

From the avoidance of human disturbances to cumulative habitat loss for migratory caribou in northern Québec and Labrador

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1.



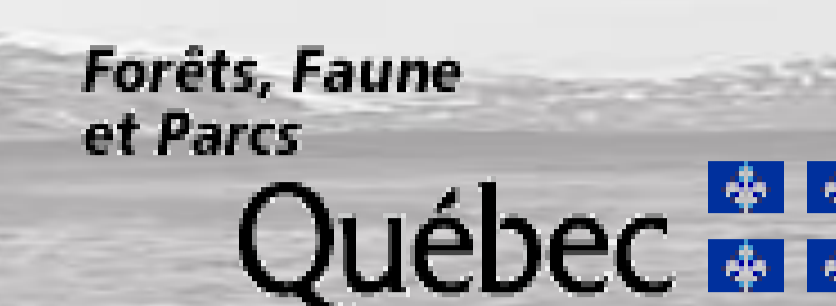
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CONTEXT

Caribou and reindeer populations are declining in boreal and arctic regions. Human development in their ecosystems is suspected to cause of this generalized decline.

In the last decades, northern Québec and Labrador (Canada) have experienced an increase in industrial disturbances (Fig.1). During this period, migratory caribou of the Rivière-aux-Feuilles (RAF) et Rivière-George (RG) herds have dramatically declined.

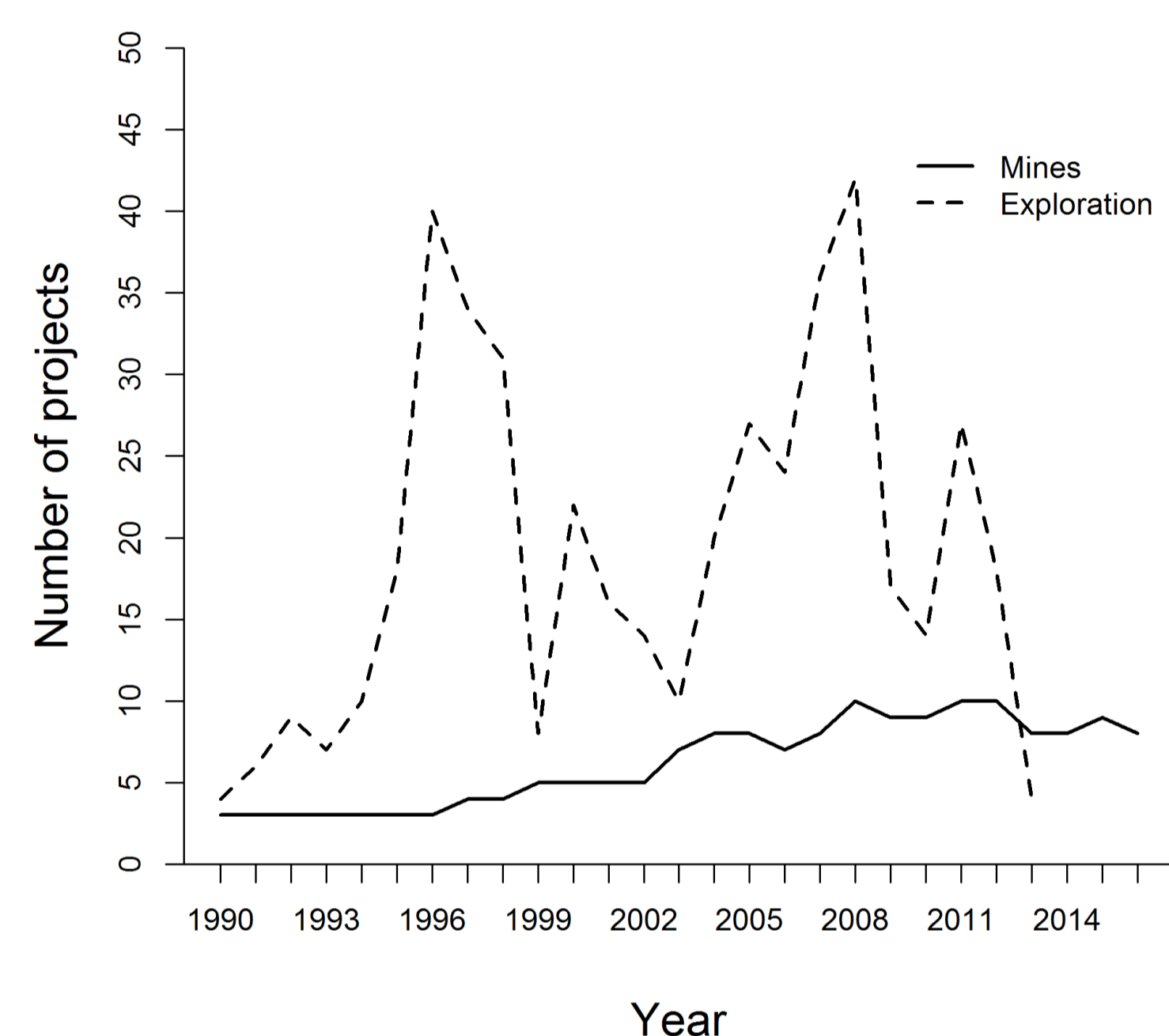


Figure 1. Evolution in the number of industrial disturbance from 1990 to 2011 in northern Québec and Labrador

