

Long-term monitoring of ecological impacts from a road project in Denmark 2012-2020

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INTRODUCTION: A new orbital road was planned at Næstved (Zealand, Denmark). The road passes a Special Protected Area (SPA H194) in the Natura 2000 network. A long-term monitoring program was designed to evaluate the impacts of road construction on nature and biodiversity in the area. The purpose was to compare the impacts with the expectations described in the environmental impact assessment during the pre-construction period. The monitoring plan was designed to cover the period prior to construction (2012), during construction (2013-2017), as well as post-construction (2018-2020).

The monitoring program focused mainly on (A) Annex-II/IV protected species (e.g. sand lizard *Lacerta agilis*), (B) protected terrestrial habitats (Annex I habitats; alkaline fens), and (C) stream water quality, which was measured conventionally by DSFI (Danish Stream Fauna Index), supplemented by DNA methods in the late part of the program. Selected preliminary data are presented on the poster. For further information and details please contact us.

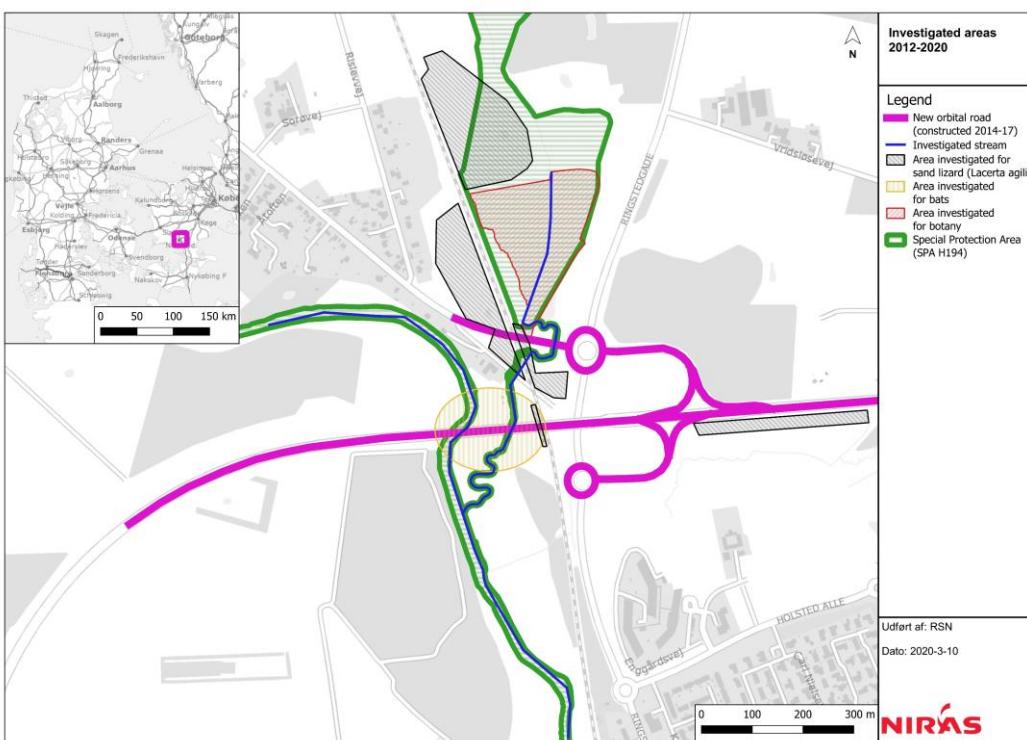


FIGURE 1. Overview map showing all investigated areas.

- CONCLUSIONS:**
- A (Fig 2): Sand lizard (*Lacerta agilis*) occurred in the area throughout the investigation period and the improved habitats were colonized.
 - B (Fig 3): The quality assessment of protected habitats (including alkaline fen, code 7230) showed mainly neutral and positive development. Negative development was only observed in one smaller area.
 - C (Fig. 4+5): Stream water quality was monitored based on macro-invertebrates as biological quality element (BQE). This parameter was monitored with conventional taxonomic expertise (Fig 4) and from 2017, compared to DNA metabarcoding (Fig. 5). The novel DNA method aligned well with the conventional assessment. This is promising for future biodiversity monitoring based on DNA.



FIGURE 2. Presence of Annex IV protected sand lizard species *Lacerta agilis* during the investigation period 2012-2020. Areas with habitat improvements established as compensations are indicated in light blue.

