

## **Silviculture Instrumentation Tech Tips**

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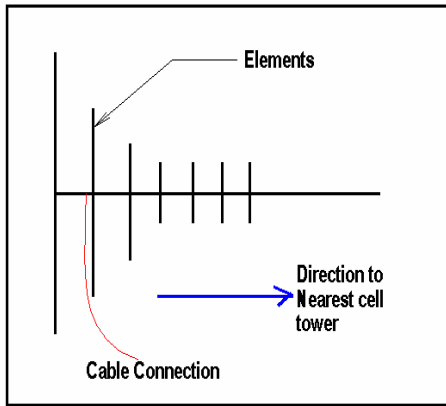
### **3. Getting your Bearings: Or, How Do You Decide Where to Aim a Directional Cell Phone Antenna?**

**Douglas Waldren, Instrumentation Specialist**

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***The Short Version.*** Once you've installed a modem-cell phone system at your datalogger remote site, you need to aim the system's directional cell antenna at the nearest cell tower in order to get the strongest signal. You need to first find out the latitude and longitude of your site. You can use maps, GPS methods or internet sites. Once you locate your site precisely, you need to locate the nearest cell tower just as precisely. What remains is drawing a line between these two spots on a map to find the direction which to point the antenna. Then use a compass to align the antenna. Finally, you can use the signal strength meter in a handset connected to your remote system to fine tune your antenna. If you're not one to fiddle with maps on the internet, find your site's latitude and longitude with a GPS system and then call your cell phone account representative, tell them exactly where your site is, and ask them where to point the antenna. The end with the narrowest elements goes toward the cell tower.

***The Full Story.*** Once a site has been selected to install a remote weather station, limited access may call for a cell phone/modem installation in order to routinely download data to a lab computer. First, the site should be checked for at least a minimal cell phone signal using a regular personal cell phone. Then a special antenna called a "Yagi" (rhymes with "baggie," sometimes pronounced "yog-ee.") may be installed. The Yagi is what is called a "directional antenna," meaning that it has to be "aimed" toward the nearest cell tower. The Yagi antenna looks like a miniature housetop TV antenna. From the side, the Yagi has a fish-skeleton shape (Figure 1):



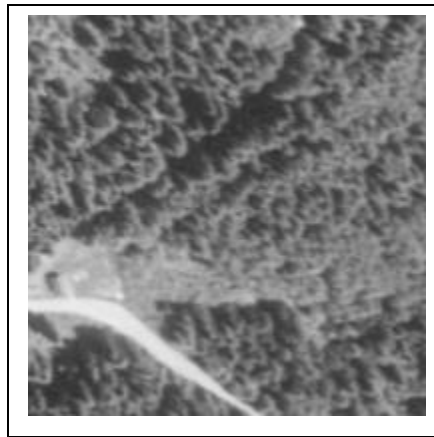
**Figure 2a. The Yagi antenna side view.**



**Figure 1b. The Yagi antenna in place.**

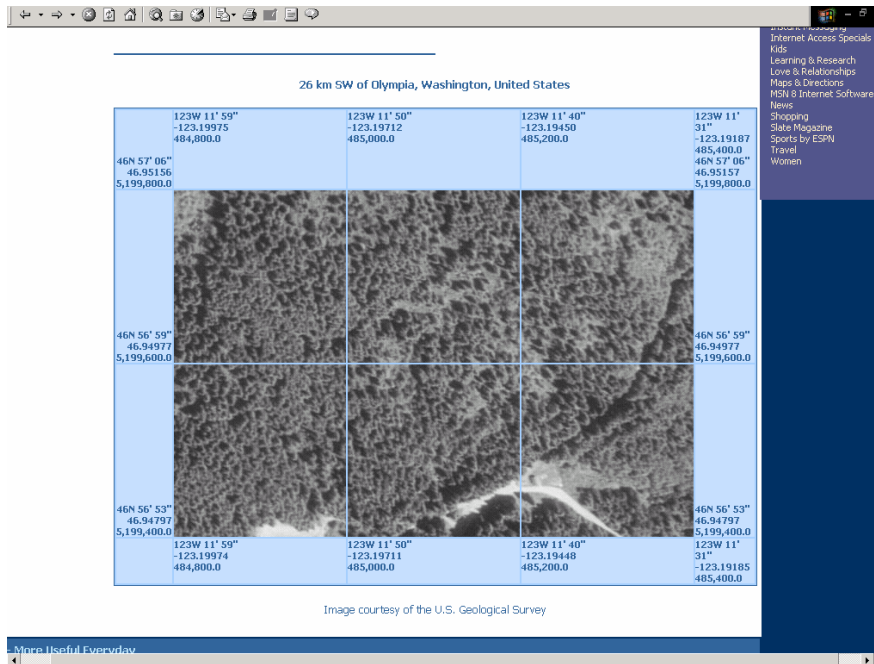
**Determining the Geographic Coordinates of the site--**The first step in locating the nearest cell tower is to accurately locate your site on a map. If a map or GIS document is available with precise coordinates in latitude and longitude (to ten seconds), use those values. Several other techniques are available. One method we use is get the GPS coordinates of the site with a portable GPS unit. In the event that a GPS system is not available, you can usually locate your site's exact location using aerial photographs available on the web at: <http://terraserver.homeadvisor.msn.com/geographic.aspx>.

