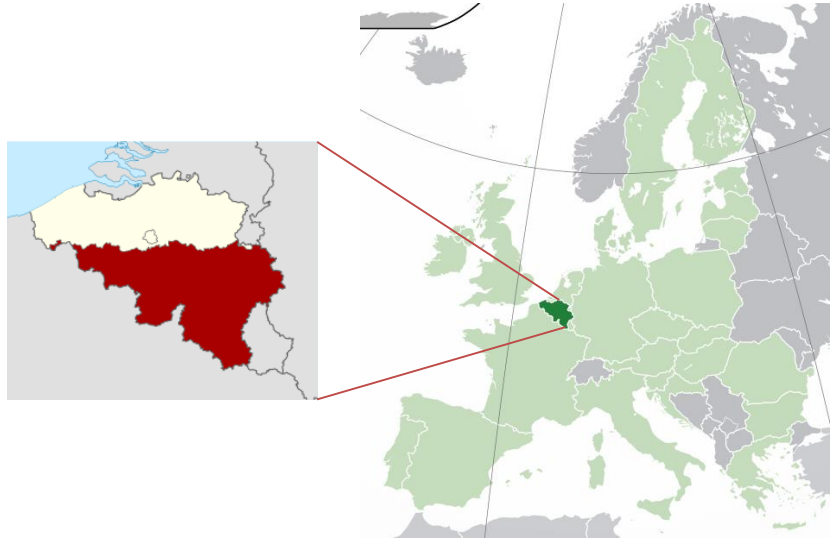
9/04/2019

High resolution mapping of population change in breeding birds in Wallonia (Southern Belgium)

Coppée Thomas, Paquet Jean-Yves and Dufrêne Marc

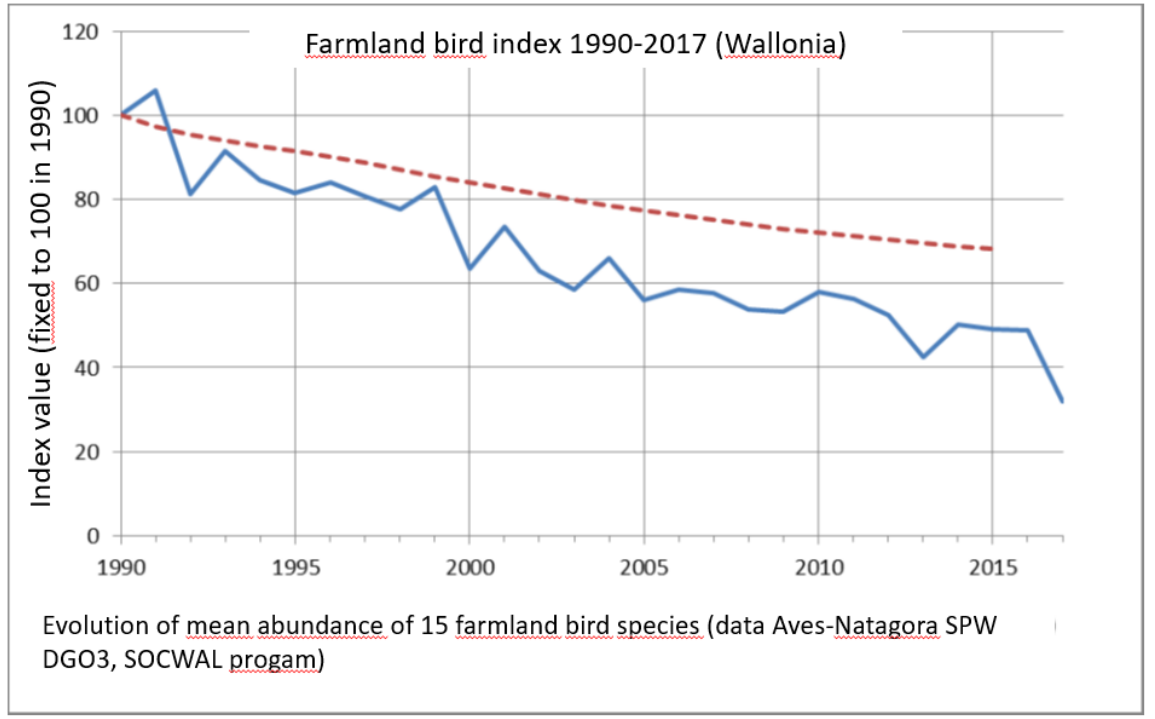
Introduction

- Generalized decrease in farmland birds
  - →Wallonia : 15 species with only 1 significantly increasing



