"Utilizing Consumer-Grade GPS Technology on Private Forestlands"

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Webinar Objectives

- **Provide an historical timeline of GPS technology in the United States of America**
- **Explain how a GPS works**
- **Define the types of GPS receivers**
- **Demonstrate how a landowner may employ a GPS receiver on their forestland**

Webinar Disclaimer

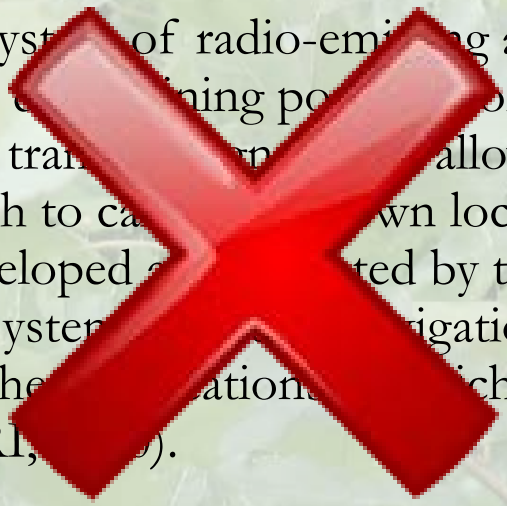
- **This presentation is not an endorsement of any one particular type or brand of hardware, software or app.**

- **The techniques or procedures demonstrated should not be a total substitute for the consultation of a Service Forester, Extension Educator, Consulting Forester or a Licensed Land Surveyor**

What is a GPS?

GLOBAL POSITIONING SYSTEM

DEFINED: A syst[illegible] of radio-emi[illegible]g and -receiving satellites used for [illegible]ning po[illegible]on the earth. The orbiting satellites tra[illegible]n[illegible] allow a GPS receiver anywhere on earth to ca[illegible]wn location through trilateration. Developed [illegible]ted by the U.S. Department of Defense, the syste[illegible]igation, mapping, surveying, and othe[illegible]ation[illegible]ich precise positioning is necessary (ESRI, [illegible]).



ESRI, . (2010). *Gis dictionary*. Retrieved from http://support.esri.com/

Simplified Terminology

- **GPS=Orbiting satellites communicating with hand held receivers used for navigation & mapping.**

Historical Timeline of GPS

The origin of GPS is from the "Cold War" approx. 1947 to 1991 and the "Space Race" approx. 1957 to the mid to late 1970s.

The United States Department of Defense wanted a reliable global navigation system for submarines and ships (intercontinental ballistic missiles).

Historical Timeline of GPS

1978 – DOD launches the first GPS satellite into orbit

1983 – Then President Reagan permits the utilization of the GPS signal to civilians

- **KAL007 airliner tragedy**

1983 – The civilian signal has an automatic degradation in signal established

- **"Selective Availability or SA" fuzzes the civilian signal by 100' to 300'**
- **GPS data must be post processed (time lag) to allow for any type of accuracy**

Historical Timeline of GPS

Historical Timeline of GPS

1994 – The 24th GPS satellite is in orbit for the creation of a full constellation

2000 – Then President Clinton & the DOD switched off "SA" thus eliminating the 100' to 300' fuzz

Real-time several meter to sub meter accuracy was possible

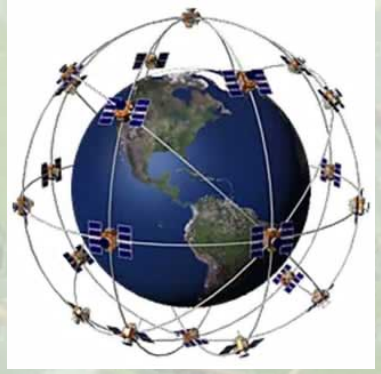
2000 through today – The era of very portable low cost consumer grade GPS available to the masses

How GPS Works

A GPS consists of three parts:
The Space Segment
The Control Segment
The User Segment

Space Segment

- **A constellation of 24 human made satellites**
- **Developed by the U.S. Dept. of Defense and the U.S. Branches of the Armed Services**
- **Each satellite orbits the Earth twice a day**
- **At any given time of the day on Earth 4-12 satellites should be within range**



Gps tutorial. (2010). Retrieved from http://www.trimble.com/index.aspx

Control Segment

- **11 monitoring stations on Earth**
- **Maintain the satellites and ensure they are operating properly**

Gps tutorial. (2010). Retrieved from http://www.trimble.com/index.aspx

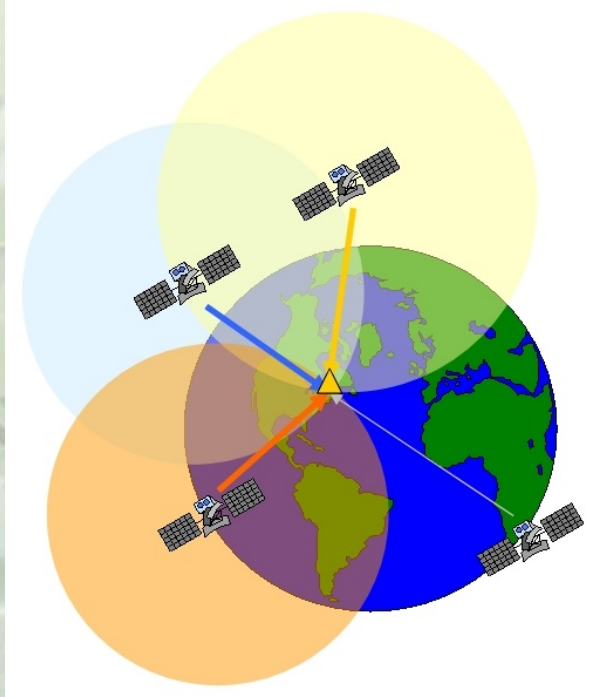
User Segment

- **Anyone (landowner, natural resource professional, etc.) using a GPS receiver**

Garmin 60 csx. (2010). Retrieved from http://www.garmin.com/garmin/cms/site/us

How GPS Works (Geometry)

The handheld GPS (User Segment) unit takes very, very accurate distance measurements from FOUR satellites (Space Segment) at the same time.



Gps tutorial. (2010). Retrieved from http://www.trimble.com/index.aspx

How GPS Works (Mathematics)

The handheld GPS (User Segment) unit receives a signal that is being sent by each of the FOUR satellites (Space Segment).

