

Accurate Mapping of Ground Control Points for Image Rectification and Holistic Planned Grazing Preparation

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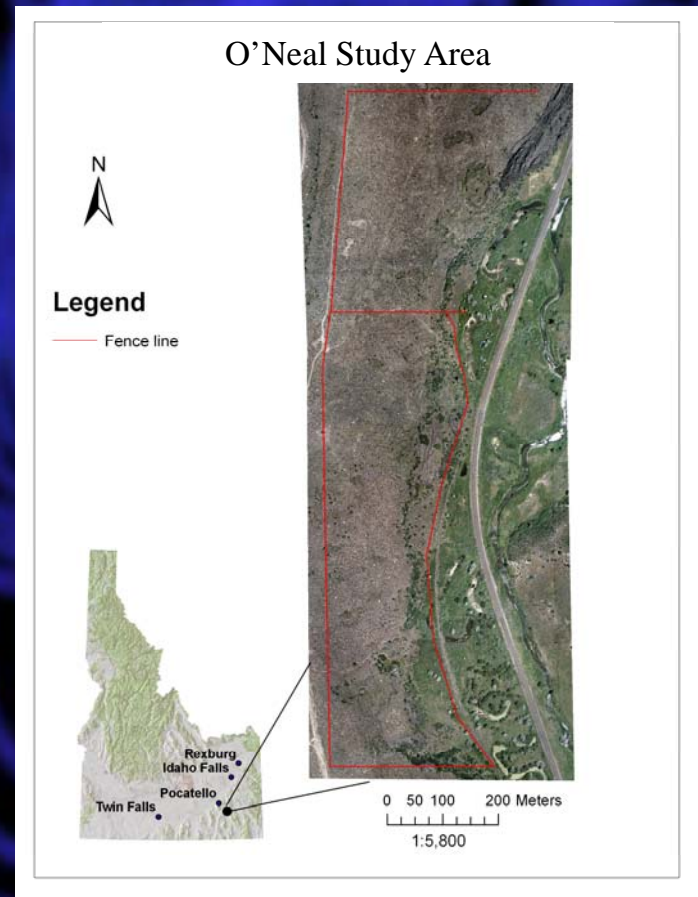


Overview

- Introduction
- Methods
- Results
- Discussion

Introduction- The Study Area

- O'Neal study area
 - Deeded to ISU for research
 - Uplands are sagebrush steppe rangelands



Introduction- The Study

- Why did we do this?
 - A new long-term study was proposed to compare the effects of high-intensity, short-duration grazing (HISD) with traditional rest-rotation grazing, and total rest in rangeland ecosystems of SE Idaho.
 - To compare long-term effects, the pre-experiment condition needed to be documented.
 - We chose to use field sampling and high-spatial resolution imagery to accomplish this.
 - To enable this experiment, we needed appropriate fencing.
 - The imagery and ground-control points will facilitate accurate fence placement.

Introduction (cont.)

- What is range management?
 - The manipulation of rangelands to produce goods and services for society
 - Protection and enhancement of the soil and vegetation complex
 - Maintaining or improving the output of consumable range products, such as red meat, fiber, wood, water, and wildlife (Holecheck et al., 2001)

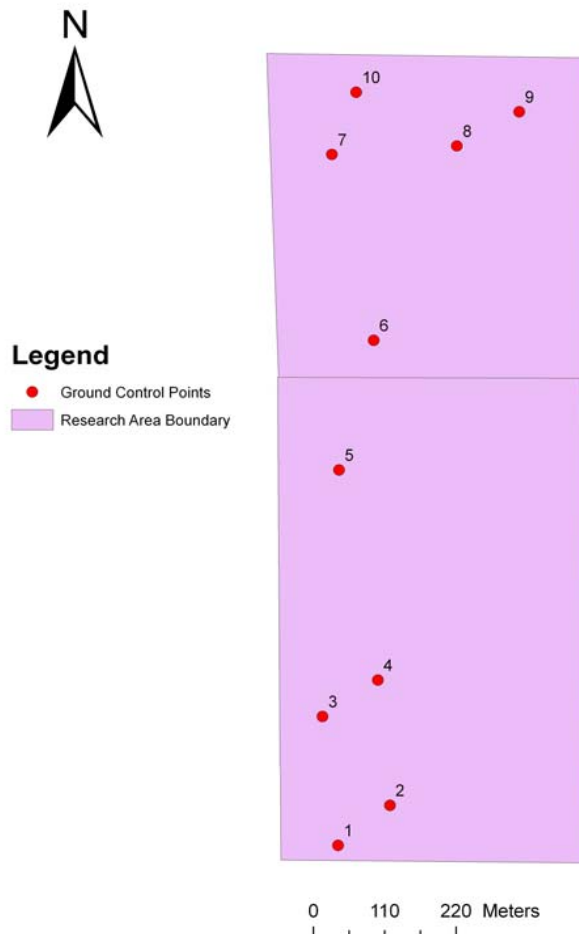
Introduction (cont.)