- Multiple possible causes :
  - ➢Loss of hedgerows
  - ➢Land drainage
  - ➢Increase of mechanization
  - ➢Increase of pesticides and fertilizers use

- Impacts on birds :
  - ➢Reproduction
  - ➢Available quantities of food
  - ➢Specific diversity



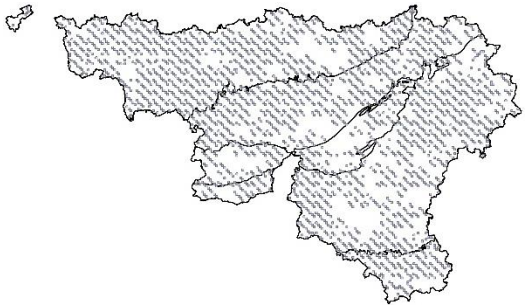
Laudelout et al., 2018

Goal

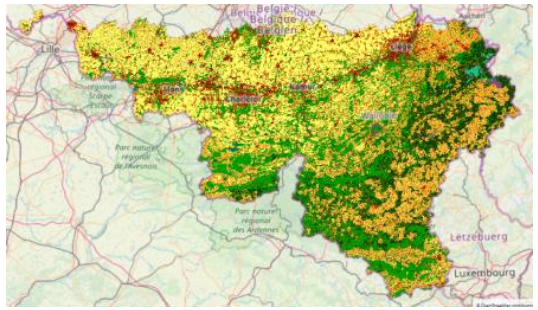
Study the population size change in breeding farmland birds in Wallonia to inform about the driving forces behind evolution

1. Estimate the population sizes

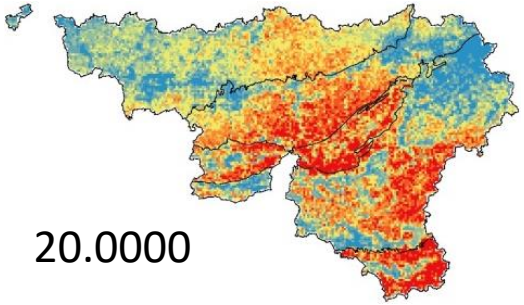
Bird data



Environmental data



Predicted mapping + estimate

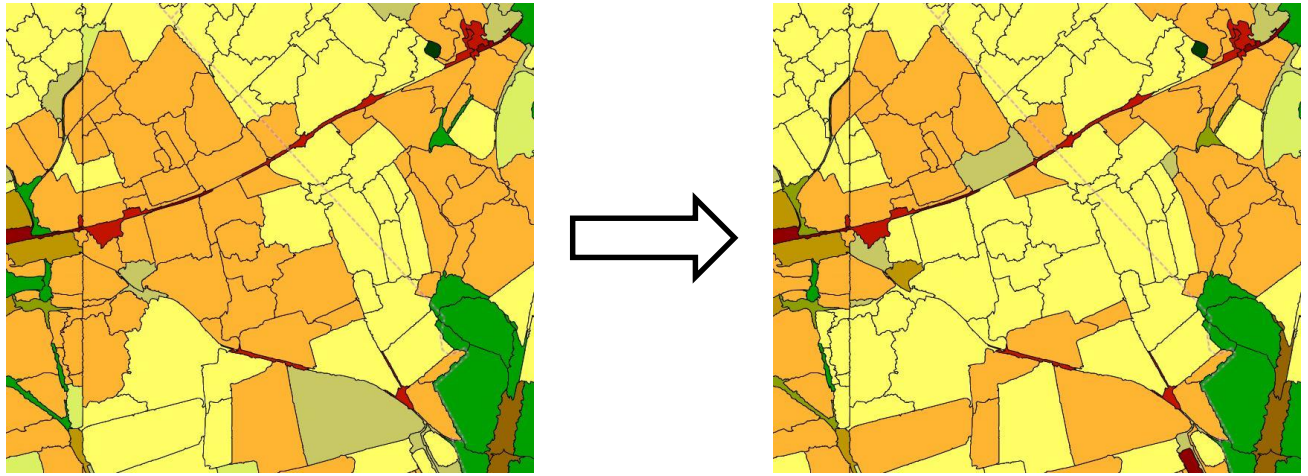


2. Compare the estimates between two periods

→ To inform about the driving forces

Material and methods

- Bird data for 2 periods : 2001-2007 (2500) / 2016-2018 (1000)
  - → 1 km² squares / 2 surveys (1 hour)
  - → All birds except migratory
- Associated environmental data
  - → Land cover classification (pixel-based - 10 classes)
  - → Classification based aerial views