Each of the FOUR satellite signals is traveling at the speed of light (about 186,000 miles/second).

The handheld GPS unit records the time it took for the signal to leave a satellite and reach the GPS unit.

The handheld GPS unit then performs a simple mathematical equation for each satellite (minimum of FOUR).

Velocity X Time = Distance

Gps tutorial. (2010). Retrieved from http://www.trimble.com/index.aspx

GPS Types

- **Survey Grade**
- **Mapping Grade**
- **Consumer Grade**
  - **AKA Recreation Grade and/or Civilian Grade**

GPS Types

Survey Grade

- **Cost >$10,000**
- **Extensive Training/Certification**
- **Accuracy below 1 cm**
- **Used for land surveys, urban infrastructure, precision land grading, etc.**
- **Can post process**
- **Access to signal is FREE!**

U.S.A., E.P.A. (2011). Retrieved from http://www.epa.gov/region5fields/htm/methods/gps/index.html

GPS Types

Mapping Grade

- Cost >$2000 to $10,000
- Extensive Training/Certification
- Accuracy between 4” and 1 meter
- Data collection with integration into a GIS solution
- Land Navigation
- Can post process
- Access to signal is FREE!

Trimble (2011). Retrieved from http://www.trimble.com/mappingGIS/nomadg.aspx?dtID=key_benefits

GPS Types

Consumer Grade

- Cost $150-$700
- Easy to use
- Very portable
- Easy to power
- Accuracy of 5 meters or more
- Easy & fast area and length calculations
- Land Navigation
- Cannot post process
- Access to signal is FREE!

Garmin (2011). Retrieved from https://buy.garmin.com/shop/shop.do?cID=145&pID=89557

Garmin GPSmap 62s

- https://buy.garmin.com/en-US/US/on-the-trail/handhelds/gpsmap-62s/prod63801.html

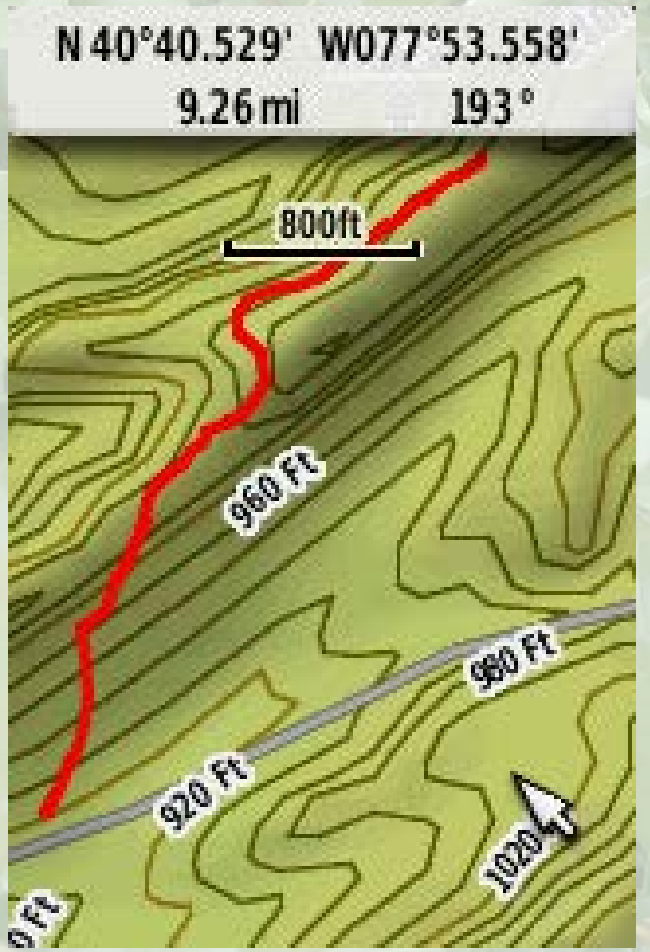
- MSRP = $349.99
- Cabela's = $349.99
- GPS City = $299.95
- REI = $261.93
- The GPS Store = $229.95

Garmin GPSmap 62s Accessories

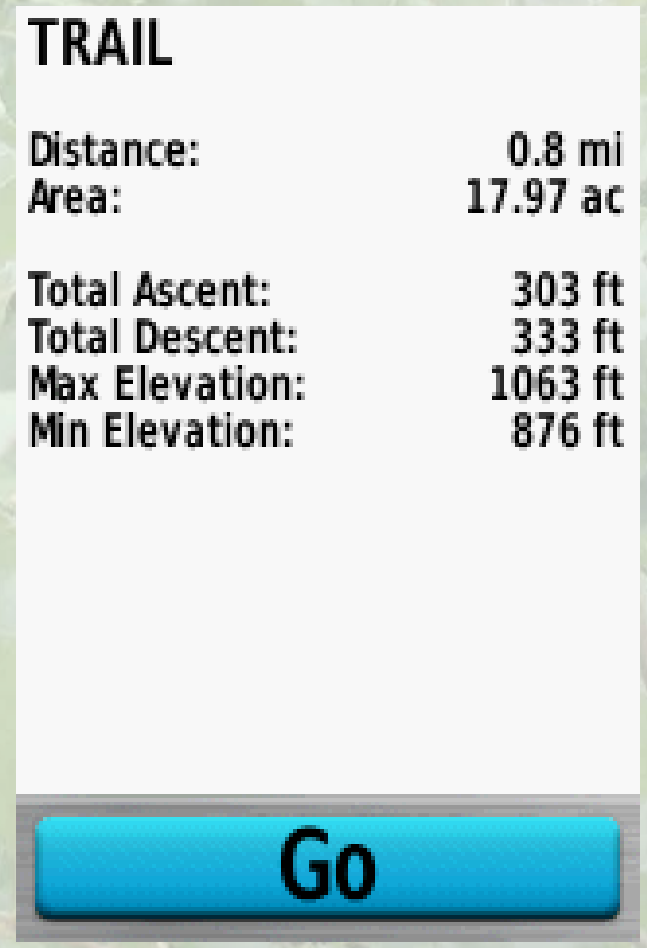
- Garmin BaseCamp (free download)
  - http://www.garmin.com/en-US/shop/downloads/basecamp
- Digital Topo Maps ($80 and up)
  - https://buy.garmin.com/en-US/US/maps/on-the-trail-maps/topo/c452-c456-c503-p1.html
- Google Earth (free download)

Landowner Usage (Tracks)

