Caribou Photocensus

1. Photocensus requirements
2. Comparison of film and digital camera systems

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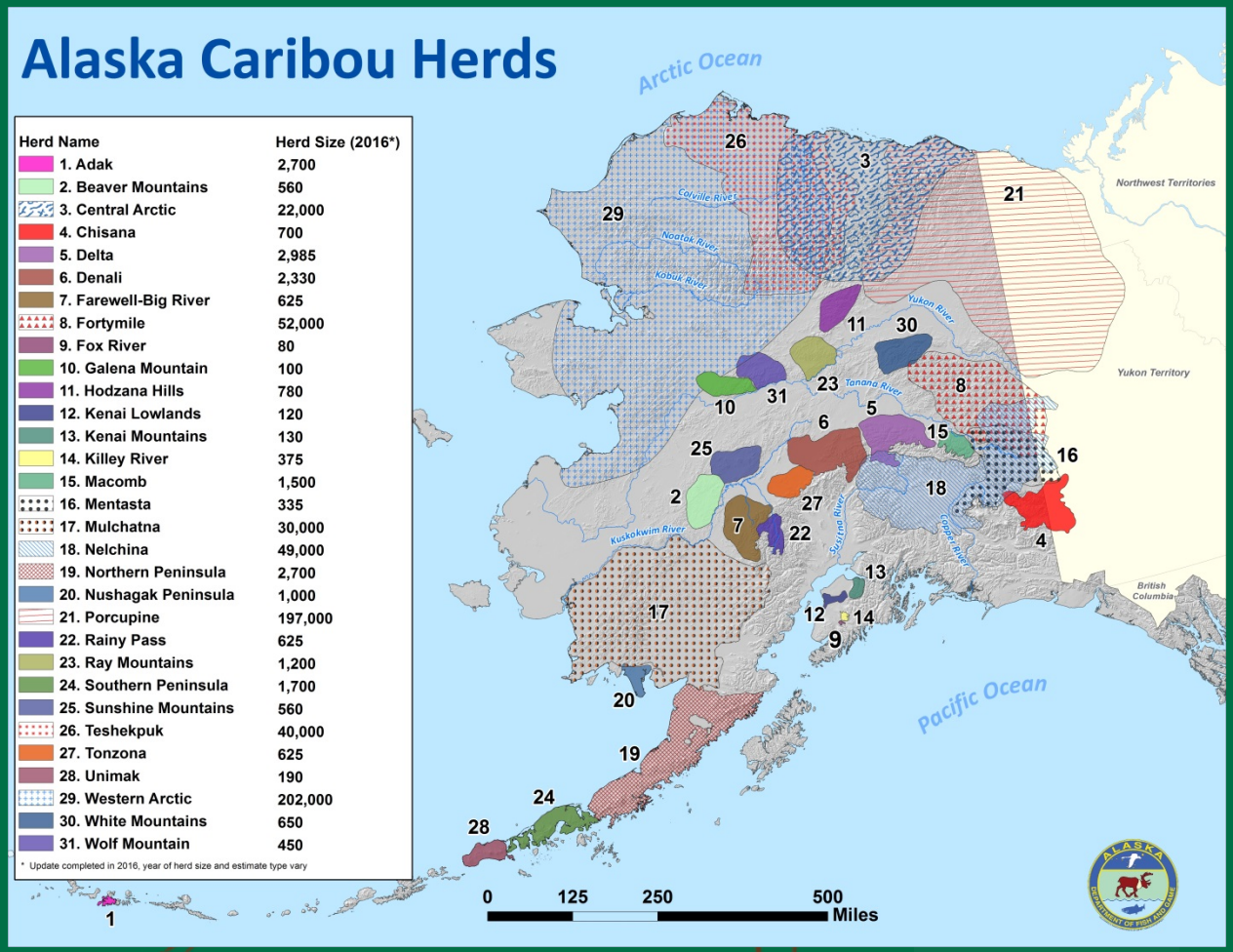
Submitted by ADF&G

Caribou Photocensus

- 31 Caribou herds 650k – 1 mill. animals
- Largest herds photocensused (~7) ~ 90% of total animals
- Annual harvest of ~20,000 caribou from focus herds
- Take advantage of post-calving groups



Herd Name	Herd Size (2016*)
1. Adak	2,700
2. Beaver Mountains	560
3. Central Arctic	22,000
4. Chisana	700
5. Delta	2,985
6. Denali	2,330
7. Farewell-Big River	625
8. Fortymile	52,000
9. Fox River	80
10. Galena Mountain	100
11. Hodzana Hills	780
12. Kenai Lowlands	120
13. Kenai Mountains	130
14. Killey River	375
15. Macomb	1,500
16. Mentasta	335
17. Mulchatna	30,000
18. Nelchina	49,000
19. Northern Peninsula	2,700
20. Nushagak Peninsula	1,000
21. Porcupine	197,000
22. Rainy Pass	625
23. Ray Mountains	1,200
24. Southern Peninsula	1,700
25. Sunshine Mountains	560
26. Teshekpuk	40,000
27. Tonzona	625
28. Unimak	190
29. Western Arctic	202,000
30. White Mountains	650
31. Wolf Mountain	450

* Update completed in 2016, year of herd size and estimate type vary

Photocensus Requirements

- Weather/insect conditions for caribou to aggregate
- Groups need defined edges
- Favorable light conditions
- Radiotracking:
  - attempt to find all active collars
  - coordinated so photo plane can progress through groups
- Properly functioning equipment (plane, cameras, GPS, IMU, etc.)