2006 2015

  - → Including climatic, topographic and soil attributes
    - → Constant between periods

=> In the future, updates for each new orthophotoplan

Material and methods

Increasing species

- Studied group : 17 farmland species

  → *Saxicola torquatus*

Material and methods

- Studied group : 17 farmland species
  - → *Saxicola torquatus*
  - → *Hirundo rustica, Sylvia communis, Carduelis cannabina*

Stable species

Material and methods

Decreasing species

- Studied group : 17 farmland species
  - → *Saxicola torquatus*
  - → *Hirundo rustica, Sylvia communis, Carduelis cannabina*
  - → *Alauda arvensis, Passer montanus, Vanellus vanellus, Perdix perdix, Streptopelia turtur, Sturnus vulgaris, Emberiza citronella, Motacilla flava*
  - → *Turdus pilaris, Corvus frugilegus, Lanius collurio, Sylvia curruca, Falco tinnunculus*

Material and methods

- GAM models (average of 10 models/species)
- Abundance (with absence) used for modelling
- Stepwise to select relevant variables
- Several methods of model constructing
    1. Models with bird and environmental data of period 1
    2. Models with bird and environmental data of period 2

Material and methods

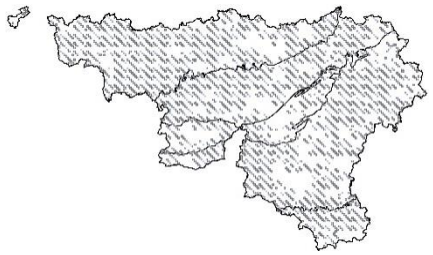
1. & 2. Models for period 1 and 2

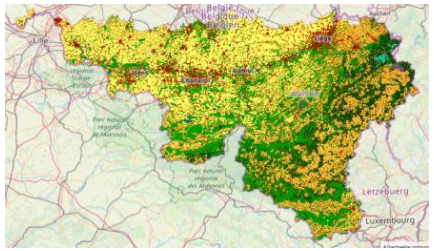
Bird abundance data on sampled squares

Environmental data on sampled squares

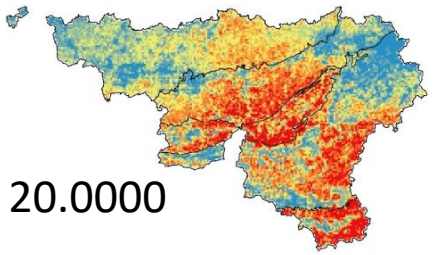
Bird abundance prediction in Wallonia

P1





Model P1



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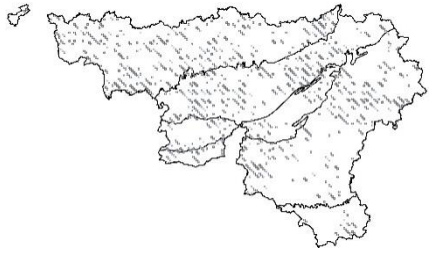
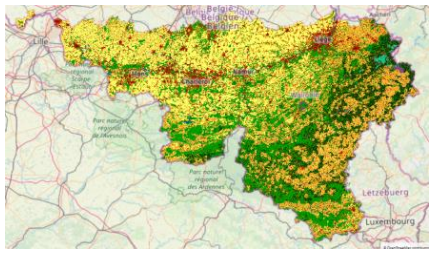
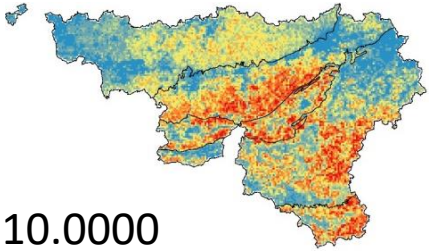
P2





