PERSPEKTIVEN FÜR UMWELT & GESELLSCHAFT umweltbundesamt

MODELLING POTENTIAL BREEDING SITES FOR THE GRIFFON VULTURE INTHE ALPS

Workpackage 5: “Corridors and Barriers”

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CONTENT

1.1 Introduction

Opinions of experts and the scientific community agree that for the griffon vulture connectivity is not a primary problem in the Alps. Griffon vulture is able to cover long distances, therefore the modeling approach needs to be adapted to its species specific barriers and disturbances. This approach does not focus on modeling connectivity but identifies breeding locations for the griffon vulture in the Alps and assesses their quality. Due to a lack of data we were not able to include density of domestic livestock in the Model as a basic parameter but used topography to include the availability of carcasses indirectly.

We followed a model proposed by Bögel 1996 to model the potential breeding places. We then assumed a daily action range of griffon vulture of about 7 km (daily action ranges of griffon vultures in Austria were found to be approx. 150 km^2). Hence we buffered each potential breeding location with 7 km. For each daily action range we analyzed the density of electric power transmission lines as an example for anthropogenic disturbance and availability of food from wild life carcases.

1.2 Methods

Most methods were based on work conducted by Bögel 1996. In the following sections the main steps are described.

1.3 Study area and resolution

For the spatial extend of the study area the area defined by the alpine convention Ruffini 2004 was taken. This encompasses an area of approximately 190.000 km^2. The model was implemented at a resolution of 1 km^2.

1.4 Data

We used CORINE land cover 2000 and SRTM as an elevation Model. We calculated the slopes from the elevation model using standard procedure in GRASS GIS.

The reclassification of landcover variables was conducted as follows:

Land cover	CORINE classes
rock	332 333
forest	311 312 313
open	211 212 221 222 231 241 242 243 244 321 322 324
urban	111 112 121 122 123 124

1.5 Potential breeding points (after Bögel 1996):

Probability of breeding locations was calculated as follows:

$P_{breeding} = P_{niche} + P_{disturbance} + P_{height}$

where P_{niche} is defined a reclassification of slope and land cover:

	Slope [°]						
land cover	< 10	< 20	< 30	< 40	< 50	< 60	> 60
rock	0.2	0.35	0.5	0.65	0.8	0.9	1
forest	0	0	0	0	0	0	0
open	0	0	0	0	0	0	0
urban	0	0	0	0	0	0	0

And $P_{disturbance}$ is defined as:

$$P_{disturbance} = \left(\frac{d_{urban}^2}{d_{urban} + d_{escape}} \right)$$

where d_{urban} is the distance to the next urban area and d_{escape} is the escape distance. For d_{escape} a value of 100 m was assumed according to Bögel.

P_{height} was calculated as follows:

$$P_{height} = 0.00426 * h - 5.759 * 10^{-6} * h^2 + 2.600 * 10^{-9} * h^3 - 3.917 * 10^{-13} * h^4$$

where h is the altitude in m.

1.6 Potential Food

The potentially available food was calculated with the following formula:

$$P_{food} = P_{carcase} + P_{visibility} + P_{sit} + P_{disturbance}$$

where $P_{carcase}$ was calculated as follows:

$P_{carcase}$= sin (*slope*) + 0,01

$P_{visability}$ was obtained through a reclassification of land cover:

	Slope [°]						
land cover	< 10	< 20	< 30	< 40	< 50	< 60	> 60
rock	1	1	1	1	1	1	1
forest	0	0.1	0.2	0.3	0.4	0.5	0.6
open	1	1	1	1	1	1	1
urban	0.1	0.3	0.4	0.5	0.6	0.7	0.8

And the probability for the Griffon Vulture to sit and and observe was also obtained through a reclassification of land cover:

	Slope [°]						
land cover	< 10	< 20	< 30	< 40	< 50	< 60	> 60
rock	0.2	0.35	0.5	0.65	0.8	0.9	1
forest	0.1	0.25	0.35	0.45	0.55	0.6	0.7
open	0.1	0.2	0.25	0.3	0.35	0.4	0.5
urban	0.2	0.35	0.5	0.65	0.8	0.9	1

$P_{distrubance}$ was calculated as explained above.