- Livestock grazing is a major component of range management
 - Traditional rest rotation grazing
 - HISD grazing has been hypothesized to improve rangeland health
 - Hoof action breaks through crusted soil allowing for better seed germination and moisture penetration
 - Grazing animals break up standing senesced vegetation
 - Grazing animals add nutrients through animal waste

Initial Setup of GCP

- Determine the appropriate number of GCP's
- Requirements:
 - High visibility from the air
 - Good spatial distribution
- GCP design
 - 6" wide by 6' long reinforced plastic
 - 2 strips crossed at center to form a +
 - Secured to ground with chicken wire
- Acquire location for return visits

O'Neal Study Area Ground Control Point Locations



Map GCPs

- Survey Grade GPS
 - Leica SR530 Rover and Base GPS units
 - Base GPS collected location information for more than two hours
 - Each GCP was navigated to, and 40 positions recorded using the Leica Rover
 - Rover positions were real time corrected based on the position of the Base unit

GPS Equipment



NGS OPUS – File Acknowledgment

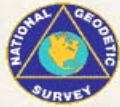
OPUS HomePage - Microsoft Internet Explorer

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Recent Developments

[Nov 10, 2004]
Format of the
OPUS data
sheet is
changed to
provide space
for the

1.
Enter your [email address](#)

2.
Enter your [DATA file](#) Now accepting RINEX and selected receiver formats.
Data files may also be compressed (.ZIP, .zip, .Z, .gz)

3. NONE no antenna selected – see FAQ #6
Select the [antenna type](#)

4. 0.0 meters
Enter the [antenna height](#)

5.
If desired, select from several options to modify the basic OPUS procedures.

Your data must be dual frequency data (L1 and L2) and a minimum of 2 hours of observations is recommended.
Your collection rate must be 1,2,3,5,10,15 or 30 seconds.

Internet

start | Idrisi | 3 Internet Explorer | My Pictures | Oneil_present.ppt | 9:09 AM

1) NGS OPUS SOLUTION REPORT

EPHEMERIS: Rapid

OPUS solution : 60__2210.050.05o 000353485

File Edit View Tools Message Help

Reply Reply All Forward Print Delete Previous Next Addre...

From: opus@ngs.noaa.gov
Date: Wednesday, August 10, 2005 6:31 PM
To: wissmahe@isu.edu
Subject: OPUS solution : 60__2210.050.05o 000353485

FILE: 60__2210.050.05o 000353485

NGS OPUS SOLUTION REPORT
=====

USER: wissmahe@isu.edu DATE: August 11, 2005
RINEX FILE: 60__221q.05o TIME: 01:31:24 UTC

SOFTWARE: page5 0411.19 master.pl START: 2005/08/09 16:03:00
EPHEMERIS: igr13352.eph [rapid] STOP: 2005/08/09 18:03:30
NAV FILE: brdc2210.05n OBS USED: 3564 / 3647 : 98%
ANT NAME: LEIAT502 # FIXED AMB: 20 / 22 : 91%
ARP HEIGHT: 0.70 OVERALL RMS: 0.015(m)

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00 (EPOCH:2005.6047)

X:	-1775551.368(m)	0.012(m)	-1775552.064(m)	0.012(m)
Y:	-4347024.131(m)	0.218(m)	-4347022.882(m)	0.218(m)
Z:	4304036.162(m)	0.145(m)	4304036.150(m)	0.145(m)

LAT:	42 42 0.20104	0.036(m)	42 42 0.22038	0.036(m)
E LON:	247 46 56.40442	0.079(m)	247 46 56.35537	0.079(m)
W LON:	112 13 3.59558	0.079(m)	112 13 3.64463	0.079(m)
EL HGT:	1420.048(m)	0.250(m)	1419.383(m)	0.250(m)
ORTHO HGT:	1432.703(m)	0.251(m)	[Geoid03 NAVD88]	

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 12) SPC (1101 ID E)

Northing (Y) [meters]	4728226.131	114780.833
Easting (X) [meters]	400268.080	195821.560
Convergence [degrees]	-0.82584035	-0.03458535
Point Scale	0.99972237	0.99994758

2) NGS OPUS SOLUTION REPORT

EPHEMERIS: Precise

OPUS solution : 60__2210.050.05o 000365423

File Edit View Tools Message Help

Reply Reply All Forward Print Delete Previous Next Addr...

