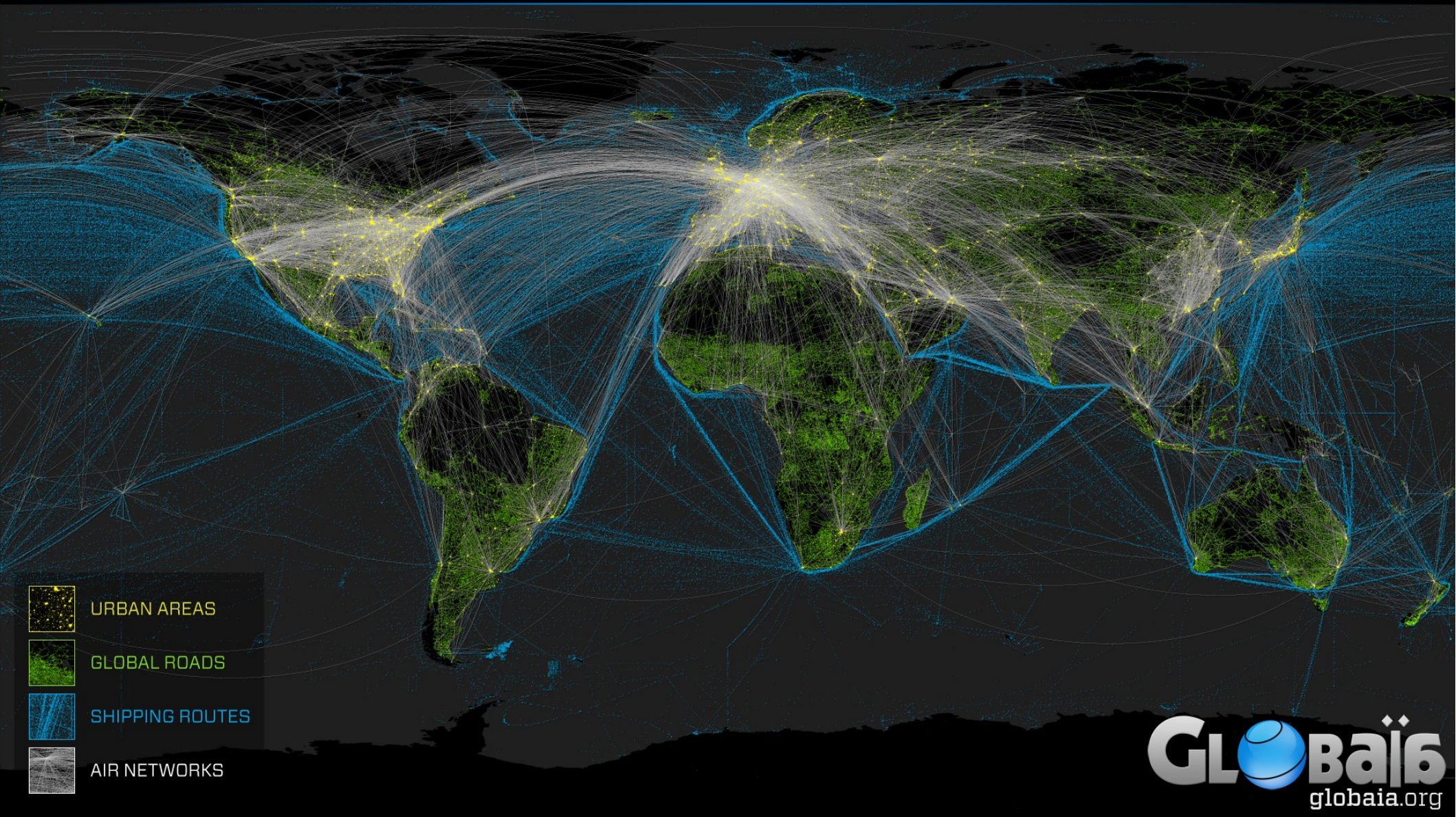
Genetic structure of *Natrix natrix* and *Alytes obstetricans* across five large-scale transportation infrastructures

J. Remon, S. Moulherat, S. Blanchet, M. Baguette, J. Prunier (TerrOïko, SETE Moulis)

SEH 2017, 19 september 2017

THE GLOBAL TRANSPORTATION SYSTEM



Dulac 2013, Laurance *et al.* 2014

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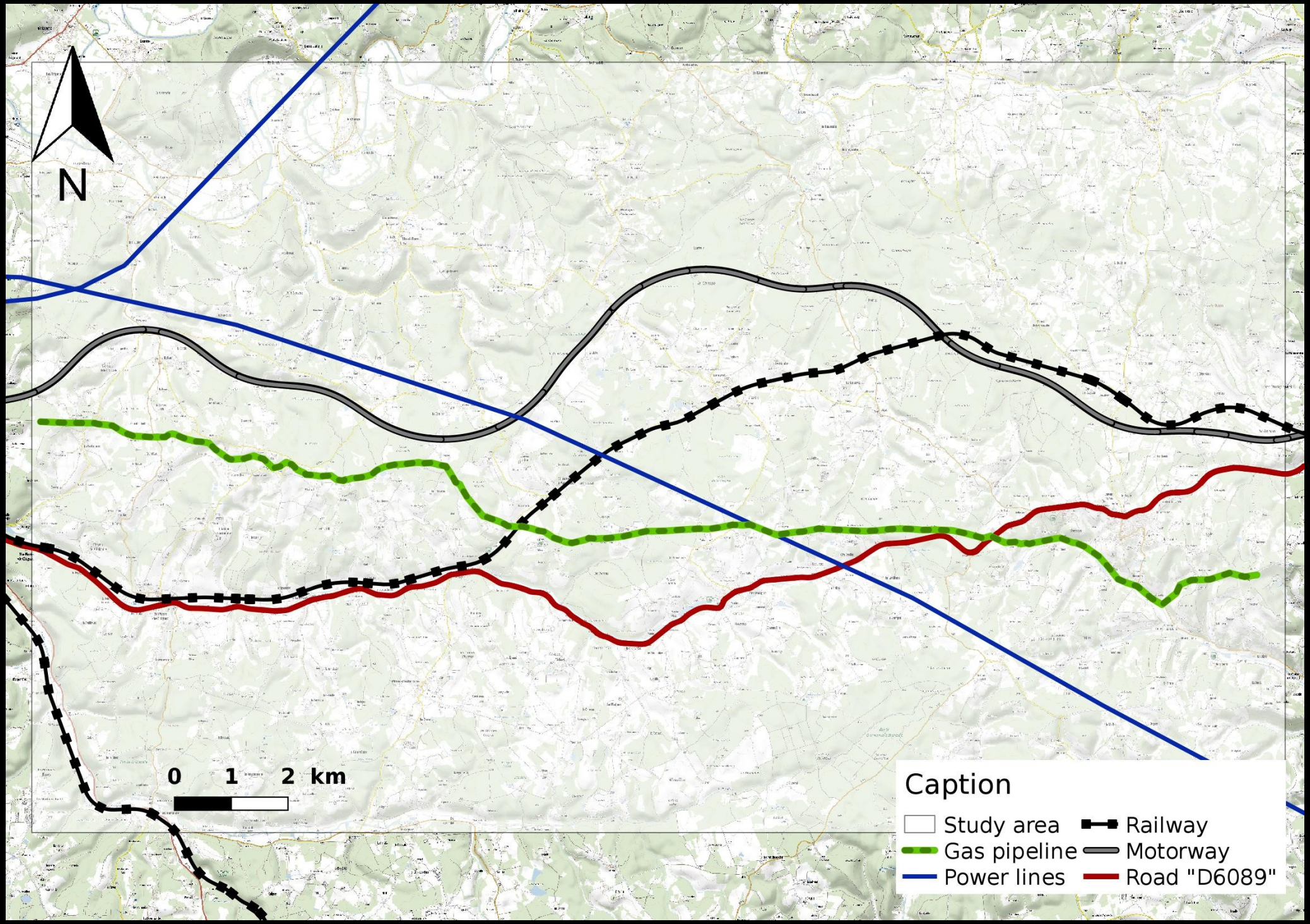
Study site


