Minnesota Wolf Monitoring

2012 Update

John Erb

Minnesota Department of Natural Resources

MN Monitoring Methods

- Research projects
- Population trend indices
  - **Scent-post survey**
  - **Winter Track Survey**
  - **Verified Depredations**
- Population Size/Distribution
  - **Surveys every 10 years, now 5**
  - **1978; 1989; 1998; 2003; 2007**

How is the MN survey conducted?

- Gather wolf observation data from a variety of sources during 1 winter
- Delineate the extent of contiguous wolf range in MN
- Quantify how much is “occupied range”
- Estimate pack and territory size from radio-telemetry studies
- Calculate final population

Gathering the main survey data

- Winter effort; record observations of wolf activity from November through April
- Use of natural resource professionals
- Opportunistic observations only

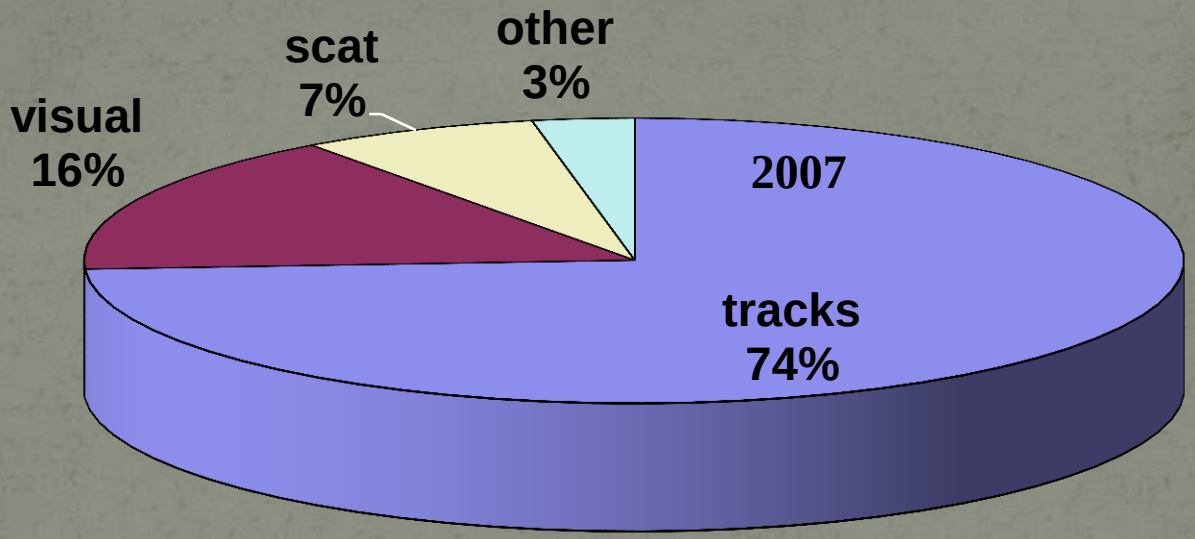
Survey Participants

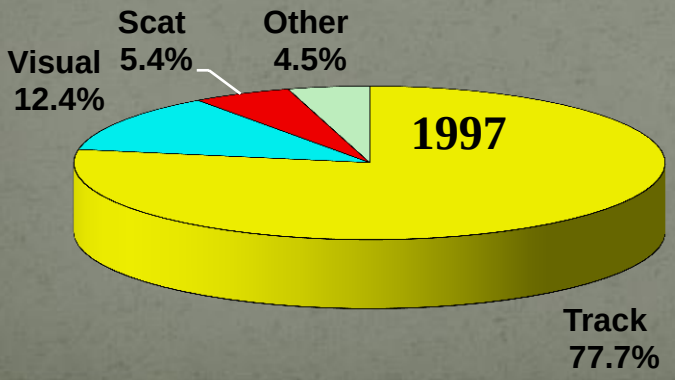
- Minnesota DNR staff
- USFS, USFWS, USDA-WS, USGS
- County Land Departments
- Tribal/treaty natural resource staff
- Private forest products industry
- Natural resources consultants
- Wisconsin DNR

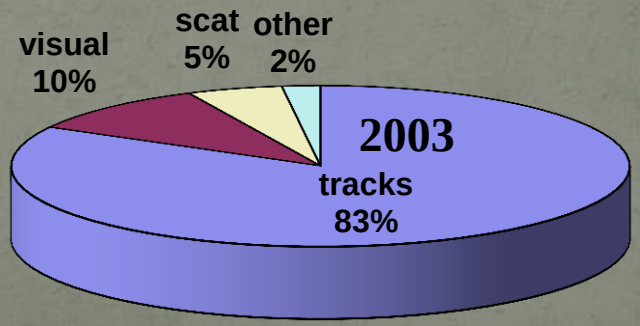
Observation Data Sources

- Main wolf survey
- USDA – WS trapping data
- MN DNR winter track survey
- MN DNR scent post survey
- Radio-telemetry data

Observation types – 1997, 2003, 2007

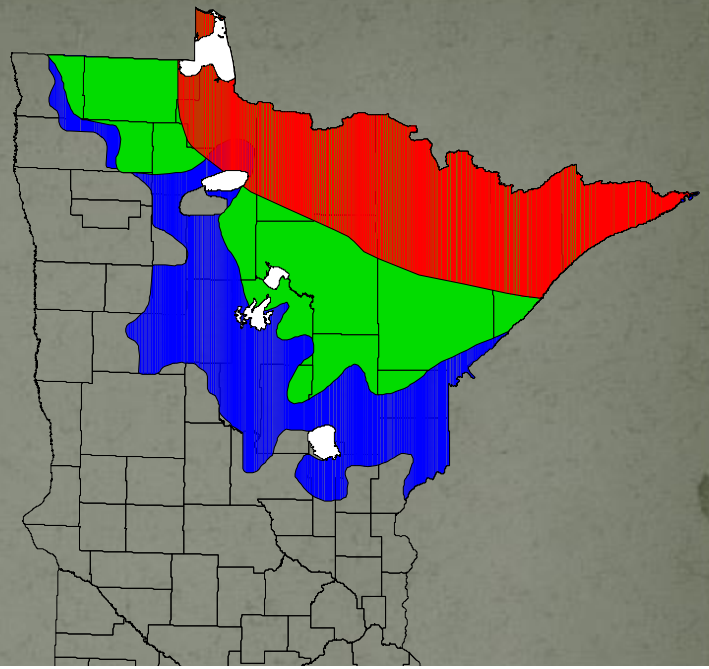


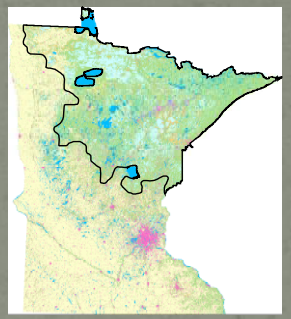


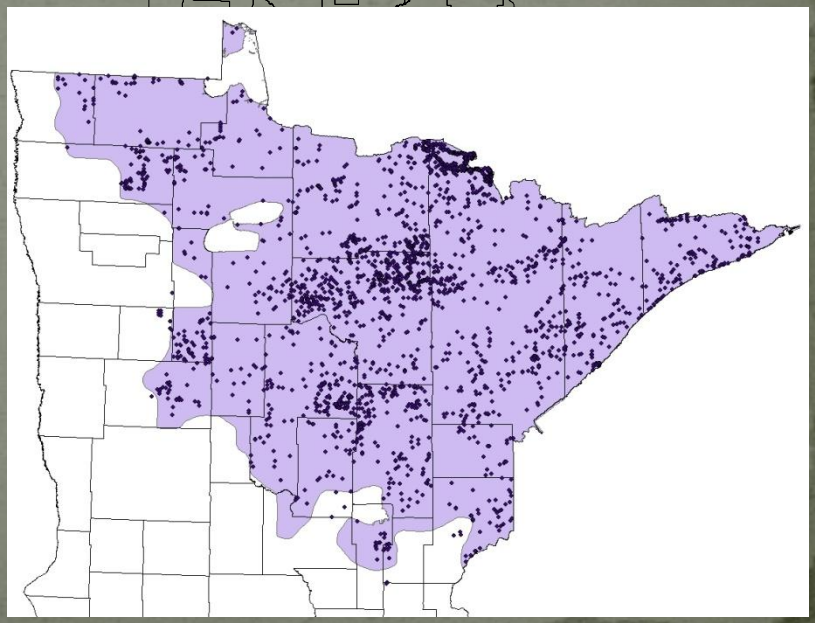


Delineating Total Range

- Wolf Survey Observations (opportunistic)
- 1988-89 Human/Road Density Model
  - Helps fill in ‘sampling gaps’
- Land Use / Land Cover
- Previous Observations
- Assume contiguous range