Model P2



10.0000

Material and methods

- GAM models (average of 10 models/species)
- Abundance (with absence) used for modelling
- Stepwise to select relevant variables
- Several methods of model constructing
    1. Models with bird and environmental data of period 1
    2. Models with bird and environmental data of period 2
    3. Models built with bird and environmental data of period 1 crossed with environmental data of period 2

Material and methods

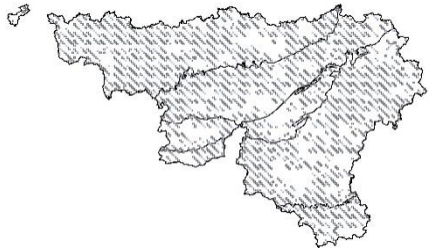
3. Models built with bird and environmental data of period 1 crossed with environmental data of period 2

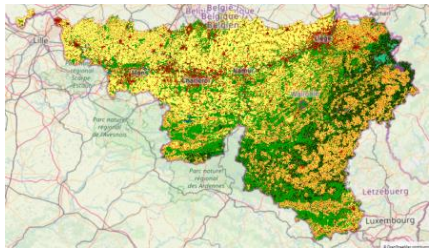
Bird abundance data on sampled squares

Environmental data on sampled squares

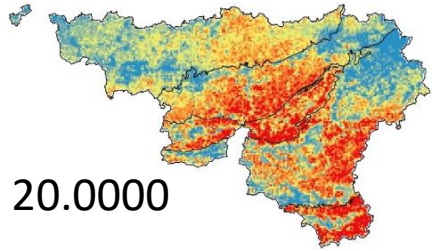
Bird abundance prediction in Wallonia

P1





Model P1



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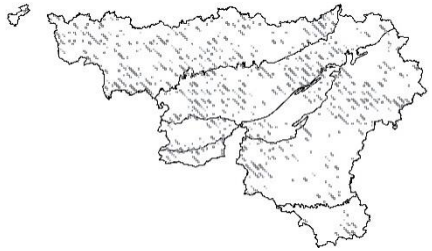
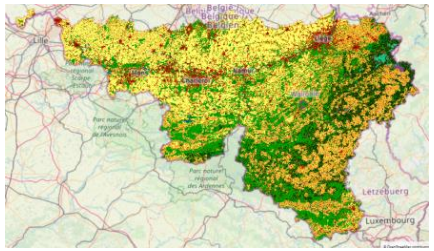
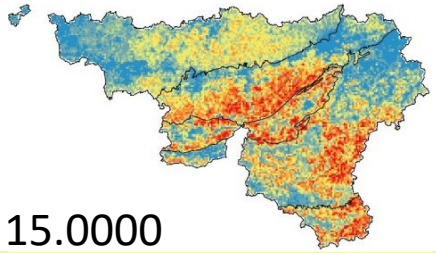
P2





Model P1



15.0000

Material and methods

- GAM models (average of 10 models/species)
- Abundance (with absence) used for modelling
- Stepwise to select relevant variables
- Several methods of model constructing
- Population change observed between periods compared to reference trends from Common Bird Monitoring Scheme (CBMS)

Results and discussion

1. Comparison between models of period 1 (2001-2007) and 2 (2015-2018)

Species	Mean of abundance		% of change		1 km² change	CBMS
	Period 1	Period 2				
Perdix perdix	2800	1700	**-40**	***	-29	↘
Falco tinnunculus	3150	4400	**40**	***	22	?
Streptopelia turtur	3350	1500	**-56**	***	-64	↘
Alauda arvensis	27600	23450	**-15**	***	-16	↘
Hirundo rustica	28250	29000	**3**	*	-5	→
Motacilla flava	7500	7500	0	*NS*	*-8*	↘
Saxicola torquatus	1400	4250	**200**	***	213	↗
Sylvia communis	17800	21400	**20**	***	11	→
Sturnus vulgaris	50000	42500	**-15**	***	-26	↘
Corvus frugilegus	2950	5750	**97**	***	67	?
Passer montanus	5650	1550	**-73**	***	-71	↘
Carduelis cannabina	24550	23200	**-6**	***	-3	→
Emberiza citrinella	28150	19850	**-30**	***	-29	↘
Lanius collurio	1500	1850	**22**	***	131	?
Vanellus vanellus	4600	3800	**-18**	***	-16	↘
Sylvia curruca	4050	4400	**9**	***	1.4	?
Turdus pilaris	4900	5050	3	*NS*	-7	?

