

# A road in the middle of one of the last reindeer migrations in Norway



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## EXECUTIVE SUMMARY

The development of roads and associated infrastructures has interrupted most traditional migrations of Norwegian wild reindeer *Rangifer trandus*. The Austhei population still migrates from winter to calving grounds by crossing a road surrounded by cabins through a narrow corridor, in which further anthropogenic development is planned. To understand if and how the road affects reindeer movements we first characterized migration patterns, and then investigated whether they were affected by the road. All trajectory parameters were clearly altered in proximity of the road, which hampered in particular the migration towards the calving ground. Further development in the migration corridor might have serious conservation consequences

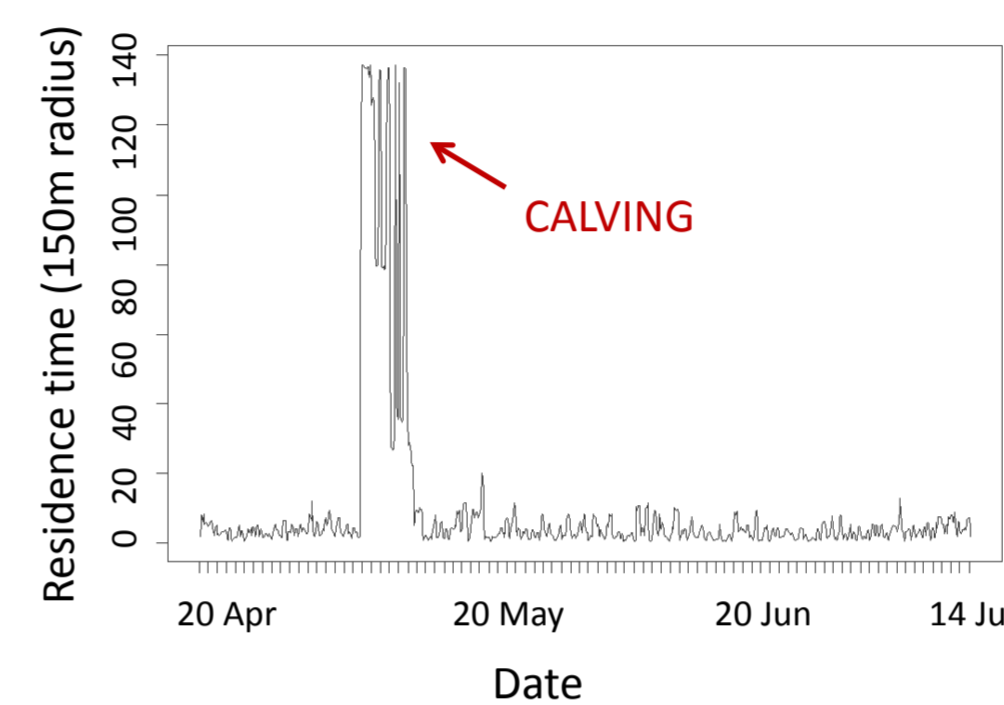
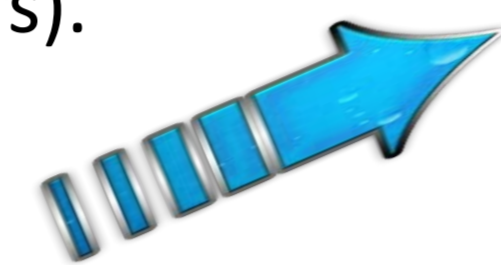
## METHODS

Data: 10 ♀ monitored from 2002 to 2010 (1 GPS location/3 hrs).