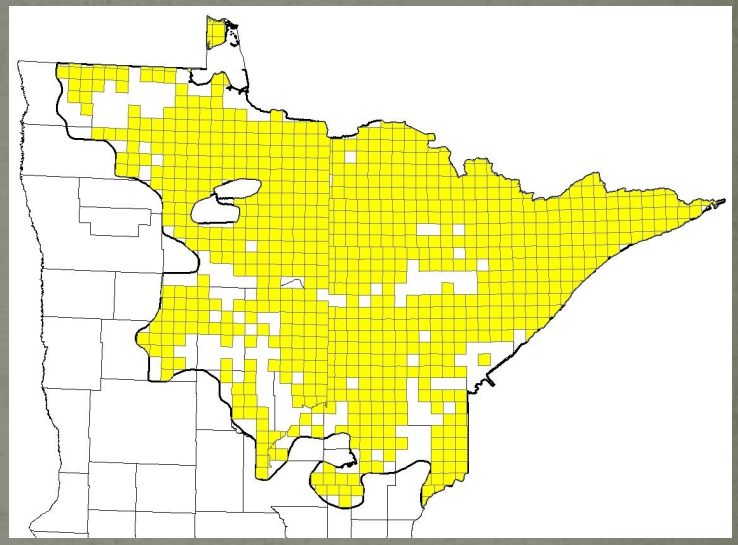






Occupied Range

- Township scale

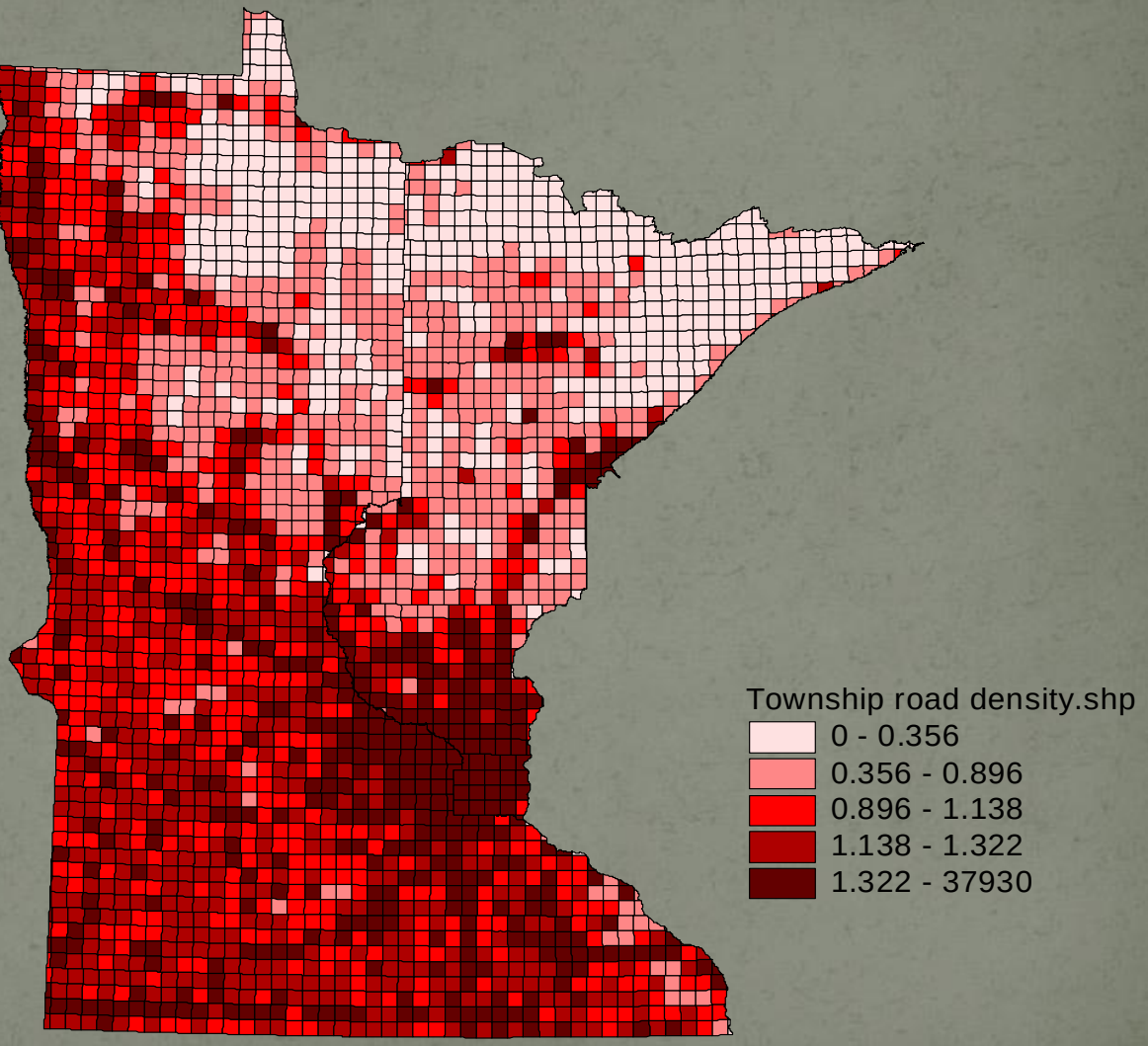


- Township occupied if:
  - Within total range, and:
    - Pack **detected; or**
    - **Meets road/human model**
      - **Roads < 0.7 km/km2 and humans < 4/km2; or**
      - **Roads < 0.5 km/km2 and humans < 8/km2**