From: opus@ngs.noaa.gov
Date: Tuesday, September 06, 2005 1:36 PM
To: wissmahe@isu.edu
Subject: OPUS solution : 60__2210.050.05o 000365423

FILE: 60__2210.050.05o 000365423

NGS OPUS SOLUTION REPORT

USER: wissmahe@isu.edu DATE: September 06, 2005
RINEX FILE: 60__221q.05o TIME: 20:36:07 UTC

SOFTWARE: page5 0411.19 master22.pl START: 2005/08/09 16:03:00
EPHEMERIS: igs13352.eph [precise] STOP: 2005/08/09 18:03:00
NAV FILE: brdc2210.05n OBS USED: 3557 / 3642 : 98%
ANT NAME: LEIAT502 # FIXED AMB: 22 / 22 : 100%
ARP HEIGHT: 0.7 OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00 (EPOCH:2005.6047)

X:	-1775551.372(m)	0.015(m)	-1775552.068(m)	0.015(m)
Y:	-4347024.196(m)	0.014(m)	-4347022.947(m)	0.014(m)
Z:	4304036.209(m)	0.016(m)	4304036.197(m)	0.016(m)

LAT:	42 42 0.20081	0.007(m)	42 42 0.22014	0.007(m)
E LON:	247 46 56.40534	0.013(m)	247 46 56.35629	0.013(m)
W LON:	112 13 3.59466	0.013(m)	112 13 3.64371	0.013(m)
EL HGT:	1420.125(m)	0.021(m)	1419.460(m)	0.021(m)
ORTHO HGT:	1432.780(m)	0.032(m)	[Geoid03 NAVD88]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 12)	SPC (1101 ID E)
Northing (Y) [meters]	4728226.123	114780.826
Easting (X) [meters]	400268.101	195821.581
Convergence [degrees]	-0.82584018	-0.03458518
Point Scale	0.99972237	0.99994758

NGS OPUS Solution Report

Geodetic & State Plane Coordinates

* peak-to-peak errors (m)

LAT:	42 39 59.51026	0.007 (m)	42 39 59.53576	0.008 (m)
E LON:	263 14 44.18589	0.013 (m)	263 14 44.14967	0.013 (m)
W LON:	96 45 15.81411	0.013 (m)	96 45 15.85033	0.013 (m)
EL HGT:	314.705 (m)	0.041 (m)	313.753 (m)	0.033 (m)
ORTHO HGT:	340.240 (m)	0.041 (m)	[Geoid03 NAVD88]	
UTM COORDINATES			STATE PLANE COORDINATES	
UTM (Zone 14)			SPC (4002 SD S)	
Northing (Y) [meters]	4726229.423		43336.983	
Easting (X) [meters]	684026.367		893325.488	
Convergence [degrees]	1.52234197		2.46893915	
Point Scale	1.00001666		1.00004366	
Combined Factor	0.99996731		0.99999430	

Notes:

- 1- Values shown on the right represent peak-to-peak errors (in meters.)
- 2- The **peak-to-peak error**, or error range (<#accuracy> and accuracy of the result) is the difference between the maximum and the minimum value of a coordinate obtained from the 3 baseline solutions.

TABLE 1. COMPARISON BETWEEN EPHEMERIS PRECISE AND RAPID PROCESS RESULTS

Processing Method	Longitude West d m s - Accuracy ^{a)} (m)	Latitude North d m s - Accuracy ^{a)} (m)	Ellipsoid Height/ Accuracy ^{a)} (m)	Orthometric Height/ Accuracy ^{a)} (m)	Processing Time Lapse After Observation date
				[Geoid03- -NAVD88]	
PRECISE	112 13 3.59466 - 0.013	42 42 0.20081 - 0.007	1420.125/ 0.021	1432.780/ 0.032	At least 10-14 days
RAPID	112 13 3.59558 - 0.079	42 42 0.20104 - 0.036	1420.048/ 0.250	1432.703/ 0.251	one day delay
DIFFERENCE	0.066 (m)	0.029 (m)	0.229 (m)	0.219 (m)	

GCP's

- Corrected GCP's achieved an accuracy of +/- 2 cm (+/-3.4 cm was required)
- Location information for GCP's was delivered to 3Di west to geo-rectify the aerial imagery