1.7 Density of Electric Transmission Lines

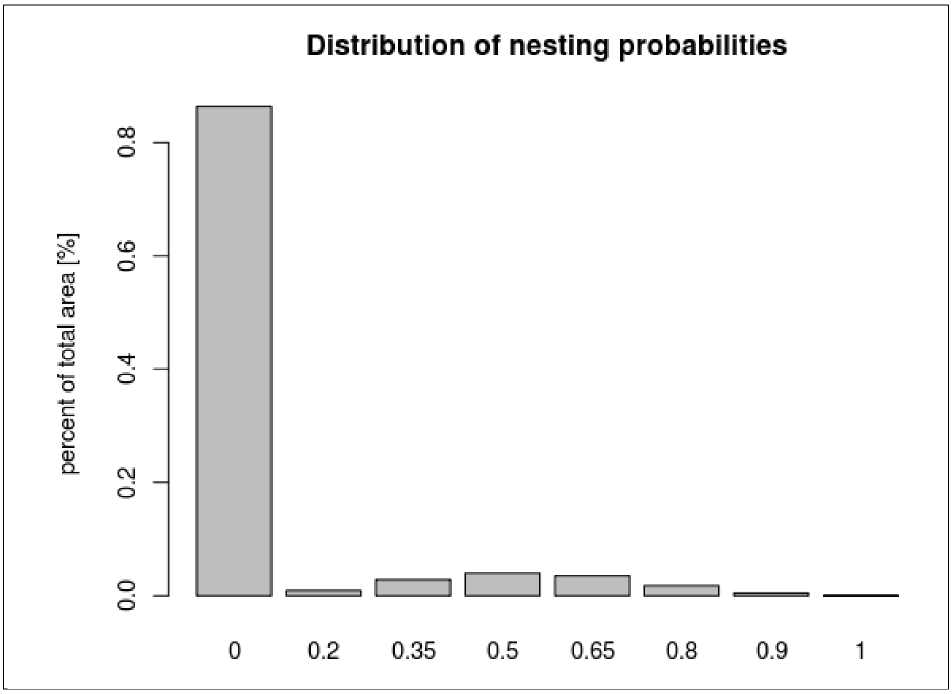
Power lines are one of the main causes of killing for Griffon Vultures. From the Power Transmission Line AT030 datasets the main power lines for the Alps were extracted. The power lines were rasterised at a resolution of 100 m. The raster was resampled at a resolution of 1 km and the amounts and power lines were sumed up. In order to adjust the range the log of the count was taken. Then the power line density was nomalised to an interval from 0 to 1.

$$v' = (v - min(v)) * ((max_{norm} - min_{norm})/(max(v) - min(v))) + min_{norm}$$

1.8 Best potential breeding sites

In order to find the best potential breeding sites, the three values from above were combined. For each breeding site we calculated a 7 km circular neighborhood. Within this neighborhood we summed the probability of food and the density of transmission lines. We then normalized these values again to an interval between 0 and 1. Then we combined the components using weighted averages.

Based on the distribution of breeding probabilities we have chosen a threshold of 0.8. In further course we only considered breeding locations exceeding this threshold.



To obtain a map of the best potential sites we calculated as follows:

$$P_{bestbreeding} = \frac{1}{3} * P_{breeding} + \frac{1}{3} * P_{food} - \frac{1}{3} * D_{power}$$

Only pixels with an elevation below 2800 m were considered.

1.9 Results

Below maps of the potential breeding sites for griffon vulture in Alps based on the methods described before. There is an accumulation of potential breeding sites in the central Alps. This can be attributed to the steeper slops.