N
0 1 2 km
Caption
Study area
Railway
Gas pipeline
Motorway
Power lines
Road "D6089"

Large-scale transportation infrastructures

Railway

Motorway

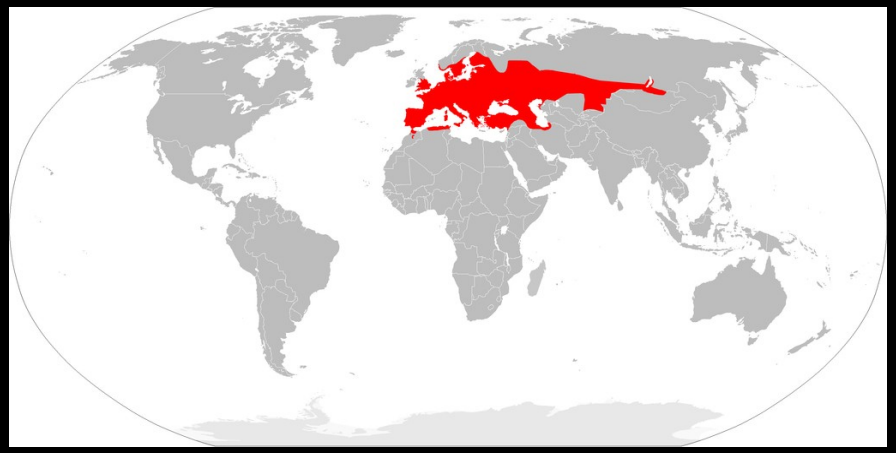
Road « D6089 »

Gas pipeline

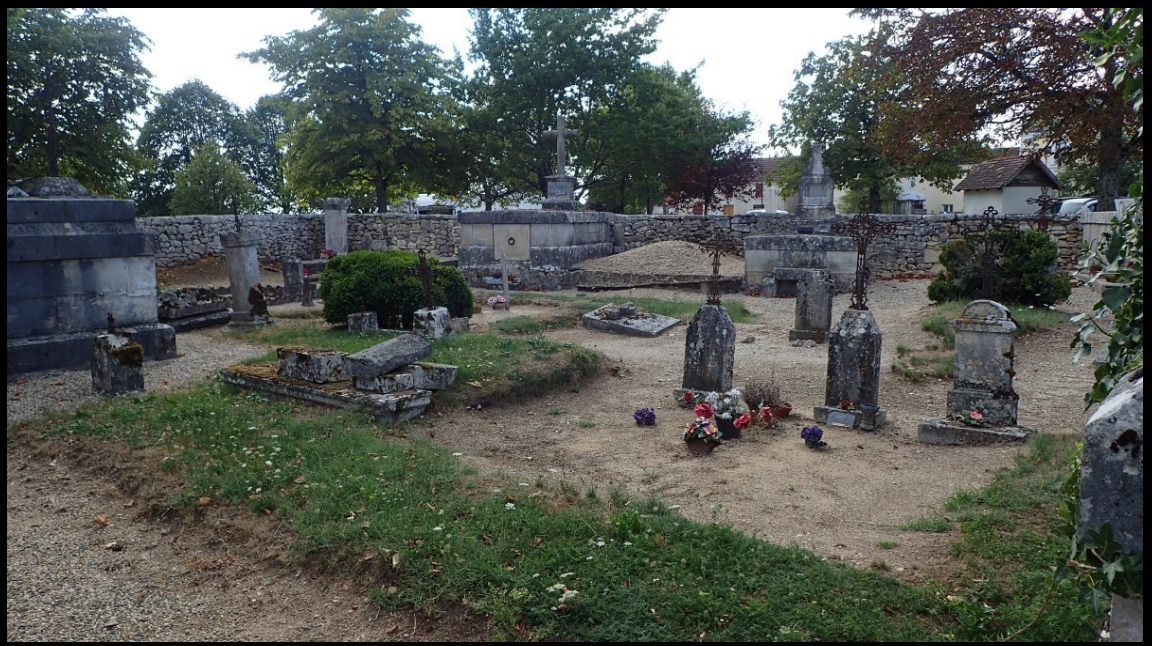
Power line

Model species

Natrix natrix helvetica
(Natrix helvetica)