Landowners may collect GPS data for:
Tracks = lines with lengths



Harding,B.(2013) *Garmin 62s screen capture.*



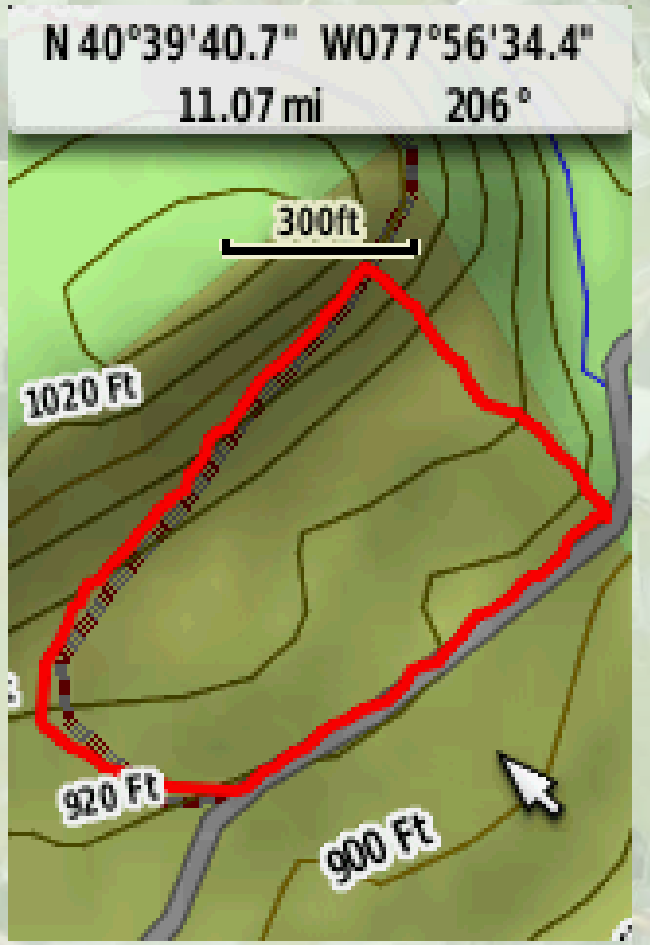
Harding,B.(2013) *Garmin 62s screen capture.*

Assist with:

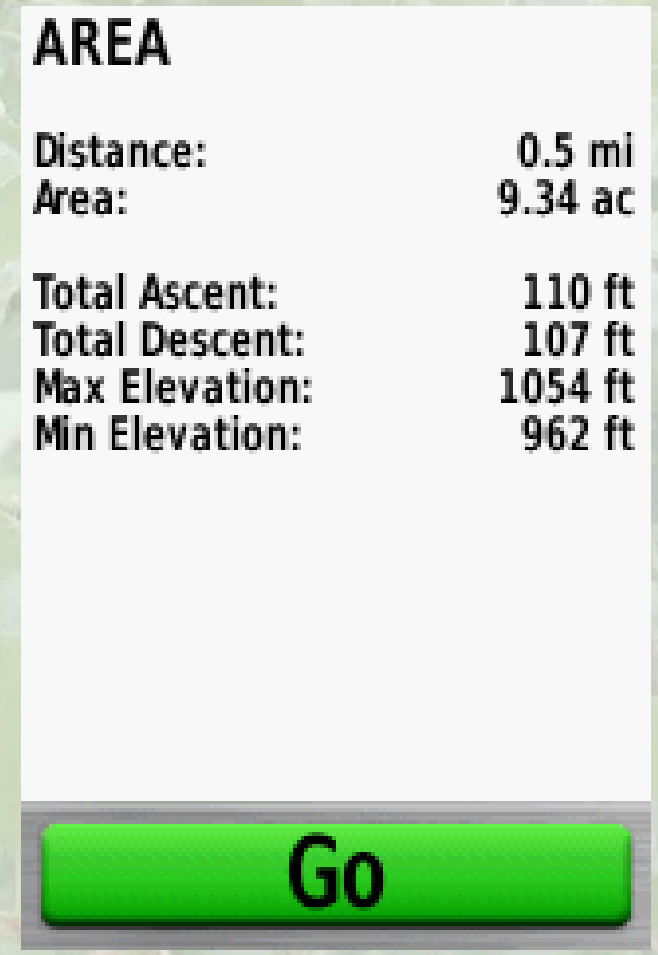
- **Road/trail construction, maintenance, bidding**
- **Harvest planning**
- **BMP implementation**
- **Deer fence construction**
- **Forest stand delineations**
- **Stream mapping**
- **Recreation**

Landowner Usage (Tracks)

Landowners may collect GPS data for:
Tracks = polygons with area



Harding,B.(2013) *Garmin 62s screen capture.*



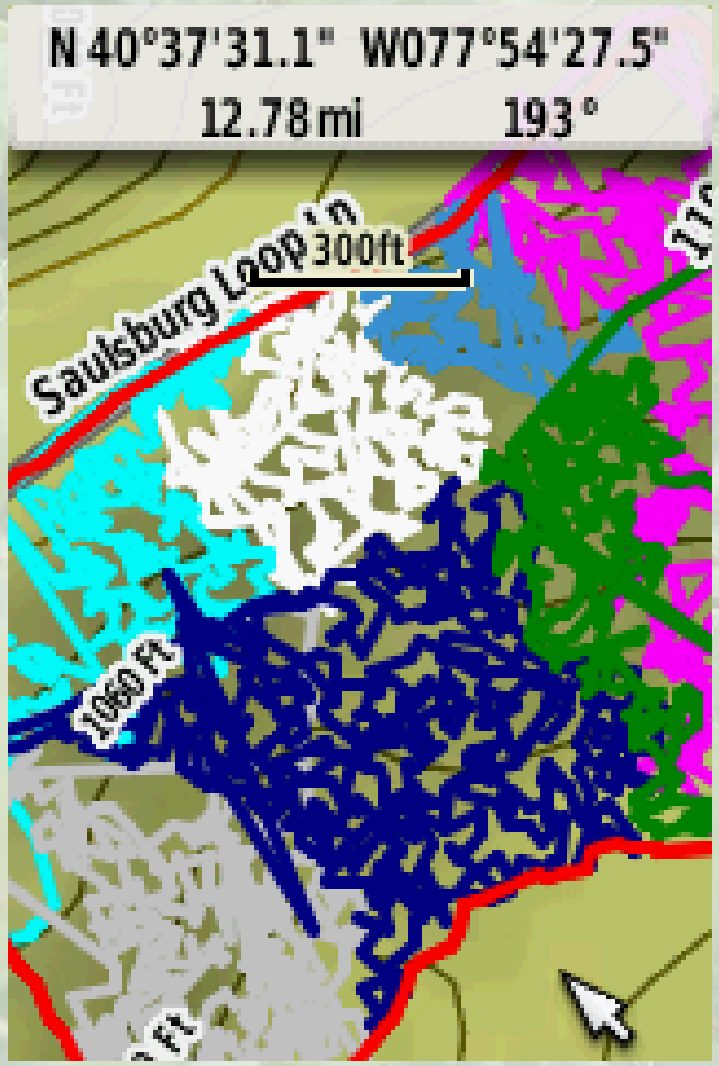
Harding,B.(2013) *Garmin 62s screen capture.*