Photocensus Challenges

- Main issues to overcome:
  - Location of photography unknown until last minute
    - flight planning on the fly
    - customized software to control cameras
  - Caribou move during photography
    - maximize swath
    - optimize overlap, minimize # of transects per group
    - need to be low enough to see caribou with naked eye

Photocensus Steps

Radiotracking Flights

↓

Flying Photo Mission

↓

Develop Imagery

↓

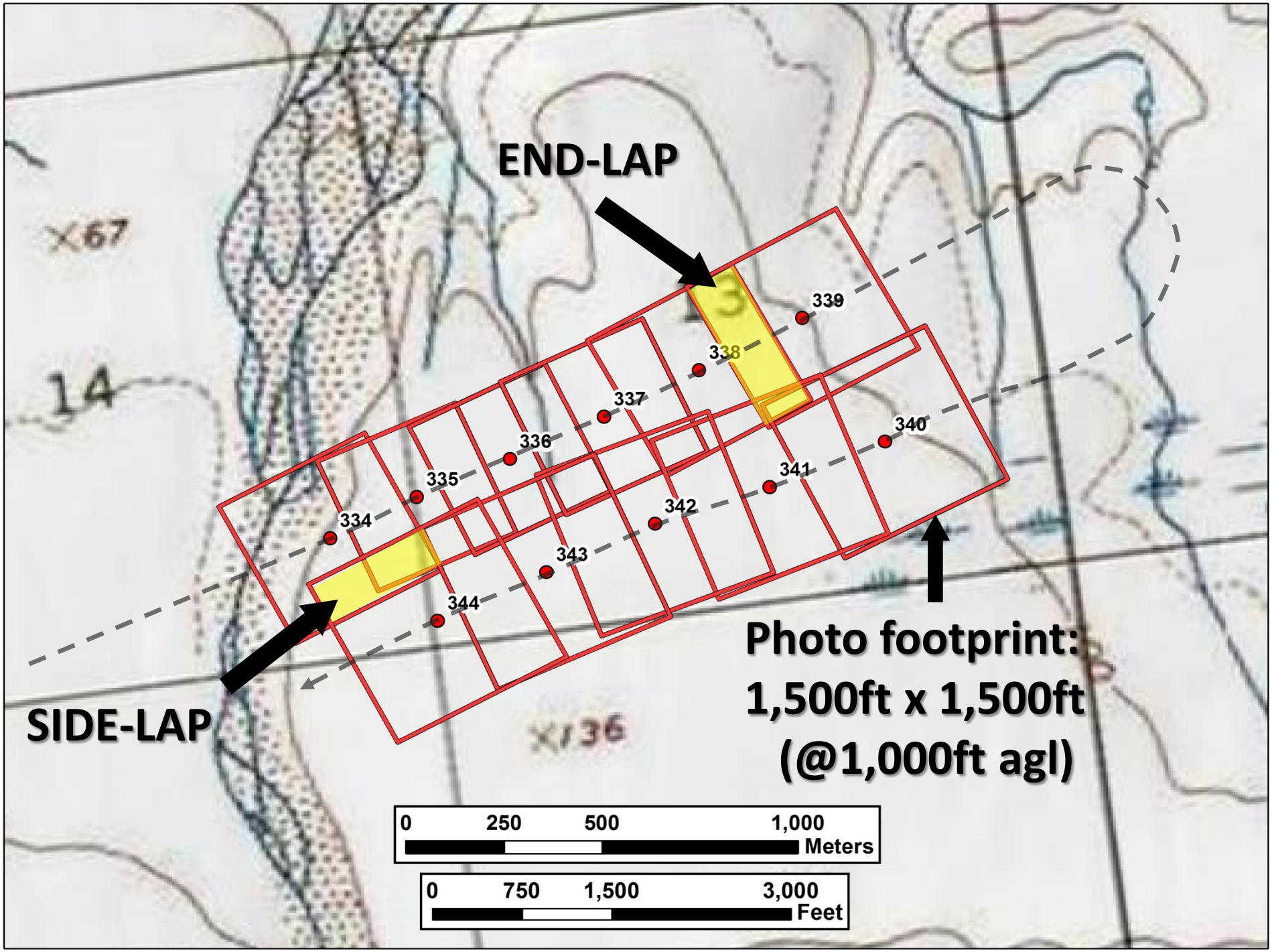
Post Processing , Photo Layout

↓

Counting Photos

Planes and Cameras

- Airplanes
  - Cessna 206 and DeHavilland Beaver
- Cameras
  - Black and white film cameras (old)
  - Digital cameras (new)
- Computer
  - Controls when cameras take pictures
  - Displays photo footprints in real time for adjusting overlap
  - Takes GPS location so we know where photos were taken


END-LAP
SIDE-LAP
339
338
337
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334
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343
344
Photo footprint:
1,500ft x 1,500ft
(@1,000ft agl)
0 250 500 1,000
Meters
0 750 1,500 3,000
Feet

