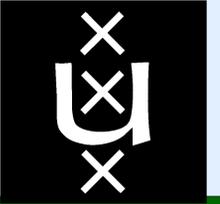


Highway light pollution in the Veluwe area

using Web Services in ArcGIS 10 & ISS spatial photographs



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Introduction

Light pollution is a type of pollution, in which excessive light from artificial sources enlightens the sky at night. Ecologically, this causes problems when the natural circadian rhythms of organisms are disturbed. Specifically, in densely populated countries such as the Netherlands, light pollution is a very common phenomenon. Especially, this is relevant in the few protected natural area's, which are scarce already. The 'Veluwe' area is the largest protected natural area that exists on the Dutch mainland. Due to urbanization and infrastructural projects, the risk of light pollution for this area has increased over the past century. Outside of urban concentrations, highways are the main source of light pollution in the Veluwe area. Therefor our research question is the following:

Are highways causing significant light pollution in the Veluwe area?

Highways and other sources of light within and around the Veluwe area were hypothesized to become visible on the ISS map, if those were to cause any significant pollution.

Aim

The goal of our research is to visualise the presence of light pollution in the Veluwe area.

WMS/WFS in ArcMap

Both WMS and WFS resources from the internet were available to us in the public domain. We have used WMS and WFS datasets to visualise the Veluwe protected area. As a reference for topography, we have used a backdrop map. High-resolution spatial night photo's made by Andre Kuipers from the ISS were used to optically estimate the severity of light pollution from highways.

Methods

As for the WFS-dataset used, concerning natural parks in the Netherlands, and for one of the WMS-datasets, concerning the surrounding network of protected area's (NL: ecologische hoofdstructuur), these overlapped with the Veluwe area and were thus not mapped. The final pictures were co-derived from a WMS dataset of the European Natura 2000 protected natural areas in the Netherlands.

Results – combined map

Firstly, Figure 1 (bottom left) shows the topographic location of the Natura 2000 Veluwe area in the Netherlands in spring-green.

Secondly, Figure 2 (bottom middle) marks the location of Veluwe area on the high-resolution spatial night photo, also in spring green.

In addition we have added Figure 3 (bottom right) to compare the intensity of light pollution with the location of the Natura 2000 Veluwe area, since it is not possible to make the Natura 2000 layer hollow.

Notable is that the Natura 2000 Veluwe area is much darker than the area around the Veluwe. This area is so dark that the main parts of the highways are not visible in this area. For example the A50, which connects the cities Arnhem and Zwolle is not clearly visible between Arnhem and Apeldoorn, but is clearly visible north of Apeldoorn. The A1, which connects Germany with Amsterdam, is also not clearly visible within the Veluwe area.



Conclusion

We can conclude that the light pollution from highways within the Veluwe area is limited. Highways and other sources of light were, in accordance with our hypothesis, clearly distinguishable on the ISS Map. However, the highways that are visible on the ISS Map are mainly located around the edges of the Veluwe area.

The main sources of light pollution for the Veluwe area are concentrated at the urban edges of the area. In addition, light pollution by highways is limited to and mainly concentrated around the urban areas (e.g. of Apeldoorn, Ede and Arnhem). In the future, field studies may more accurately test for any potentially harmful light-pollutive effects of highways in the designated area.

Literature

- Topography & ISS Map: Dataset Andre Kuipers (2012)**
Provided by de Boer, T. at the GIS-Studio, University of Amsterdam, NL
- WMS's and WFS's of protected areas: PDOK (2011)**
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