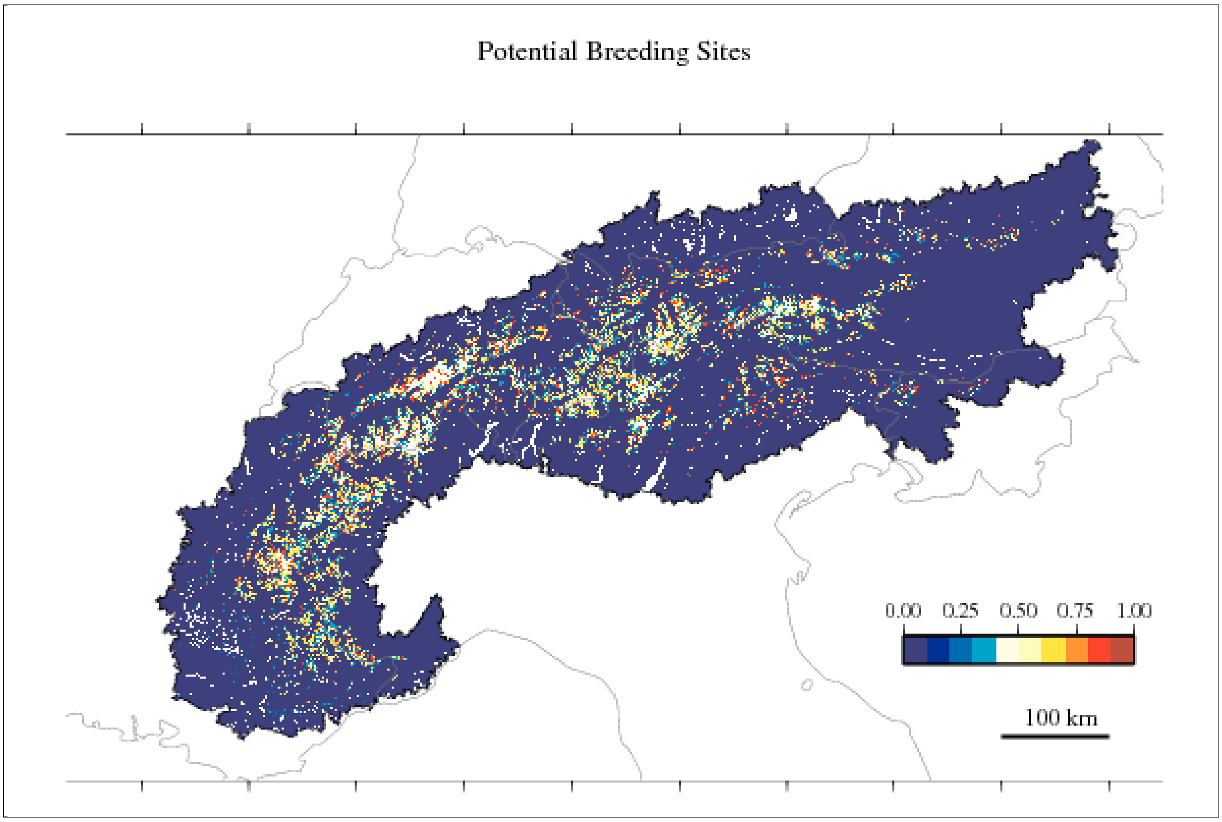


Illustration 1: Potential breeding sites for the griffon vulture in the alps.

In the next figure potentially available food from wildlife carcases are shown.