Large group…

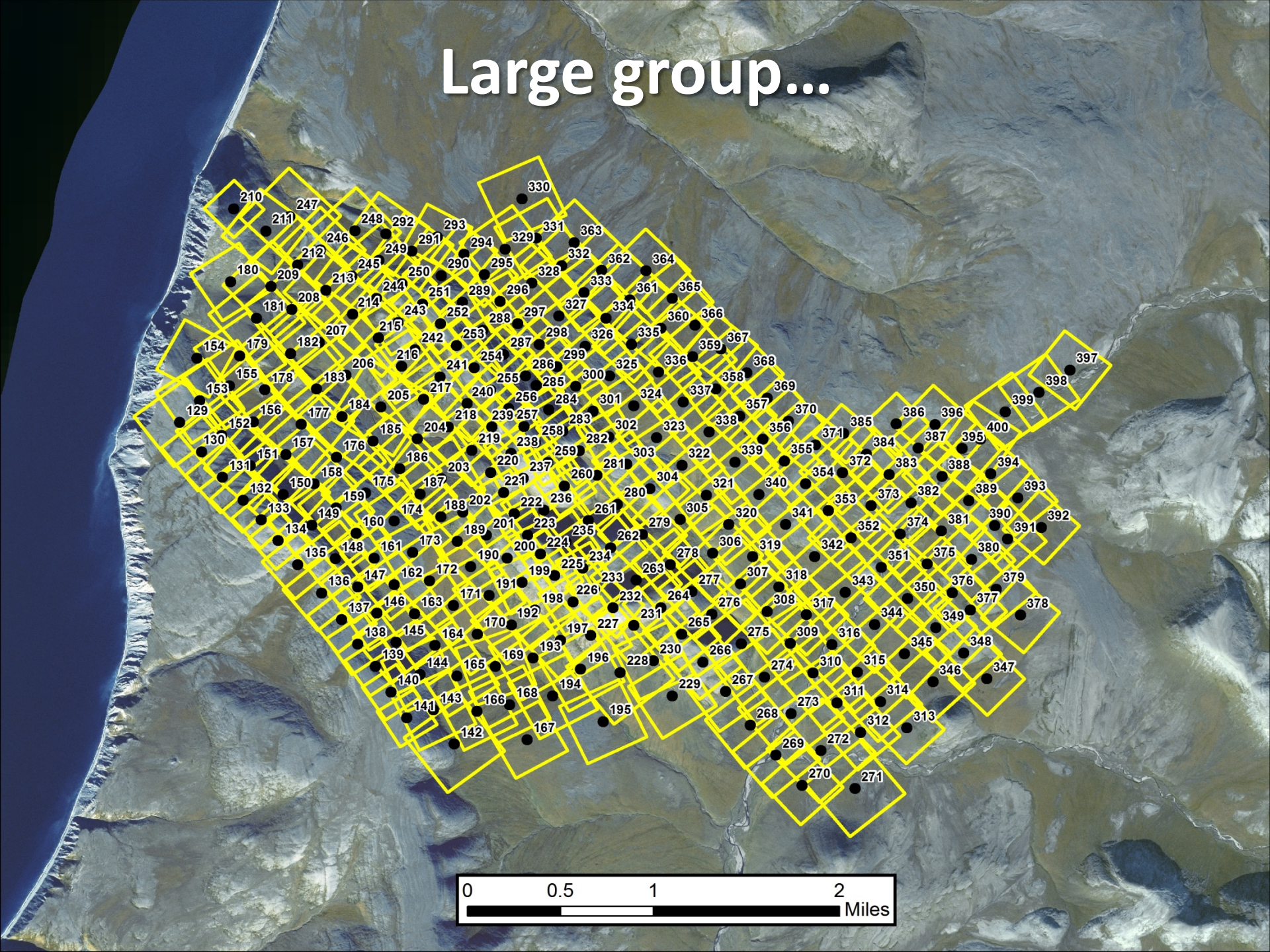
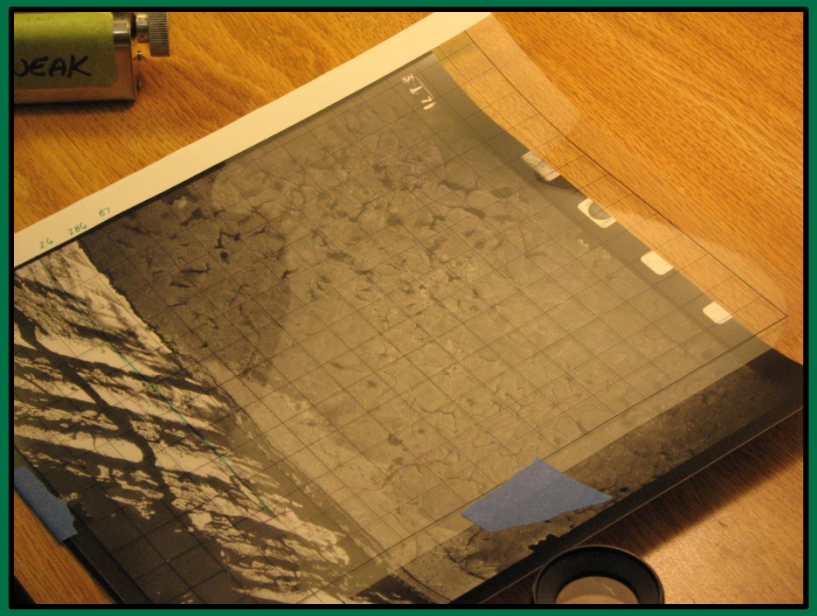