- Exclude lakes > 200 km^2

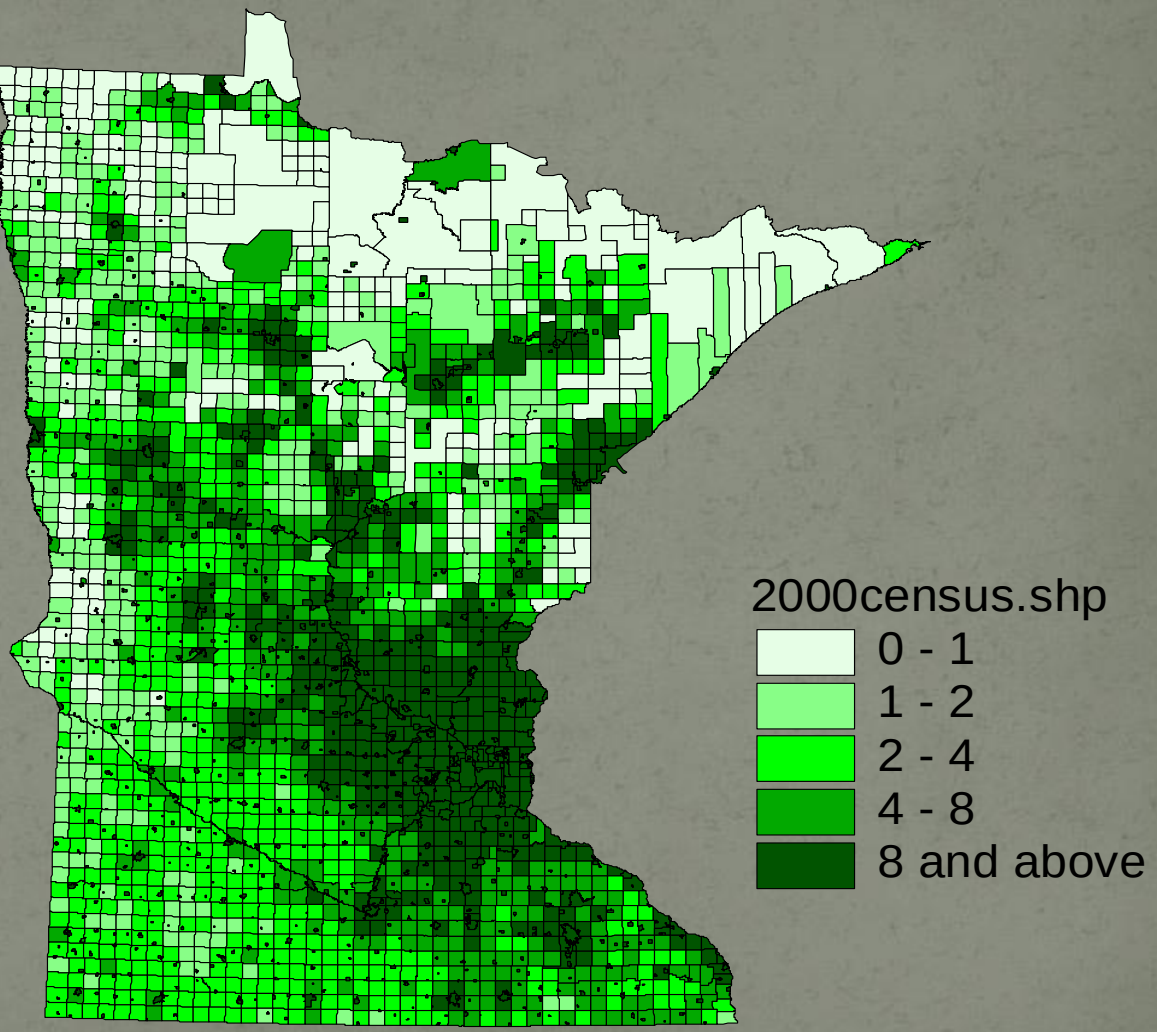
Calculate Road Density

- township roads and ‘higher’
- does not include ‘forest’ roads.

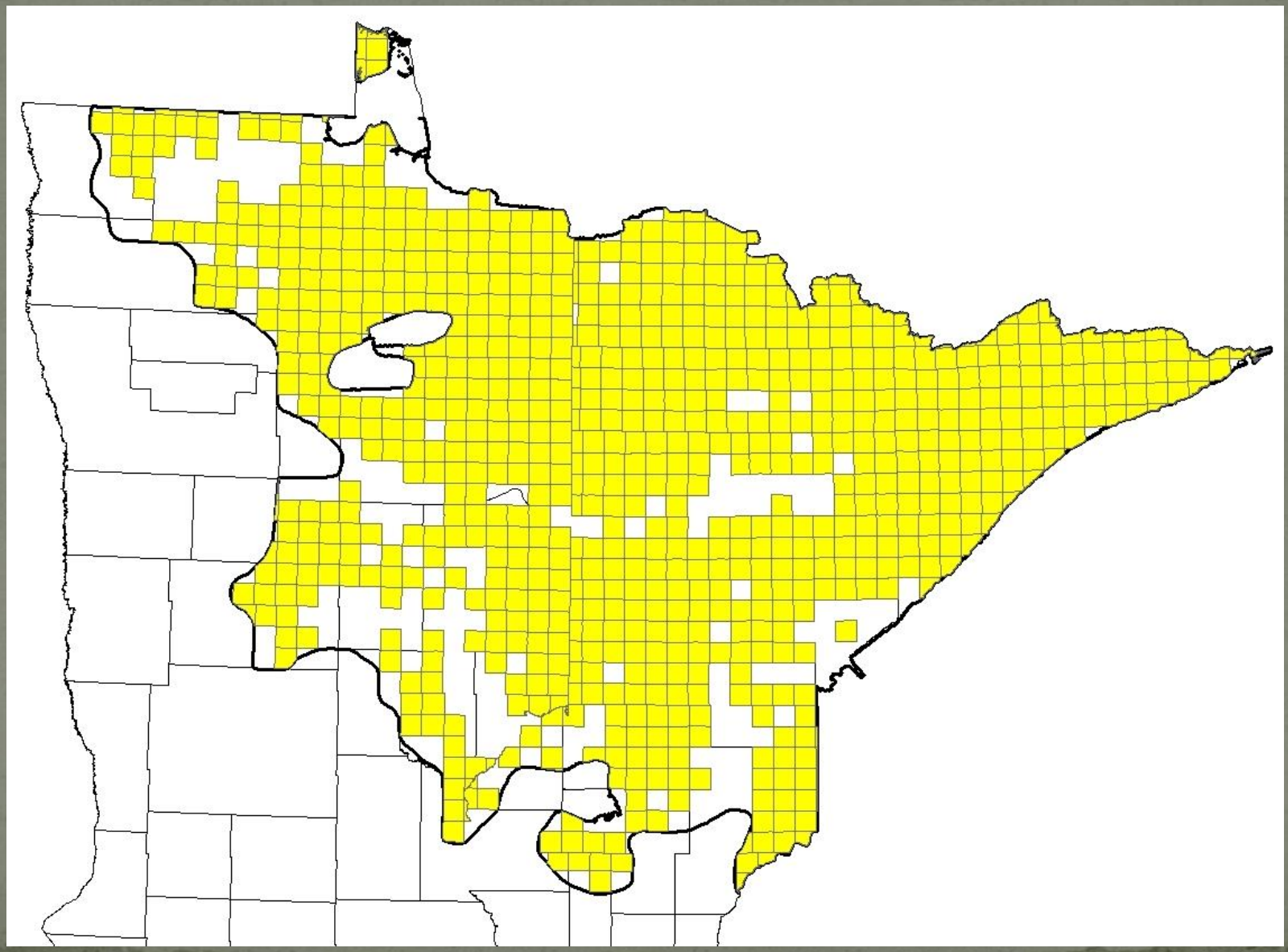


Calculate Human Density

- most recent US census

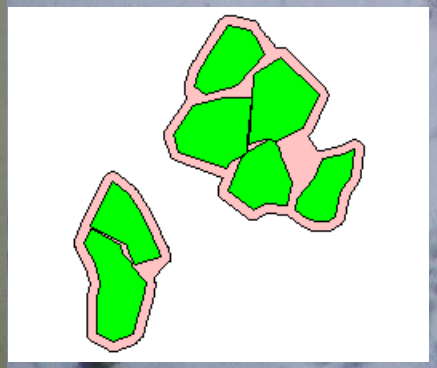


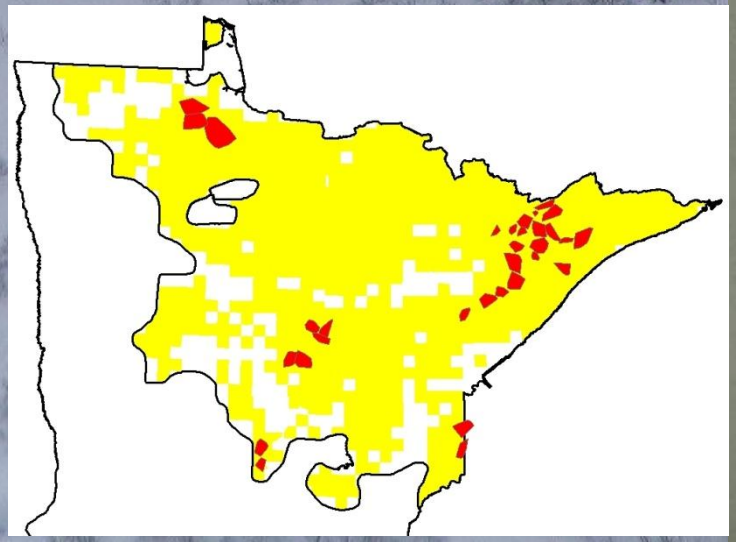
Occupied Range - 2007



Gather pack parameters

- Average mid-winter pack size
- Average territory size (MCP)





Calculate

- Area of total wolf range: 88,325 km^2
- Area of occupied wolf range: 67,852 km^2
- Adjust mean territory size (102 km^2) upwards by 37% to compensate for interstices (140 km^2 total)
- Divide occupied area by mean pack area = number of packs (485)
- Multiply by mean pack size (5.3 wolves) = number of pack wolves (2,567)
- Divide by 0.85 for single wolves in the population and add to packs = 3,020
- CI obtained by bootstrapping pack/territory data