Model species

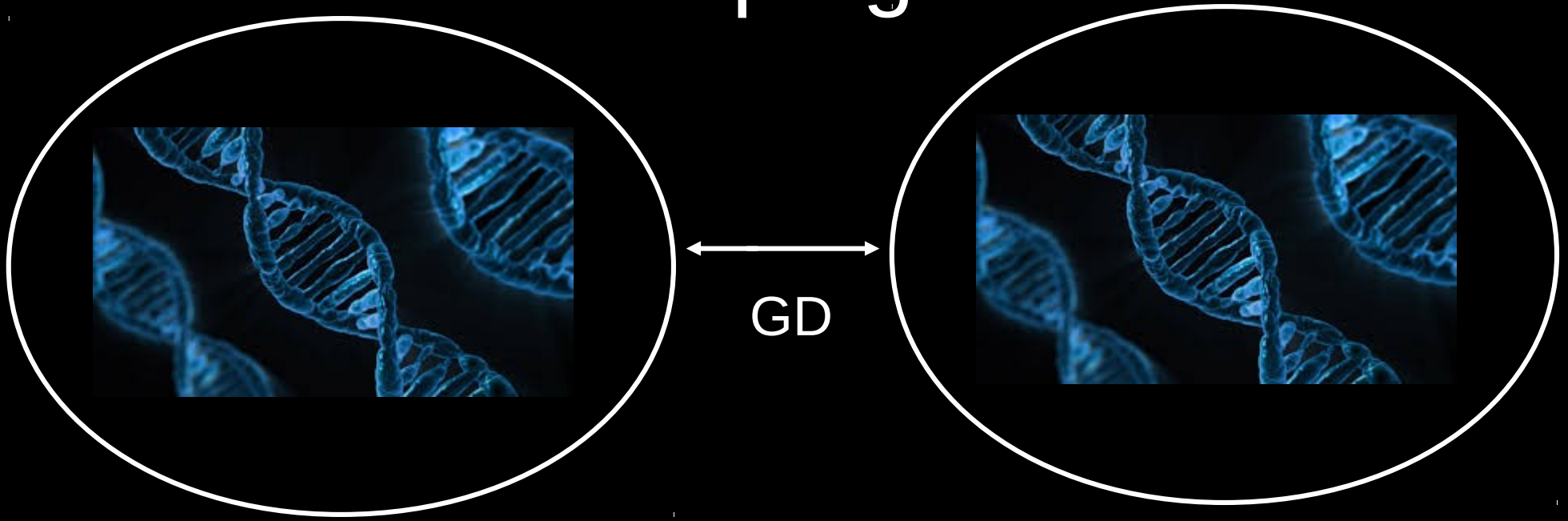


Alytes obstetricans

http://www.edgeofexistence.org

Landscape genetics

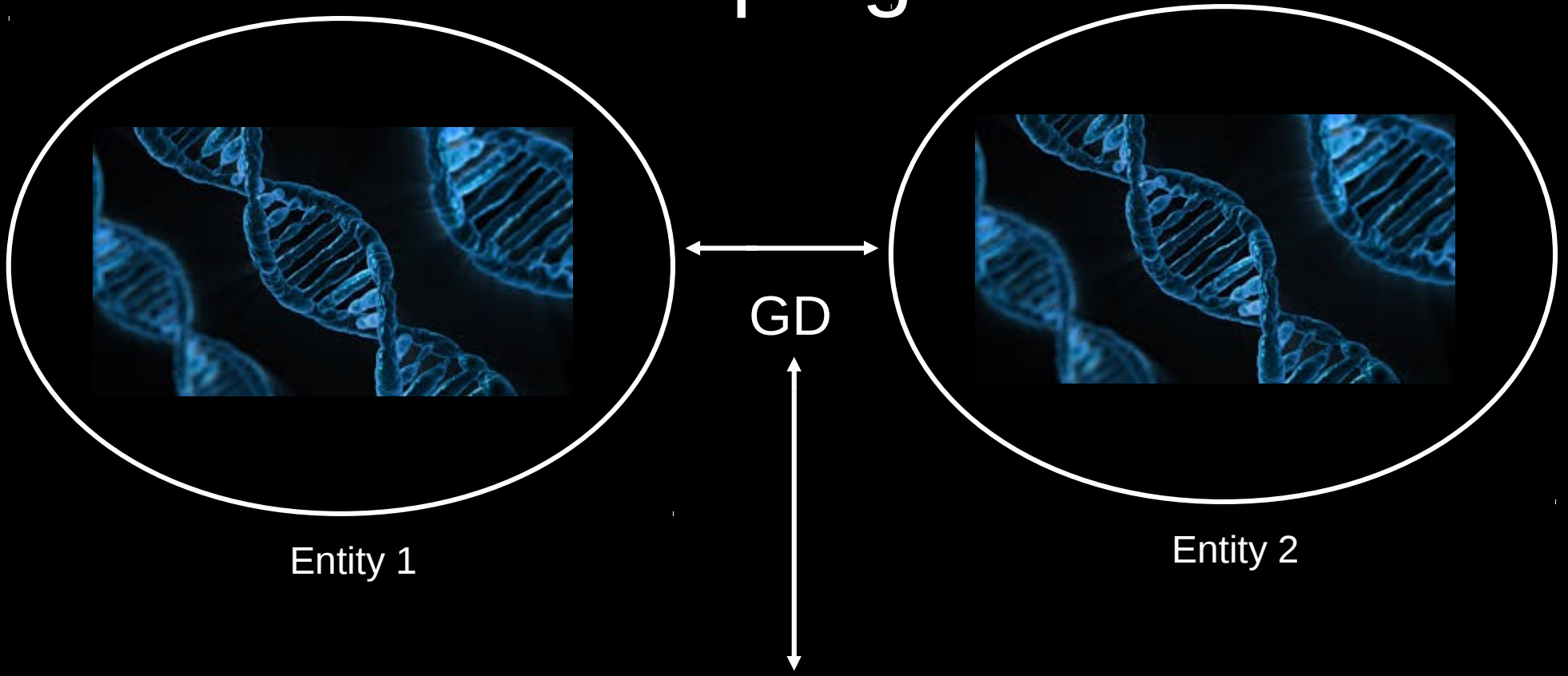
Landscape genetics



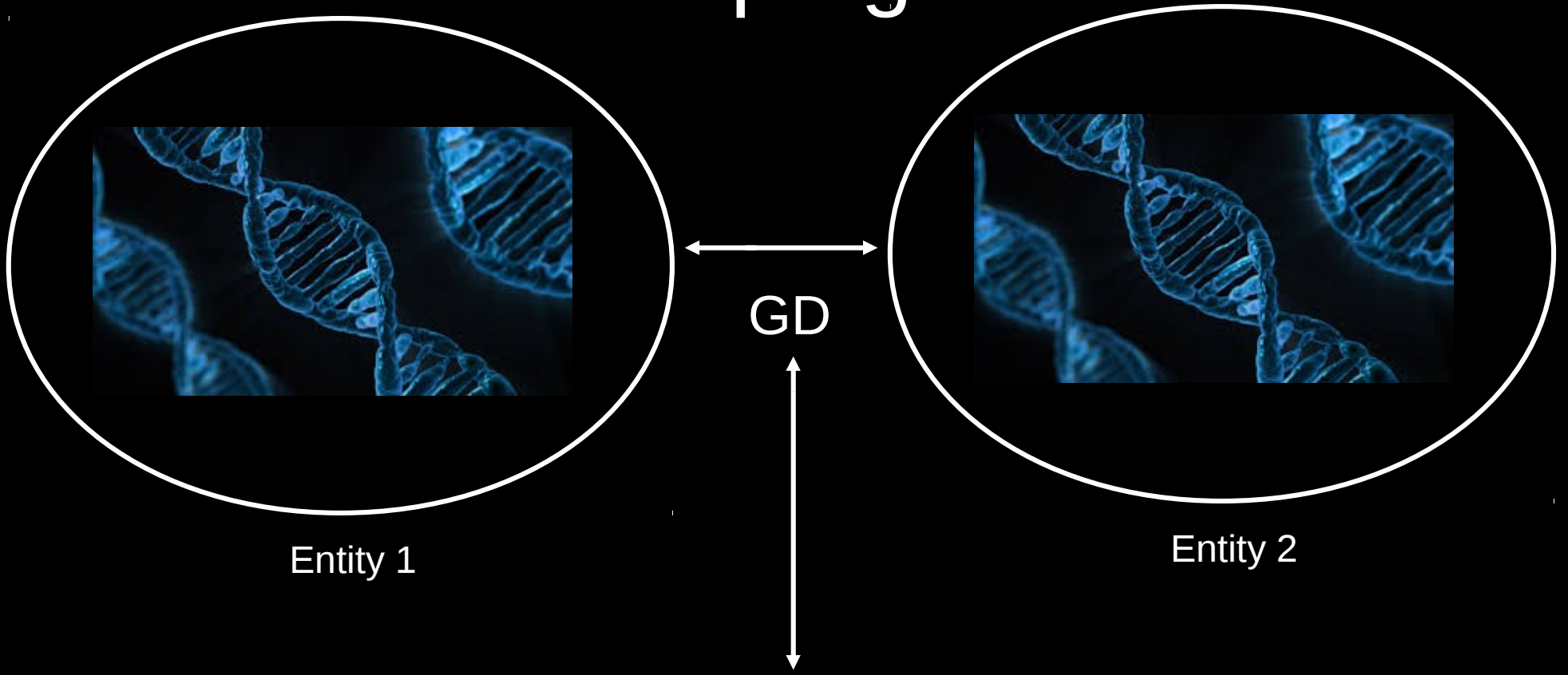
Entity 1

Entity 2

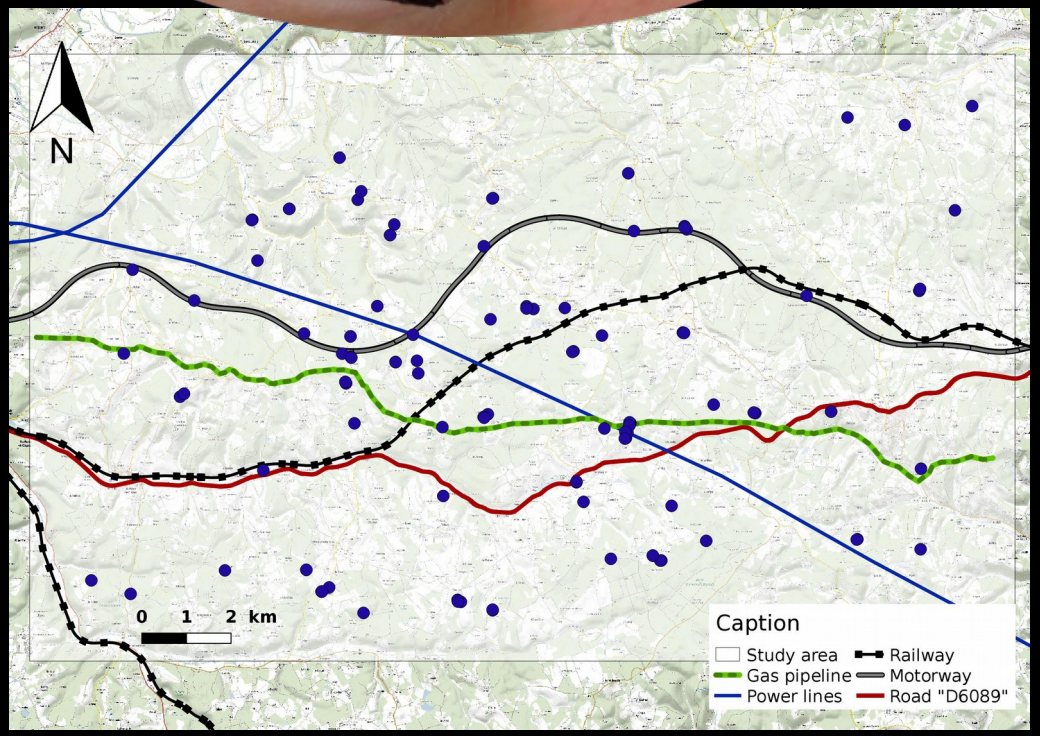
Landscape genetics



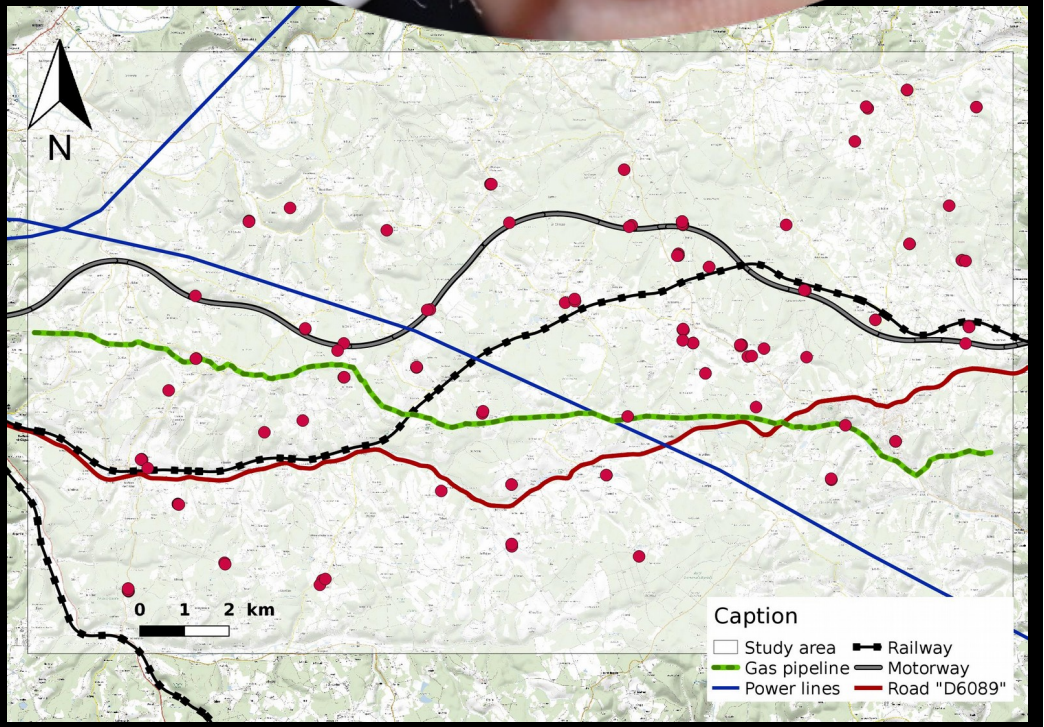
Landscape genetics



Data collection

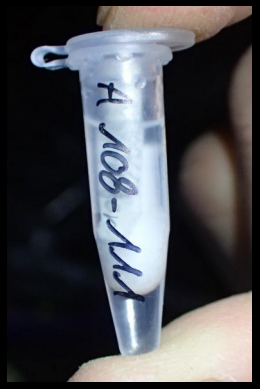


115 individuals



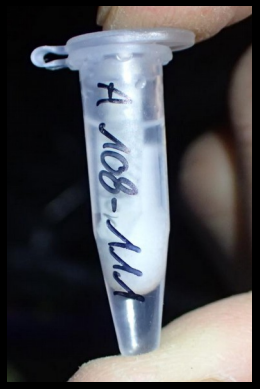