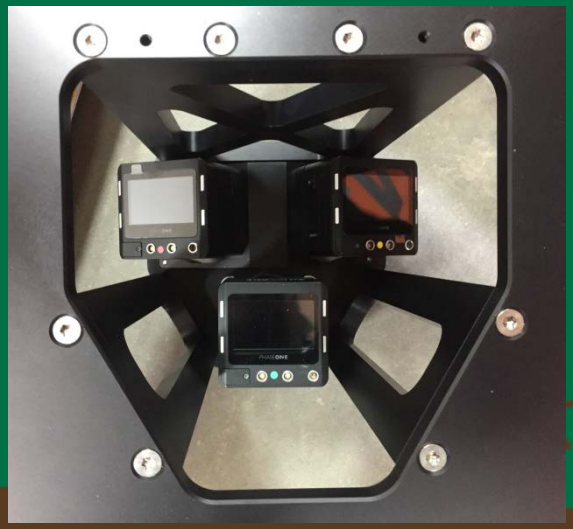
Photo Layouts

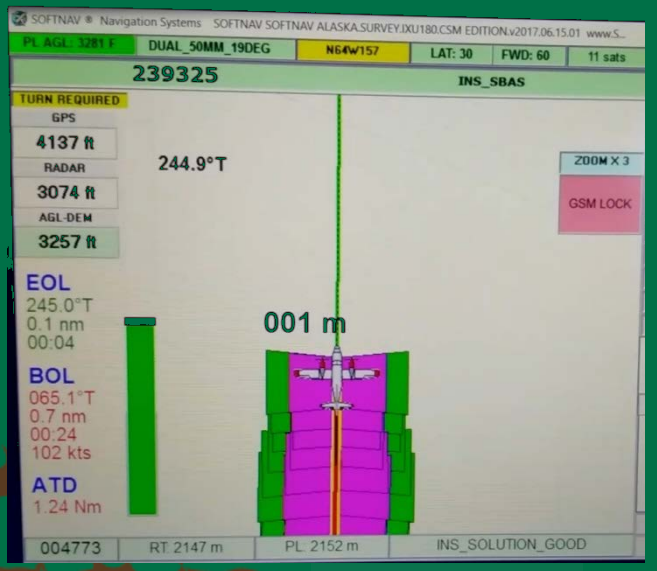


Counting

Digital Camera Systems

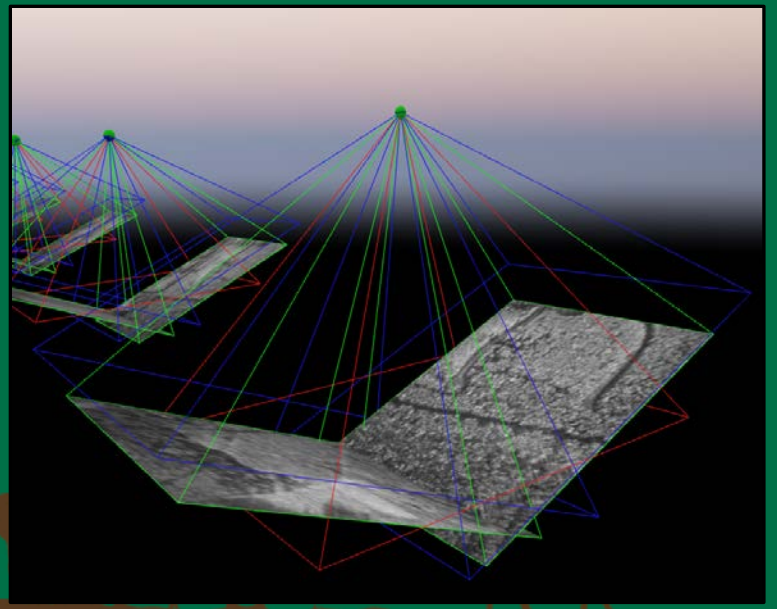
1. 3 cameras, each 100MP
2. Stabilized mount
3. GPS and IMU
4. Advanced flight management software
5. Software to stitch images together