For forested areas, it may take a little work with a map to correctly identify the exact location of your site as it shows up on Terraserver. Once you have located major roads and structures, you can use the zoom feature of Terraserver to zoom in to your site, in this example, a picnic structure (Figure 2).



**Figure 2. Web-based aerial photo of the Wedekind Picnic area of the Capitol State Forest near Olympia, Washington.**

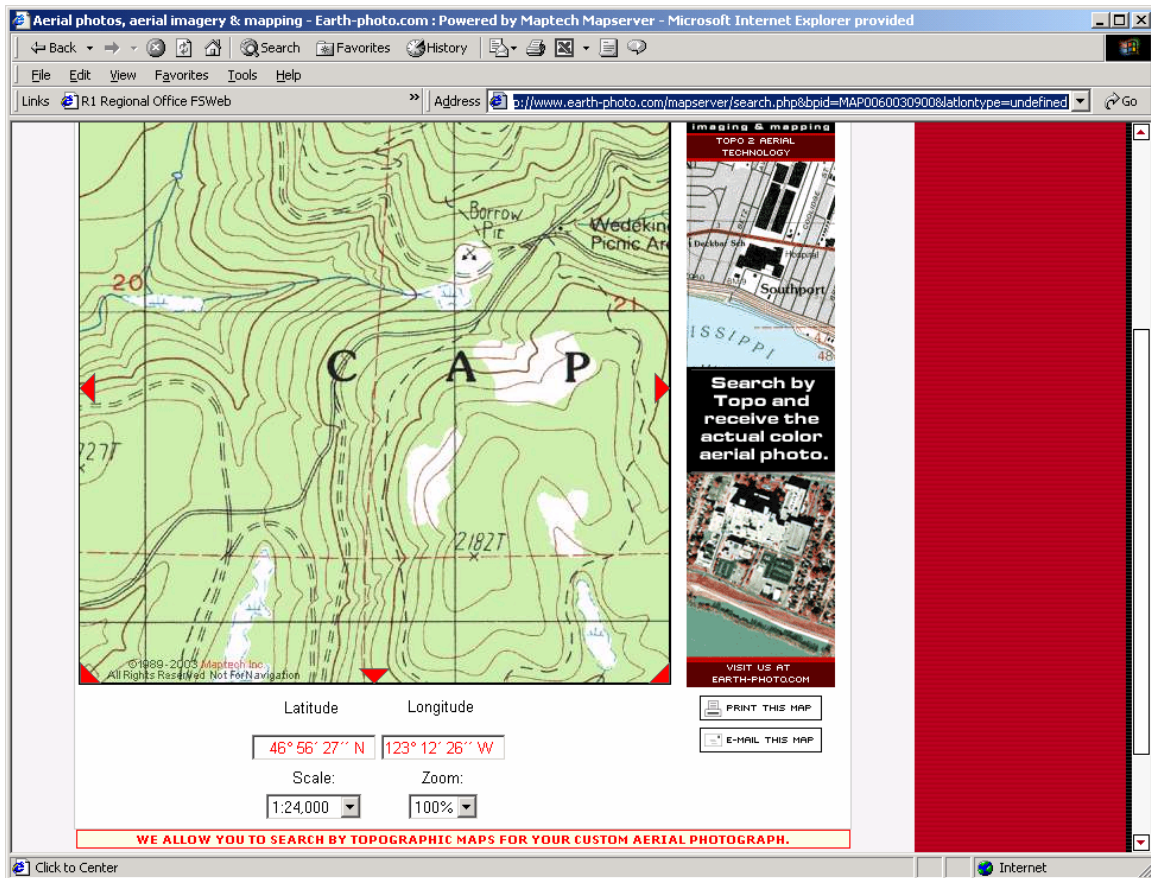
When you have precisely located your site, you can read the coordinates off Terraserver (Figure 3).



