



NSF#1504934



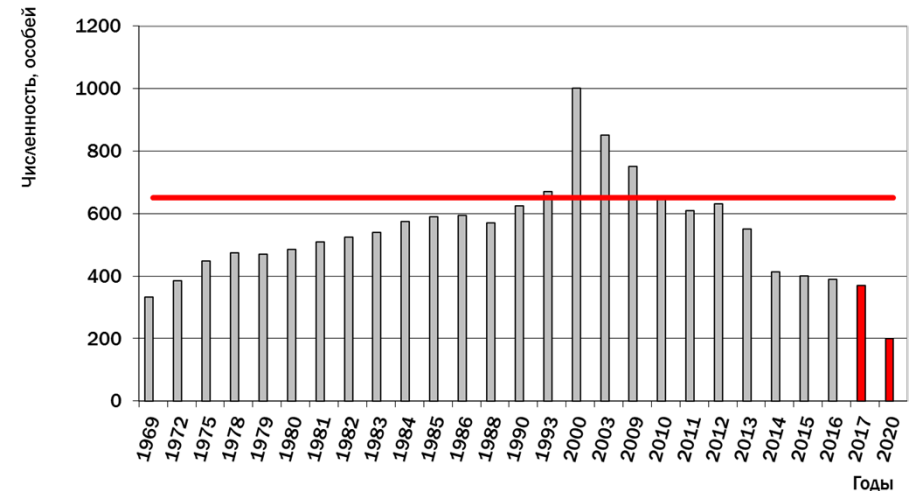
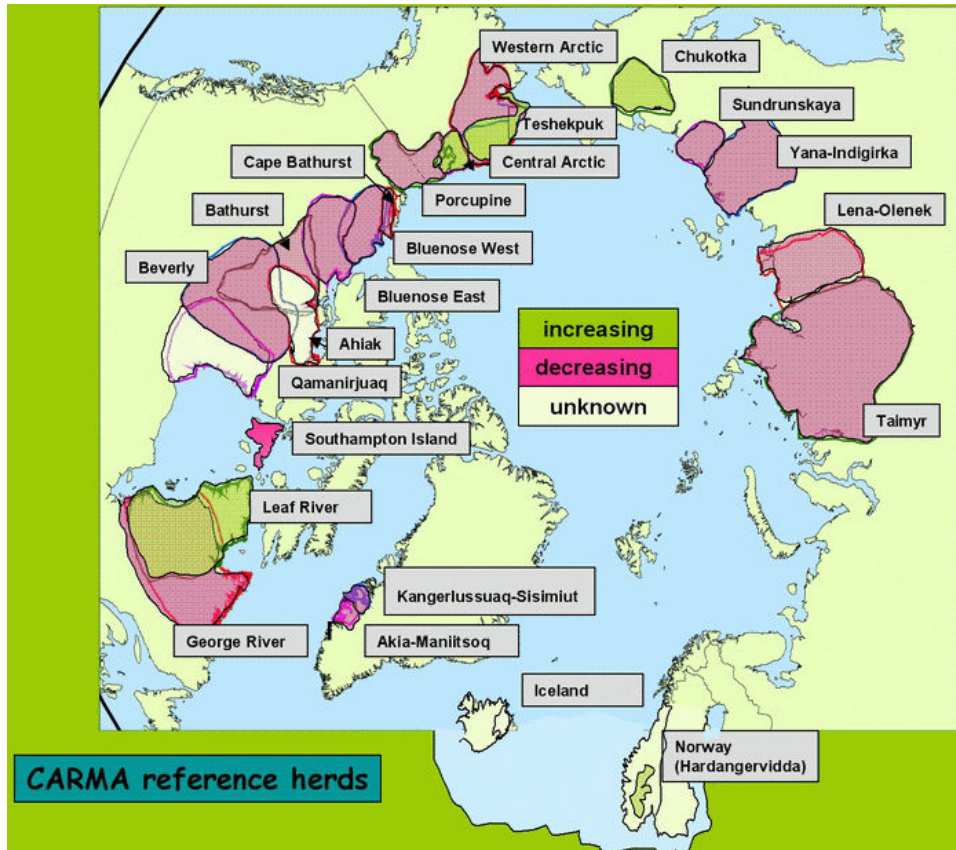
Taimyr Reindeer and Environmental Change: Monitoring Wild Reindeer Migration in Changing Natural and Social Environments

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Declining Reindeer/Caribou Populations!