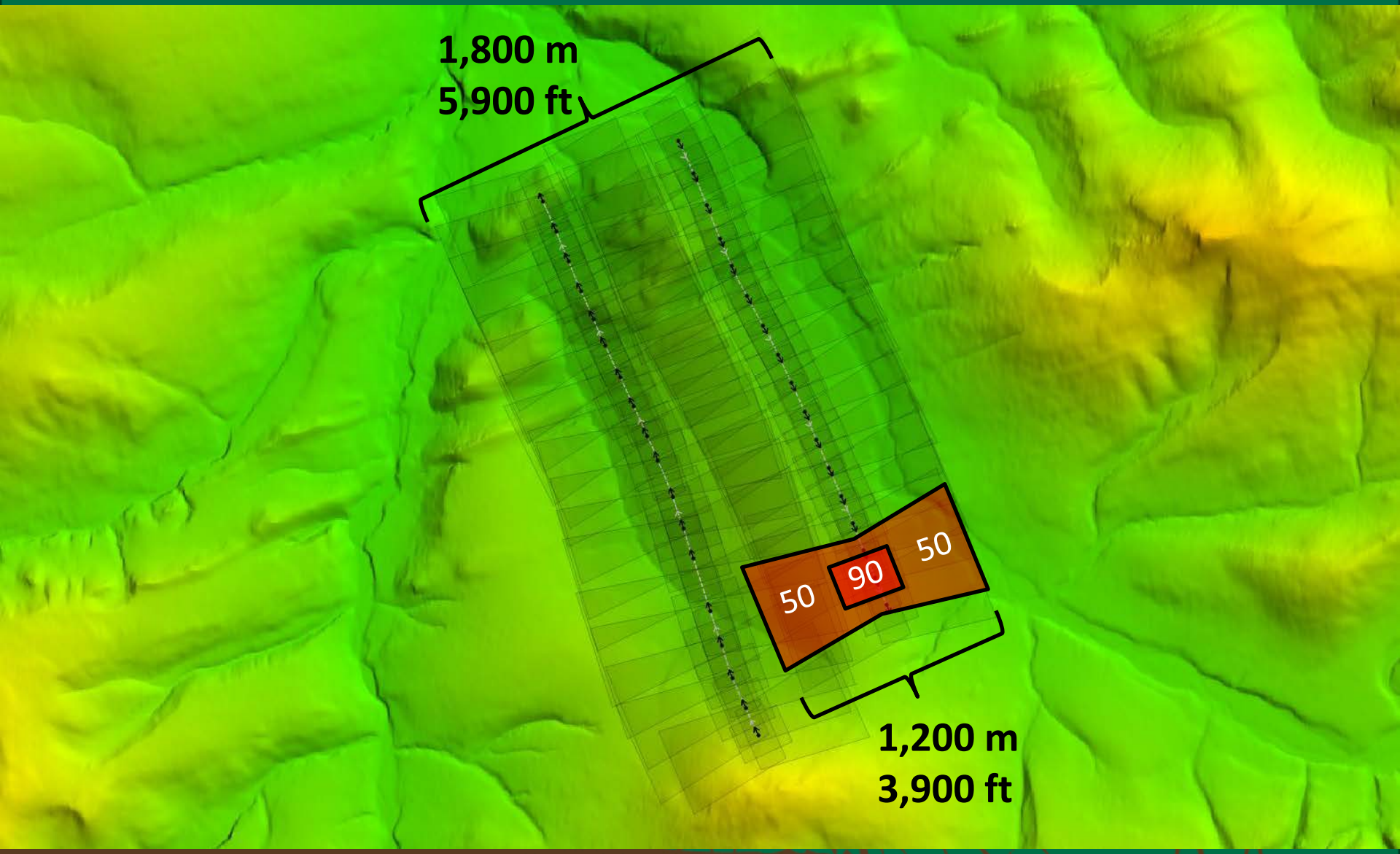


Swath width

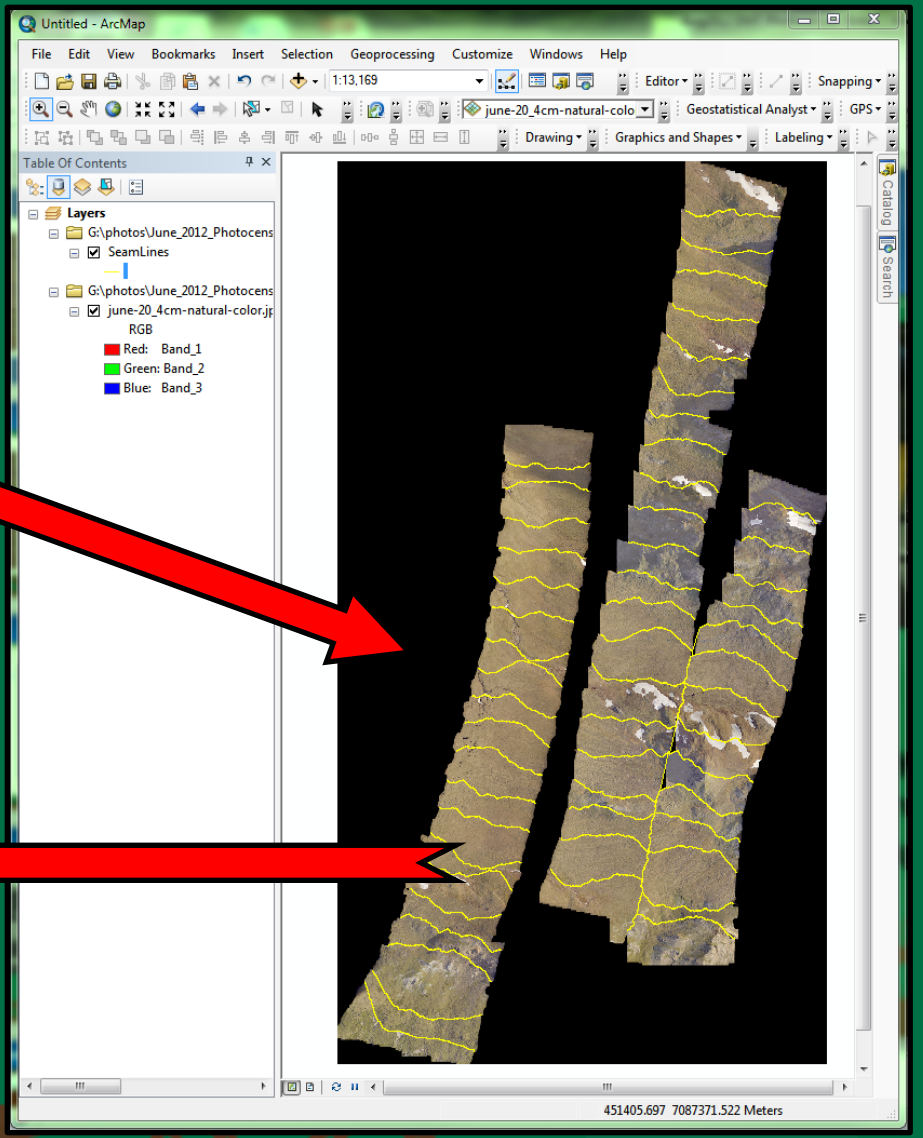
Dual 50mm Cameras	Swath	Ground Sample Distance (GSD) (image center, oblique)
1,500 feet AGL	3,700ft	4cm, 11cm
3,000 feet AGL	7,400ft	8cm, 22cm