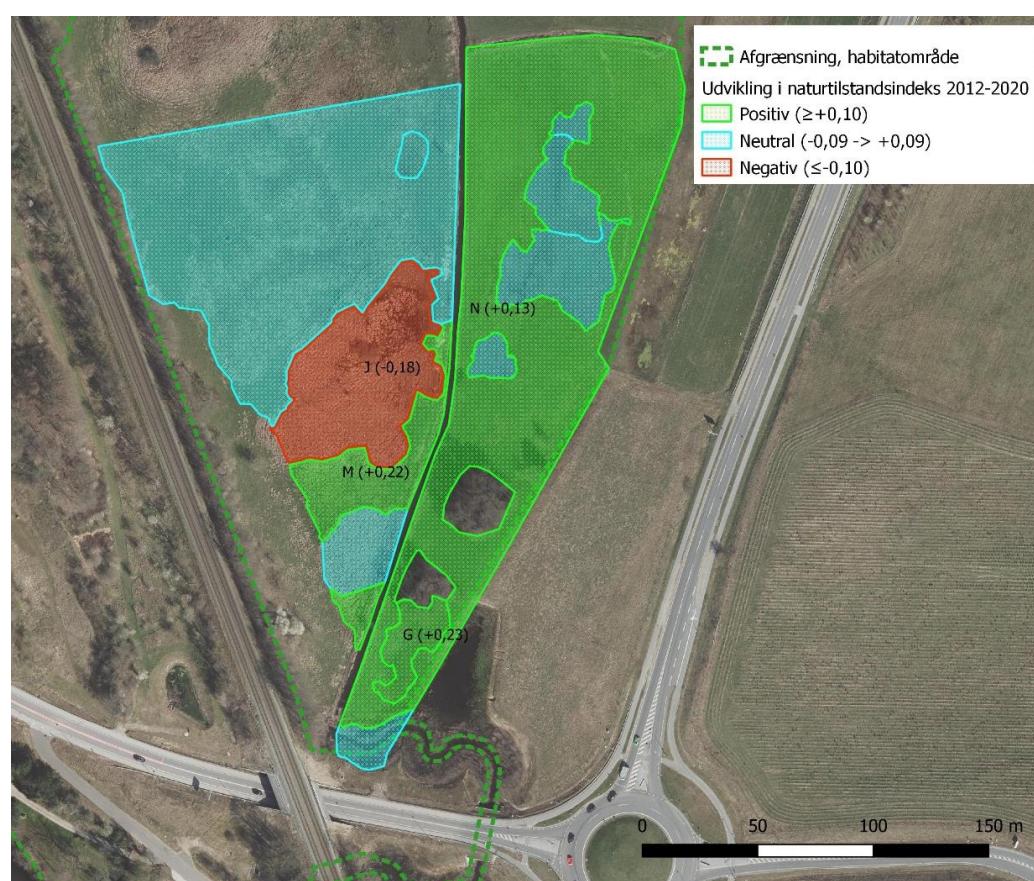


FIGURE 3. Botanical assessment of protected habitat types 2012-2020. Most of the terrestrial protected habitats showed a positive development, including the areas with Annex I protected alkaline fen (code 7230). Assessments were based on standard protocols applied for botanical quality assessment in the Denmark (the NOVANA programme).

