WebGIS and Mobile Data Collection Workshop

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Sean Hogan, sdhogan@ucanr.edu
Shane T. Feirer, stfeirer@ucanr.edu
& Robert Johnson, robjohnson@ucanr.edu
Today

Agenda

• Introductions
• Informatics and GIS
• GPS and Mobile Data Collection
• Web Mapping
• Practical Exercise
Supporting...

• research,

• management, and

• outreach

for agriculture and natural resources
Supporting...

- research,
- management, and
- outreach

for agriculture and natural resources
IGIS

Training – Fall 2015

- Hopland REC
  Web GIS and Mobile Data Collection
- Sheraton Grand Hotel, Sacramento
  Web GIS and Mobile Data Collection
- ANR Bldg 2nd St
  GIS for Agriculture,
  Intro to GIS: Forestry Emphasis
- Lindcove REC
  Web GIS and Mobile Data Collection & Intro to GIS: Crop Agriculture Focus
- UC Berkeley
  Web GIS and Mobile Data Collection
- UC Riverside
  Web GIS and Mobile Data Collection & Intro to GIS: Crop Agriculture Focus

University of California
Agriculture and Natural Resources
Informatics and GIS Statewide Program
Entry, editing, storage, query and retrieval, transformation, manipulation, analysis, and display of geospatial data.

*Key point:* All data in a GIS is georeferenced, i.e. located by means of geographical coordinates with respect to some reference system (usually bound to the Earth).

The spatial aspects of an environment... (e.g. location, amount, distance, adjacency, isolation, fragmentation, pattern)...impact ecological, human and environmental functions.
Remote Sensing - Satellite Imagery

NDVI: Vegetation Health

Landsat Imagery - every 16 days
Crop Distributions

Spatial Analysis

Elevation

Data Integration

Web
What is GPS? Global Positioning System

- 24 -32 active satellites make up civilian GPS (currently 31 active satellites*)
- At least 6 satellites are visible from any spot on Earth
- 6 orbit planes, each with 4 operational satellites in each
- Orbiting 12,500 miles above earth at ~ 7,000 mph (medium Earth orbit)
- 2 complete orbits in less than 24 hours
- 4 or more GPS satellites used to compute X, Y, and Z

What is GPS?

Global Positioning System

Signals travel by line of sight:

- Will pass through clouds, glass, & plastic
- Will not pass through most solid objects, such as buildings & mountains
How GPS Works

Good Satellite Geometry

GPS Status

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How GPS Works

Poor Satellite Geometry

GPS Status
Officially named NAVSTAR GPS (Navigation Signal Timing and Ranging GPS) managed by the United States Air Force 50th Space Wing

GPS satellites began being launched in 1978, and was completed in March 1994.

Developed by the US Department of Defense to provide navigation capabilities for military forces. In 1983, US President Ronald Reagan issued a directive making GPS freely available for civilian use as a “common good”\(^1\)

Managed by the Schriever Air Force Base; costs approx. $400 mil/year (maintenance, replacement of aging satellites, etc.), but GPS is available for free use in civilian applications as a public good.

\(^1\)“History of GPS”, usinfo.state.gov (February 3, 2006).
Conventional GPS Units

Recreational-grade

Mapping-grade

Survey-grade

<table>
<thead>
<tr>
<th>GRADE</th>
<th>ACCURACY</th>
<th>AVG. COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation</td>
<td>3-10 m</td>
<td>$400</td>
</tr>
<tr>
<td>Mapping</td>
<td>1 m</td>
<td>$5,000</td>
</tr>
<tr>
<td>Sub-meter</td>
<td></td>
<td>$10,000</td>
</tr>
<tr>
<td>Survey</td>
<td>0.1 m</td>
<td>$20,000</td>
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Smartphone GPS Apps
Ecological Data Collection - OakMapper

Welcome to OakMapper

Browse the latest SOD trees

Search the nearest SOD trees
Ecological Data Collection - Calflora
Survey123 and other ESRI Applications

GPS
GPS Navigation Apps
Open Source GPS Apps – Oruxmaps

- Free
- No advertisements
- Integrates with GPS Status app
- Online maps can be saved, and can be used offline later
- Build composite maps from online map sources, with different values of transparency
- Add photos/videos/audios to the wpts
- Support to external GPS bluetooth
- Support to external heartrate monitors bluetooth
- Support to ANT+ (cadence, speed, heart rate, steps, temperature)
- Save and export your tracks and points in different format files (gpx, kml and kmz)
- Import tracks (gpx, kml and kmz)
Open Source GPS Apps – MotionX

Go To: Access the Search Wheel to select a navigation point; function changes to Stop Nav while navigating.

Share: Share your current position, track or waypoint via email, Facebook, or Twitter.

My Position: View/share current position, create a waypoint, take a photo, view signal strength.

Waypoints: View a list of your saved waypoints; view GPX file import instructions.

Compass: Current heading, speed, VMG, ETA, waypoint distance & bearing to wp/pt.

Record Tracks: Open the GPS stopwatch to record a track.

Live Updates: Setup/controls for sharing your position with others in real-time.

Map: View maps, with tracks, waypoints, and optional gridlines overlaid.

Tracks: View a list of your saved tracks; view GPX file import instructions.

Setup: Access the various user-based settings and controls.