First, we identified the migration period in 2 steps:

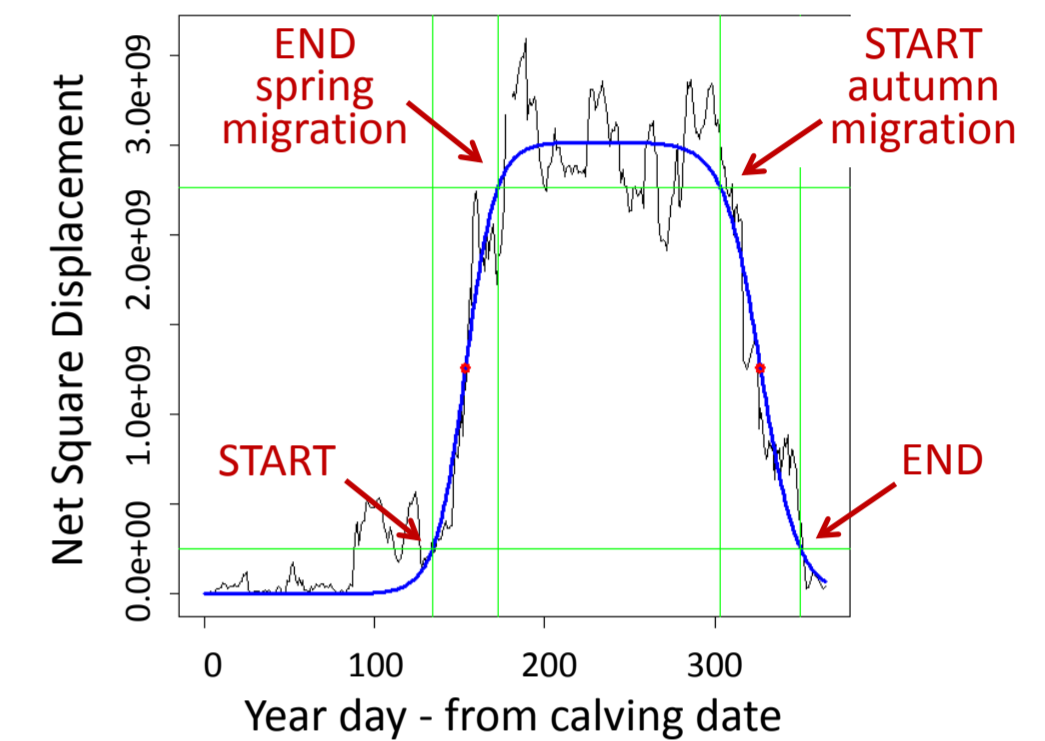
- (1) based on ♀ spatial behavior we **identified calving dates**
- (2) starting from each calving date we calculated the Net Square Displacement, NSD (squared distance between start location and current relocation), to **identify start & end of migration**

After, we calculated and compared Step Length, Turning Angles and NSD during migration and in proximity of the road



Calving events were identified by detecting peaks in Residence Time and Step Length (Van Moorter *et al*, in prep)

We fitted to the NSD a double sigmoid (blue) representing spring migration (1<sup>st</sup> sigmoid) & the return to calving ground (2<sup>nd</sup>; Bunnefeld *et al*. 2011). Start & end of migration were defined as 5% and 95% of the sigmoid



## RESULTS

**MIGRATIONS:** on average start on Sept 20<sup>th</sup> & Mar 15<sup>th</sup>, last 49 & 69 days, respectively, and cover 56 Km