**Figure 3. Finding geographic coordinates using web-based aerial photography. Once you have navigated to your site on Terraserver, use the “i” (Info) button to access the geographic coordinates. In case that you’re more of a map person, try:**

<http://www.earth-photo.com/mapserver/search.php>

Looking at same location as we saw on Terraserver, now we're looking at (Figure 4)



**Figure 4.** A map that reads out latitude and longitude, available at <http://www.earthphoto.com/mapserver/search.php>.

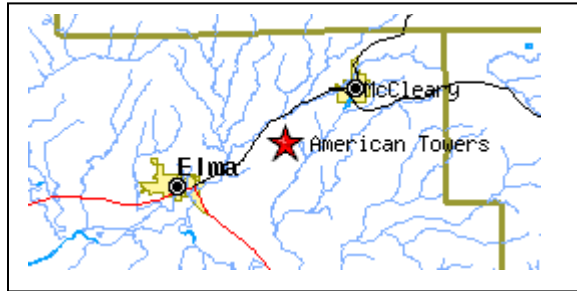
Locating the Nearest Tower. Now that you know where YOU are, you need to find the nearest tower. One easy way is to try

<http://www.antennaguy.com>

Maybe a tip or two about using this site—you'll have to wander a bit. Navigate to "Tower Maps" and then "Tower Locations." Or go directly to

<http://www.berkana.com/tower.php3>

Don't worry about the registration number or company, set "Result per Page" to 20, "Show Maps" is YES, and once you get rolling, use "Nearby Matches." After a few minutes of familiarization, you'll locate a map like the one shown in Figure 5. The only thing you need now are the coordinates of the tower. Double click on the map and watch the fireworks which show coordinates several ways. (See Table 1).



**Figure 5. Locating the cell tower nearest to you. One way is to go to the “Antennaguy” site, locate the cell tower nearest you and draw a line on your map from your site to the cell tower. Then it’s a matter of using your compass to find the right direction.**

Table 1. The latitude and longitude from the antennaguy.com site.

United States of America Federal Communications Commission Antenna Structure Registration  Owner: GRAYS HARBOR - MASON CELLULAR LIMITED PARTNERSHIP <b>FCC Registration Number (FRN): 0001572320</b>	
GRAYS HARBOR - MASON CELLULAR LIMITED PARTNERSHIP ONE VERIZON PLACE ALPHARETTA, GA 30004-8511	Registration Number: 1031677 Issue Date: 01/25/2001
Location of Antenna Structure: PORTN NE1/4 NE1/4(GOV LOT#1) SEC 4, T18N, R4W MCCLEARY, WA	Ground Elevation (AMSL): 459.6 meters Overall Height Above Ground (AGL): 63.4 meters
Latitude: 47-04-51.0 N Longitude: 123-11-08.0 W NAD83	Overall Height Above Mean Sea Level (AMSL): 523.0 meters

**Believe it or not, there’s an easier way yet**—I contacted the Major Accounts representative for our wireless vendor and explained what I was doing and he gave me the location of the closest tower. A key point: I still had to give him the precise location of the weather station. He contacted his engineer for the area in question, and found the nearest tower. He relayed the information to me along with the correct direction to aim the Yagi, accurate to a few degrees. I called the representative back to thank him for the help and he related three things:

- 1) He appreciated the feedback and can use it in the future.
- 2) Things worked out quickly in this instance because I was able to give him a **precise** location.
- 3) You can use the signal strength indicator of a handset plugged into the remote system to really “zero in” on the peak signal strength. Just make a call out from your site and when you connect, watch the signal strength vary as you aim the antenna and adjust for peak strength. Finally, tighten the antenna clamps.

By the way, if you're not familiar with using a compass for navigation, check out

<http://www.silvacompass.com/123.html>

for a great three-step lesson on compass use.