TRIMmaps
creating maps from monitoring data and casual observations

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EBCC
European Bird Census Council
every bird counts

Spatial models

- Regression-type statistics
- Spatial interpolation
- Combinations of the two above

Regression-type statistics

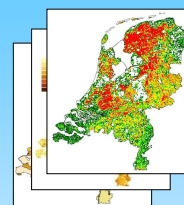- combine counts with environmental data

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Model types

- General Linear Models (GLM): linear, quadratic
- General Additive Models (GAM) : splines
- Regression Trees
- Models for presence-only data (ENFA, Maxent)
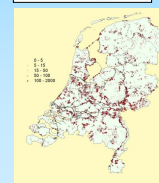- etc, etc.

Environmental data

- Land use
- Soil
- Geographical region
- Climate
- Disturbance
- Pollution
- X- & Y-coordinates
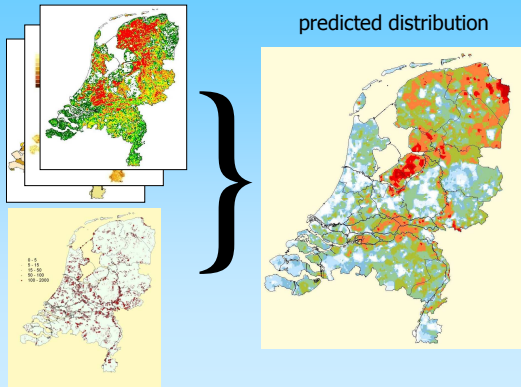- etc, etc.

Regression models

habitat data

bird data

} *regression model*
'y=a+bx+cz+..'

Regression models
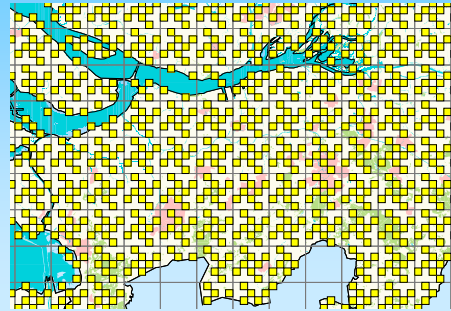
predicted distribution

Spatial interpolation

- Inversed Distance Weighting (IDW)
- Kriging
- Bayesian methods

Spatial interpolation

- based on spatial correlation in the observations itself
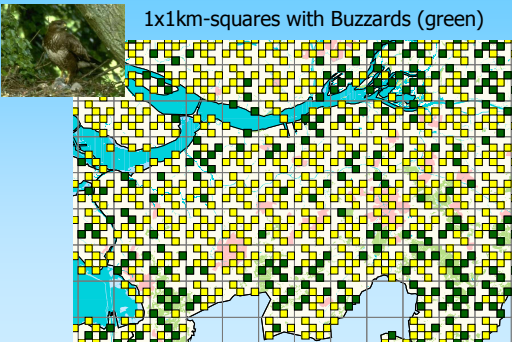- no environmetal data needed
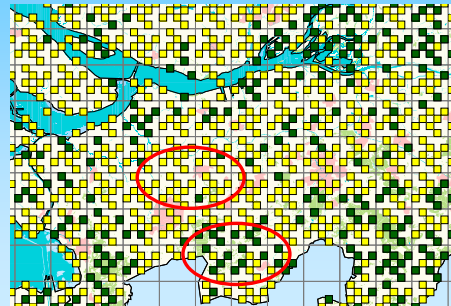

Relative densities

sampled 1x1km-squares (yellow)
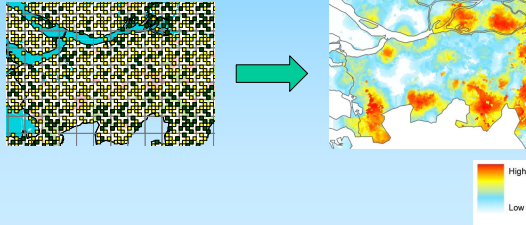

Relative densities

1x1km-squares with Buzzards (green)

Relative densities

spatial correlation
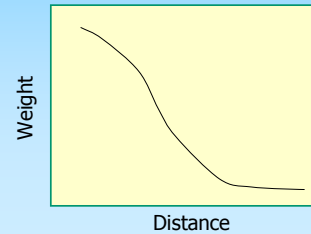
Relative densities

spatial interpolation (kriging)

Spatial interpolation

- weight observation dimishes with distance

IDW

- a-priori choices about the spatial correlation
- no measure for error
- quick and easy to make: good for first ideas

IDW

Interpolate Surface

Method: IDW
Z Value Field: Rel_dens
○ Nearest Neighbors   ○ Fixed Radius
No. of Neighbors: 12
Power: 2
Barriers: No Barriers
OK   Cancel

Kriging

- Spatial correlation described from the data: semi-variogrammes
- measure for error
- Calculation-intensive