132 individuals

Lab analysis



DNA extraction

Lab analysis

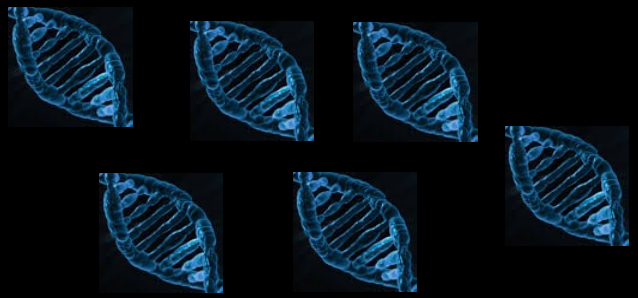


DNA extraction

PCR

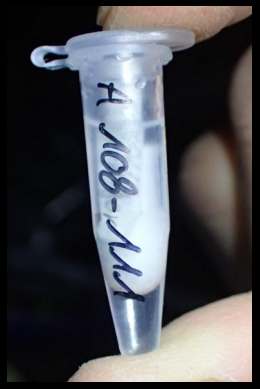
13 microsatellite loci*

14 microsatellite loci**



* Burns & Houlden 1999, Prosser *et al.* 1999, Gautschi *et al.* 2000, Garner *et al.* 2002, Blouin-Demers *et al.* 2003, Meister *et al.* 2009, Sloss *et al.* 2012, Pokrant *et al.* 2016
** Tobler *et al.* 2013, Maia-Carvalho *et al.* 2014,