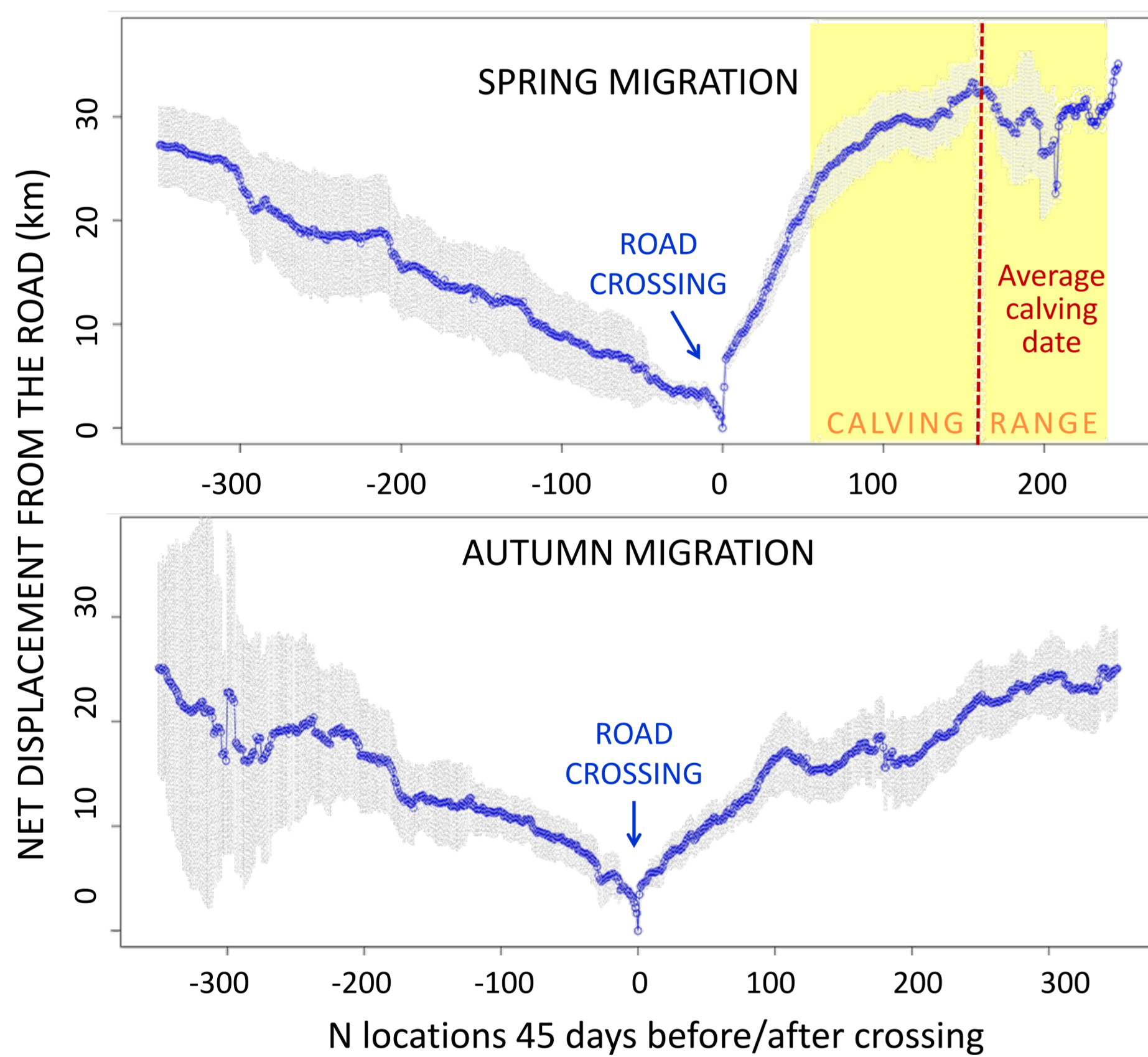
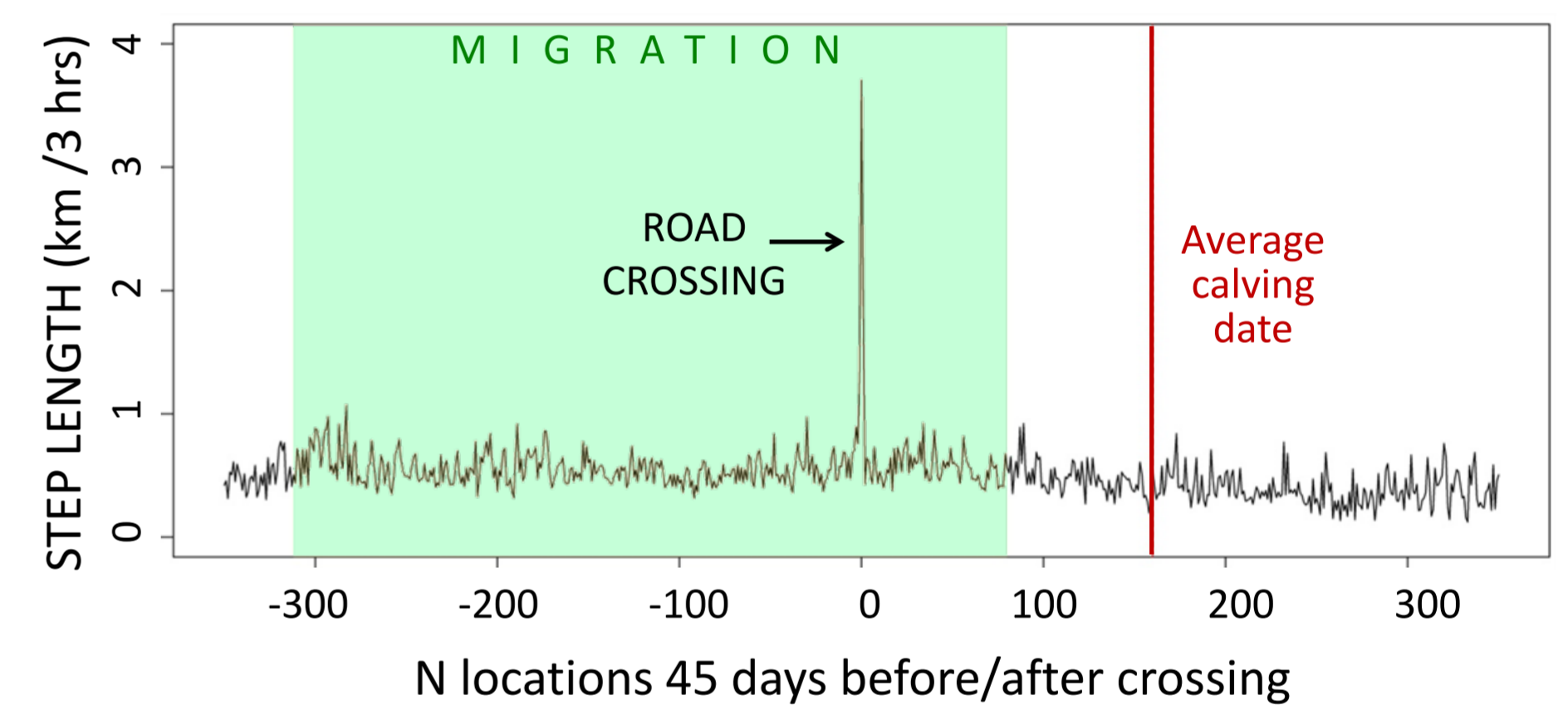
**ROAD CROSSINGS:** occur on average on Apr 23<sup>rd</sup> & Oct 9<sup>th</sup>, before daylight in spring, at any time in autumn