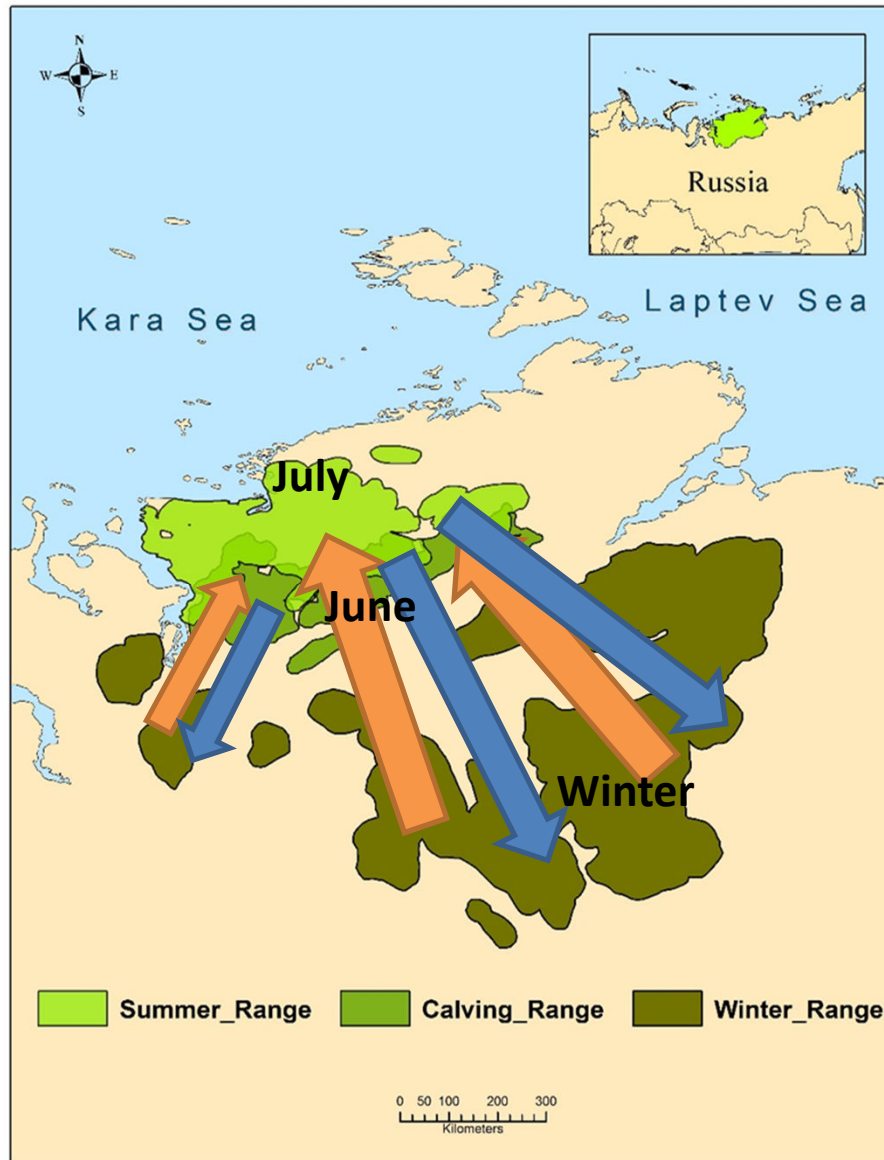


Фактическая динамика
 Прогнозируемая динамика
 Оптимальный уровень

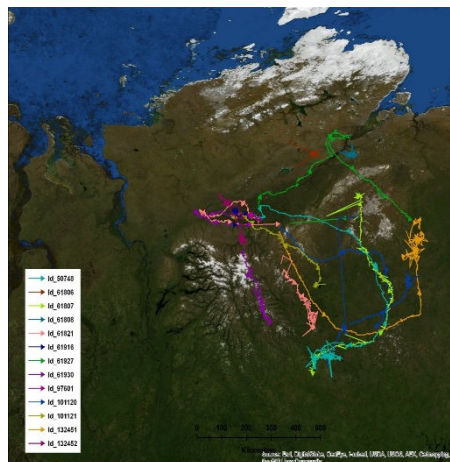


Source: CircumArctic Reindeer Monitoring and Assessment (2014)