Lab analysis



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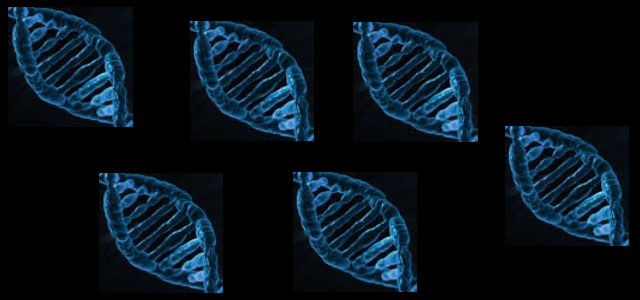
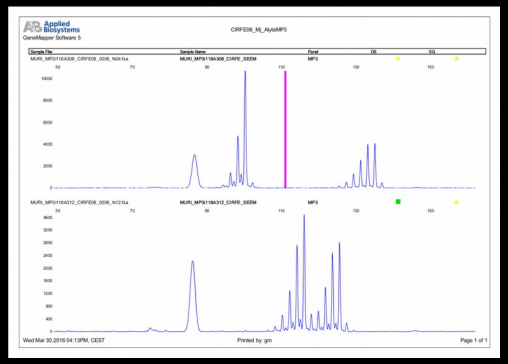


Genotyping



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Genetic analysis

1) Genetic structure
(STRUCTURE software)

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2) Isolation By Distance (IBD)
Mantel test

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3) Isolation By Resistance (IBR)
Circuitscape and CAonDM

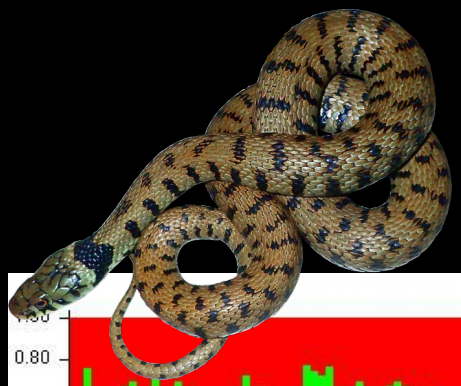
Genetic analysis

1) Genetic structure
(STRUCTURE software)

2) Isolation By Distance (IBD)
Mantel test

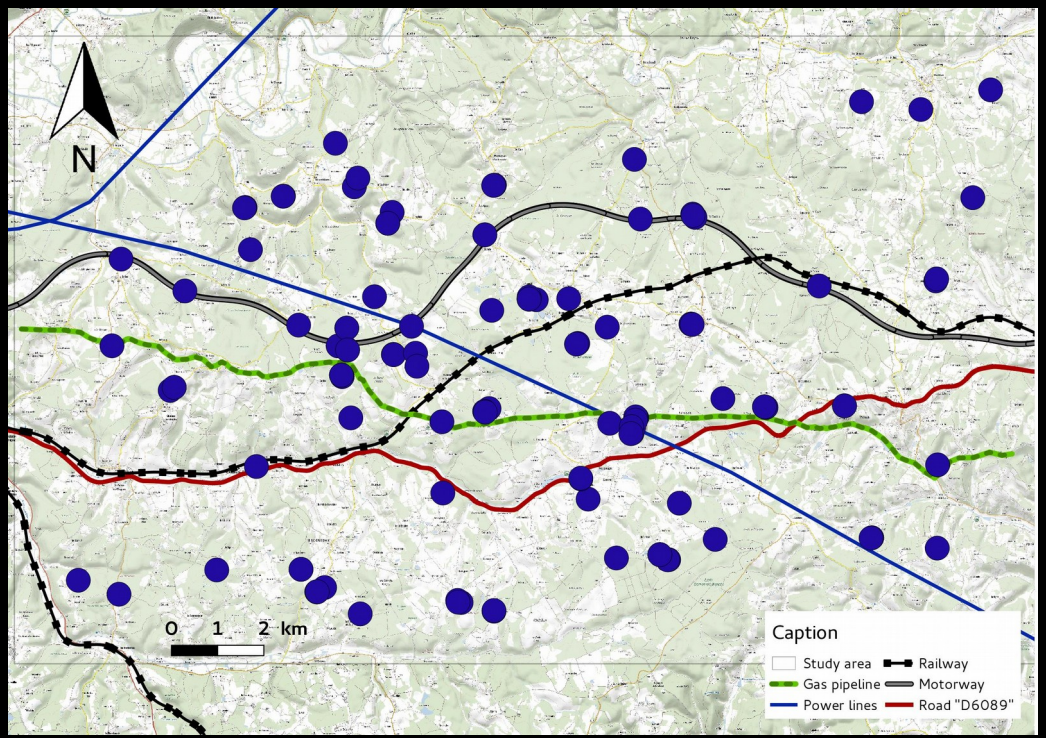
3) Isolation By Resistance (IBR)
Circuitscape and CAonDM