Assist with:

- **Harvest planning**
- **Deer fence construction**
- **Forest stand delineations**
- **Prescribed fire**
- **Pesticide applications**
- **Herbicide applications**
- **Foodplot establishment**
- **Habitat restoration**

Landowner Usage (Example)

Collecting tracks to monitor progress



A track of a polygon was collected that delineated a forest stand to be manipulated (red).

A continual track of a line was collected daily as I worked through the forest stand (different color each day).

I would visually see where I had worked and where I needed to still work.

Possible applications:

- **Timber marking**
- **Herbicide application**
- **Gathering morel mushrooms**

Harding,B.(2013) *Garmin 62s screen capture.*

Landowner Usage (Waypoints)

Landowners may collect GPS data for:
Waypoints = positions

Harding,B.(2013) *Garmin 62s screen capture.*

Assist with:

- **Recreation**
- **Location of unique plants**
- **Location of dens/snags**
- **Insect infested trees**
- **Culvert locations**
- **Active OGM well heads**
- **Orphaned oil/gas infrastructure**
- **Inventory points**
- **Property corners**

Landowner Usage (Example)

A landowner may create waypoints to locate unknown or lost property corners.

Essential items in addition to a consumer-grade GPS:

- **A list of property deed calls**
- **One property corner that can be visited or have a lat/long position for it**

Procedure may occur outside or inside.

Landowner Usage (Example)

BEGINNING at an iron pin on the westerly side of Highway Route 26 at the common corner with lands of D. Houtz; thence along said Highway Route 26 South 44° 47' East a distance of 651.53 feet to a point; thence South 51° 01' East a distance of 420.12 feet to a point; thence South 63° 03' East a distance of 167.60 feet to a stone; thence South 25° 42' East a distance of 876.14 feet to a maple, fence corner; thence South 48° 33' West a distance of 1473.35 feet to a concrete monument; thence South 47° 35' West a distance of 1513.57 feet to a concrete monument; thence North 40° 49' West a distance of 2048.78 feet to stones; thence North 25° 07' East a distance of 347.56 feet to stones; thence North 42° 41' East a distance of 1968.84 feet to stones; thence South 46° 15' East a distance of 547.26 feet to a maple; thence North 29° 22' East a distance of 750.88 feet to an iron pin, the place of beginning.

CONTAINING 154.219 acres.

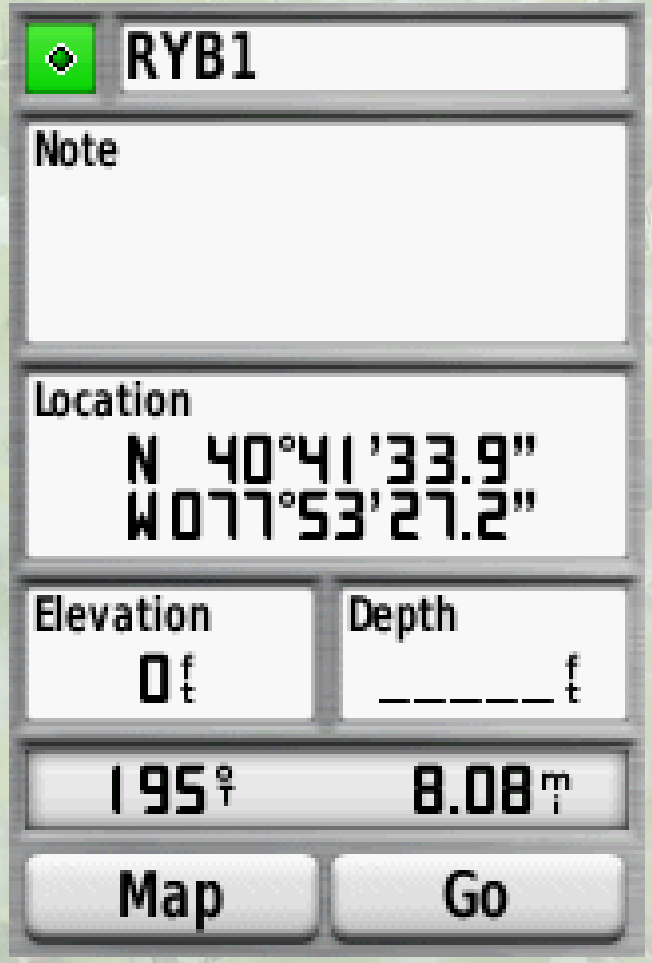
As shown on a survey prepared by E. E. McGuire, dated September 22, 1975.

CORNERS	DEED CALLS (DEGREE & MINUTES) BEARINGS	DEED CALLS (DEGREE) BEARINGS	DEED CALLS AZIMUTHS	SEGMENT DISTANCE (FEET)
RYB1	0	0	0	0
RYB2	S44°47'E	44.7833	135.2167	651.53
RYB3	S51°01'E	51.0167	128.9833	420.12
RYB4	S63°03'E	63.05	116.95	167.6
RYB5	S25°42'E	25.7	154.3	876.14
RYB6	S48°33'W	48.55	228.55	1473.35
RYB7	S47°35'W	47.5833	227.5833	1513.57
RYB8	N40°49'W	40.8167	319.1833	2048.78
RYB9	N25°07'E	25.1167	25.1167	347.56
RYB10	N42°41'E	42.6833	42.6833	1968.84
RYB11	S46°15'E	46.25	133.75	547.26
RYB12	N29°22'E	29.3667	29.3667	750.88