Observing Shifts in Wild Reindeer Migration: airborne and satellite data



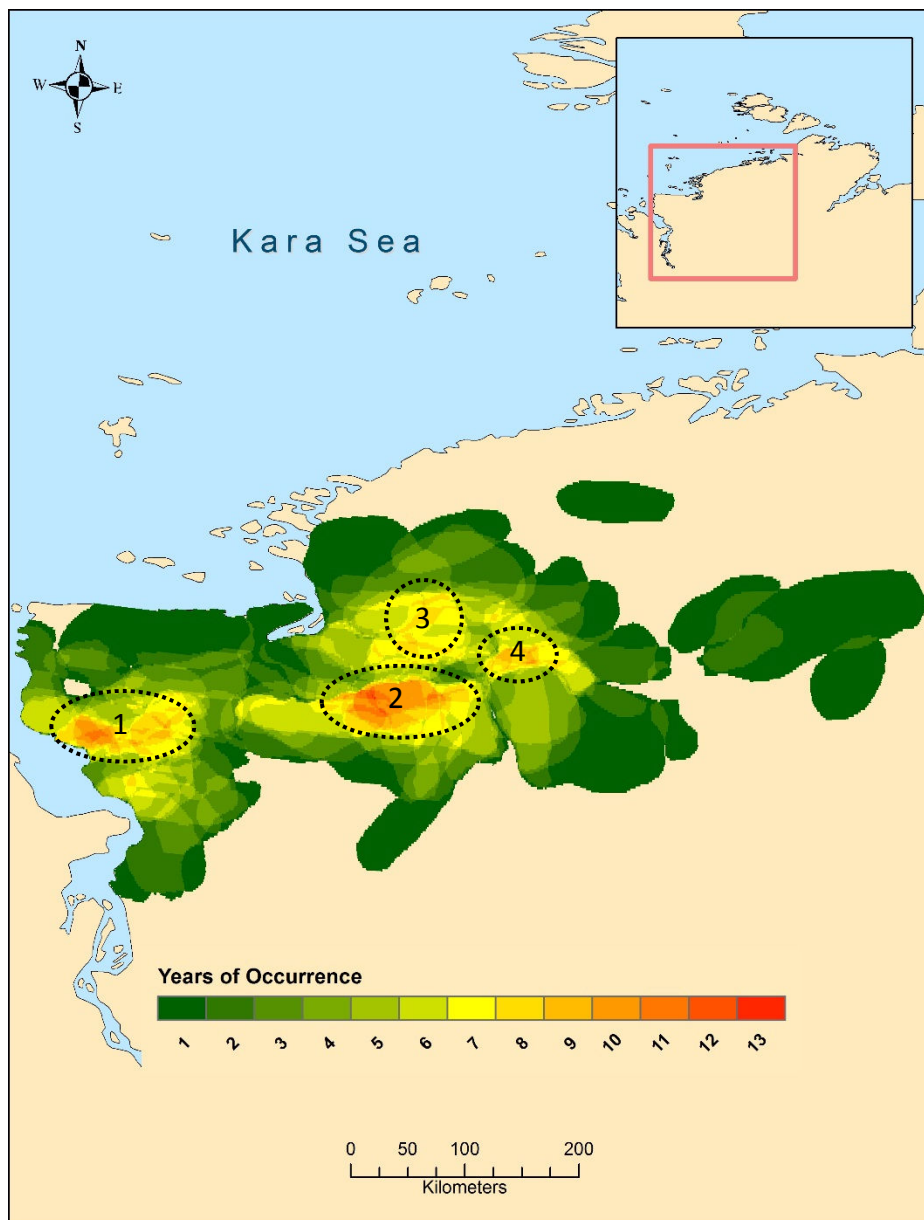
Real-time
tracking using satellite collars



Landsat land cover data