Aerial Photography





Fencing

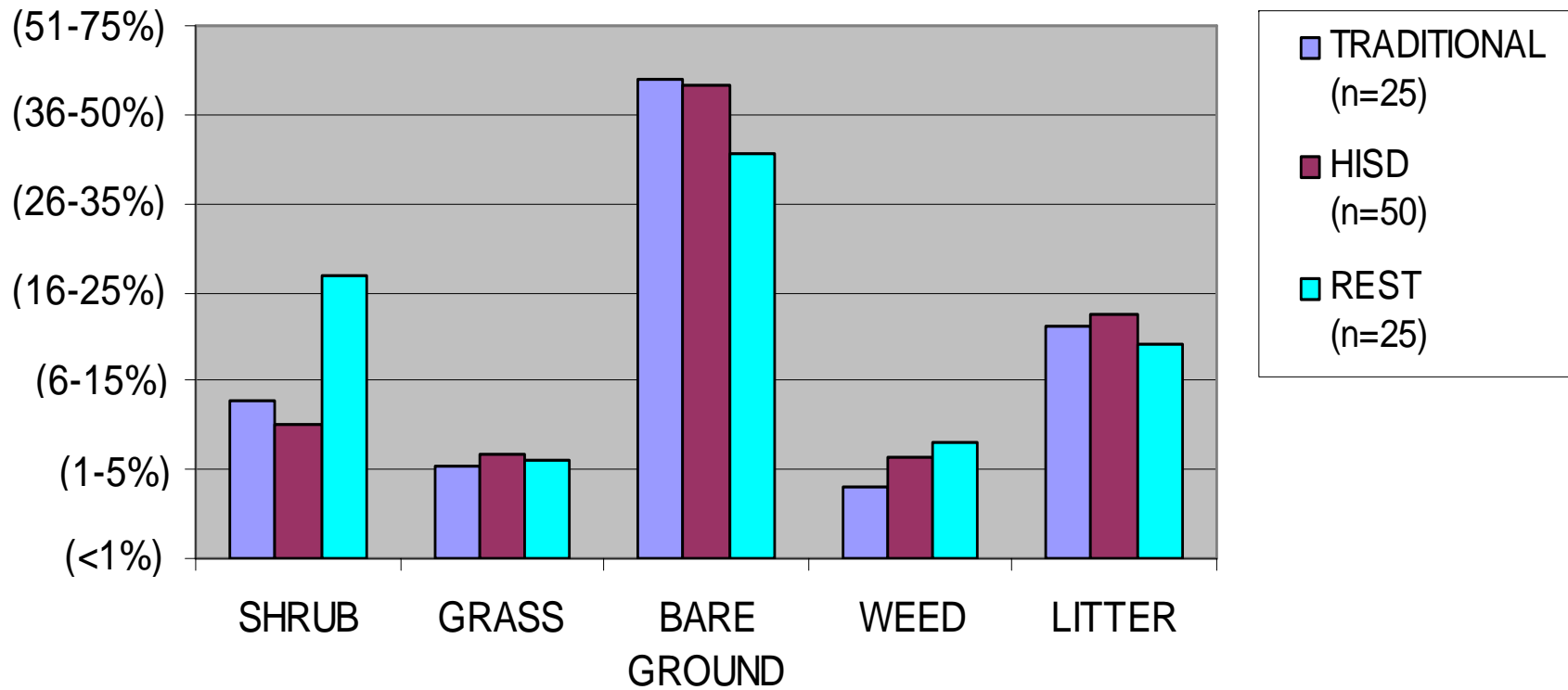
- Fence placement was designed using ArcGIS
 - Lines were sketched
 - Split lines using ArcMap editor tool
 - Waypoints created at nodes
- Load waypoints into GPS
- Navigate along the proposed fence line and mark with flags at every waypoint (50 m)

Collect Pre-study Vegetation Data

- 100 waypoints were randomly generated throughout the study area
 - 50 in the pasture to be rested
 - 25 in the pasture to be used for HISD grazing
 - 25 in the rest-rotation pasture
- Each waypoint was navigated to and percent cover estimates recorded
- Photos in each of the 4 cardinal directions were taken at every fifth point visited

Percent Cover Results

AVERAGE PERCENT COVER FOR GRAZING TREATMENT PASTURES



Results

- Ground-control points were established with high accuracy for future use
- Aerial imagery was acquired, rectified and delivered along with a digital terrain model
- Fences were installed
- Pre-study ground cover data was collected for comparison with future data
- Pastures are ready for long-term grazing study

Discussion

- This imagery will be used:
 - To create a vegetation census of the study area
 - To provide visual documentation of the condition of the land prior to the planned grazing study
 - Imagery can serve as a reference in future years

Discussion (cont.)

- Next steps...
- Use Quickbird and SPOT imagery
 - Large ground control structures (8'x8') will be erected over five of the existing GCP's
 - This will allow us to eliminate the co-registration errors plaguing past Quickbird projects of ours

Acknowledgments

I would like to acknowledge Maher Wissa for his help with field work and preparation of this presentation



Questions?