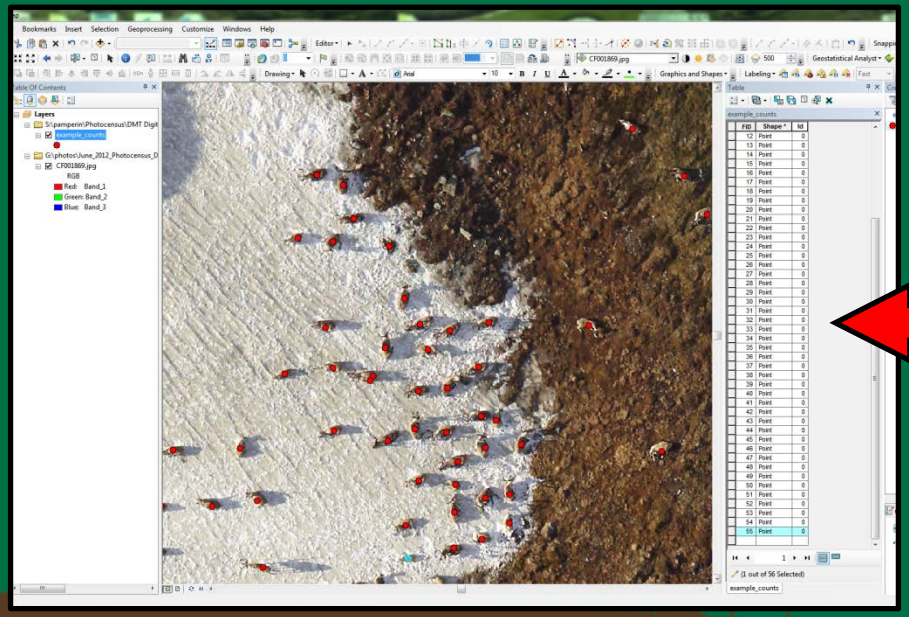


Digital System Footprints

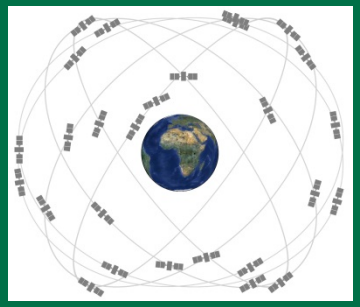


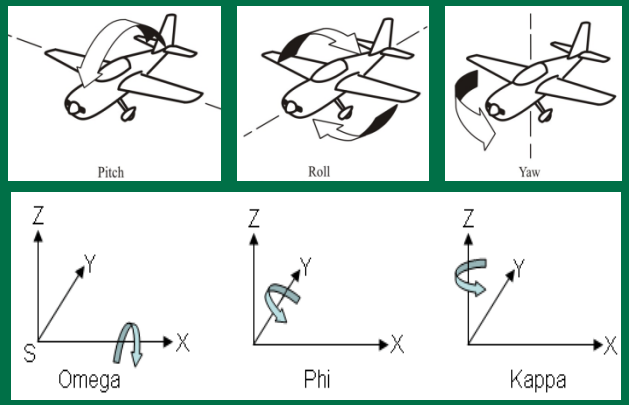
Digital Advantage



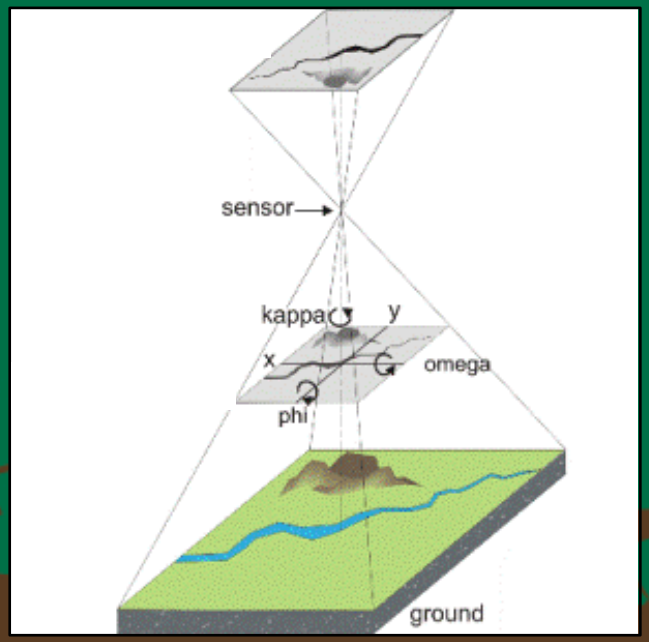


Data Sources