Results: Spatial Fidelity and Shift Confirmed



Temporal variation **STRONG SPATIAL FIDELITY**

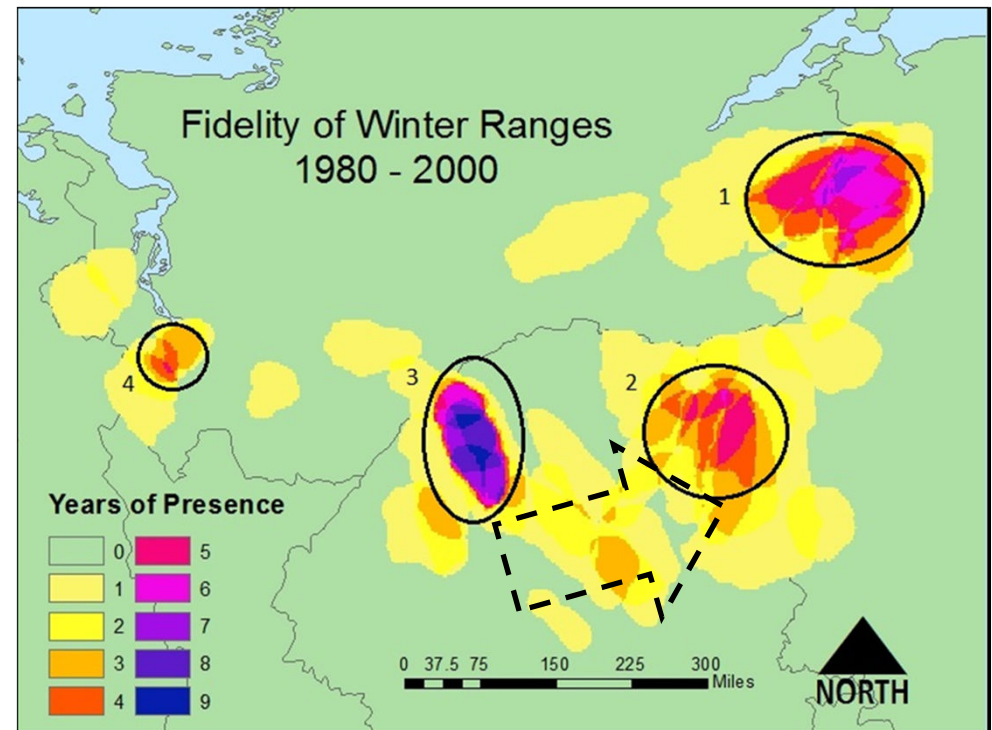
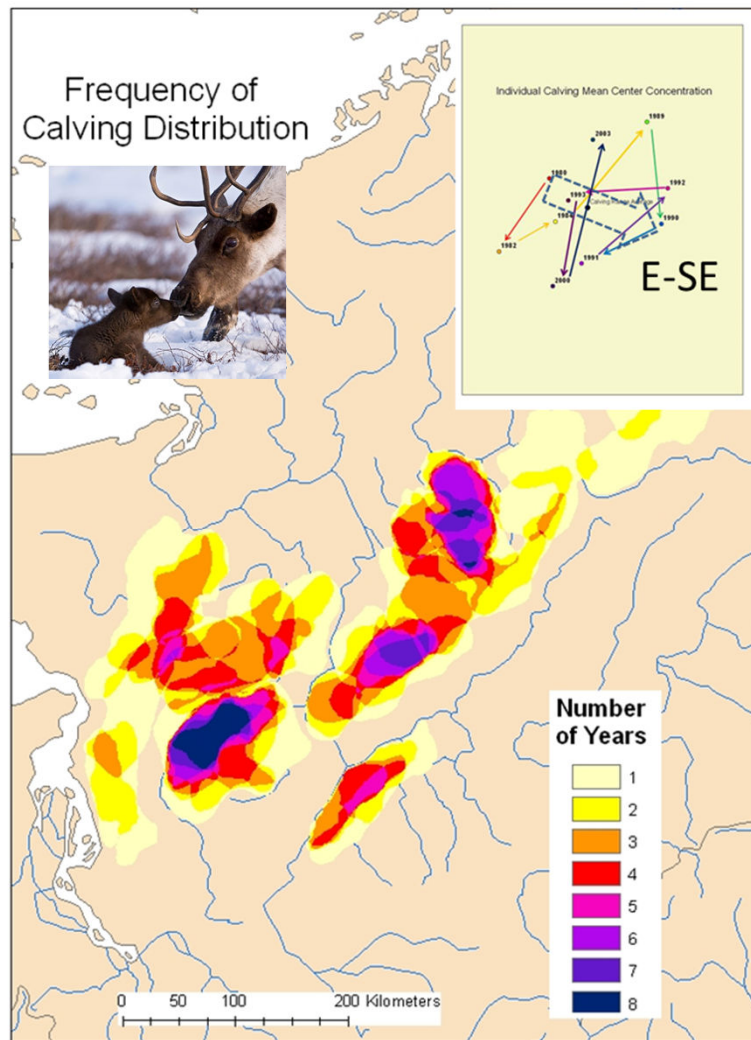
SUMMER Fidelity:

- Compact distribution of annual summer grounds
- 4 areas identified as frequently used (> 50%)

Change (since 2000):

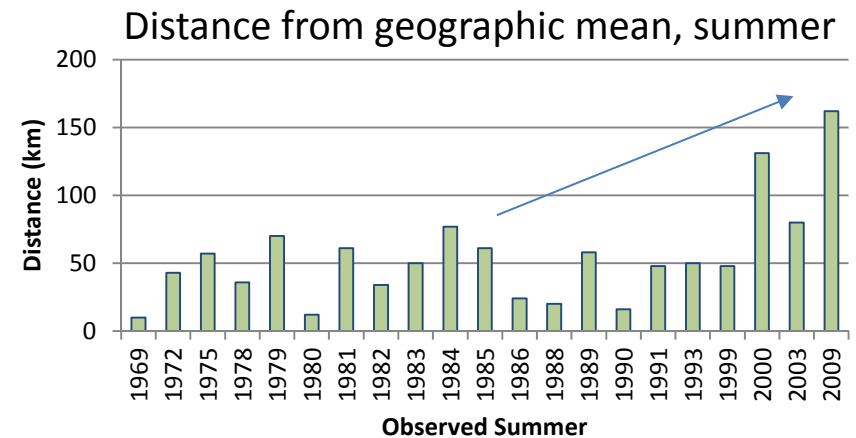
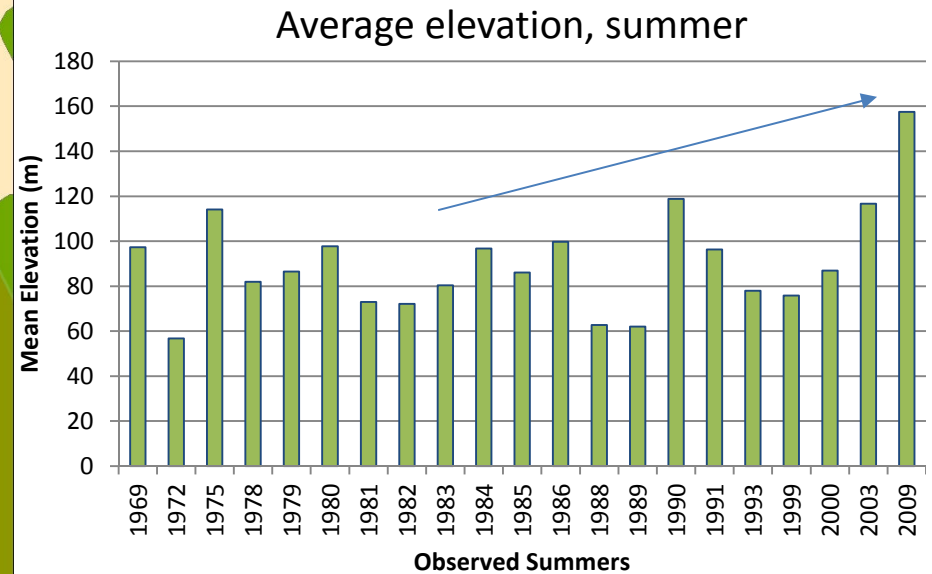
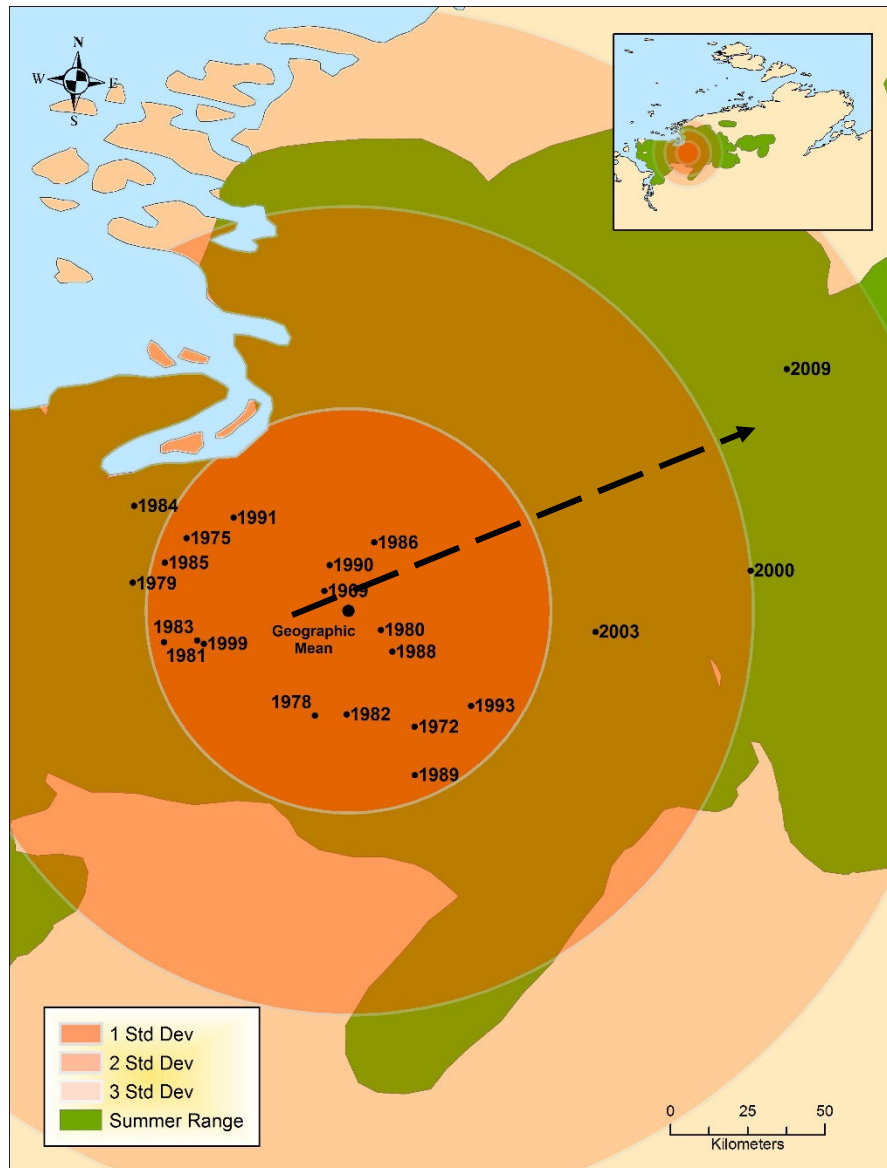
- Deviate **further away** from historical locations
- Summer concentrations are shifting to the **east and north**
- Re-utilizing smaller percentages of range
- Summer grounds **rising in elevation**
- Populations **declining in western habitat**

Calving and winter shifts: East



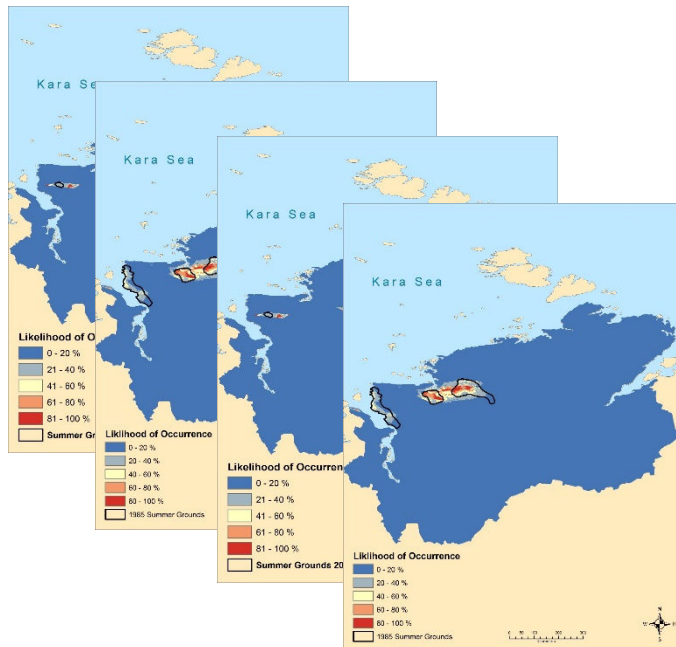
- ☐ Longer distances to travel between calving and summer ranges
- ☐ Increasing calf mortality
- ☐ Forced to cross open rivers