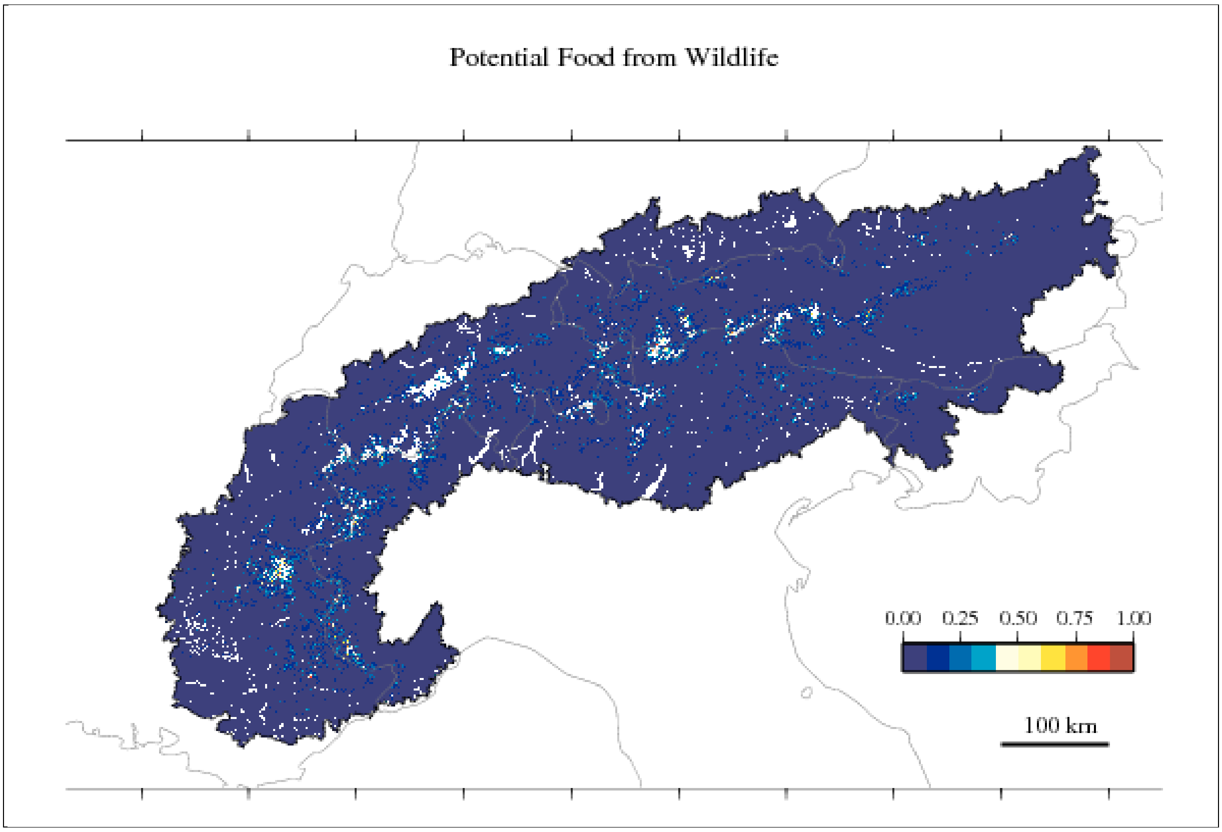


Illustration 2: Potential food availability for the griffon vulture from wildlife. Note that carcases from livestock is not considered here.

Adding the potential breeding sites and food availability and subtracting the influence of power lines resulted in potential breeding sites. Pixels with values above 0.8 are highlighted with red filled circles.