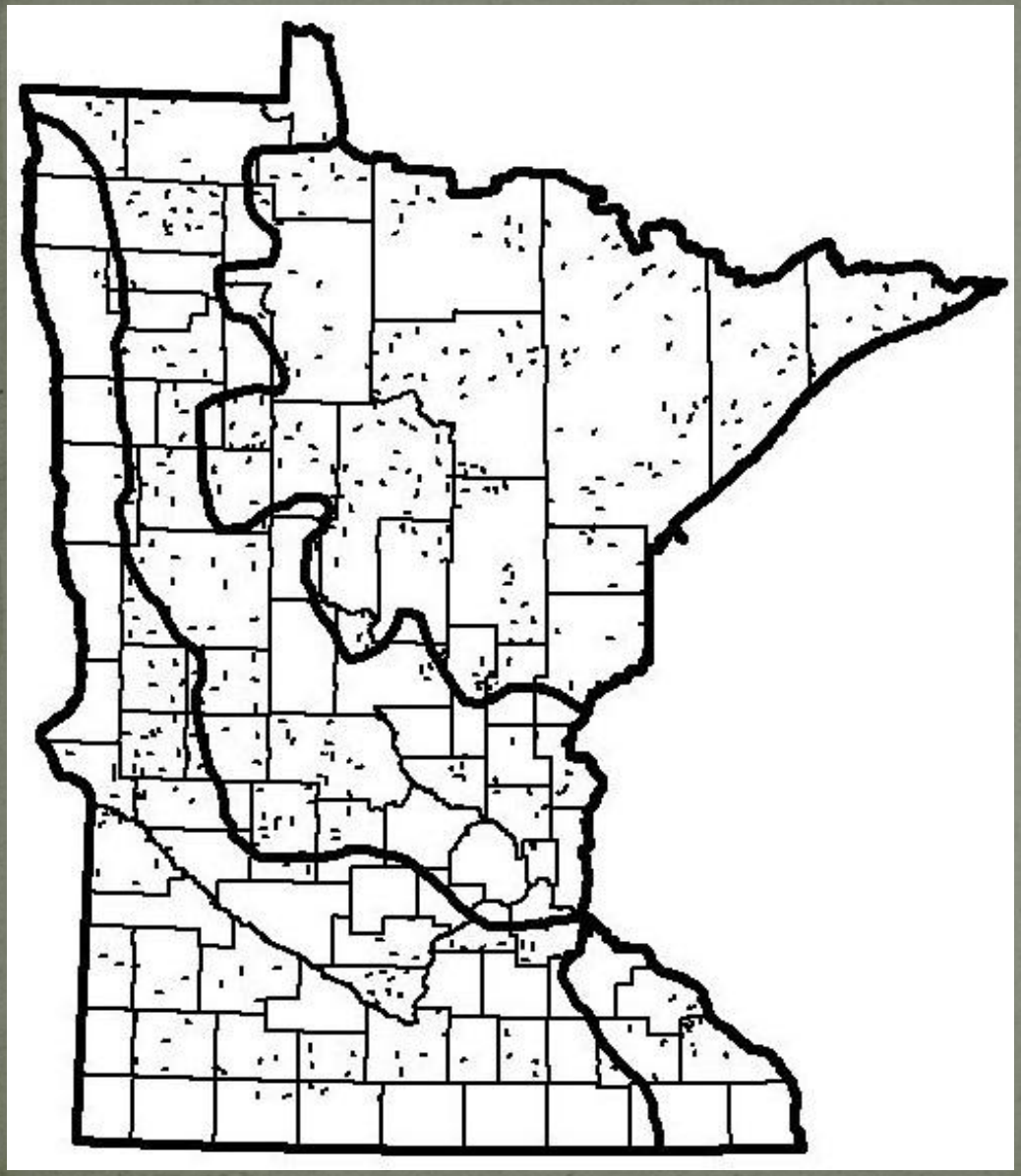
Comparison of Minnesota wolf surveys

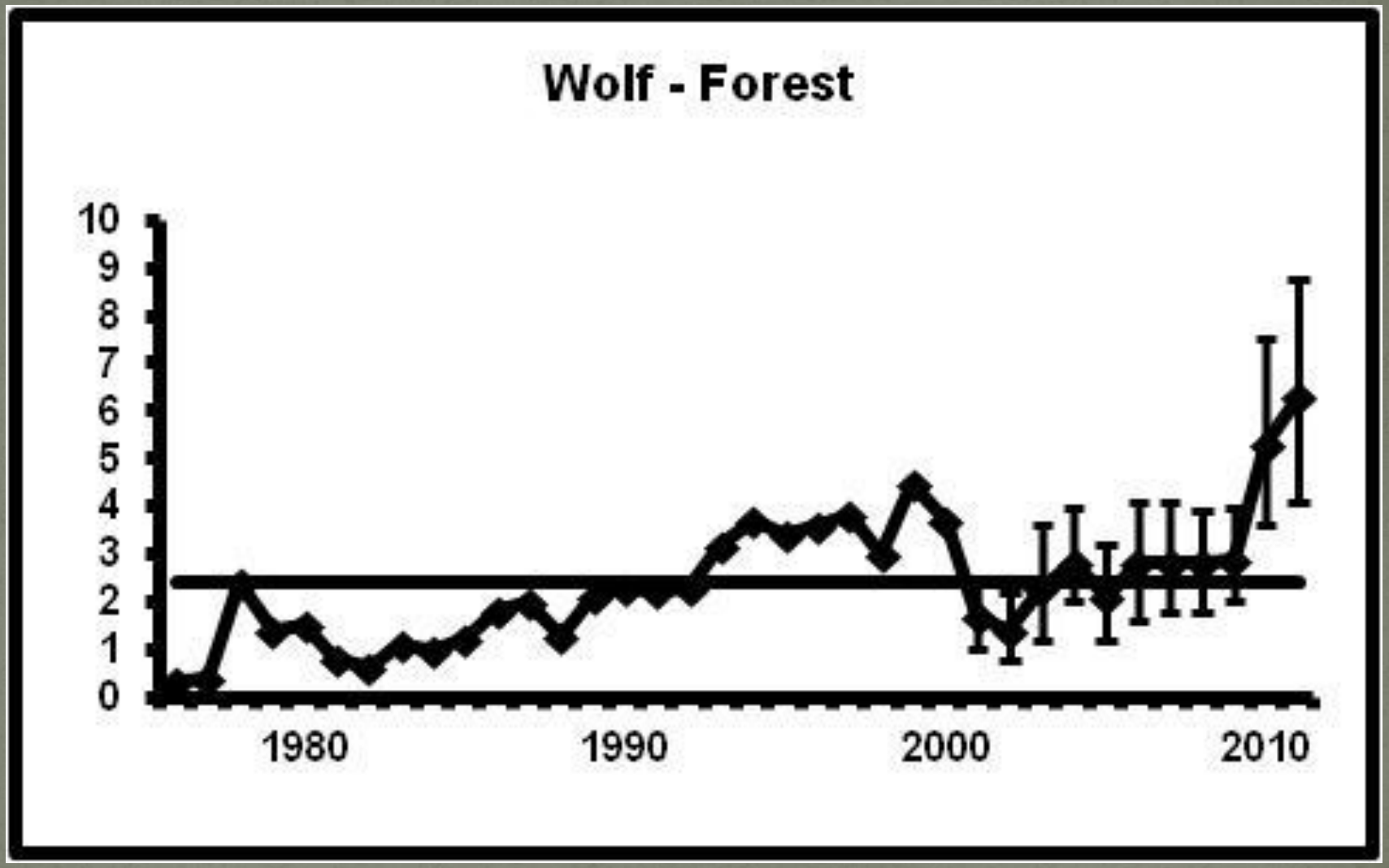
	1978-79	1988-89	1997-98	2003-04	2007-08
# field obsn's	480	1244	3451	1719	2710
Total range (km2)	36,500	60,178	88,325	88,325	88,325
Occupied Range (km2)	36,500	53,000	73,920	67,852	71,514
# radioed packs	--	108*	36	24	32
Ave. pack size	--	5.55	5.4	5.3	4.9
Ave. Territory Size (km2)	--	166	140	102	104
Estimated # packs	--	233	385	485	503
Population Estimate	1235	1500-1750	2445	3020	2,921
~ 90% CI			+/-500	+/-700	+/-650

