Land Conservation & GPS
Saving Special Places, April 5, 2008
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Basics of Global Positioning System

Global Positioning System accuracy

What to look for when buying a GPS unit

GPS for conservation
Basics of Global Positioning System

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Global Positioning System:

- developed by the US Dept. of Defense
- satellite-based
- designed to provide positioning and timing information:
  - 24 hours/day, 7 days/week
  - under any weather conditions
  - anywhere in the world
- Three components: space, ground, user
1. Space component

- 24 satellites in constellation
- orbit every 12 hours at 11,500 miles
- 4 satellites in each of 6 orbital planes
- transmit a uniquely coded radio signal
- equipped with onboard atomic clock

2. Control component

- ground-based monitoring and upload stations
- control orbit and timing information
3. User component

- military and civilian users
- navigation and positioning applications on land, sea, in the air and in space

How does GPS work?

- The receiver picks up the signals from the satellites
- Uses signal travel time to calculate distance to the satellites
- Triangulates to determine position of the receiver
How does GPS work?

1. The receiver picks up the signals from the satellites

2. Travel time of signal from satellite used to calculate distance

   - 0.075 sec = 14,000 mi
   - 0.059 sec = 11,000 mi
   - 0.070 sec = 13,000 mi
   - 0.065 sec = 12,000 mi

3. Receiver triangulates to determine position of the receiver
3. Receiver triangulates to determine position of the receiver
How does GPS work?

3. Receiver triangulates to determine position of the receiver

You are here!
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GPS Accuracy: what are your needs?

- How accurate does your GPS data need to be?
- Is vertical accuracy important?
- What are the ways to improve accuracy?
GPS Accuracy: signal delay
- atmosphere, clock errors, multipath error

GPS Accuracy: satellite arrangement
- bad arrangement
- good arrangement
GPS Accuracy: satellite arrangement

- Geometric arrangement of satellites in space

GPS Accuracy: differential correction

- Base stations measure inaccuracies and send out correction signal
- 15m: typical handheld GPS accuracy without corrections
- 3m: typical handheld GPS accuracy with corrections
- WAAS: Most common handheld correction
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**What to look for when buying a GPS unit**

GPS for conservation

1. **Geodetic GPS receivers**
   - capable of sub-centimeter accuracy
   - bulky, expensive
   - high-precision applications such as surveying, geodetics
2. Mapping GPS receivers

- capable of 10 meter accuracy (<1 meter with differential)
- light-weight, portable, less expensive
- resource mapping and navigation applications

3. Handheld GPS receivers

- capable of 10 meter accuracy (capable of <3m with differential)
- light-weight, cheap!
- navigation applications and basic mapping applications
Choose your weapon…

1. Geodetic
   High quality surveying of fixed positions

2. Mapping
   Collection of GPS data with large amounts of auxiliary data and strict data quality control

3. Handheld
   Collection of GPS data with good data quality for more limited budgets

Questions to think about…

- Can you add an external antenna to the GPS?
- Does the GPS have a color screen?
- Can the GPS receive the WAAS signal?
- Is the unit waterproof?
- Does the GPS float?
- Does the GPS have a built-in compass?
- Does the GPS have a built-in altimeter?
- Does the GPS come with background maps?
- How much memory is available for maps?
- How much data can you collect at once?
- What type of computer does the GPS have?
### Basics of Global Positioning System

- **Global Positioning System accuracy**
- **What to look for when buying a GPS unit**

**GPS for conservation**
How to navigate with GPS

Using Waypoints

A  C  D

B

E  F

How to navigate with GPS

Using Waypoints: Point-to-Point

Go to waypoint "A" to waypoint "D"

A  C  D

B

Go to waypoint "C"

E

Go to waypoint "E"

Go to waypoint "F"
How to navigate with GPS

Using Waypoints: Routes

Make route “X” using the following points in this order: A, B, C, D, E, F

Navigate route “X” from A to F

Using Tracks

Navigate track
How to navigate with GPS

Don’t forget your map and compass!
What can you do with GPS data

- Collect
- Catalog
- Display
- Store
- Analyze
- Communicate
- Plan

Questions?

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