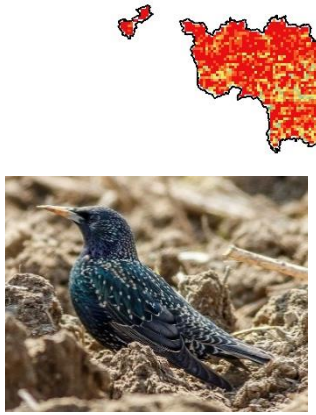
=> 8 decreasing and 7 increasing species between 2001-2007 and 2015-2018

=> Good overall adequacy with CBMS trends but also differences

Results and discussion

1. Comparison between models of period 1 (2001-2007) and 2 (2015-2018)
   → Examples of decreasing species

Period 1 | Period 2 | Difference



Sturnus vulgaris

Passer montanus

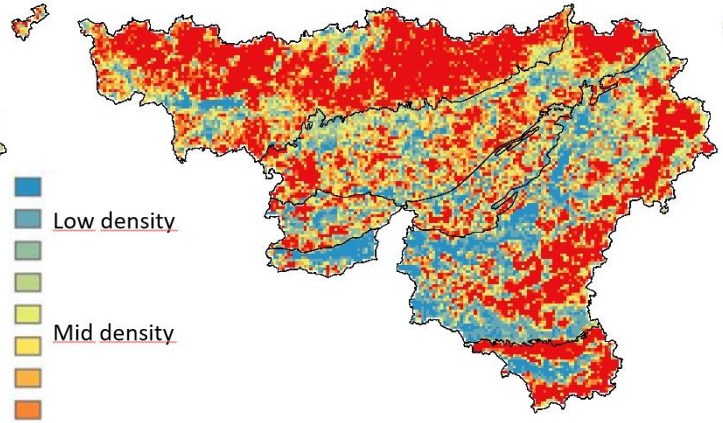
Results and discussion

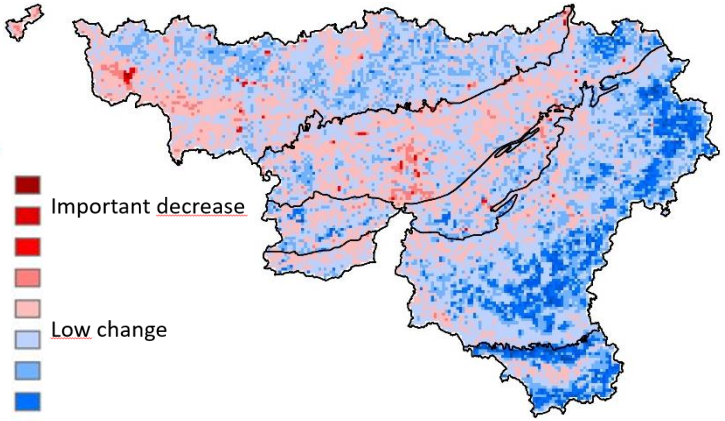
1. Comparison between models of period 1 (2001-2007) and 2 (2015-2018)
   → Examples of increasing species