Wolf Survey Methodology – Future Research Direction

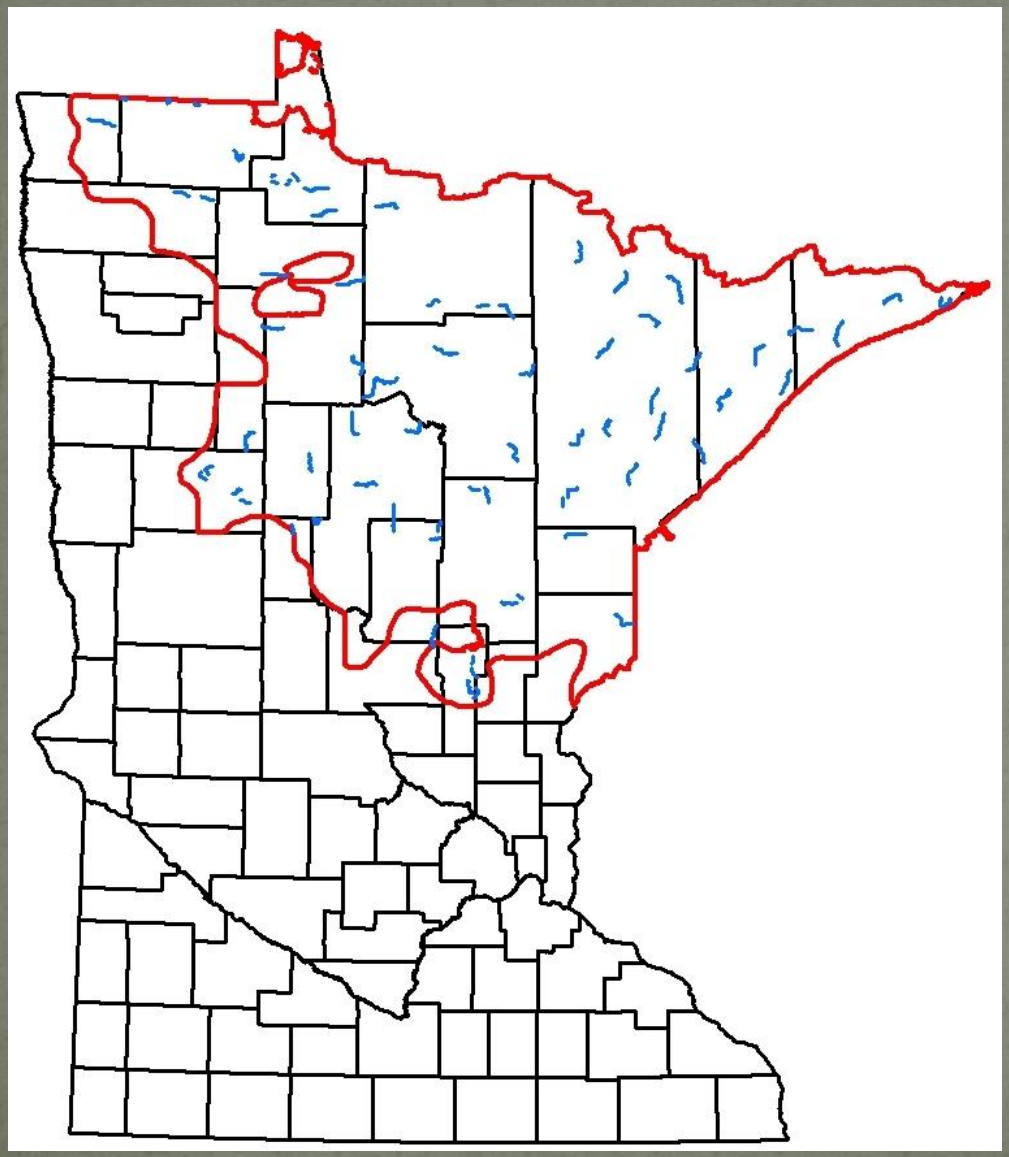
- **Sample size and geographic representation of radio-collared packs.**
- **Standardize (sample size and temporal distribution) telemetry location data used to construct territory boundaries; interstitial spaces?**
- **Consider more quantitative approaches for delineating range**
  - **Can we draw on home range methodology?**
  - **MCMC mapping – 'image reconstruction'**
  - **Occupancy models**
- **Spatial scale of range/occupancy mapping – is the township scale best?**
- **Human/road density model – time to update criteria? Add or replace with forest or deer criteria? When is a road a road?**
- **Confidence interval estimation – uncertainty in range delineation?**
- **New methodology??? SUPE method; Genetic mark-recap?**
- **HOW PRECISE DO WE NEED TO BE? Cost-Benefits?**