Maps
- See your position and tracks anywhere in the world on fast live MotionX open topographic and road maps.
- Course-up and direction-up maps.
- Apple Road, Satellite and Hybrid maps. (iOS 6)
- NOAA experimental marine charts.
- Total of nine map choices, no other app offers a bigger selection!

Record Tracks
- Record and save up to 101 tracks.
- See your track in real-time with Track Up, North up, or Direction Up, then follow it later if you want to retrace your path.
- Record time, distance, speed and max speed.
- Live speed and altitude graphs.
- Ascent/descent and gradient data.
- Add a geotagged photo during your activity to share the experience!

Mark Waypoints
- Save up to 500 personal waypoints for your favorite locations like your home, end of a hike or your favorite restaurant.
- Use the MotionX TapTap® tool for easy waypoint creation.
- Add a geotagged photo to capture the moment!
GPS for agriculture and natural resources?

- Accurately determine location \((x,y,z)\) in [almost] any weather, day or night, anywhere on Earth.
- Surveying for research and natural resource management:
  - Tracking subjects (animals, humans, vehicles, etc.)
  - Mapping sample points / validation locations / training point location
  - Returning to your study sites in areas that are difficult to navigate in
  - Finding your way around ("wayfinding")
For Rangeland Management

**Vectors**
- Grazing patterns
- and/or refuse deposits

**Rasters**
- Standing Crop or RDM per unit of area
GPS

For Agriculture
WebGIS - Web Mapping
What is a WebGIS?

A GIS application on the Internet

- Powerful, interactive tool for communicating, collecting data
- Allows access to data by viewing, searching, querying, and exporting data and maps
- Generally designed for users who are not GIS experts
- Public / mass participation enabled
An Application Programming Interface is typically a set of computer functions, procedures, methods, classes or protocols made available for public use, usually by a third party. APIs are generally associated with “open source”, as they allow any user to customize an application (or at least use its features in a custom manner).

Examples:

- iPhone API – customize mobile apps for Apple’s iPhone
- Google Maps API – build geospatial web apps
- Drupal API – open-source content management system
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• “If I have seen further, it is by standing on the shoulders of giants” Issac Newton 1676.

API’s allow end users to stand on the data of others.

• APIs – Applications’ adaptation to Moore’s Law
An Application Programming Interface is typically a set of computer functions, procedures, methods, classes or protocols made available for public use, usually by a third party. APIs are generally associated with “open source”, as they allow any user to customize an application (or at least use its features in a custom manner).
“Open Source” or Free

- Google Maps API
- CartoDB
- MapBox
- OpenLayers
- GeoServer
- MapServer

Proprietary

- ArcGIS.com
- Intergraph (CAD/CAM)
  - GeoMedia WebMap
Google Maps API
Which WebGIS should I use?

*It depends on...*

- Your users, audience and stakeholders
- Tools and functionality required
  - Are you displaying data, or do you need to *collect* it as well?
  - Do you require interactive features? GeoProcessing?
- Level of programming skill
- How much $$ you are willing to spend?
Alternatives to the Google Maps API

Google
- Google Fusion Tables
  http://www.google.com/fusiontables

ESRI
- ESRI’s interactive mapping website.
  http://arcgis.com

Open Source
- CartoDB
  http://cartodb.com/
- MapBox
  http://mapbox.com/
- MapServer API
  http://mapserver.org/
- Batchgeo
  http://batchgeo.com/features/google-earth-kml/
WebGIS

CartoDB
Google Fusion Tables
WebGIS

ArcGIS Online
IGIS - ArcGIS Online

• 120 datasets available
• Both UCANR and other publically available data
• Can be used in GIS software and on webmaps
WebGIS

ArcGIS Online

[Image of ArcGIS Online interface]
WebGIS

ArcGIS Online

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ArcGIS Online

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Native Apps – App Studio for ArcGIS

- **Build Apps with No Coding**
  Configure out-of-the-box templates using easy-to-use wizards, with no coding.

- **One App for All Devices**
  Build an app once, and it is automatically ready for Android, iOS, Windows, OS X, and Linux.

- **Leverage Your Existing Maps**
  Leverage your existing GIS work and turn it into beautiful, consumer-friendly mobile apps.

- **Get to the App Stores**
  Get your own branded apps into the Google Play, Apple and Microsoft app stores.

- **Share Your App Across the Enterprise**
  Deploy and manage your own apps within your organization.

- **Save Money on Development**
  No need to hire expensive third-party developers to build consumer-friendly GIS
Survey 123 is designed to allow everyday people to collect data efficiently in the field and use that information to make better decisions. Here’s how it works:

1. Ask Questions
   Design surveys in a spreadsheet. Use Survey123 Connect to upload your surveys to ArcGIS.

2. Get the Answers
   Get the Survey123 for ArcGIS mobile app from the Google Play and Apple App Store, download surveys and start collecting data.

3. Make the Best Decisions
   Use the power of maps and ArcGIS to analyze facts from the field, gain insights, and make your best calls.

Originally based upon the Open Data Kit (ODK)
[https://opendatakit.org/](https://opendatakit.org/) XLS Forms tool
Surveying Human Subjects

- UC research must be approved by the UC Institutional Review Board (IRB)
- Resulting web maps may be constrained to not disclose sensitive geospatial data
**Terminology**

**Native Apps**
- An application that runs on your smartphone without an immediate internet connection

**Web Mapping Application**
- A stylized and published web map
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http://igis.ucanr.edu