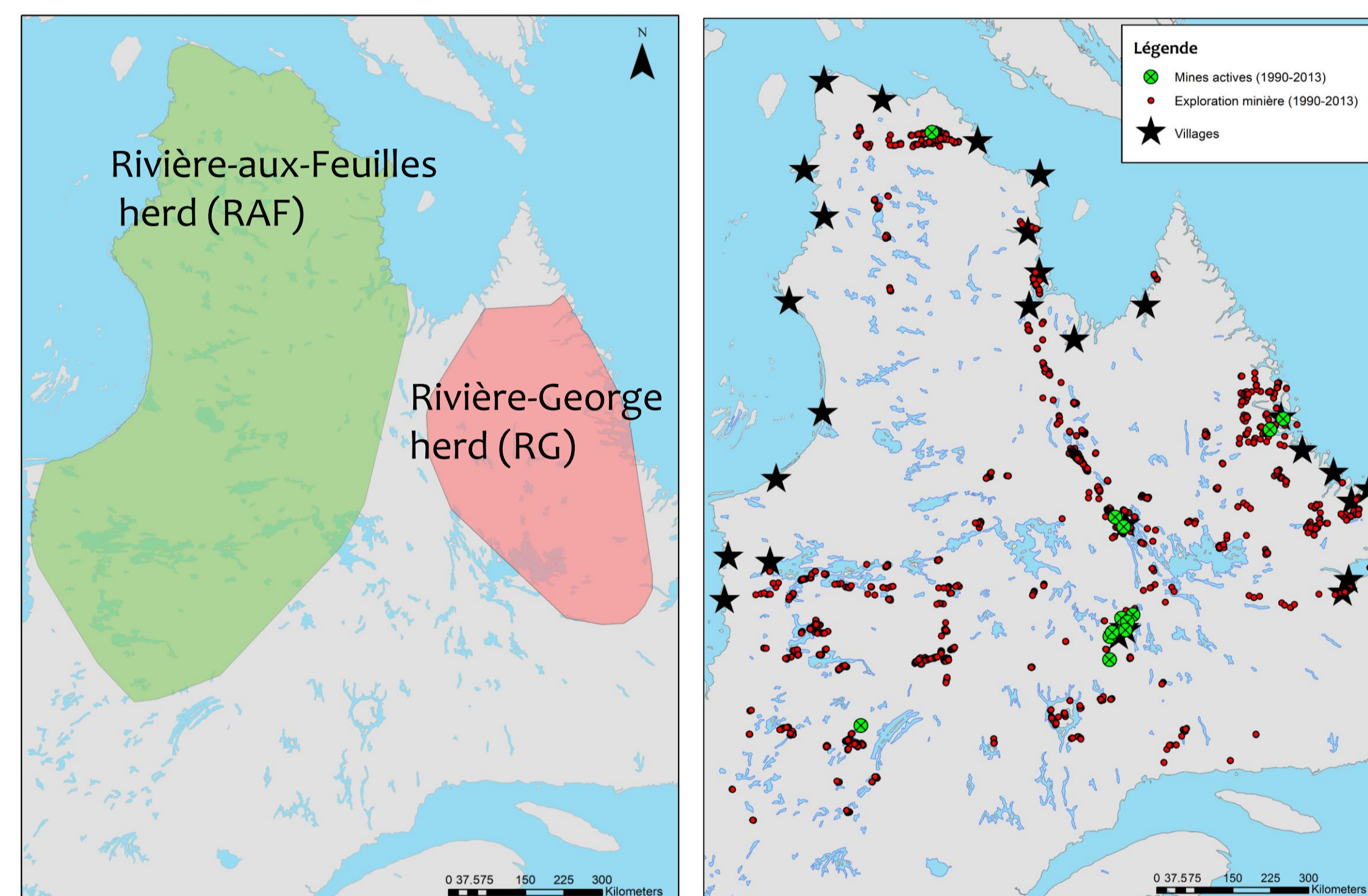


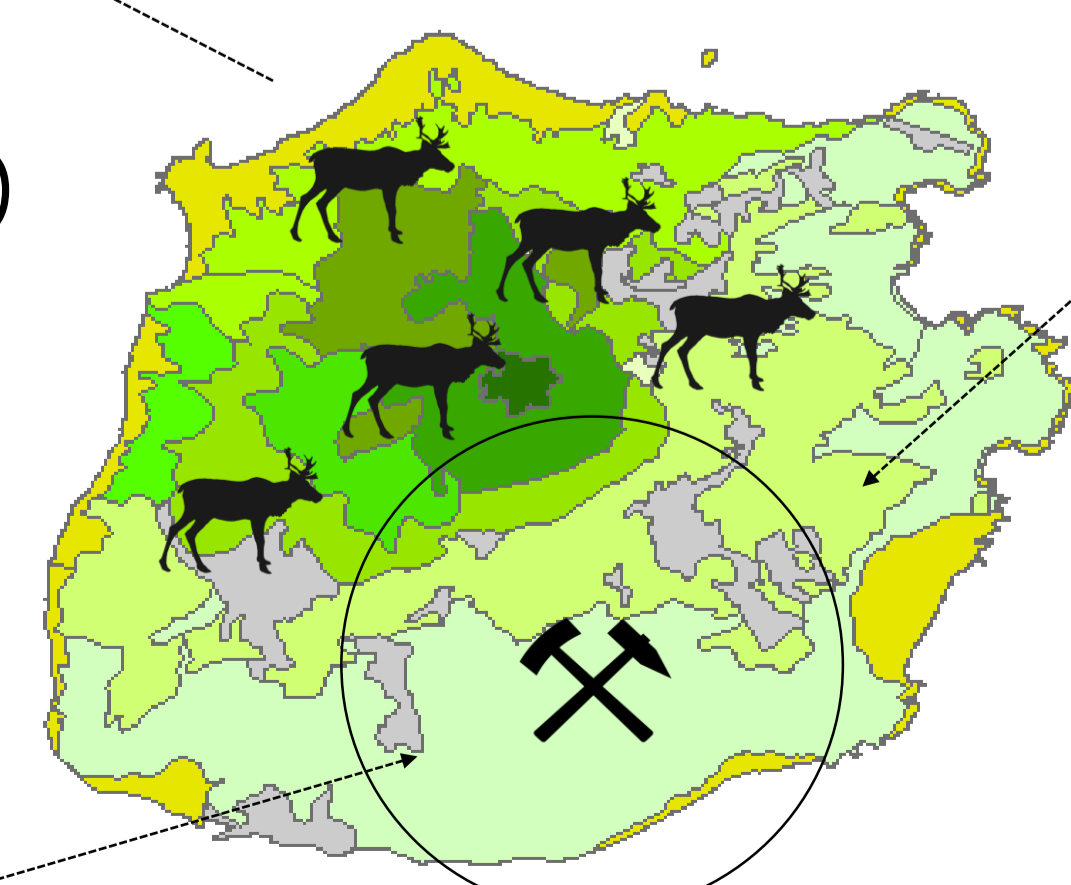
Figure 2. Distribution of caribou of the RAF and RG herds and human disturbances (1990-2013)

OBJECTIVES 1- Evaluate the zones of influence (zones avoided by caribou) of human disturbances for the RAF and RG herds

2- Quantify cumulative habitat loss caused by the avoidance of human disturbances

METHODOLOGICAL APPROACH – DISTINGUISH HABITAT AND DISTURBANCE EFFECTS

- Evaluate habitat selection patterns in undisturbed areas (GPS collars):
 - Vegetation cover
 - Vegetation productivity (NDVI)
 - Distance to coast (wind/insects)
 - Elevation



- Predict habitat use around disturbance (based on habitat characteristics only)

- Determine the zone of influence (0-50 km): Selection ratio < 1 = avoidance

- Compare observed use (GPS collar) to predicted use (habitat selection model) at various distances from the disturbance:

$$\text{Selection ratio } i = \frac{\text{Observed use (habitat+disturbance)}}{\text{Predicted use (habitat only)}}$$

RESULTS

Zones of influence for human disturbances in summer and winter ranges of the RAF and RG herds

	Mines	Exploration	Villages	Roads	Power lines
RAF (summer)	19-21 km	2 km	2-4 km	0-16 km	----*
RG (summer)	----*	4 km	----*	----*	----*