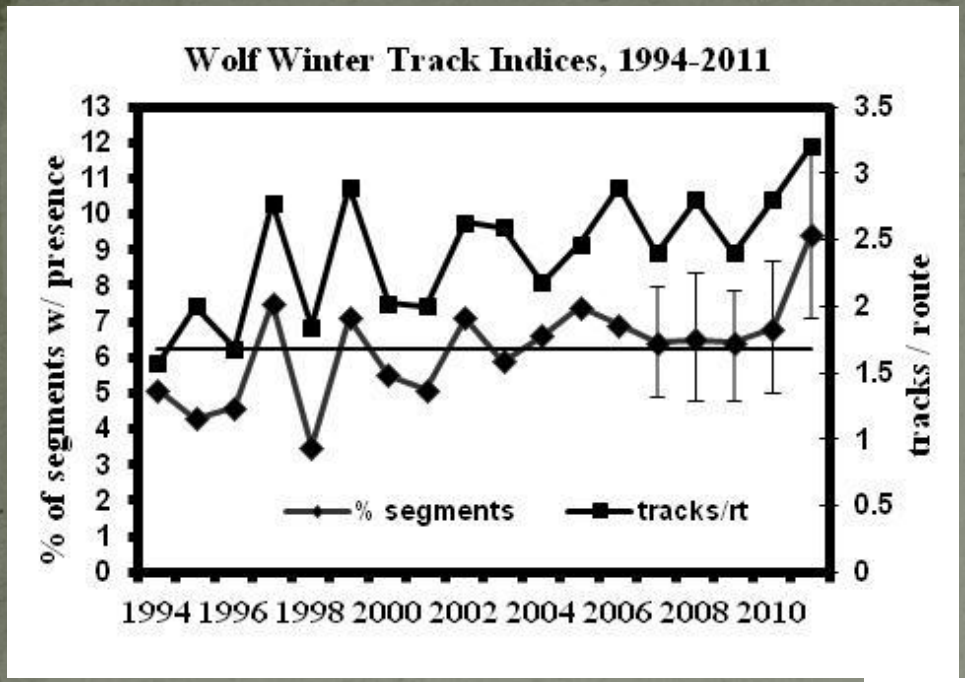
Scent Station Survey Routes

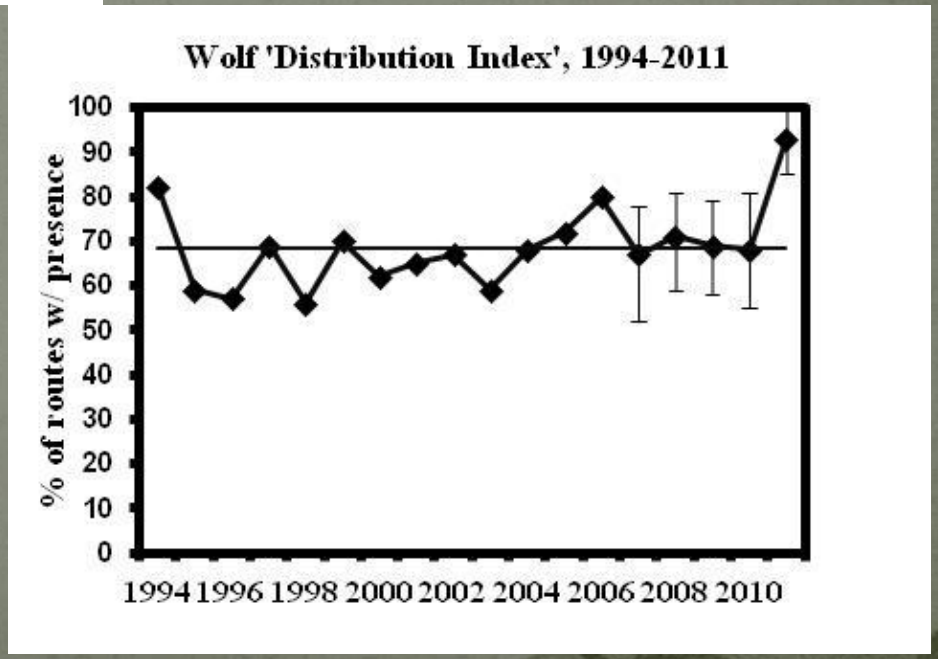


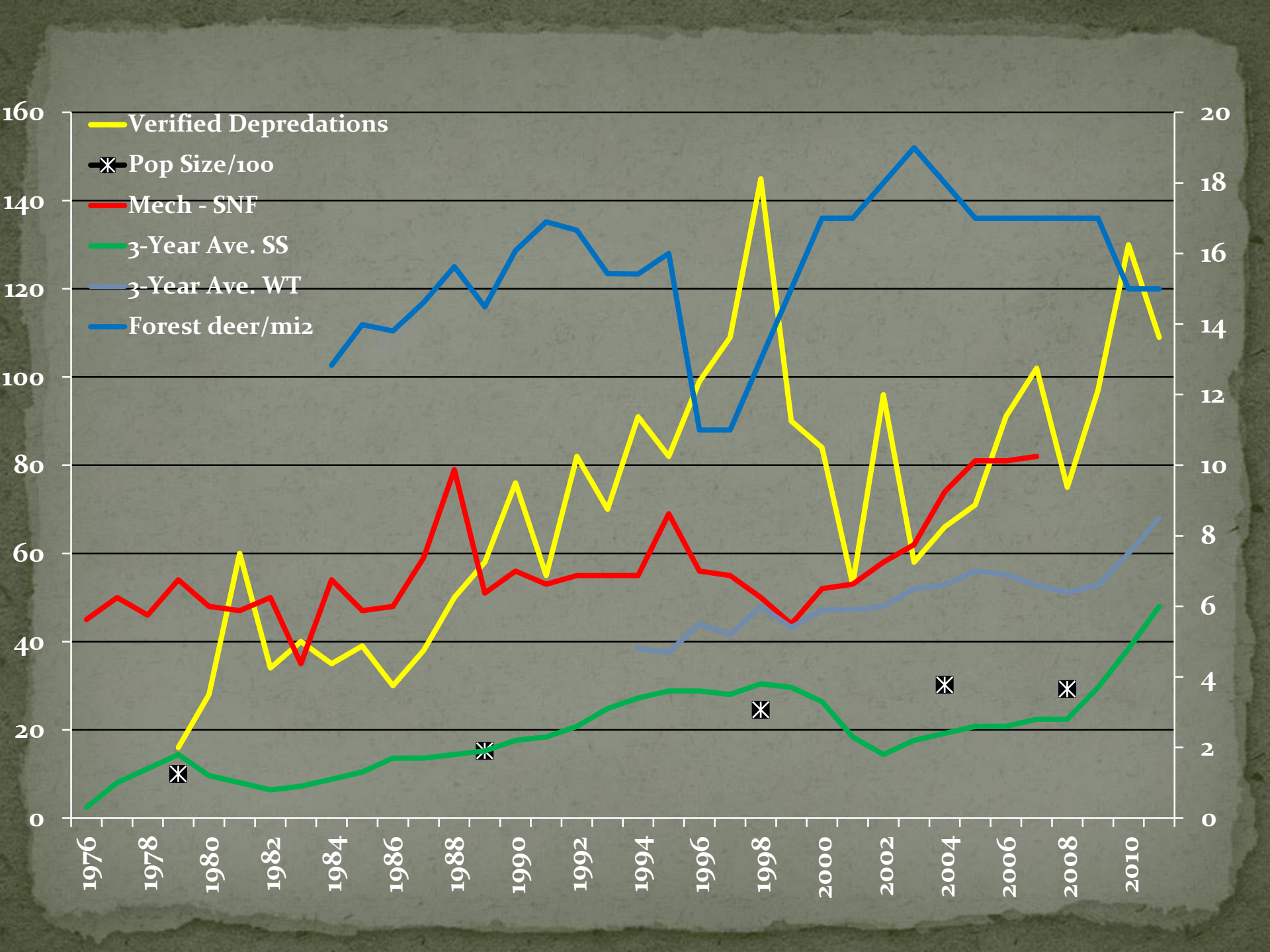

Wolf - Forest
10
9
8
7
6
5
4
3
2
1
0
1980
1990
2000
2010

Winter Track Survey Routes




Wolf Winter Track Indices, 1994-2011
% of segments w/ presence
tracks / route
% segments
tracks/rt
0
1
2
3
4
5
6
7
8
9
10
11
12
13
0
0.5
1
1.5
2
2.5
3
3.5
1994 1996 1998 2000 2002 2004 2006 2008 2010


Wolf 'Distribution Index', 1994-2011
% of routes w/ presence
0
10
20
30
40
50
60
70
80
90
100
1994 1996 1998 2000 2002 2004 2006 2008 2010


Verified Depredations
Pop Size/100
Mech - SNF
3-Year Ave. SS
3-Year Ave. WT
Forest deer/mi2
160
140
120
100
80
60
40
20
0
20
18
16
14
12
10
8
6
4
2
0
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

Alternative Population Estimation Methods

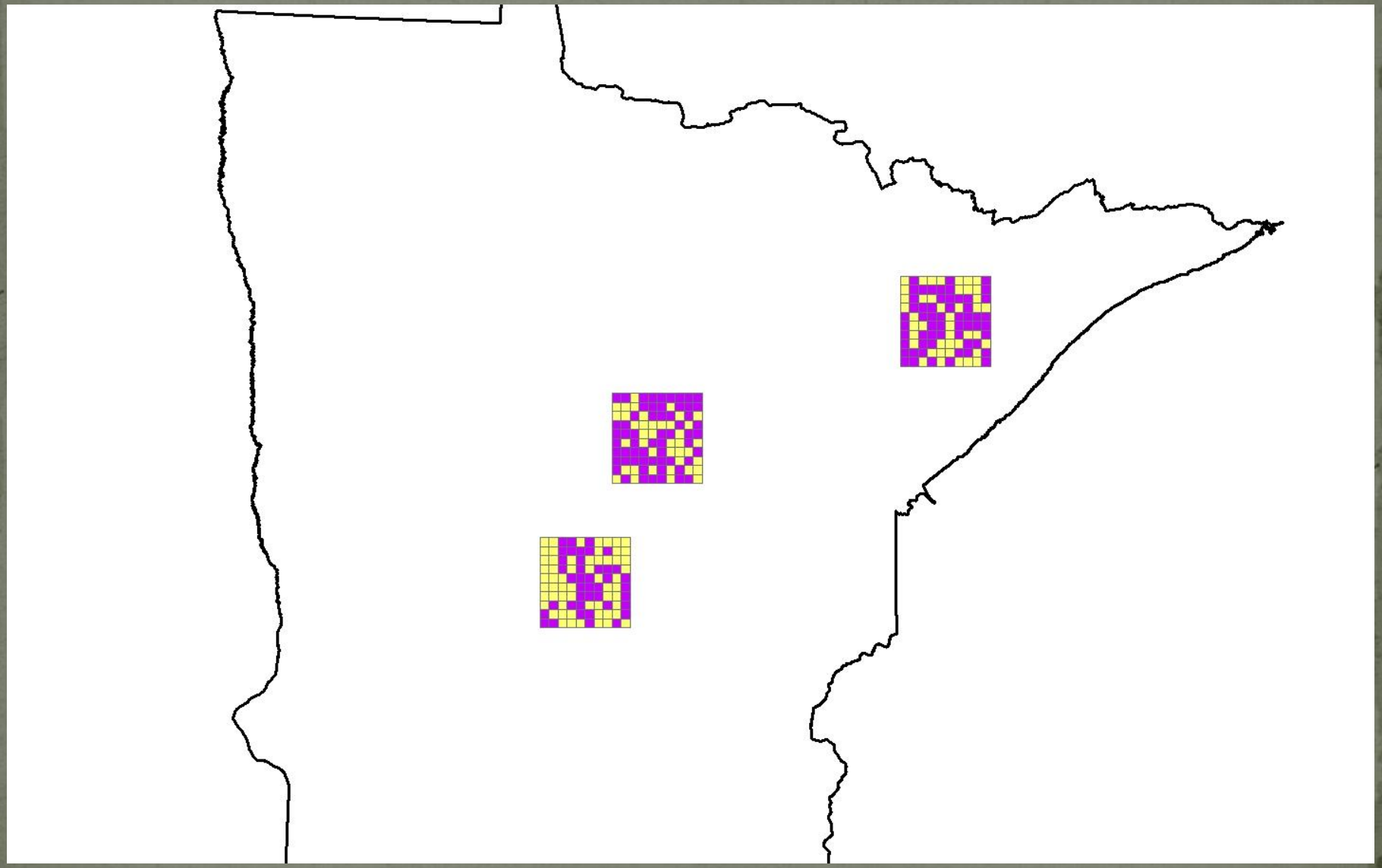
- Pack 'Census' / Territory Mapping
- Various detection-corrected counts
  - Mark-recapture (tags, DNA, biomarkers, etc)
  - Aerial Survey w/ estimate or model of detection
    - sightability model, distance-sampling, SUPE, etc
- Population Reconstruction
- CIR, CPUE
- Demography / Population Modeling