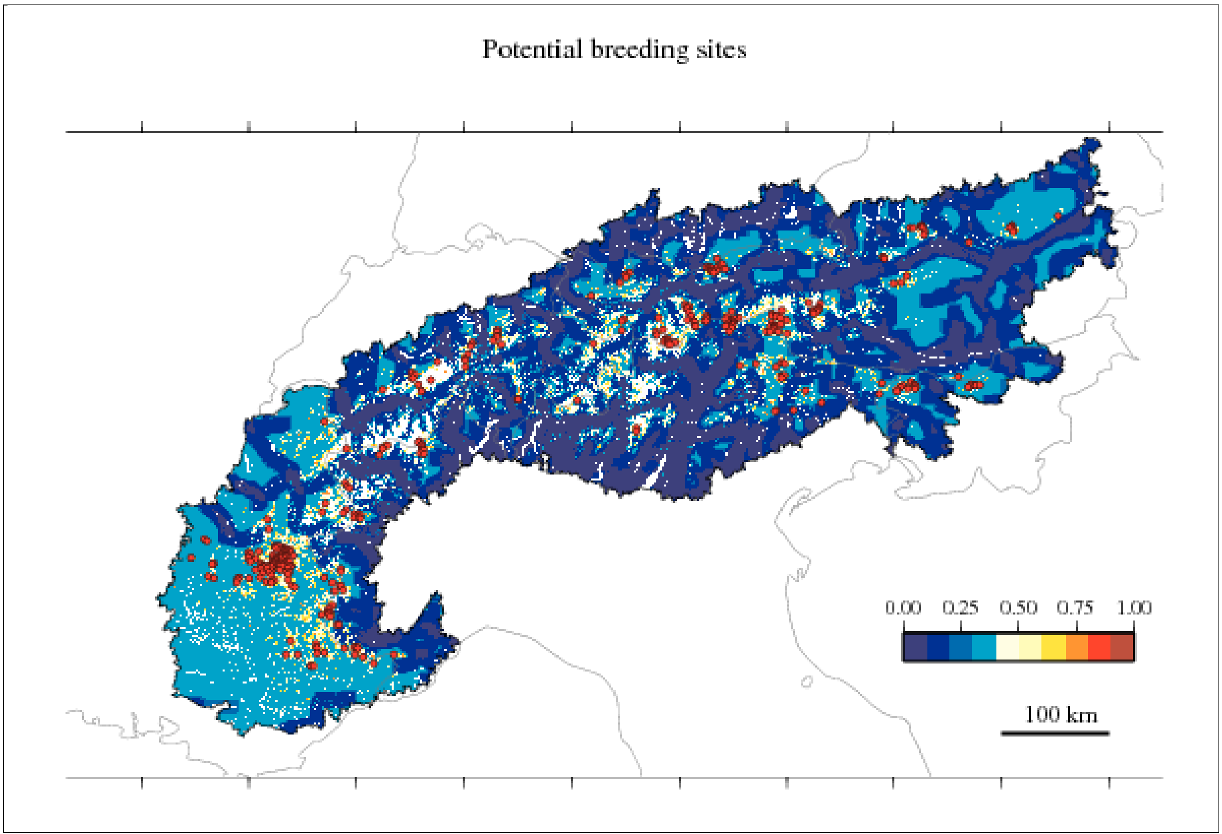


Illustration 3: Potential breeding sites of the griffon vulture in the Alps. In addition to illustration 1 breeding sites are supplemented with information on availability of food from wildlife and anthropogenic disturbance (represented by power lines).

1.10 Discussion

Even though we took a simplified approach to model potential breeding sites for griffon vulture in Alps, we were able to compute a map of potential breeding sites and give and weight them according to a few crucial variables that influence the distribution of griffon vulture.

Additional aspects that should be included in further models are the distribution of livestock carcases and thermal aspects. We did not include the distribution of livestock carcases because very limited to no information was available. The availability of livestock carcases strongly depends on the legislation and management practices in the given area. Qualitative surveys on this topic are still in progress. The issue of thermal aspects was not included due to the complexity of the issue and also a lack of data. Since thermal conditions are highly variable an algorithm would need to be developed to reduce and summarize a series of observation to few meaningful predictors with regard to griffon vulture.

1.11 References

Bögel, Ralf 1996, Untersuchungen zur Flugbiologie und Habitatnutzung von Gänsegeiern. Forschungsbericht 33, Nationalpark Berchtesgaden.

F. Ruffini, T. Streifender, and B. Eiselt. Definition des perimeters der alpenkonvention, provisorische Liste der konventionsgemeinden. Technical report, Europäische Akademie Bozen, 2004.