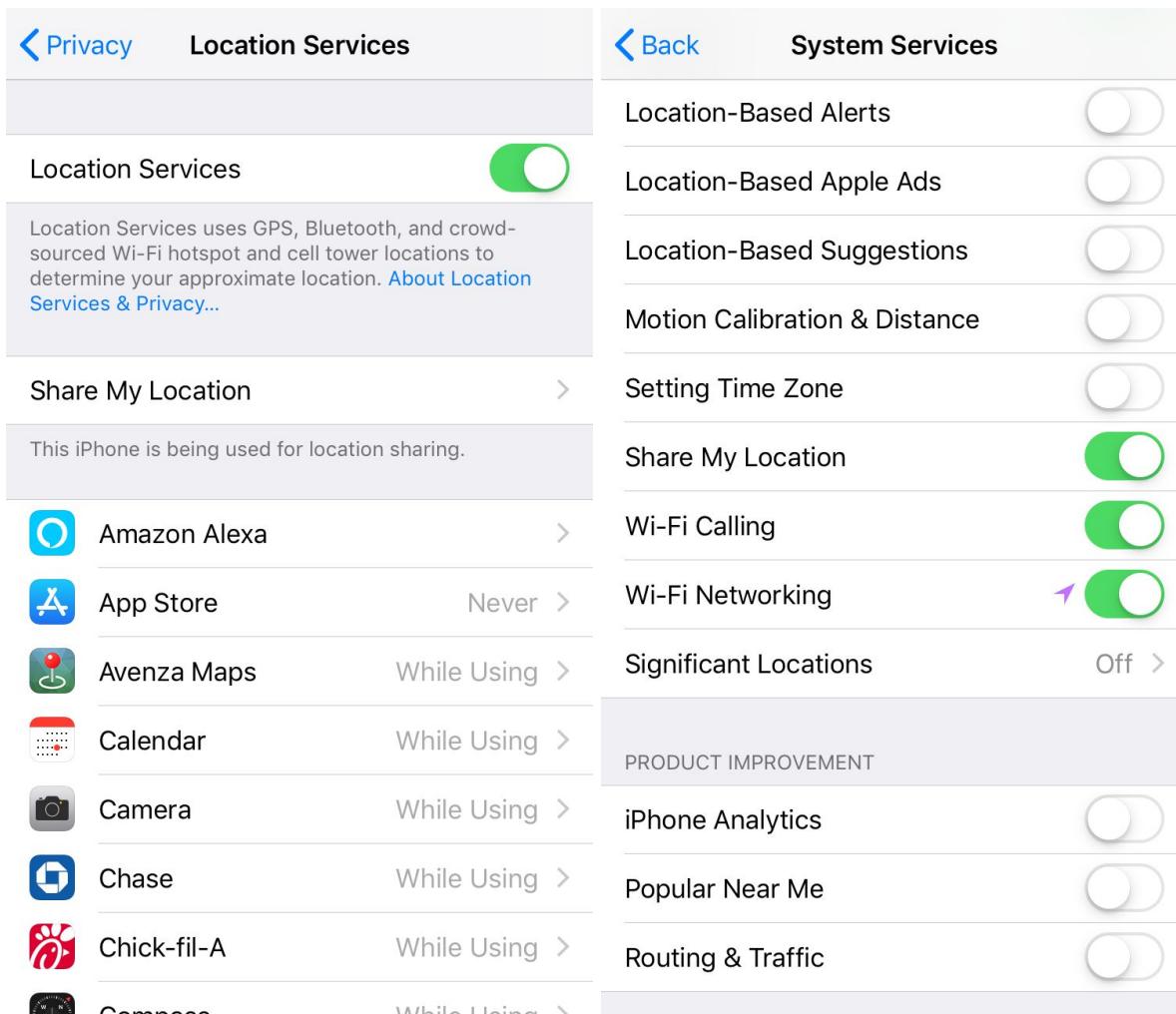


Figure 5-5: Your list of applications will appear in Location Services

Figure 5-6: System Services allows you to toggle off certain location options.

Other Tips

You can find a lot of other tips on the Internet, but for many, it is difficult to say if they actually save battery. Therefore, you can try these modifications, especially if they are not needed much:

- Activate Dark Mode.
- Disable “Hey Siri,” so your phone does not continuously listen for the command.
- Turn off Bluetooth and AirDrop.
- Disable vibrate for notifications.
- Reduce Motions which limit iPhone animations such as screen transitions.

Android

Android phones have widely varying skins from Oxygen OS to MIUI, so the adjustments will not be the same across different brands. Therefore, I will only list the general settings you should pay attention to, which you can further look into for your specific phone.

- **Power Saving Mode:** This mode decreases your phone’s performance and reduces the brightness, only using the minimum amount of resources to function.
- **Location Tracking:** Arguably, the most drastic improvement can be seen through disabling much of the automatic GPS functions. Take control of this setting by revoking permissions for apps that do not require it all the time.
- **Limit Background App Refresh:** A lot of the time, apps will automatically check for updates even if you exit them.
- **Limit Notifications:** Notifications will constantly power on your screen which is annoying and a strain on the battery.
- **Manage Background Cellular Data Access:** Since a cellular connection uses more battery than WiFi, it is a good idea to limit applications’ access to data.
- **Disable Google Assistant:** Your phone is perpetually listening for “OK Google” which definitely gobbles up a lot of battery even though it is fun to use. Also, it takes your location to fetch contextual results.
- **Dark Mode:** Since an OLED screen can disable individual pixels, a dark mode will preserve your battery by keeping many pixels off.

Closing

As your smartphone becomes increasingly powerful and technologies target the outdoors more, hikers should embrace this change and take advantage of the convenience they bring. In this eBook, I introduced some of my favorite applications which make my hiking experience considerably more convenient and enjoyable. Whether it be your love of nature or your star-gazing hobby, all these free technologies present a wealth of information that facilitate your hike. However, know that these applications are simply enhancements of the tools available to you and definitely not replacements of the ten essentials. Leave No Trace and outdoor ethics principles always apply.

I first presented some great online resources to assist your trip preparation, namely online gear lists and navigation systems. LighterPack is great for displaying your items in an organized, detailed manner while allowing other users to critique and learn from your list. To map your route, the combination between CalTopo and Avenza Maps is especially powerful since you can easily create an offline, GPS-trackable map with detailed terrain statistics. I additionally detailed two fun applications that I commonly use to educate myself of nature's wonders on the trail. They demonstrate technology's potential to fuel people's interests and passions about the outdoors. Finally, I concluded with some tips for iPhone and Android users to maximize their battery life away from civilization.

Although this may seem like a comprehensive guide to many technologies related to backpacking, I definitely do not consider myself an expert on these applications, nor is my purpose to fully document them. Beyond my introduction to getting started and their chief usages, resources on the Internet will definitely contain further detailed information. If you find any inaccuracies or missing information, please contact me through the email address in my description. These technologies are rapidly evolving, so I plan to continually update the book as time progresses. I truly hope my eBook will increase people's excitement about the outdoors by providing an easy, accessible way to be involved in backpacking.

Happy Trails,
Joseph Zhang