

Statement;

## Dependence on longer term observational data to address management blind spots

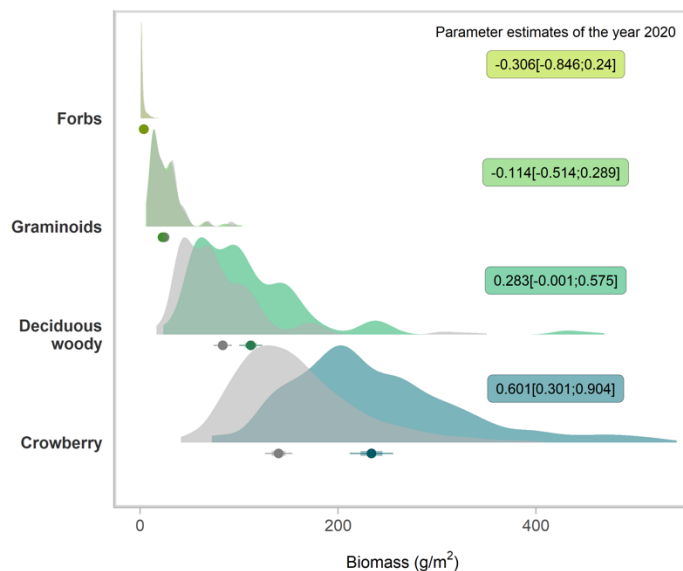
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The statement is related to a scientific paper with several co-authors (provided in the internet-form) soon to be uploaded to BioRxiv (simultaneously as being in a referee-process) and from which figures presented here are derived.

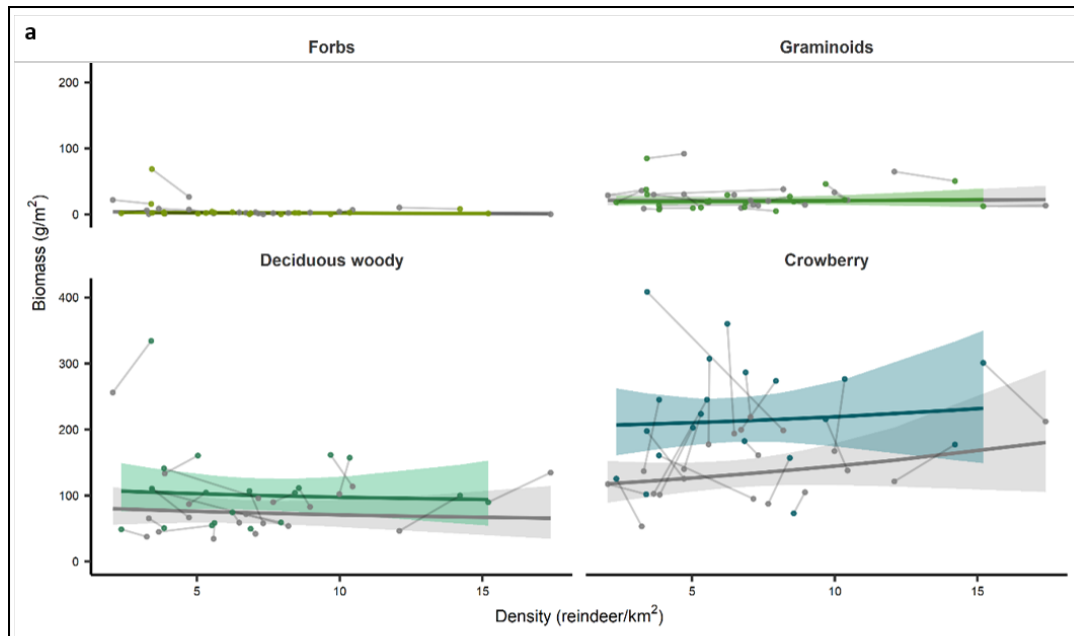
Management blind spots, influential processes not included in a management model, may undermine management objectives and reduce system resilience.

Here we apply a blind spot in the management of an ungulate, reindeer in Norway, as a showcase and basis for the statement. The current management model of reindeer in Norway is based on regulation of pastures and vital rates through reindeer densities, with lack of validation of the underlying assumptions of stability, such as of forage, as the blind spot. We report pasture changes over an 18-yr period, under variable reindeer densities and changing climate. We show an extensive increase of the native evergreen, allelopathic crowberry, contrasted by small increments of deciduous shrubs and stagnation of herbaceous plants (Figure 1). Importantly, we find no evidence of these pasture changes depending on reindeer densities (Figure 2). Our results unveil a trajectory of Arctic evergreening and increasing allelopathy, a process towards an ecosystem state of lower biodiversity and function – an example of transient change in a management blind spot impacting social-ecological systems.

This development was discovered from research alone, and points to the vulnerability of management objectives not being met and not discovered unless observations back in time can help address management assumptions.



**Figure 1. Recent changes in the abundance (biomass) of pasture forage groups, forbs, graminoids, deciduous woody plants and crowberry of decreasing nutrient content, in the management blind spot of reindeer in Norway.** Estimates (presented as density distributions) are separately for each forage group in 2003 (grey) and in 2020 (green). Parameter estimates (mean and 95% credible intervals) are provided in green boxes, with 2003 as model intercepts. Means and 95% confidence intervals from observed data are provided for each year below each biomass density plot. **Increase in crowberry alone, the least nutritious and an allelopathic plant, far surpasses that of all the deciduous shrubs, whereas the most nutritious groups that are also the most species rich and the groups expected to increase with a warming climate, show no change.**



**Figure 2. Abundance (biomass) of pasture forage groups, forbs, graminoids, deciduous woody plants and crowberry of decreasing nutrient content, in relation to reindeer density. Means and 95% confidence intervals are separately for 2003 (grey) and in 2020 (green). Each dot represents mean biomass value for a given herding district, and dots combined belong to the same district with a line for the estimate in 2003 (grey) and 2020 (green).**