**CALVING:** occurs on average on May 13<sup>th</sup> (n = 20), 9-32 days after crossing

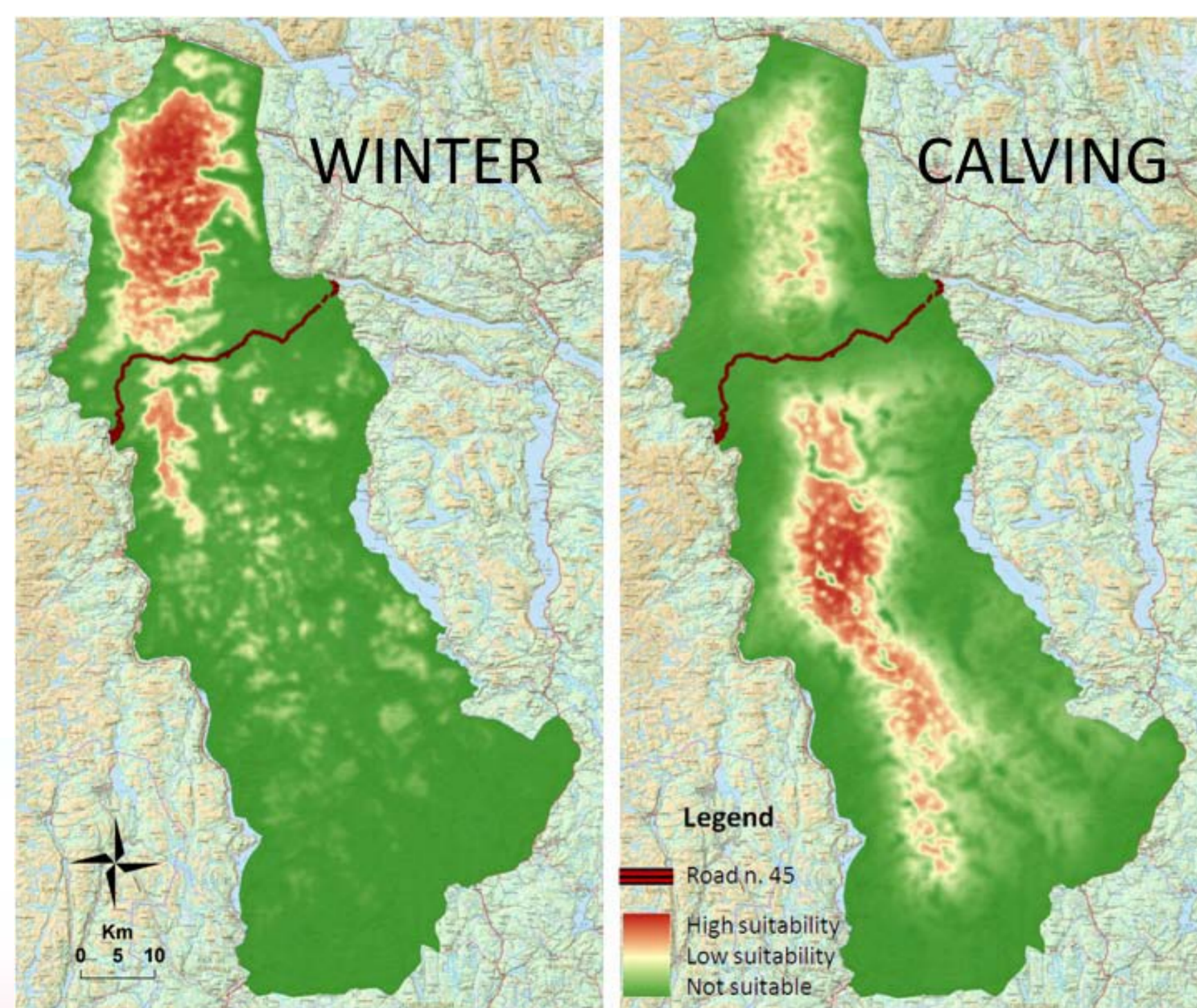
**SPATIAL BEHAVIOR DURING CROSSING:** travel speed (Step Length, above)

is much higher (4 km/3 hr) than during migration (0.5 km/3 hrs); highly directional movement

**PATTERNS OF SPRING & AUTUMN MIGRATION:** in spring reindeer move slowly (15km/25 days; see **Net Displacement, left**) towards the road; in proximity of the road, reindeer move parallel to it back and forth for ca. 5 days without approaching further, possibly searching for a quiet place to cross. After crossing, reindeer head quickly to calving grounds (15km/5 days). In autumn they approach slowly the road, cross it without much waiting, and move slowly towards winter areas



## Optimal habitat (fundamental niche)



## CONCLUSIONS

The motivation to cross is high, as optimal calving and winter grounds (left – see poster on fundamental niche) are on the opposite sides of the road. However, the disturbance associated to the road, which is higher during spring, hampers and delays the arrival to the calving ground. Further human development in the migration corridor might severely affect the persistence of migration

## Density of locations & calving locations