Landowner Usage (Example)

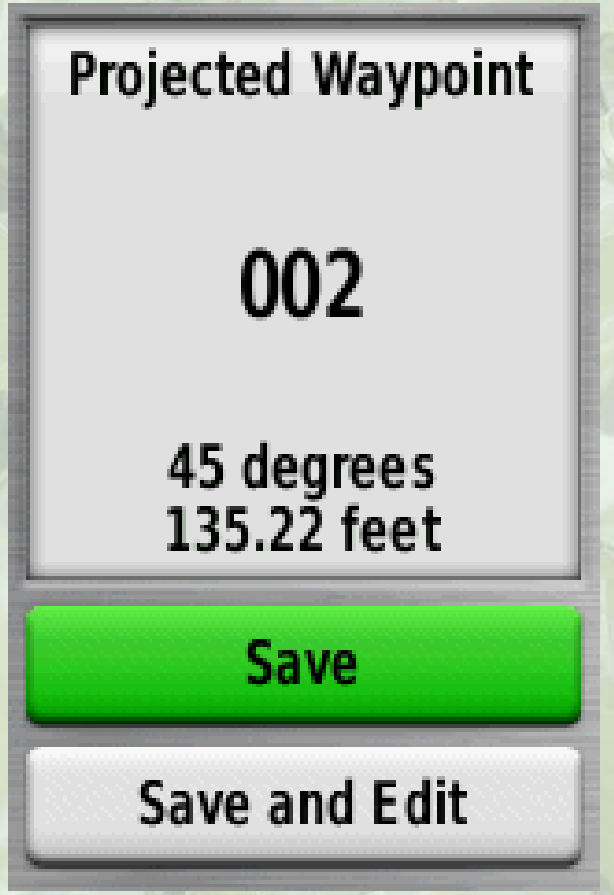
You must collect a waypoint with the GPS or know the lat/long for one property corner.

For this webinar I collected my first corner (RYB1).



Harding,B.(2013) *Garmin 62s screen capture.*

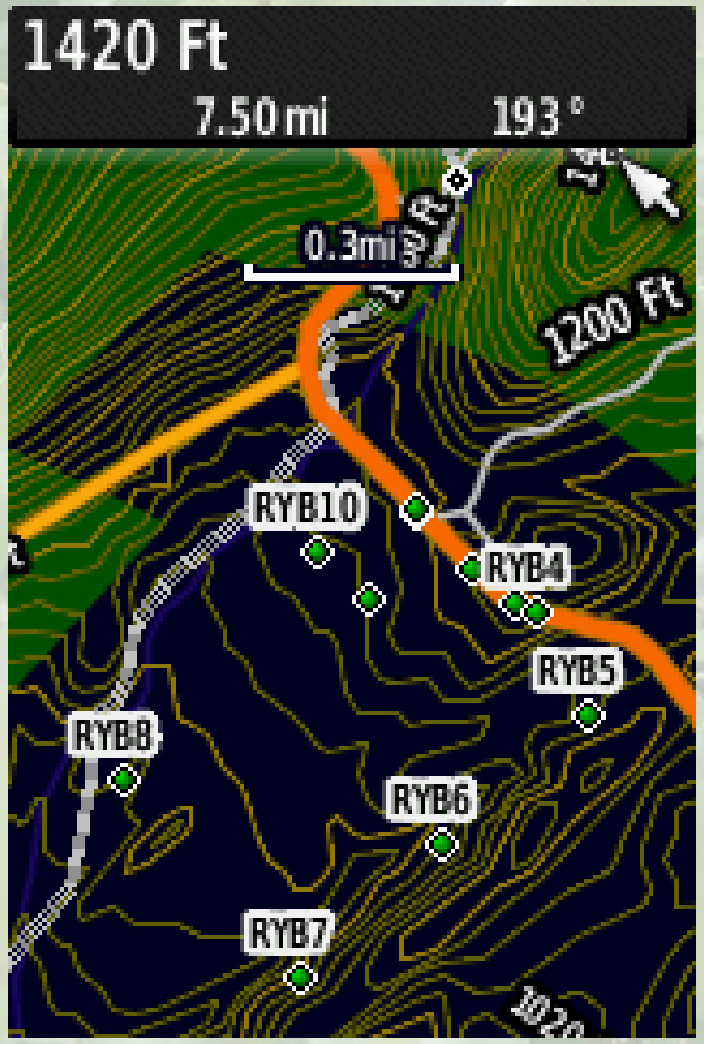
Landowner Usage (Example)



I start at RYB1 and project a waypoint. From that waypoint I project another waypoint and so on until 11 total waypoints have been projected.

Harding,B.(2013) *Garmin 62s screen capture.*

Landowner Usage (Example)