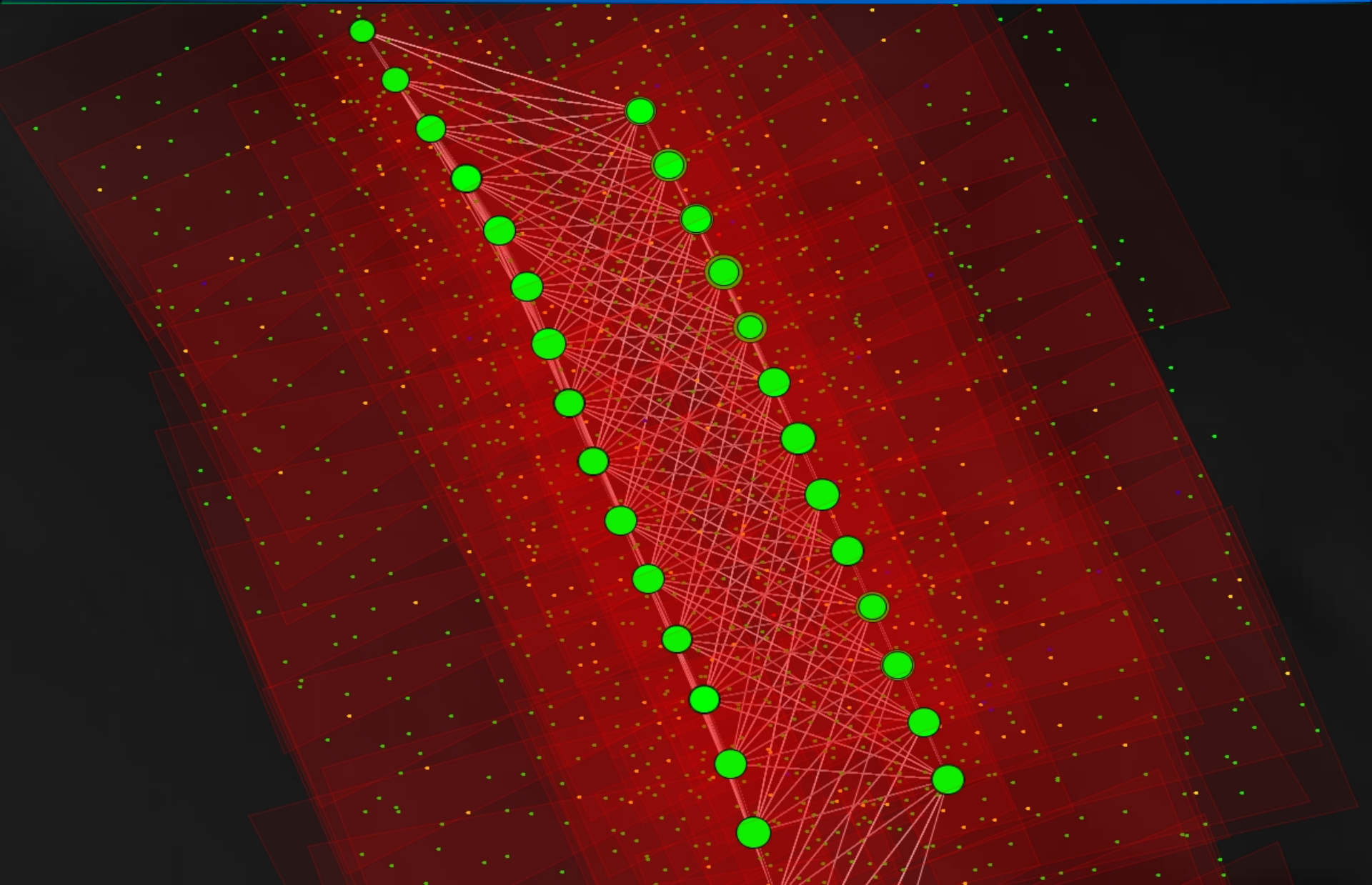




Imagery **GPS** **Inertial**



Tie Points and Bundle Adjustment



Software Demonstration: Orthorectification

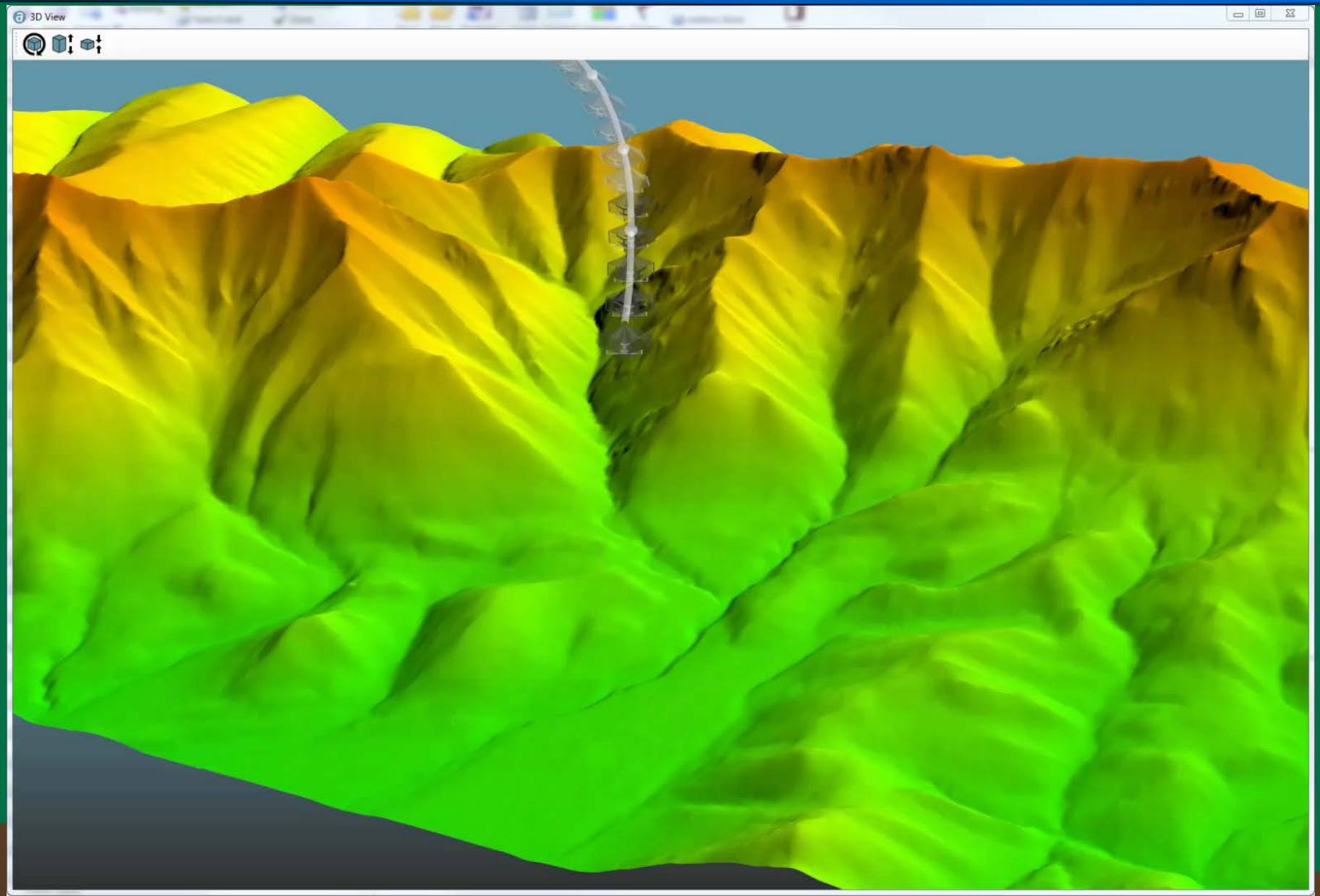
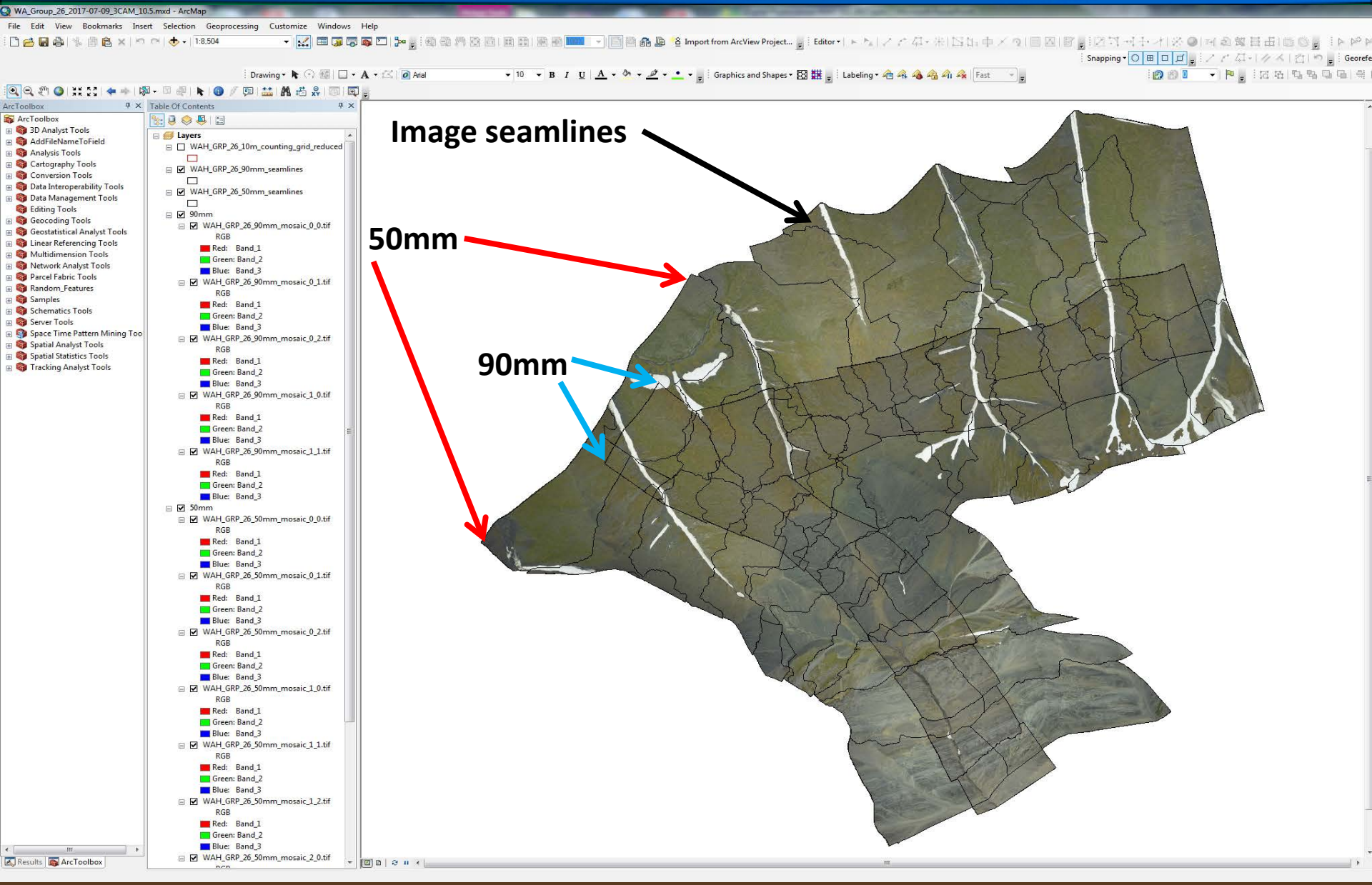