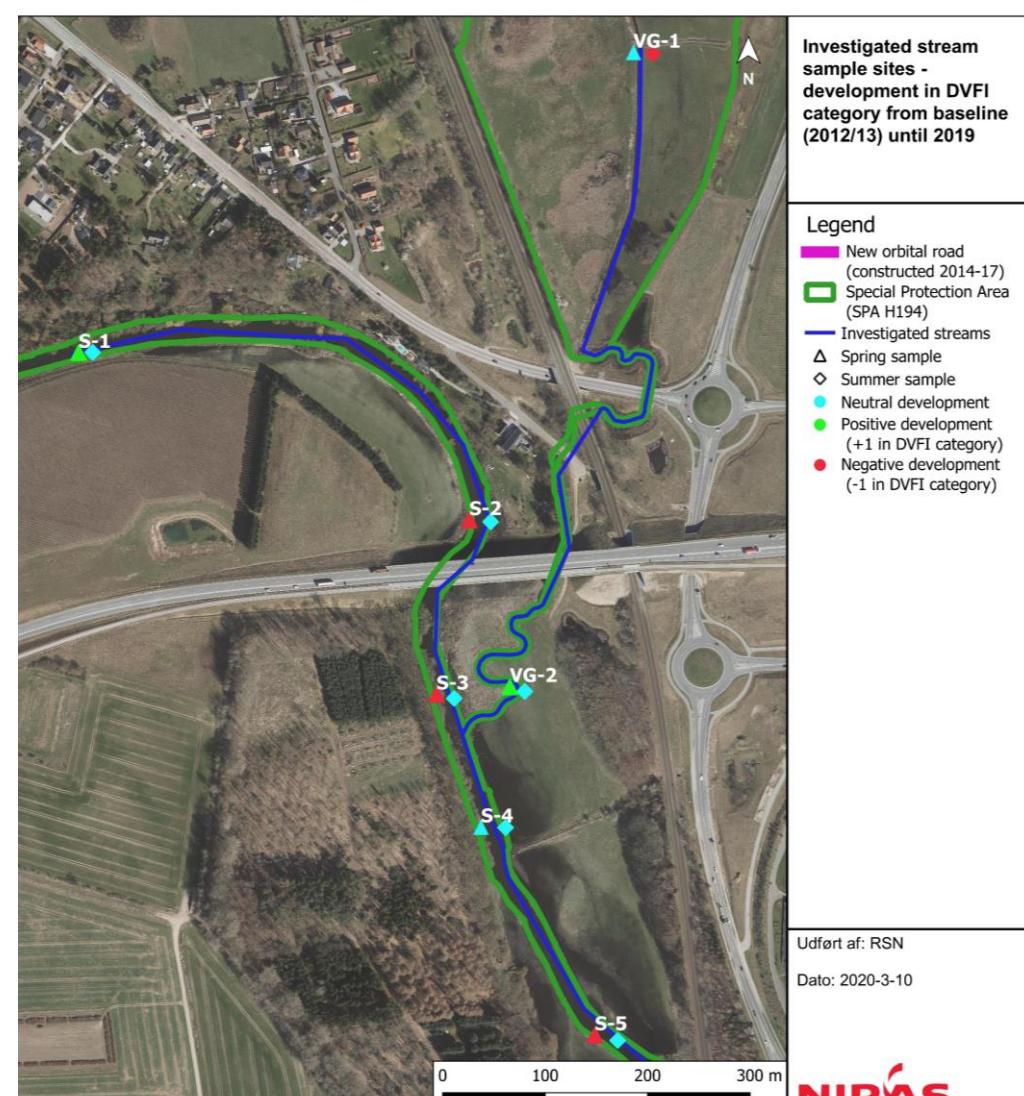


FIGURE 4. Macroinvertebrate index (DVFI-category) from baseline until 2019 in the two investigated streams; Suså (S-1 to S-5) and Vasegrøften (VG-1 and VG-2). Assessments were based on standard protocols applied for quality assessment of freshwater streams in Denmark (the DSFI index).

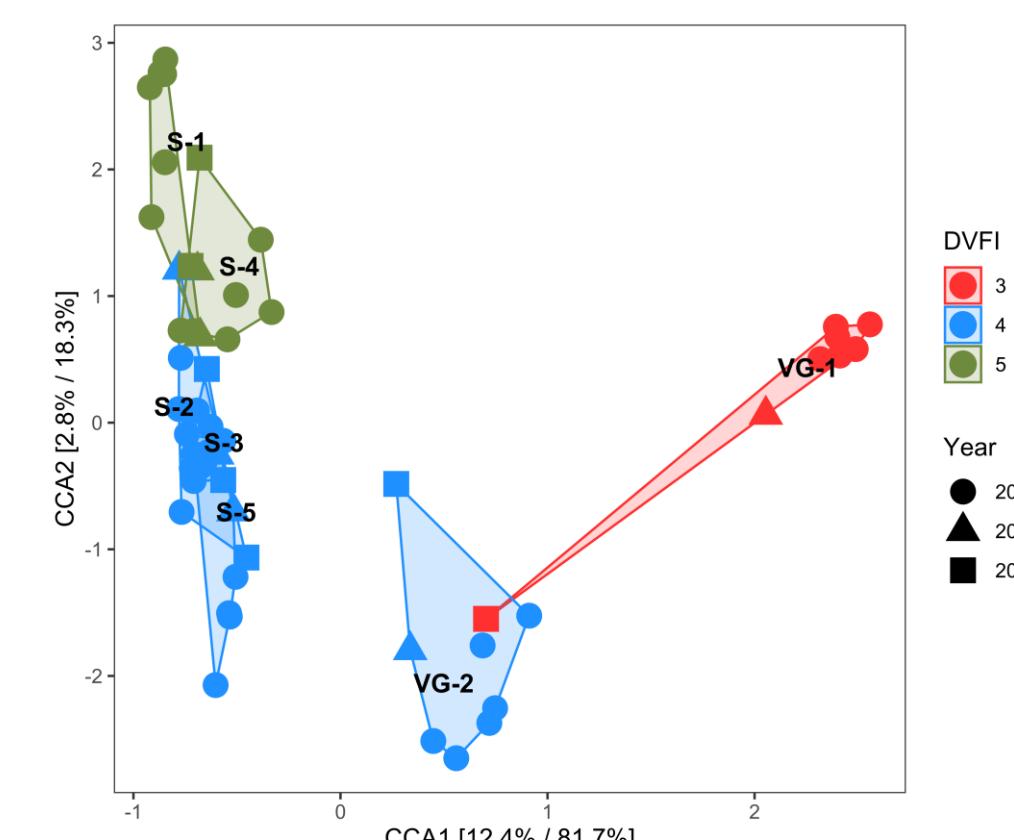


FIGURE 5. Danish macroinvertebrate index (DVFI-category) aligned with DNA analysis of macro invertebrate samples. Points are colored by the conventionally determined DVFI category in the first year of DNA investigations (2017). DNA analyses were carried out according to Kuntke, de Jonge, Hesselsoe and Nielsen, Ecological indicators 111-105982 (2020).