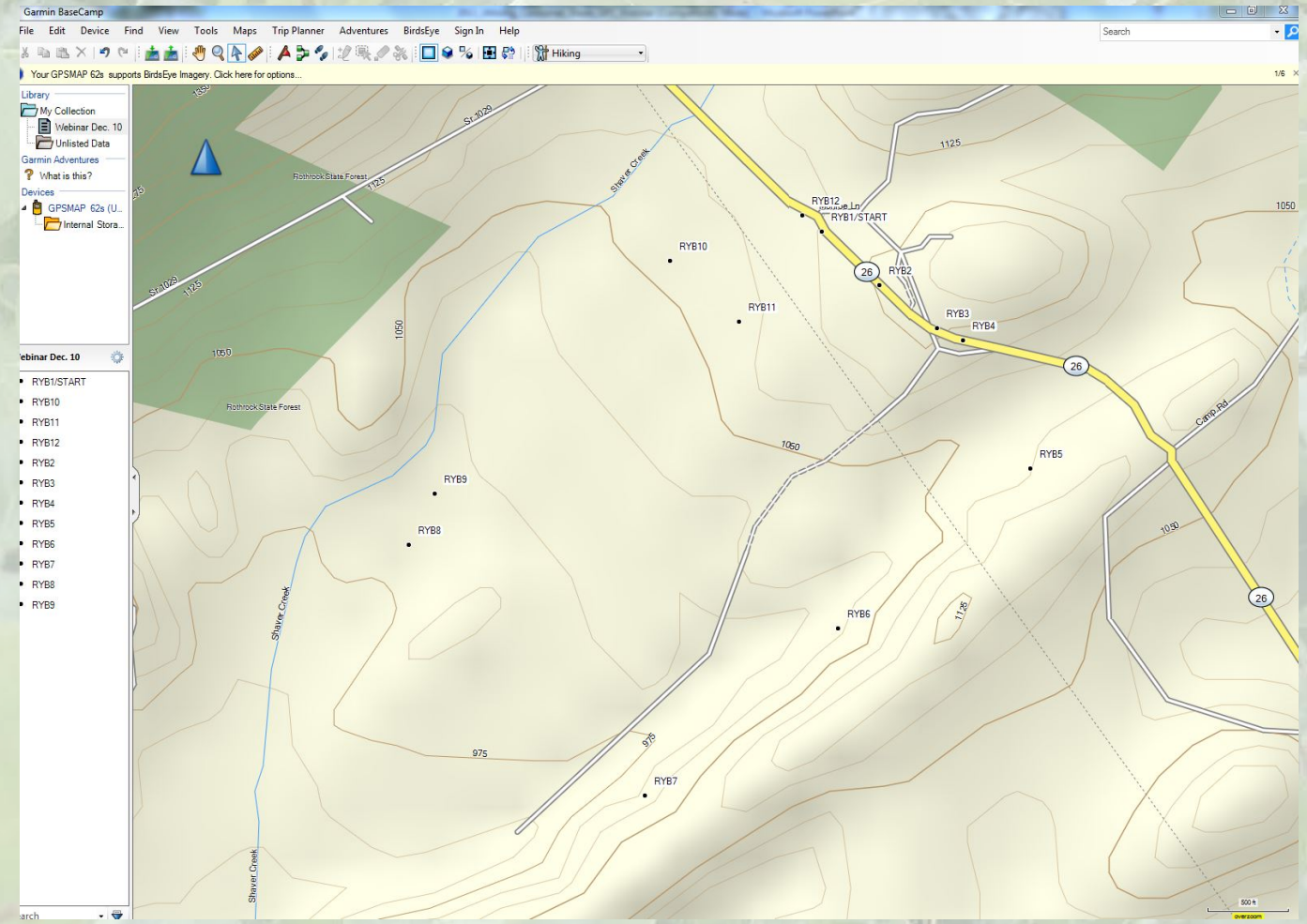


Harding,B.(2013) *Garmin 62s screen capture.*

A total of 12 waypoints are created (property only has 11 corners but the error in closing the traverse requires the twelfth corner).

This webinar will not explore allowable misclosure of a polygon.

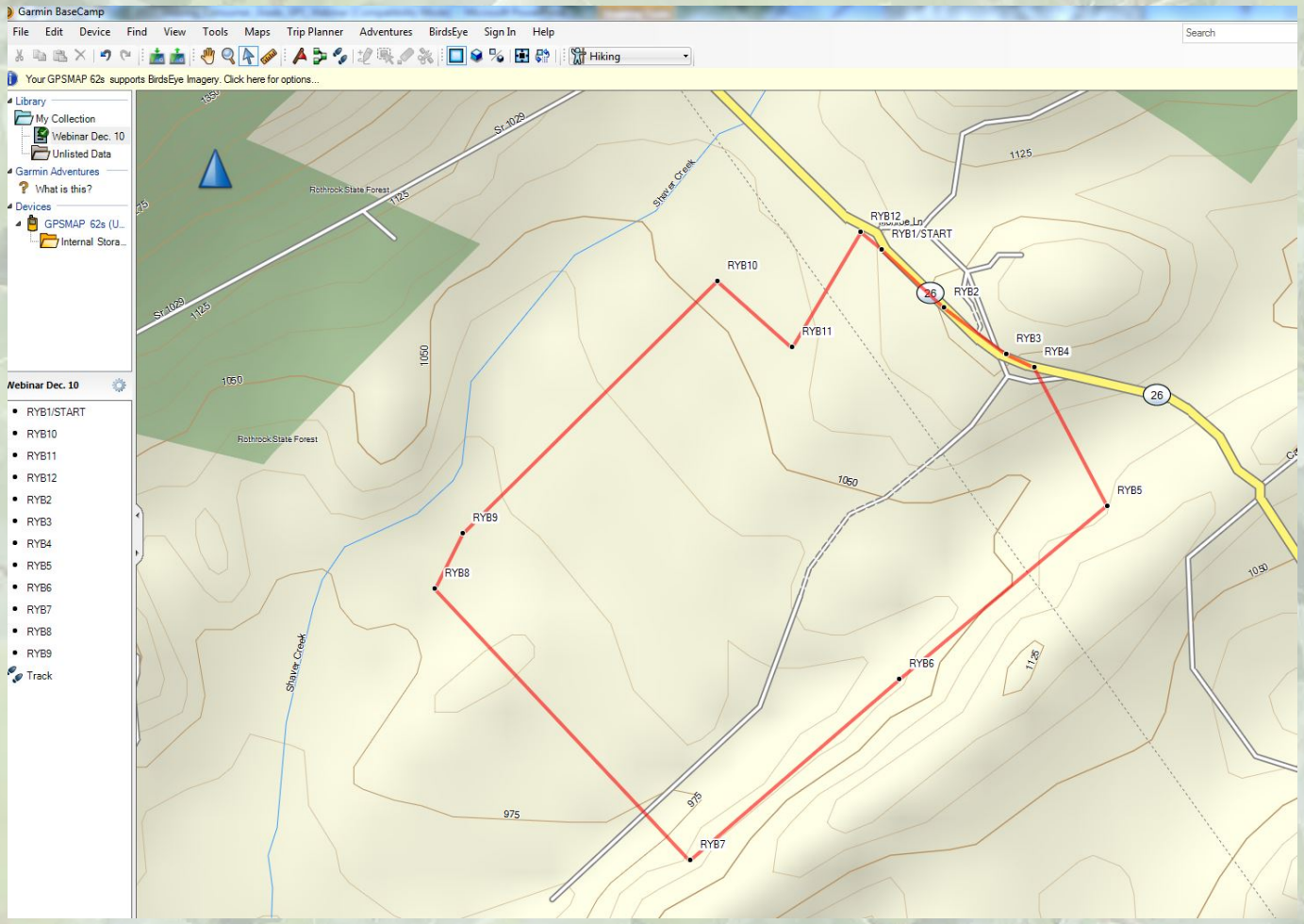
Landowner Usage (Example)



Connect the Garmin 62s via a USB cable to a computer running the Garmin BaseCamp freeware software.