Extensions of regression

- regression-kriging
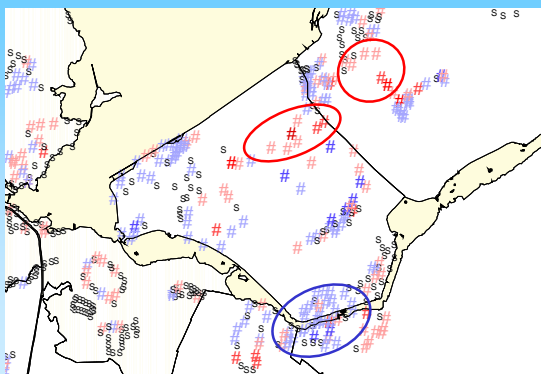- autologistic regression
- Bayesian methods

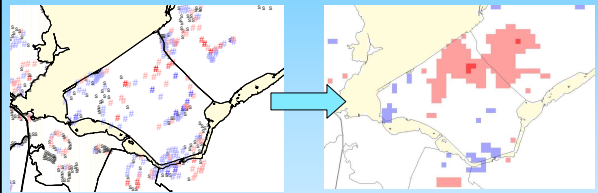Differences between model predictions and observations (residuals)

more Buzzards than predicted (red)

less Buzzards than predicted (blue)
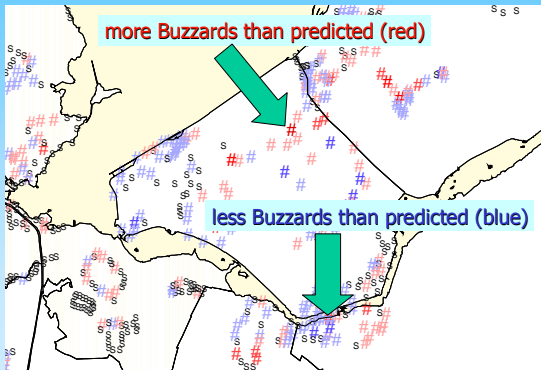
Combining regression models and spatial interpolation:

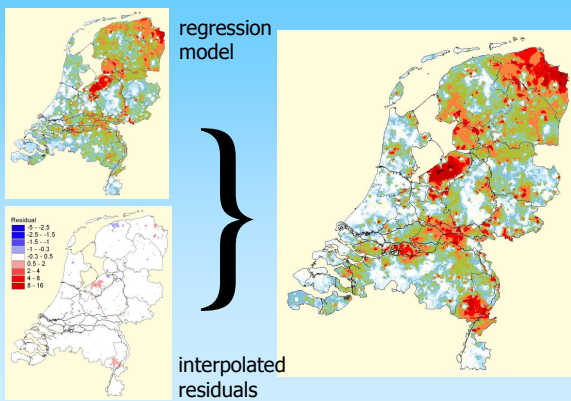*regression kriging*

Spatial correlation in the residuals

Spatially interpolated residuals

red: more than predicted
blue: less than predicted

Final map

regression model

interpolated residuals

Software

Software: regression

- statistical software €€
- free software for some methods (ENFA, Maxent): cannot make use of zero-observations!
- free statistical software: R
  (Presence/absence data: BIOMOD)

Software: spatial interpolation

- gis-programs (arcview of arcgis with spatial analyst) €€ ; black box ■
- Statistical software €€
- gstat (standalone and R-version); (freeware)
- WinBUGS: not easy to use (freeware)

Software: combinations

- gis-programmes: limited possibilities (eg co-kriging in ArcGis)
- commercial statistical sofware: limited possibilities
- R combined with open source GIS-programs: sky is the limit
- WinBUGS

Facilitate creation of maps

TRIM*maps*

TRIM*maps*

- Facilitate production of maps from monitoring data
- R-programme
- Open source / freeware

Programming

Caspar Hallmann

Statistics TRIM*maps*

- Combination of
  - Regression type statistics
  - Spatial interpolation of residuals
- Uses TRIM-input (data-files) or -output (F1-files) and a number of other formats

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TRIM*maps*

- Generate file per species, including zero-observations, from F1-files or csv
- Combine with XY-coordinates
- Add environmental data
- Regression type modelling
- Combine predictions with spatially interpolated residuals
- Determine model quality
- Create output
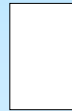

Generate zeroes

.F1- or .dat-files

}
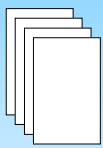
- Generate species list
- Generate zero-observations

Combine with coordinates

.F1- or .dat-files

Census data with xy-coordinates
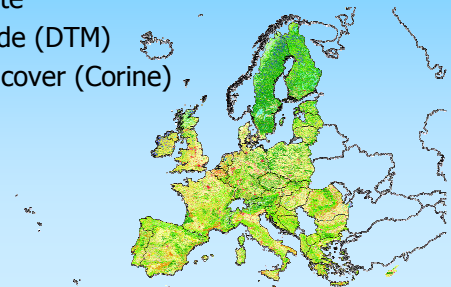
}

Table with xy-coordinates
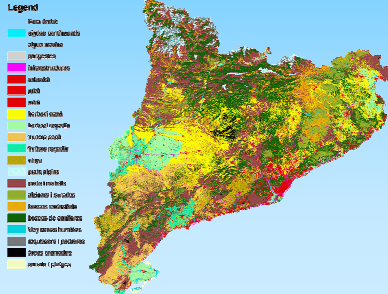
- Table with coordinates census locations

Other formats

- CSV-file with observations
- CSV-file with plot ánd environmental information
- CSV-file with observations ánd environmental information

Overlay with European environmental data sets

- Climate
- Altitude (DTM)
- Land cover (Corine)
- ...