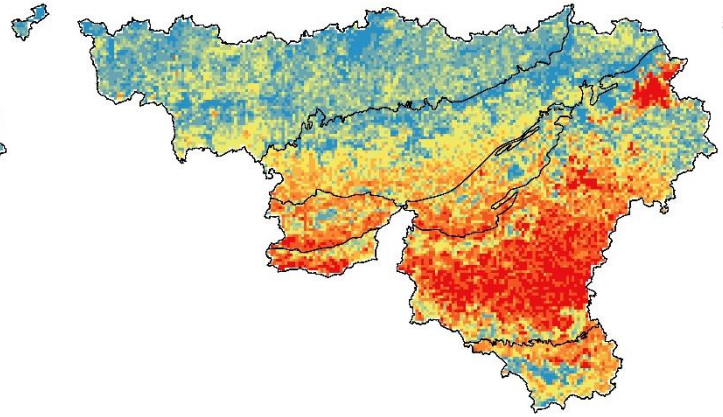
Period 1 | Period 2 | Difference

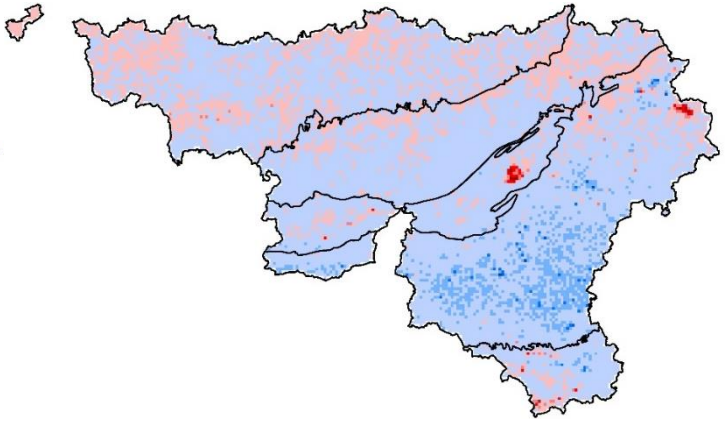
Falco tinnunculus

Saxicola torquatus









Results and discussion

2. Comparison between models of **period 2** (2015-2018) and models built with data of period 1 crossed with **environmental data of period 2**

Species	Model 1 on period 1	Model 2 on period 2	% M1P1-M2P2	Model 1 on period 2	% M1P1-M1P2	1 Km² change
Perdix perdix	2800	1700	-39%	2750	**-2%**	-29
Falco tinnunculus	3150	4400	40%	3350	**6%**	22
Streptopelia turtur	3350	1500	-55%	3150	**-6%**	-64
Alauda arvensis	27600	23450	-15%	30600	**11%**	-16
Hirundo rustica	28250	29000	3%	28500	**1%**	-5
Motacilla flava	7500	7500	0%	8100	**8%**	-8
Saxicola torquatus	1400	4250	204%	1650	**18%**	213
Sylvia communis	17800	21400	20%	16850	**-5%**	11
Sturnus vulgaris	50000	42500	-15%	50550	**1%**	-26
Corvus frugilegus	2950	5750	95%	3100	**5%**	67
Passer montanus	5650	1550	-73%	5550	**-2%**	-71
Carduelis cannabina	24550	23200	-5%	24200	**-1%**	-3
Emberiza citrinella	28150	19850	-29%	26750	**-5%**	-29
Lanius collurio	1500	1850	23%	1450	**-3%**	131
Vanellus vanellus	4600	3800	-17%	4800	**4%**	-16
Sylvia curruca	4050	4400	9%	3950	**-2%**	1.4
Turdus pilaris	4900	5050	3%	4850	**-1%**	-7

⇒ No more trends … or only small one …

⇒ Difficult to predict trends with only the changes of land use variables.

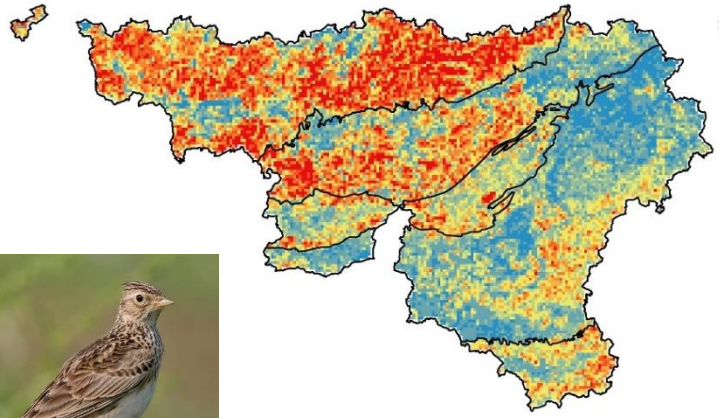
⇒ For example, several species specialized of crops would increase because crops increase where we observe a decrease between the 2 periods