Harding,B.(2013) *Garmin BaseCamp screen shot.*

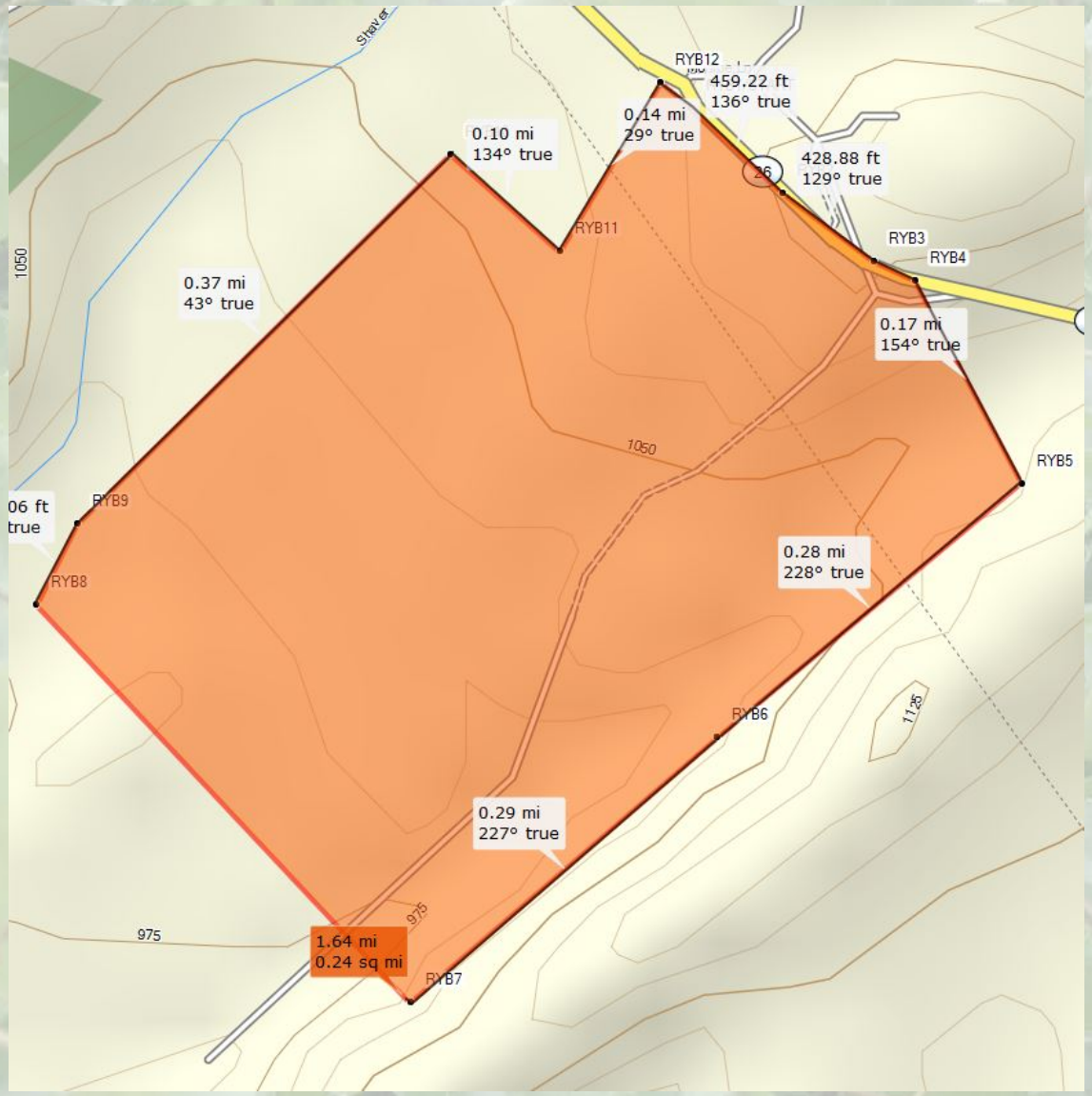
Landowner Usage (Example)



Harding,B.(2013) *Garmin BaseCamp screen shot.*

Using a tool in BaseCamp to physically draw a track that connects the created waypoints.

Landowner Usage (Example)



A BaseCamp tool permits the calculation of the area of the created property polygon track.