4) Isolation By Barriers (IBB)
Circuitscape and CAonDM

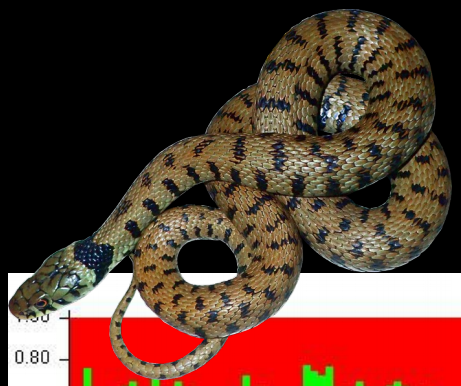


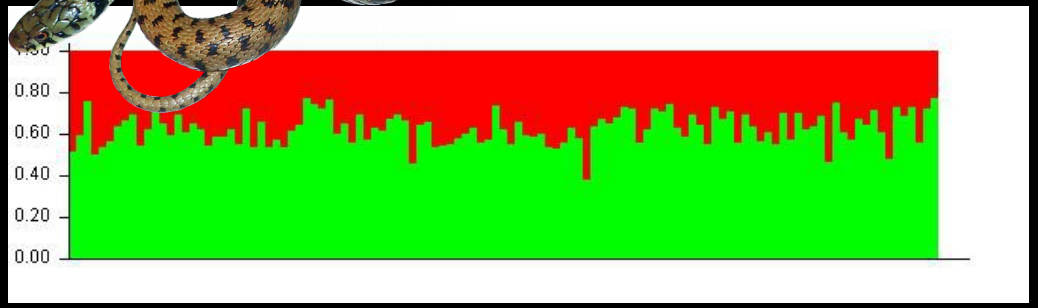
1) Genetic structure

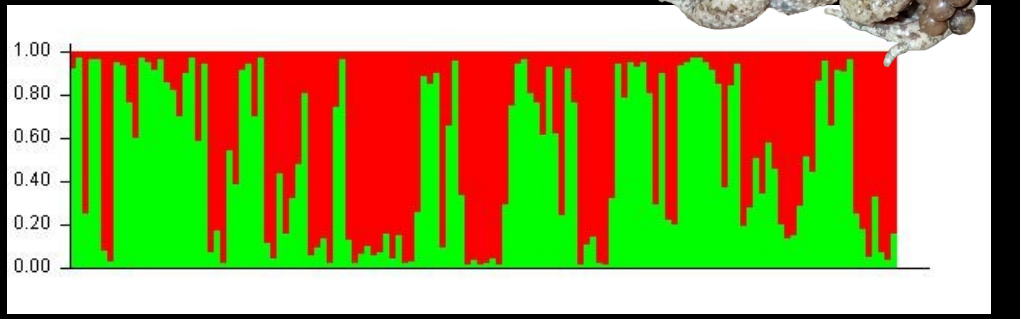
1 Cluster



1) Genetic cluster

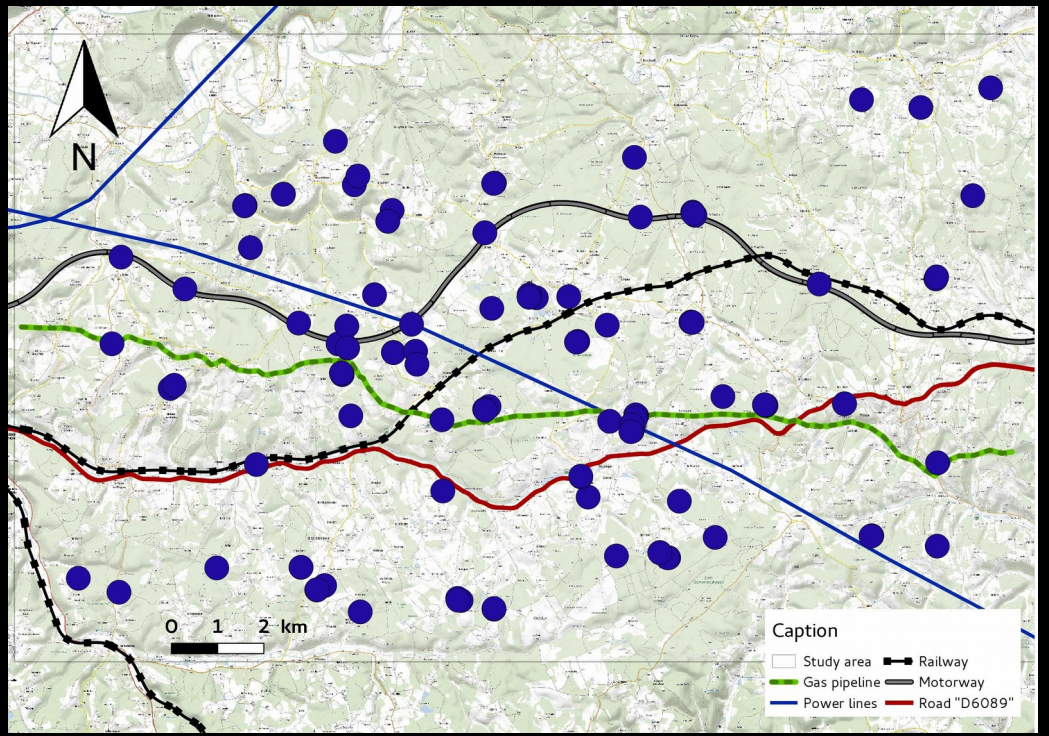


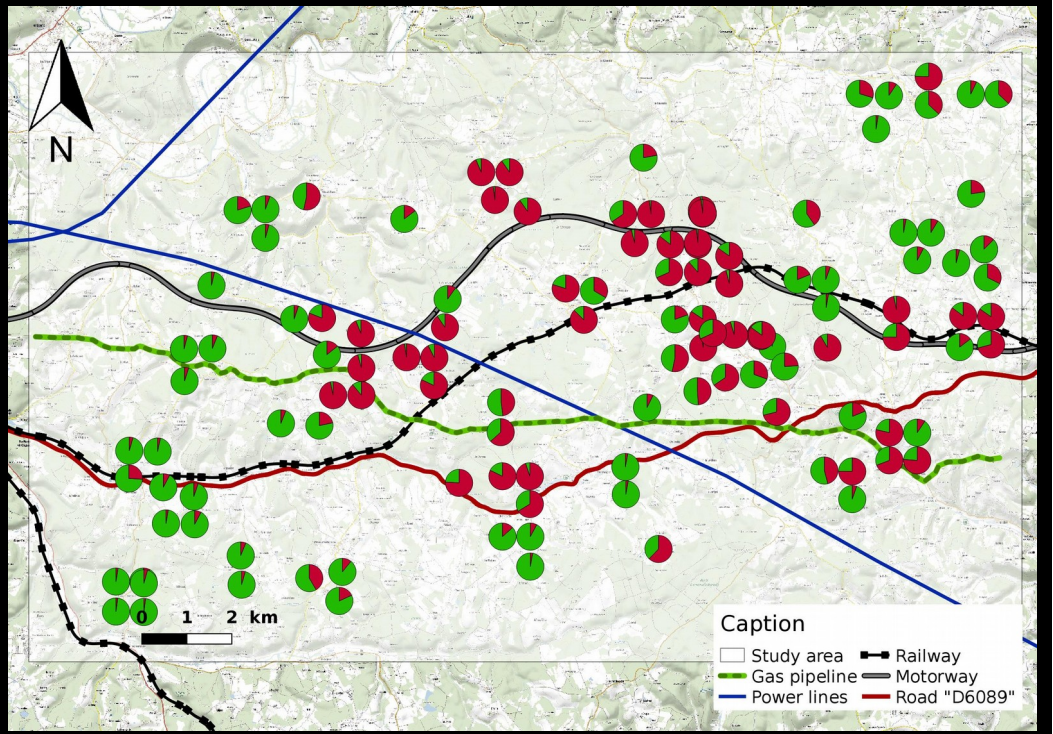




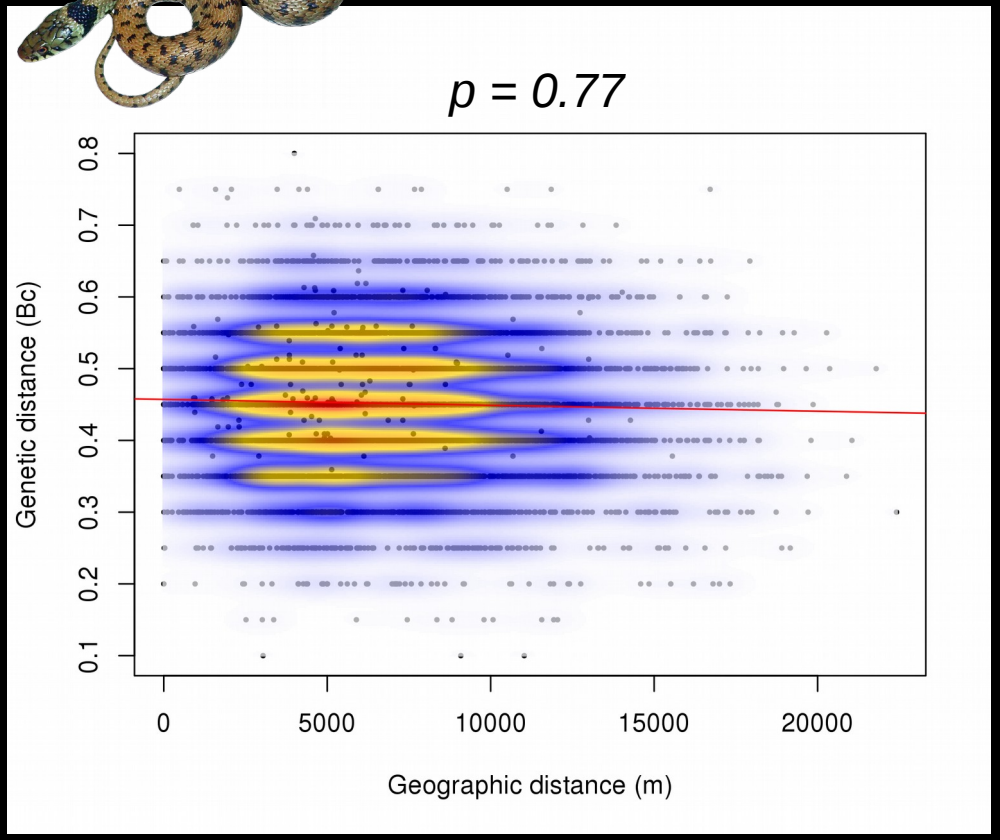
1 Cluster

2 clusters





2) Isolation By Distance



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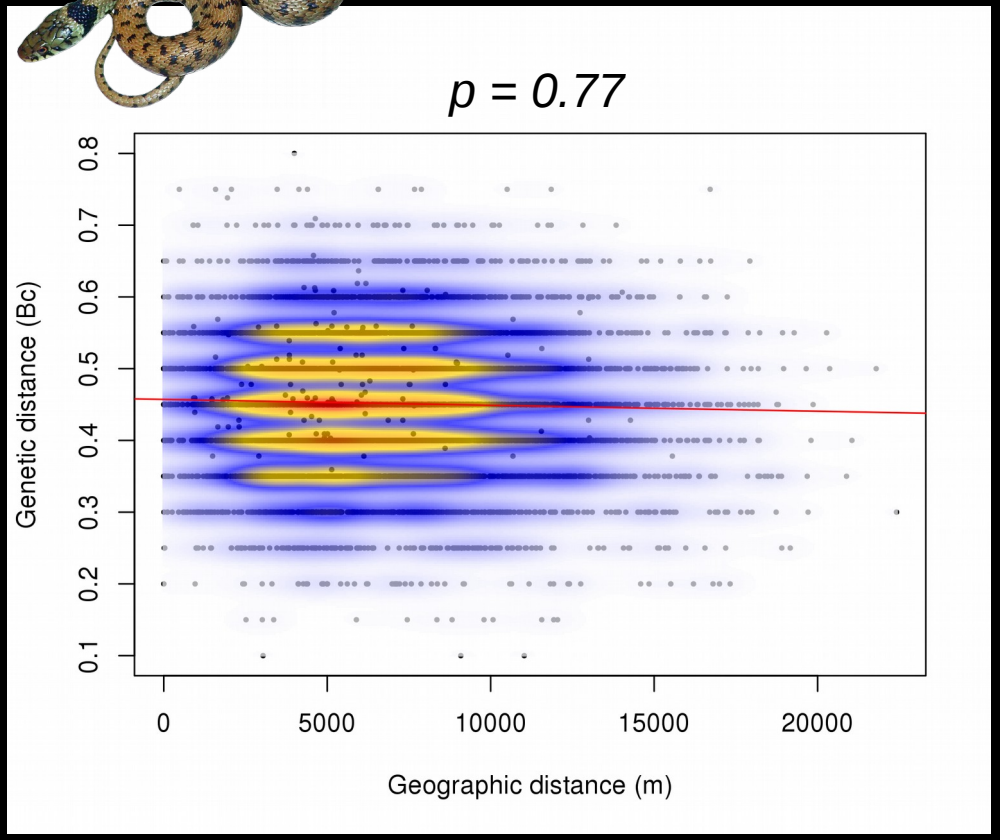

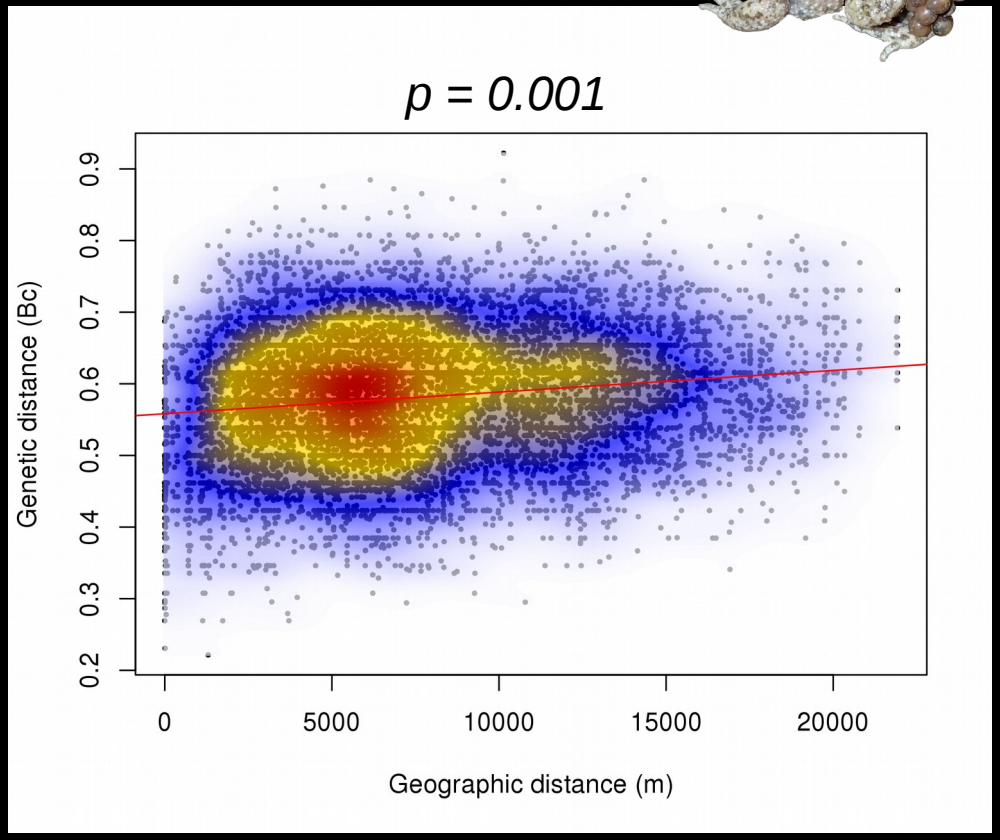

3) Isolation By Resistance

3) Isolation By Resistance

No effect

No effect

No effect

p = 0.068

No effect

3) Isolation By Resistance

No effect

No effect

No effect

No effect

No effect

No effect

+ *p = 0.068*

+ *p = 0.063*

No effect

No effect

4) Isolation By Barriers

4) Isolation By Barriers

p = 0.095

No effect

No effect

No effect

No effect

4) Isolation By Barriers

p = 0.095

No effect

No effect

No effect

No effect

No effect

No effect

p = 0.017

Summary

- **Genetic structure** weak

- **IBD** No IBD

- **IBR** (Water)