Results: East, North, High



Results: Habitation/mobility factors

Variable contributions in ecological niche models



Variables	Habitat-wide	
	1985	2000
Temperature	21.1%	32.2%
Wind	57.6%	15.9%
Precipitation	18.5%	16.5%
Elevation	0.7%	0.4%
Previous Areas	2.1%	35.1%

Optimal ranges for reindeer summer habitation

Variables	Habitat-wide	
	1985	2000
Temperature	7° - 9° C	6° - 8.5° C
Wind	6.1 - 6.7 m/sec	5.5 - 6.7 m/sec
Precipitation	10 - 25 mm	18 - 24 mm
Elevation	0 - 210 m	0 - 210 m

Results: How does reindeer presence affect vegetation?

Large herd observed in July 2000
Moved on north in two weeks

Mean NDVI values on 7/26/2000

Within: .369

Outside: .391

Difference: 0.228

Mean NDVI values on 8/11/2000

Within : .451

Outside: .469

Difference: 0.184

Depression, but quick
recovery of NDVI





Take home messages

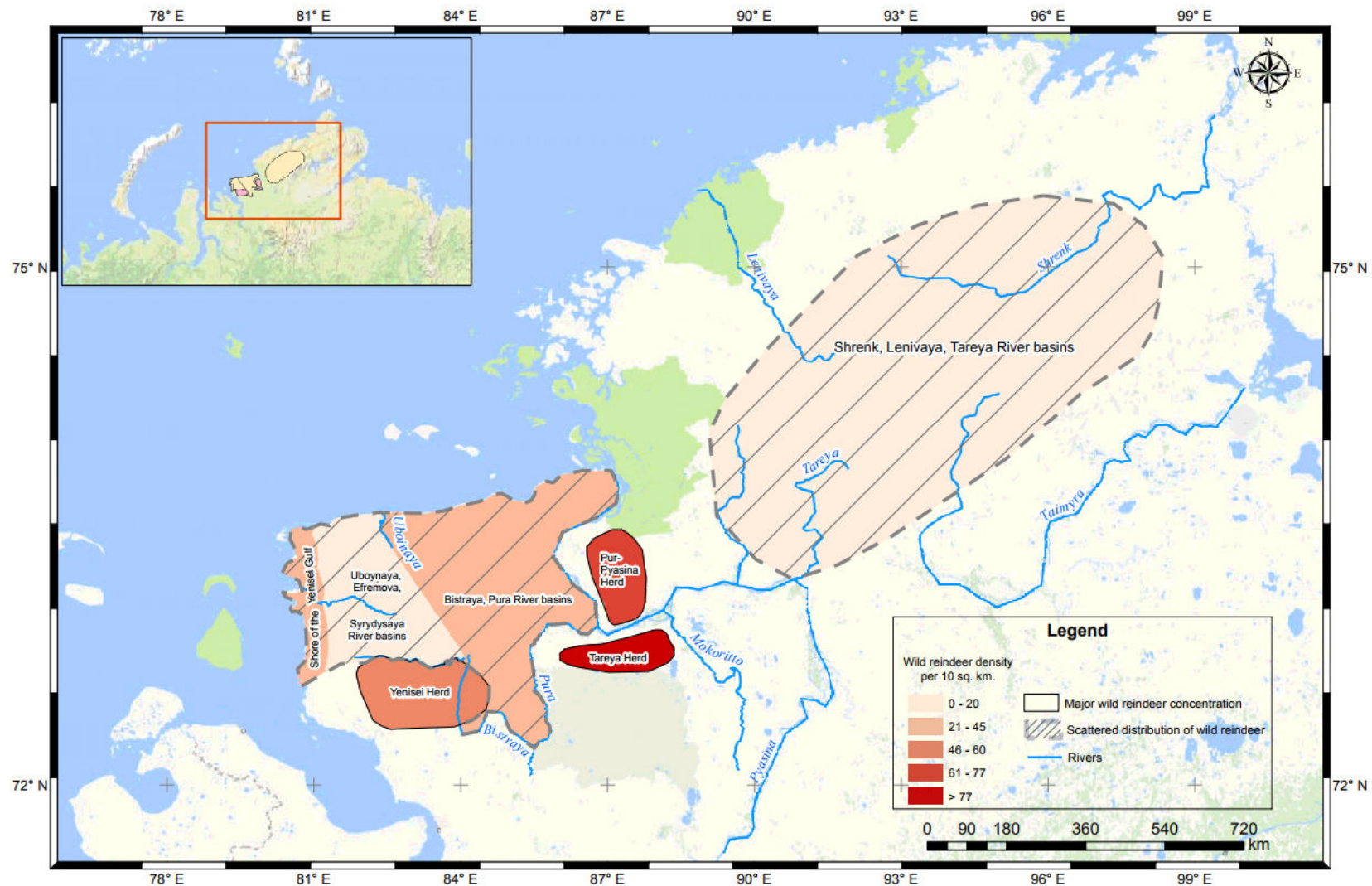


- ❑ Strong evidence of long-term **spatial fidelity**
- ❑ Recent **migration shift** in summer habitats (N-NE): colder and higher elevations
- ❑ Recent spatial shift in calving areas (S-SE)
- ❑ Increasing distance between summer and calving and winter grounds: larger migration distances
- ❑ Likely effect of climate change: warmer temperatures, increased mosquito harassment, rivers open early
- ❑ Human activity: industry in the western part of the habitat
- ❑ Presence of reindeer depresses “greenness”, but vegetation quickly recovers: natural ability to sustain the habitat?

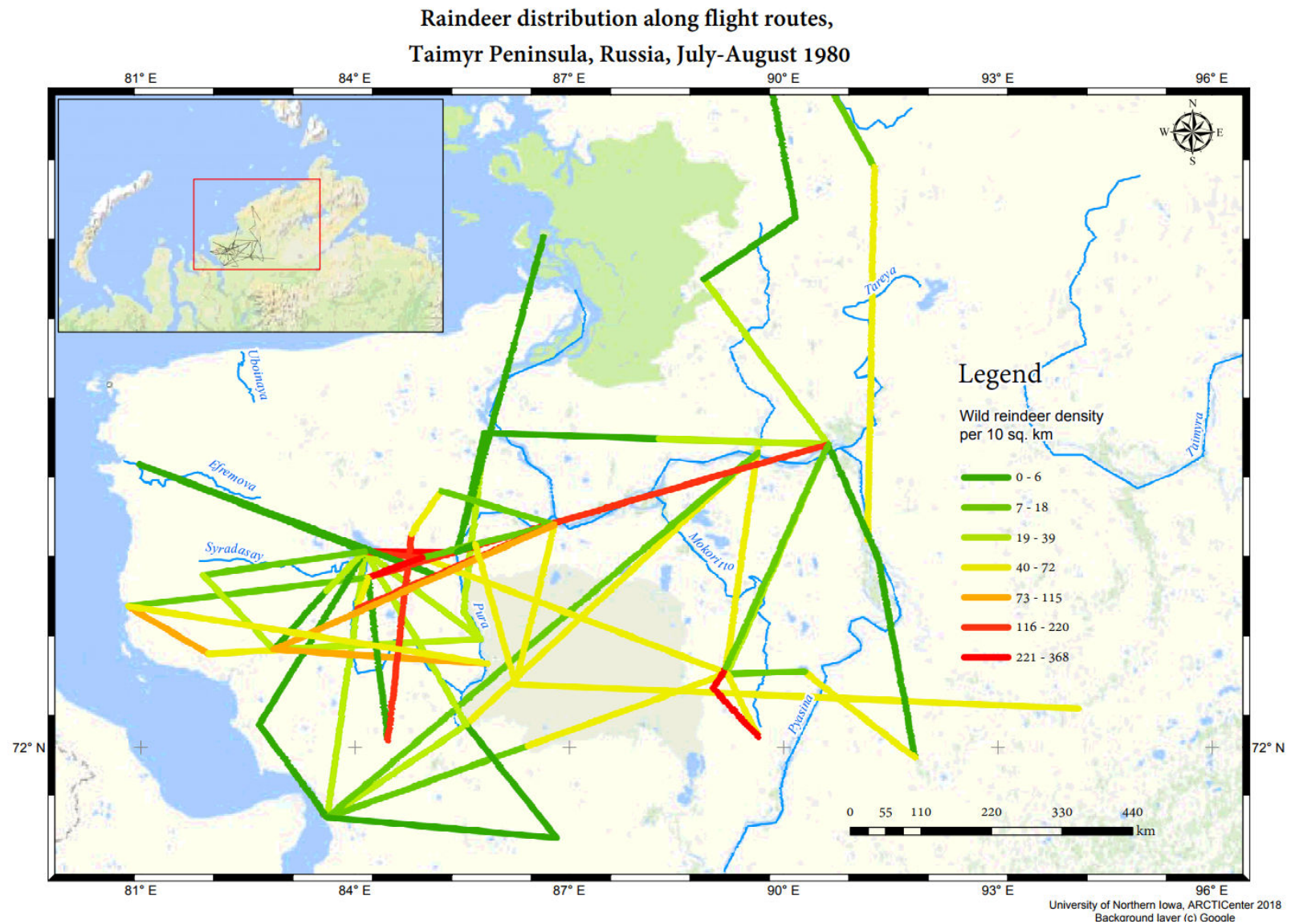
TAMARA: Taimyr Reindeer Migration Reanalysis