Photo Mosaic: Digital System



Counting: Digital System

Counting: Digital System

Table

TCH_caribou_counts_2017_Ryan_Klimstra

OBJECTID *	SHAPE *	AgeClass	CounterName	Herd	dTime	DateTime	photo_group_date	GroupName	image_res
264	Point	adult	rlklimstra	TE	2017-11-22 10:48:57.396000	11/22/2017 10:48:57 AM	7/14/2017	1A	90mm
265	Point	adult	rlklimstra	TE	2017-11-22 10:48:58.628000	11/22/2017 10:48:59 AM	7/14/2017	1A	90mm
266	Point	calf	rlklimstra	TE	2017-11-22 10:49:00.282000	11/22/2017 10:49:00 AM	7/14/2017	1A	90mm
267	Point	adult	rlklimstra	TE	2017-11-22 10:49:02.747000	11/22/2017 10:49:03 AM	7/14/2017	1A	90mm
268	Point	adult	rlklimstra	TE	2017-11-22 10:49:09.361000	11/22/2017 10:49:09 AM	7/14/2017	1A	90mm
269	Point	adult	rlklimstra	TE	2017-11-22 10:49:11.966000	11/22/2017 10:49:12 AM	7/14/2017	1A	90mm
270	Point	adult	rlklimstra	TE	2017-11-22 10:49:13.402000	11/22/2017 10:49:13 AM	7/14/2017	1A	90mm
271	Point	adult	rlklimstra	TE	2017-11-22 10:49:15.164000	11/22/2017 10:49:15 AM	7/14/2017	1A	90mm
272	Point	calf	rlklimstra	TE	2017-11-22 10:49:16.537000	11/22/2017 10:49:17 AM	7/14/2017	1A	90mm
273	Point	adult	rlklimstra	TE	2017-11-22 10:49:20.125000	11/22/2017 10:49:20 AM	7/14/2017	1A	90mm
274	Point	adult	rlklimstra	TE	2017-11-22 10:49:22.855000	11/22/2017 10:49:23 AM	7/14/2017	1A	90mm
275	Point	adult	rlklimstra	TE	2017-11-22 10:49:32.028000	11/22/2017 10:49:32 AM	7/14/2017	1A	90mm
276	Point	adult	rlklimstra	TE	2017-11-22 10:49:33.822000	11/22/2017 10:49:34 AM	7/14/2017	1A	90mm
277	Point	adult	rlklimstra	TE	2017-11-22 10:49:35.476000	11/22/2017 10:49:35 AM	7/14/2017	1A	90mm
278	Point	adult	rlklimstra	TE	2017-11-22 10:49:37.379000	11/22/2017 10:49:37 AM	7/14/2017	1A	90mm
279	Point	adult	rlklimstra	TE	2017-11-22 10:49:39.547000	11/22/2017 10:49:40 AM	7/14/2017	1A	90mm
280	Point	adult	rlklimstra	TE	2017-11-22 10:49:41.372000	11/22/2017 10:49:41 AM	7/14/2017	1A	90mm
281	Point	adult	rlklimstra	TE	2017-11-22 10:49:42.636000	11/22/2017 10:49:43 AM	7/14/2017	1A	90mm
282	Point	calf	rlklimstra	TE	2017-11-22 10:49:44.992000	11/22/2017 10:49:45 AM	7/14/2017	1A	90mm
283	Point	adult	rlklimstra	TE	2017-11-22 10:49:46.193000	11/22/2017 10:49:46 AM	7/14/2017	1A	90mm
284	Point	adult	rlklimstra	TE	2017-11-22 10:49:47.269000	11/22/2017 10:49:47 AM	7/14/2017	1A	90mm
285	Point	adult	rlklimstra	TE	2017-11-22 10:50:25.817000	11/22/2017 10:50:26 AM	7/14/2017	1A	90mm
286	Point	adult	rlklimstra	TE	2017-11-22 10:50:29.233000	11/22/2017 10:50:29 AM	7/14/2017	1A	90mm
287	Point	adult	rlklimstra	TE	2017-11-22 10:50:31.994000	11/22/2017 10:50:32 AM	7/14/2017	1A	90mm
288	Point	adult	rlklimstra	TE	2017-11-22 10:50:34.225000	11/22/2017 10:50:34 AM	7/14/2017	1A	90mm
289	Point	adult	rlklimstra	TE	2017-11-22 10:50:35.879000	11/22/2017 10:50:36 AM	7/14/2017	1A	90mm
290	Point	adult	rlklimstra	TE	2017-11-22 10:50:37.610000	11/22/2017 10:50:38 AM	7/14/2017	1A	90mm
291	Point	adult	rlklimstra	TE	2017-11-22 10:50:39.592000	11/22/2017 10:50:40 AM	7/14/2017	1A	90mm

Differences Between Film and Digital Counts

- **Image quality**
  - digital produces better images under poor light
  - easier to count calves on digital imagery
- **Group photography/layout**
  - less transects with digital system = less sidelap
    - 2017: only 8 of 116 groups with >1 transect
  - flight management more accurate with digital
- **Digital counting in GIS**
  - more accurate than grid overlay and film prints
- **Day to day differences in groups**
  - back to back censuses can vary

Questions