Add national/regional environmental data

Regression models

- GLM
- GAM
- MARS
- Mixed models
- Hurdle models
- **Boosted Regression Trees**
- ..

Interpolate residuals
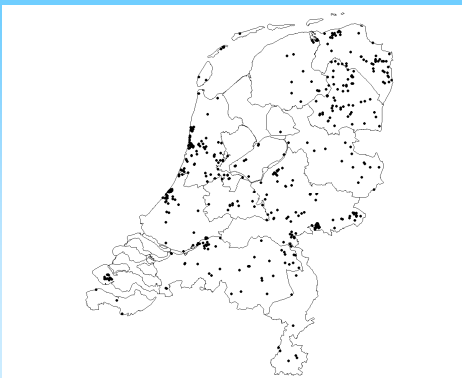
- IDW
- Kriging

Model quality

- Cross-validation

Output

- Regression models
- Maps
  - Observations
  - Predictions regression
  - Residuals
  - Combined map
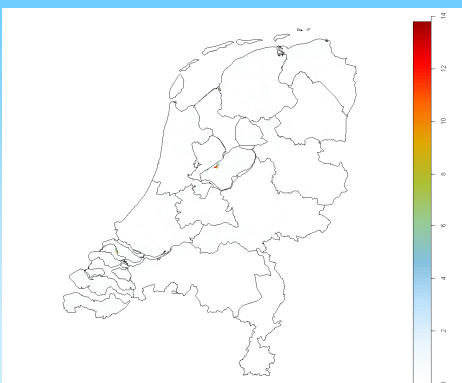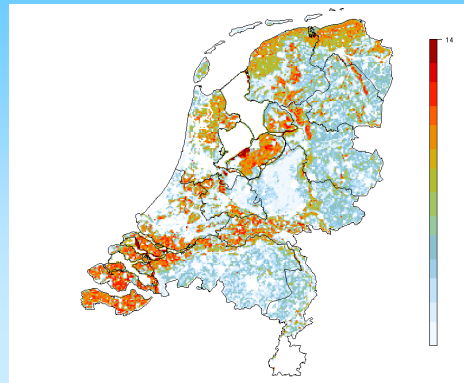- Shape-files or ASCII-grids with output

Output

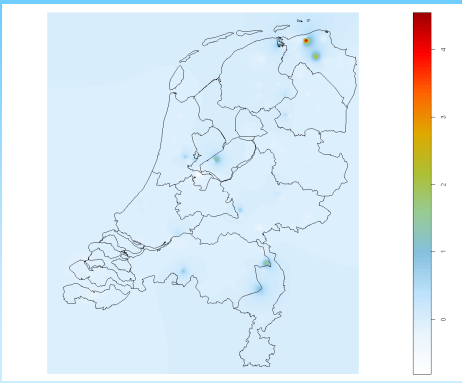## Map with locations

Locations in Bird_stat-example
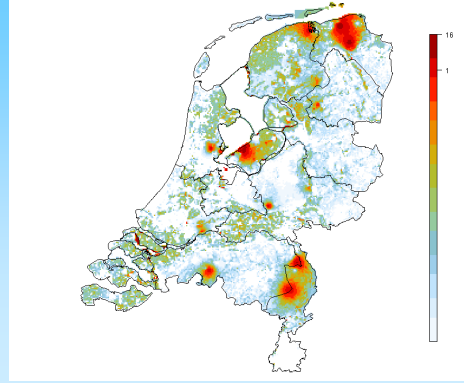

Output regression model

Adjusted legend

Interpolated residuals

Combined map

Variable contributions

	var	rel.inf
1	Ecoh_grasland	35.4
2	Ecoh_water	11.7
3	Ecoh_bebouwing	11.1
4	Ecoh_heide_hoogveen	9.3
5	Schaal	7.8
6	Bodemhfd_Klei	6.4
7	Ecoh_wegen	4.3
8	Bodemhfd_Zand	3.8
9	Ecoh_akker	2.8
10	Bodemhfd_Veen	2.6
11	Ecoh_moeras	2.1
12	Area	1.2
13	Bodemhfd_Kleiopveen	1.0
14	Ecoh_bos	0.4
15	Bodemhfd_bebouwing	0.0
16	Bodemhfd_Leem	0.0
17	Bodemhfd_onbekend	0.0
18	Ecoh_kwelders	0.0

Work in progress

- Summary functions output

Important remarks

- Bird counts ≠ Birds present !
- Assumes minor influence of differences in detection probabilities between habitats