RAF (winter)	----*	3-21 km	0 km 2-18 km (hunt)	2-3 km 0-15 km (hunt)	0 km
RG (winter)	----*	----*	----*	0 km 0-2 km (hunt)	----*

----*: No disturbance in range or ZOI undertermined

Cumulative area and high-quality habitat* loss caused by disturbance avoidance (in % of range and km2)

	Cumulative area loss	Cumulative high-quality habitat* loss
RAF (summer)	1.5-2.2% (2,709-4,209 km ²)	0.7-1.6% (179-3,980 km ²)
RG (summer)	0.1% (91 km ²)	0.02% (9 km ²)
RAF (winter)	4.6-6.7% (1,354-3,169 km ²)	3.7-7.3% (312-1,304 km ²)
RG (winter)	0% (0 km ²)	0% (0 km ²)
RAF (winter hunting)	0-20.5% (0-4,339 km ²)	0-23.8% (0-2,854 km ²)
RG (winter hunting)	3.1% (555 km ²)	4.7% (307 km ²)

*High-quality habitat : Identified with a contrast validation index (CVI : Fedy et al 2014 Wild. Monogr.), which identify habitat quality threshold (minimal RSF score) that includes the most caribou locations within the smallest area.

CONCLUSIONS

Migratory caribou populations have fluctuated in the past, but recovery of these populations in the context of climate change and increased human development is questioned. We showed that disturbances can have substantial individual and cumulative effects on caribou behavior, but we still do not know whether these negative effects could contribute to the recent decline of the herds.