SUPE

- Subdivide study area into sample blocks (e.g., 3mi X 3mi grid)
- Stratify blocks according to expected wolf density (high, med, low)
- Select subsample from each strata (e.g., 50% high, 25% med, 10% low)
- After fresh snowfall, survey selected blocks from aircraft
- When track detected, must backtrack to 'start', and forward to wolves
  - Record track path, or at least all sample blocks wolves entered
  - Record group size

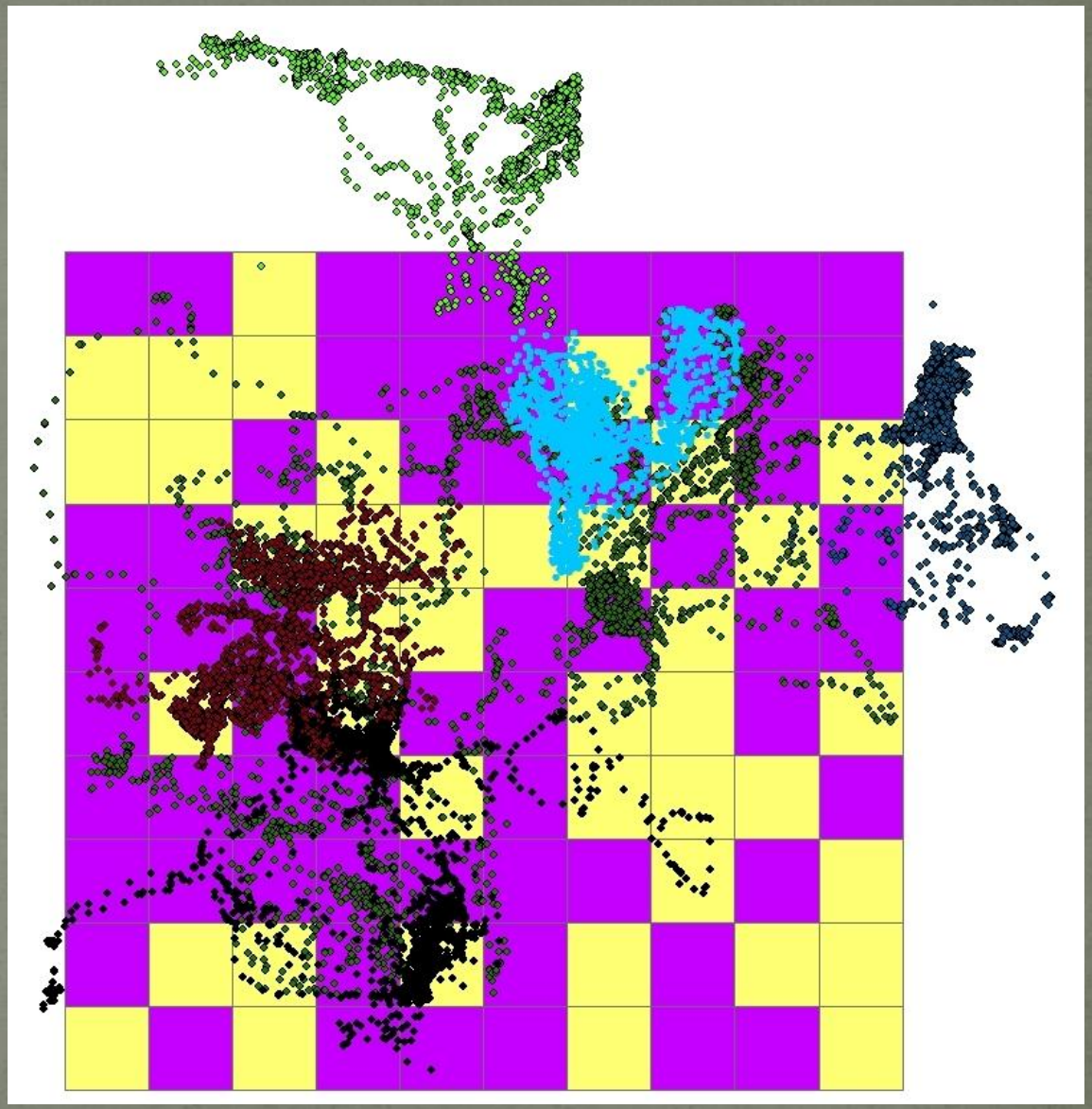
- Assumptions:
  - All wolves/groups detected
  - Track paths accurate and continuous
  - Group counts accurate
  - Spatially and temporally completed to ensure no double-counting

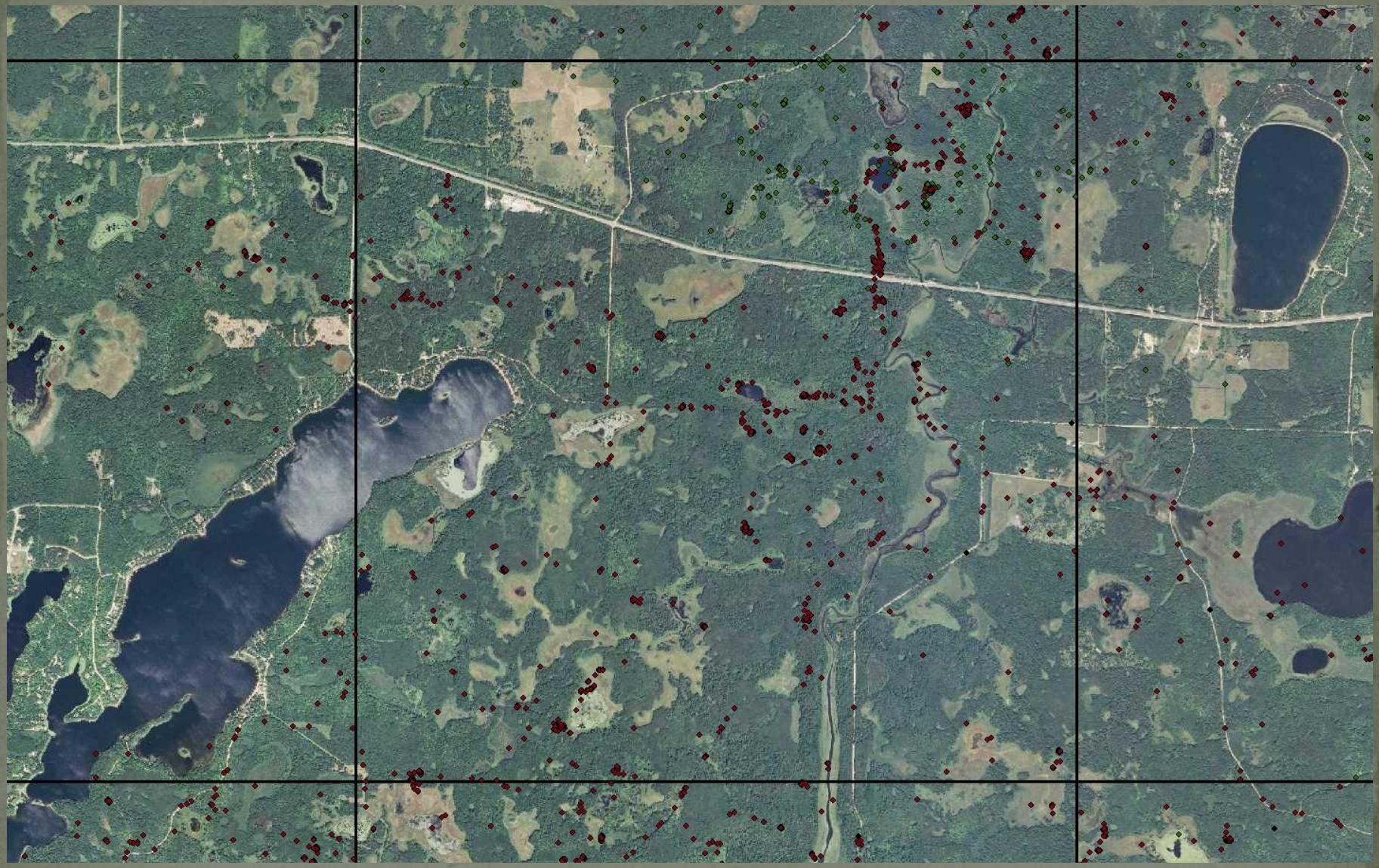
Study Areas – Stratify & Select Sample Plots