Results and discussion

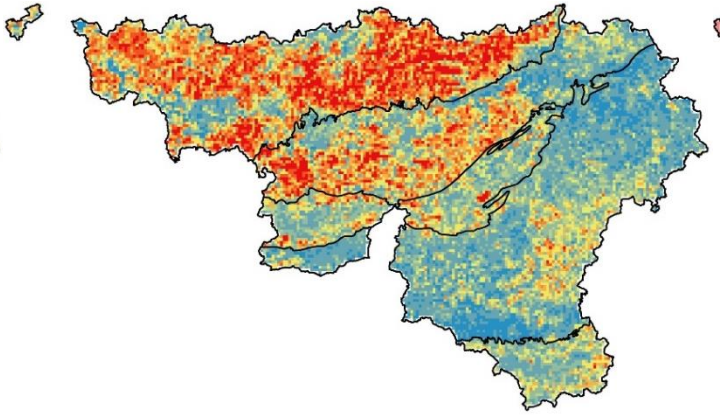
2. Comparison between models of **period 2** (2015-2018) and models built with data of period 1 crossed with **environmental data of period 2**

   → Example of *Alauda arvensis*

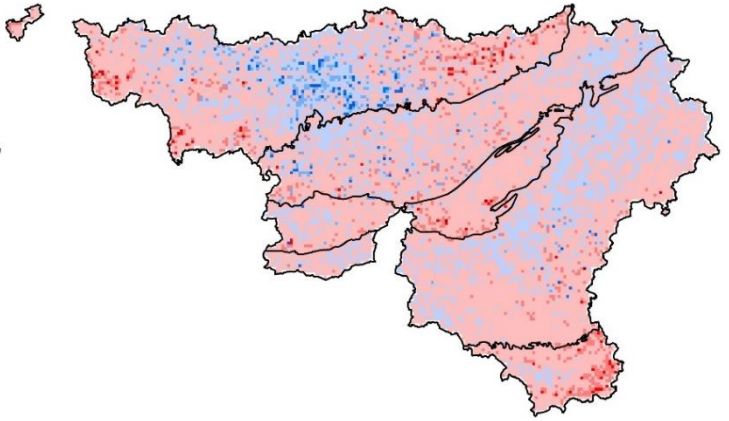
Period 1



Period 2

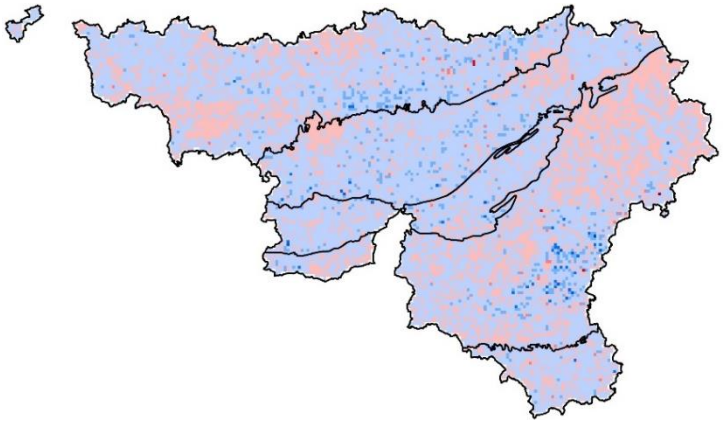


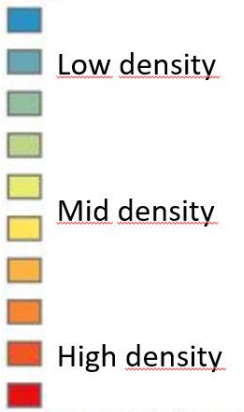
Difference between period 1 and 2

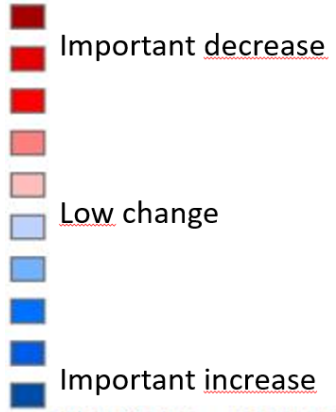


Alauda arvensis

Difference between period 1 and 2 (with model of period 1)







Conclusion and perspectives

1. Models independently built can indicate some trends in bird population
   → Difficult to observe trends with models crossed

2. Land use variables not always sufficient to explain changes
   → Interesting to obtain more data (agricultural practices : pesticides, rotations, etc.)
   → Further analyses on decreasing/increasing species

3. Need to study trends per walloon biogeographical regions
   → Important variations of trends in different regions

Thank you for your attention

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Autres : Jean-Louis Coppée et Thomas Coppée