Area=0.24 sq.miles

1 sq.mile=640 acres

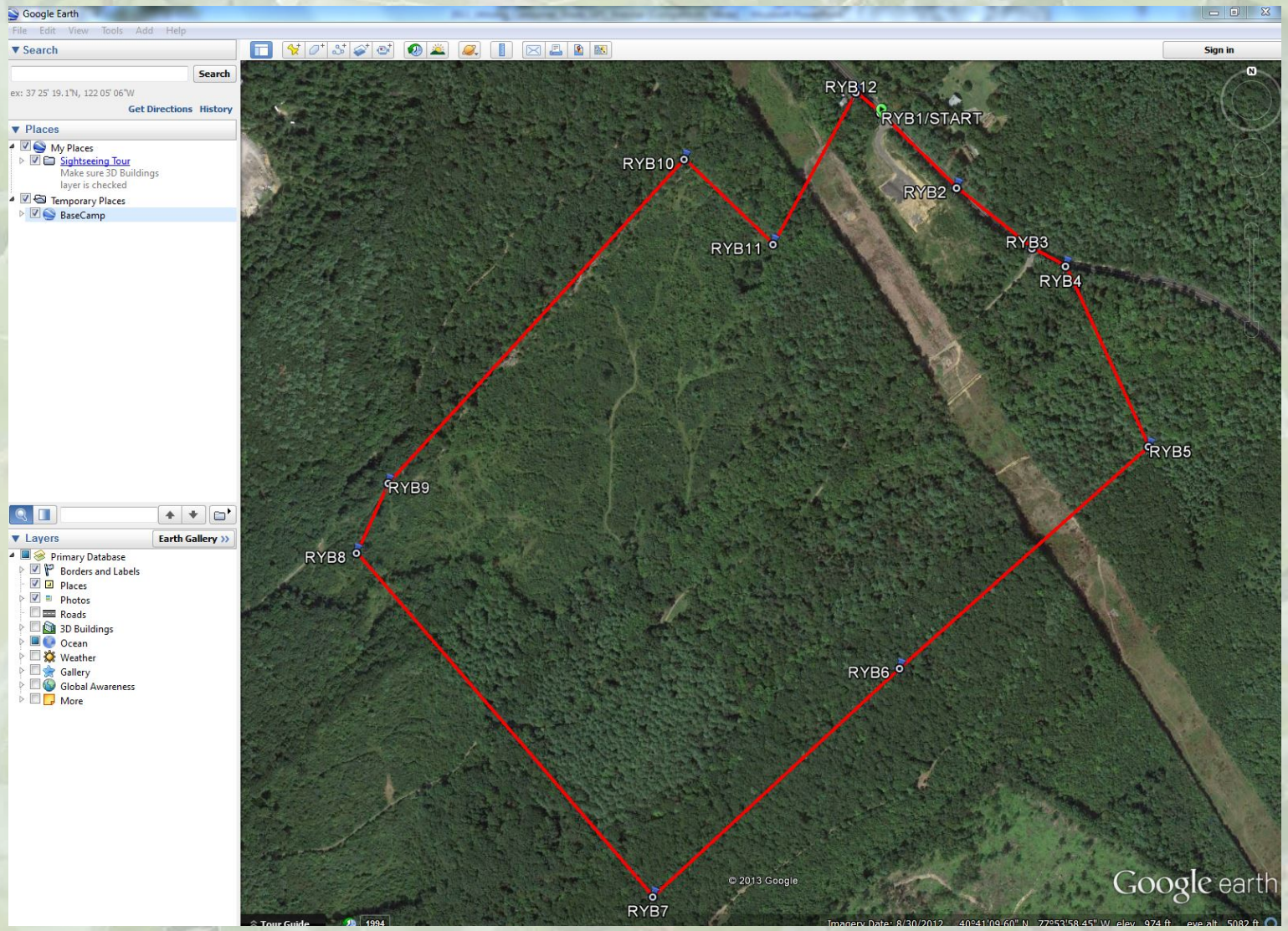
0.24 x 640 = 153.6 acres

CONTAINING 154.219 acres.

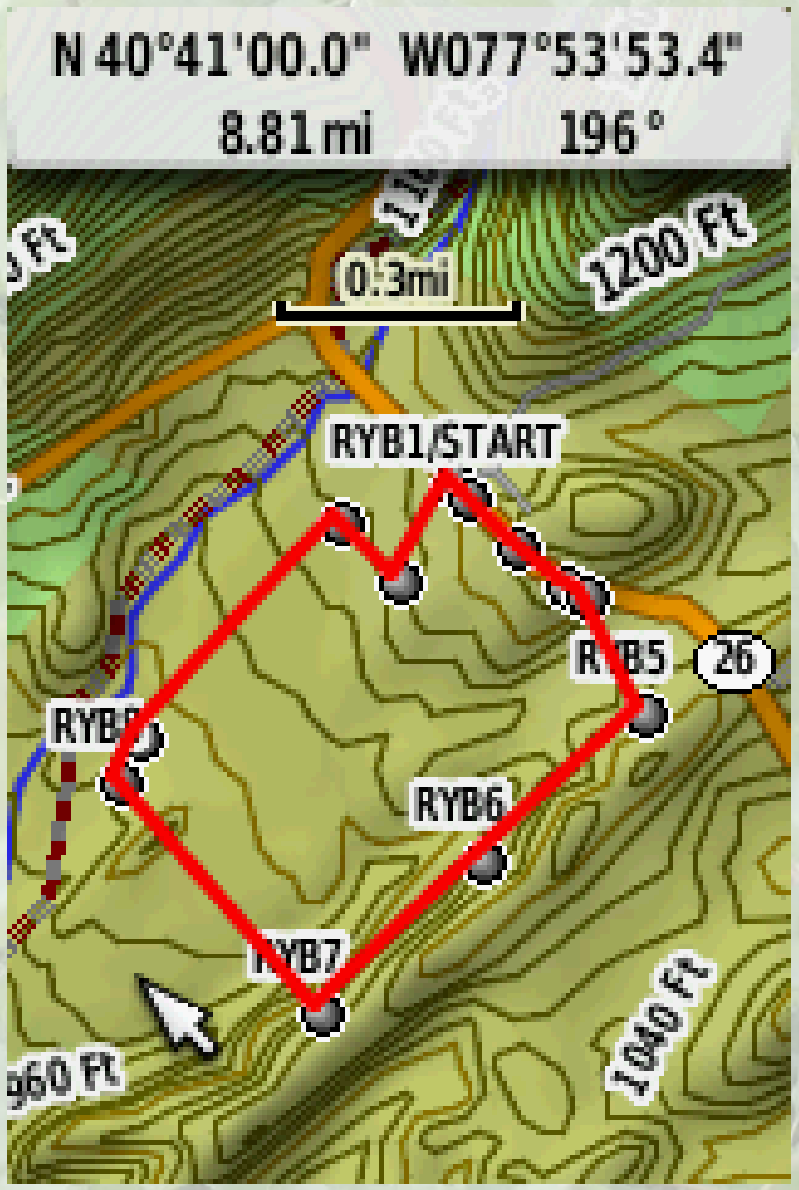
Difference of 0.619 acres between the deed and the GPS.

Landowner Usage (Example)

A BaseCamp tool permits the viewing of the property track within Google Maps.



Landowner Usage (Example)



Harding,B.(2013) *Garmin BaseCamp screen shot.*

A BaseCamp tool permits the transfer of the property polygon track over to the Garmin 62s GPS receiver.

A landowner may now traverse the property with the aid of the GPS.

Visual clues such as rock piles, rock walls, barbed wire, blaze marks, woven wire fence, paper posters, nails, open grown trees, stark vegetation changes, etc. may support the occurrence of a property boundary.

Landowner Usage

Garmin (2011). Retrieved from https://buy.garmin.com/shop/shop.do?cID=145&pID=89557

Things that may hinder your consumer-grade GPS usage in the forest may be:

- **Dense foliage (conifer)**
- **Rugged terrain (steep)**
- **Large water bodies (lakes)**
- **Weak or cold batteries**
- **A covered GPS receiver antennae**

Snow, rain & clouds do not impact the GPS receiver's functionality

In Closing

The affordability, accuracy and ease of use of a consumer-grade GPS receiver makes them an essential tool for the tech savvy engaged forest landowner.

Careful consideration is necessary to decide on a GPS solution that meets your individual needs.

The Garmin GPSmap 62s is just one of many capable consumer-grade GPS receivers on the market.

Good Luck

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