Collar wolves – GPS collars, recording every 15-30 minutes

- Detection?
- Correct track path?
- Correct count?
  - Plane v chopper
- Double count?

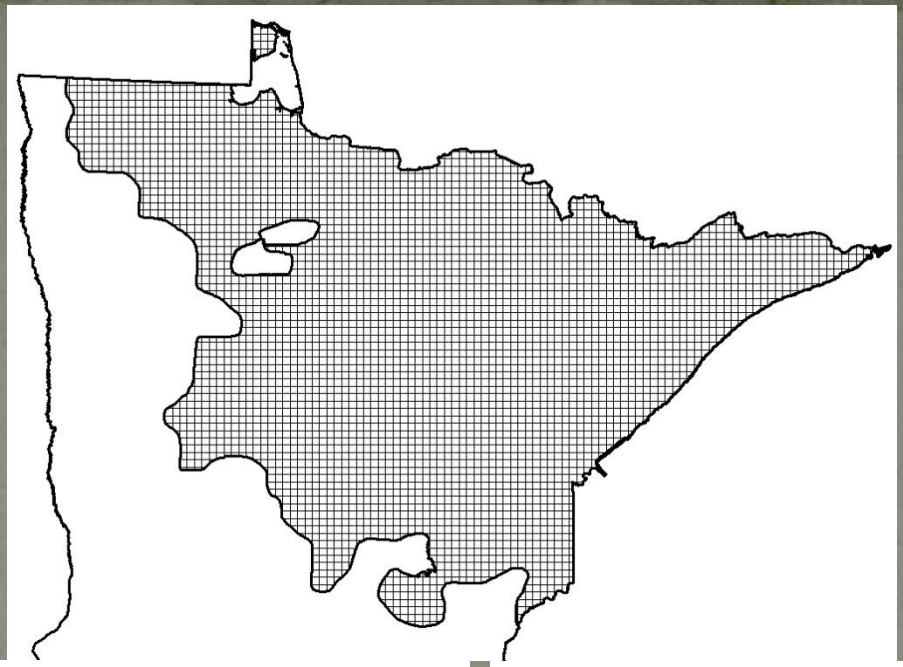


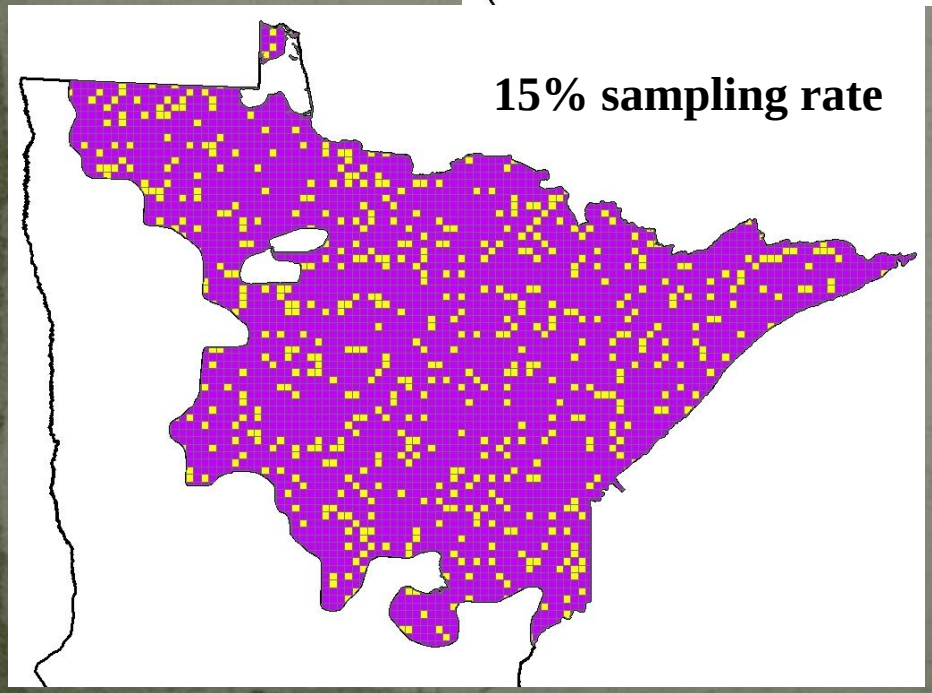


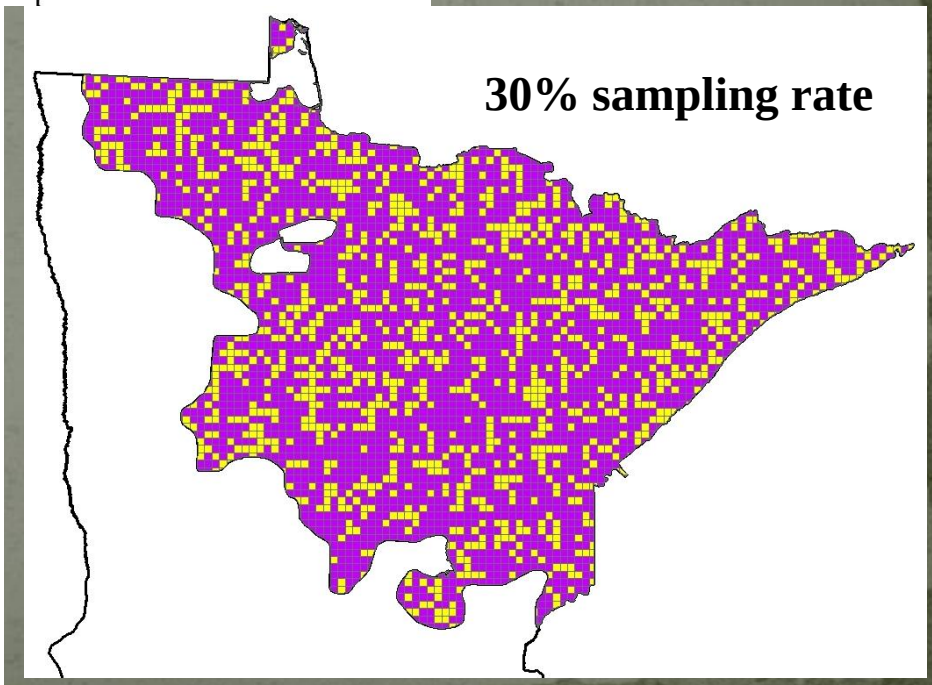
Results

- I wish I knew!!!
  - But I have concerns
    - aircraft availability
    - optimal snow, enough times
    - optimal flying conditions after fresh snow
    - track path difficulties
      - sparse snow
      - deep snow
      - deer….lots
    - accurate group counts in dense cover
    - helicopter may be required - $$$$$
  - We still have useful GPS data yet to analyze regarding optimal search pattern, so not all has been for nothing

  - Even if all else works out, is there enough time during the course of 1 winter??




15% sampling rate


30% sampling rate

Hybrid Approach??