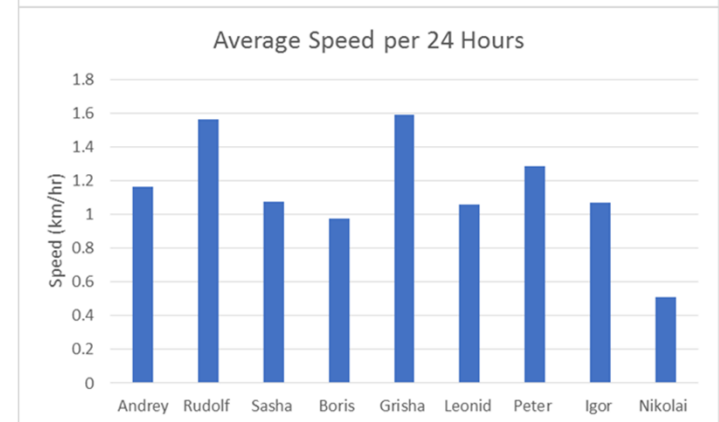
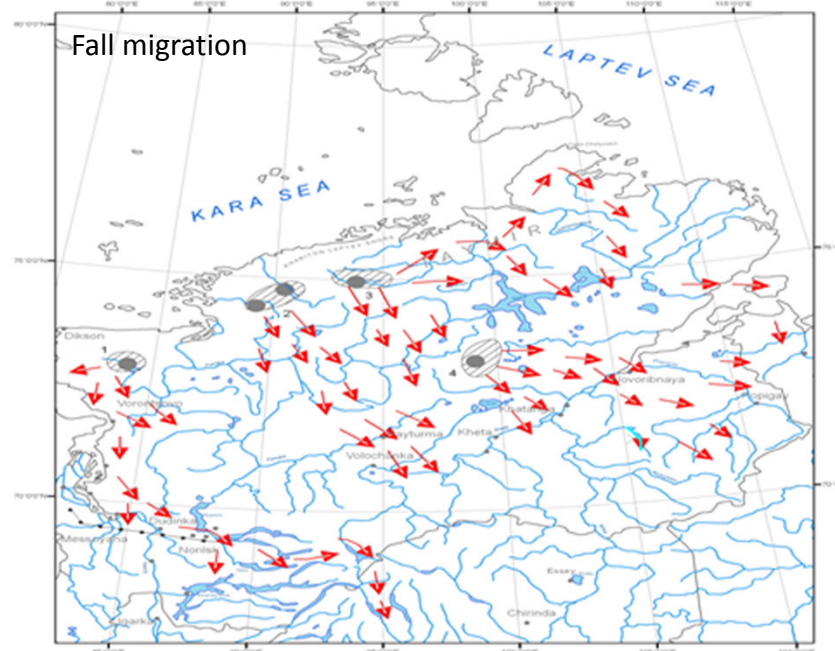
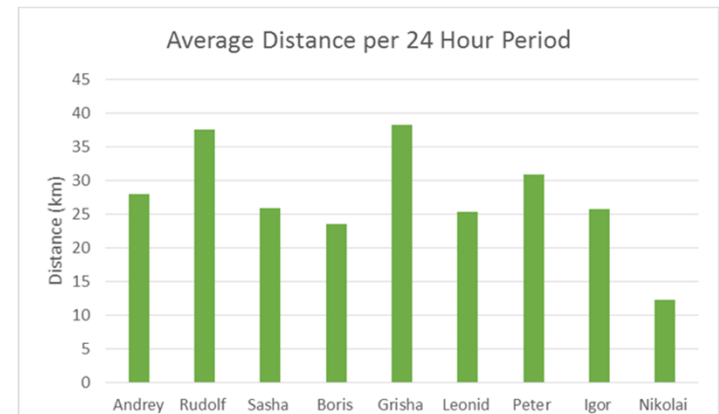
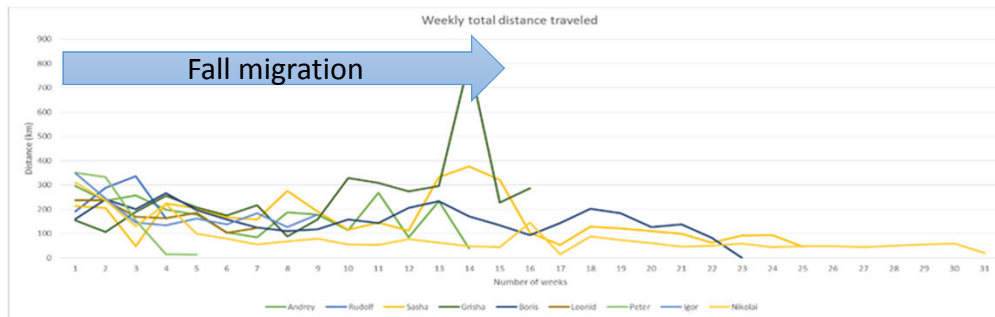
Wild Reindeer Distribution and Density,
Taimyr Peninsula, Russia, July-August 1982



TAMARA: Taimyr Reindeer Migration Reanalysis



Taimyr reindeer migration: new data from satellite monitoring



Collar data collected by the
Central Siberian Nature Preserve
2013-2014