- **IBB** No IBB (Motorway)

Summary

- **Genetic structure**: weak / Strong
- **IBD**: No IBD / IBD
- **IBR**: (Water) / (Water)
- **IBB**: No IBB (Motorway) / Road D6089

CONCLUSIONS

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: big effective population size ? High mobility ? Low phylopatry ?

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→ **Conservation issues :**

- preserving water bodies for both species (reproduction/feeding)

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- main roads and amphibians 

CONCLUSIONS

: big effective population size ? High mobility ? Low phylopatry ?

: clumped distribution. High phylopatry ?

→ **Conservation issues :**

- preserving water bodies for both species (reproduction/feeding)

- main roads and amphibians 

- motorway : recent infrastructure but may be a strong barrier for snakes on the long term

Thanks for your attention !

Acknoledgements :
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Emmanuelle Chevallier
Allison Mira
Eva Garcia
Aymeric Brissaud
Raphaël Roudier
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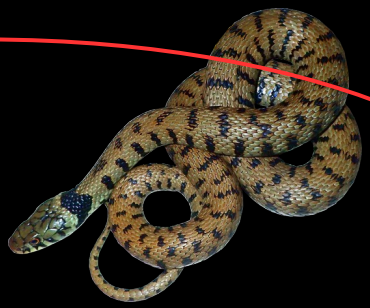
Aurélia Dubois
Nicolas Macel
Manon Guillau
Damien Jacquet
Morgane Pujol
Lucille Tillion
Kirsten Henderson
Maddie Sanders
Agathe Verzeni
SEH organizers !

« You first !
- No thanks ! »

3) Isolation By Barriers



p = 0.095

No effect

No effect

No effect

No effect

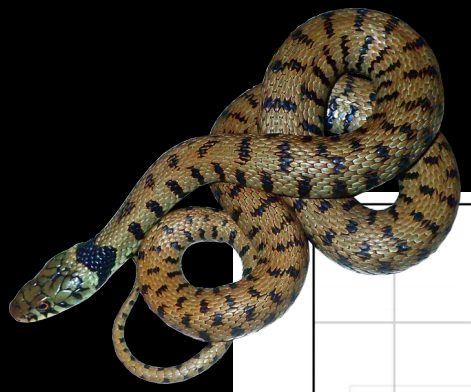
No effect

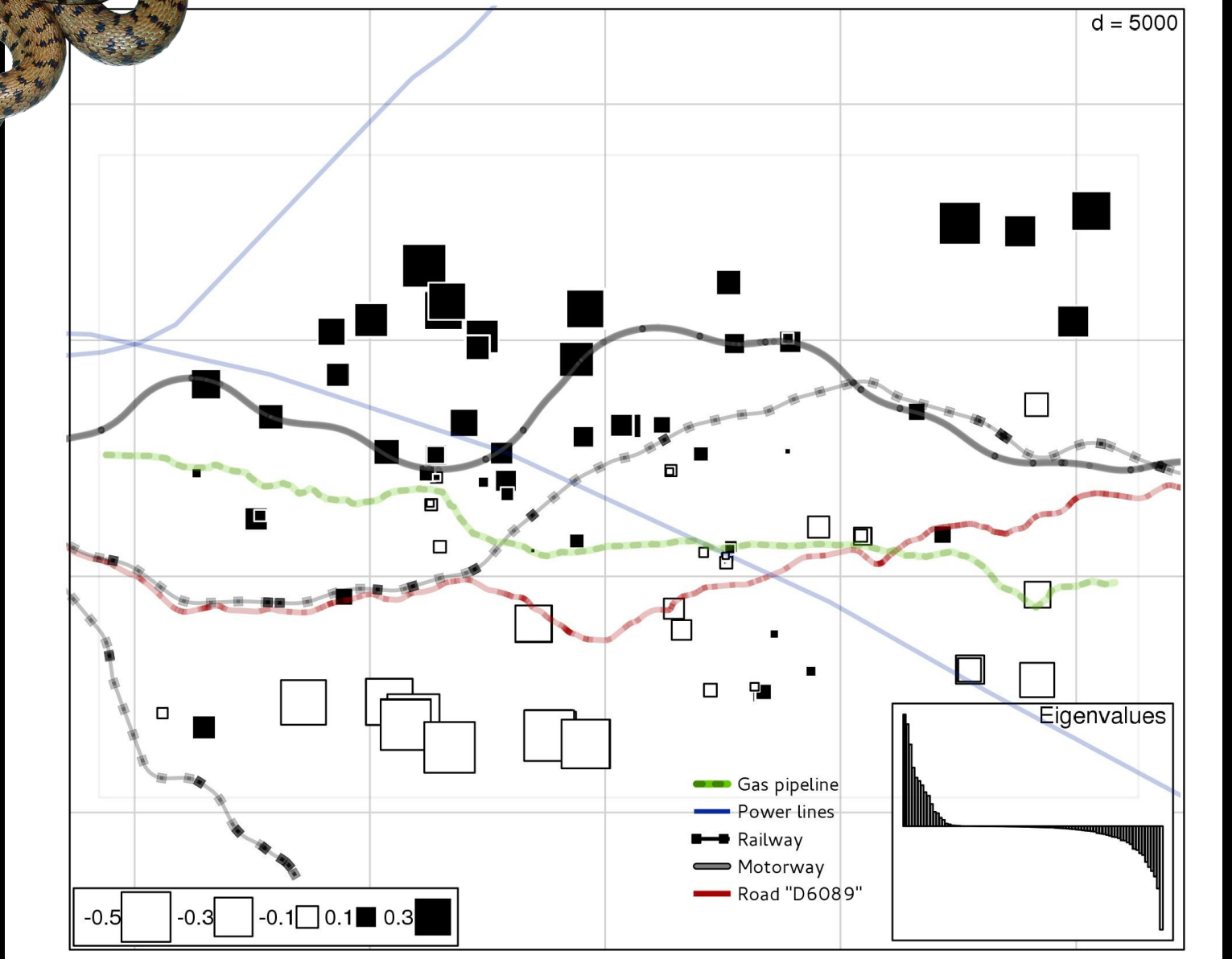
No effect

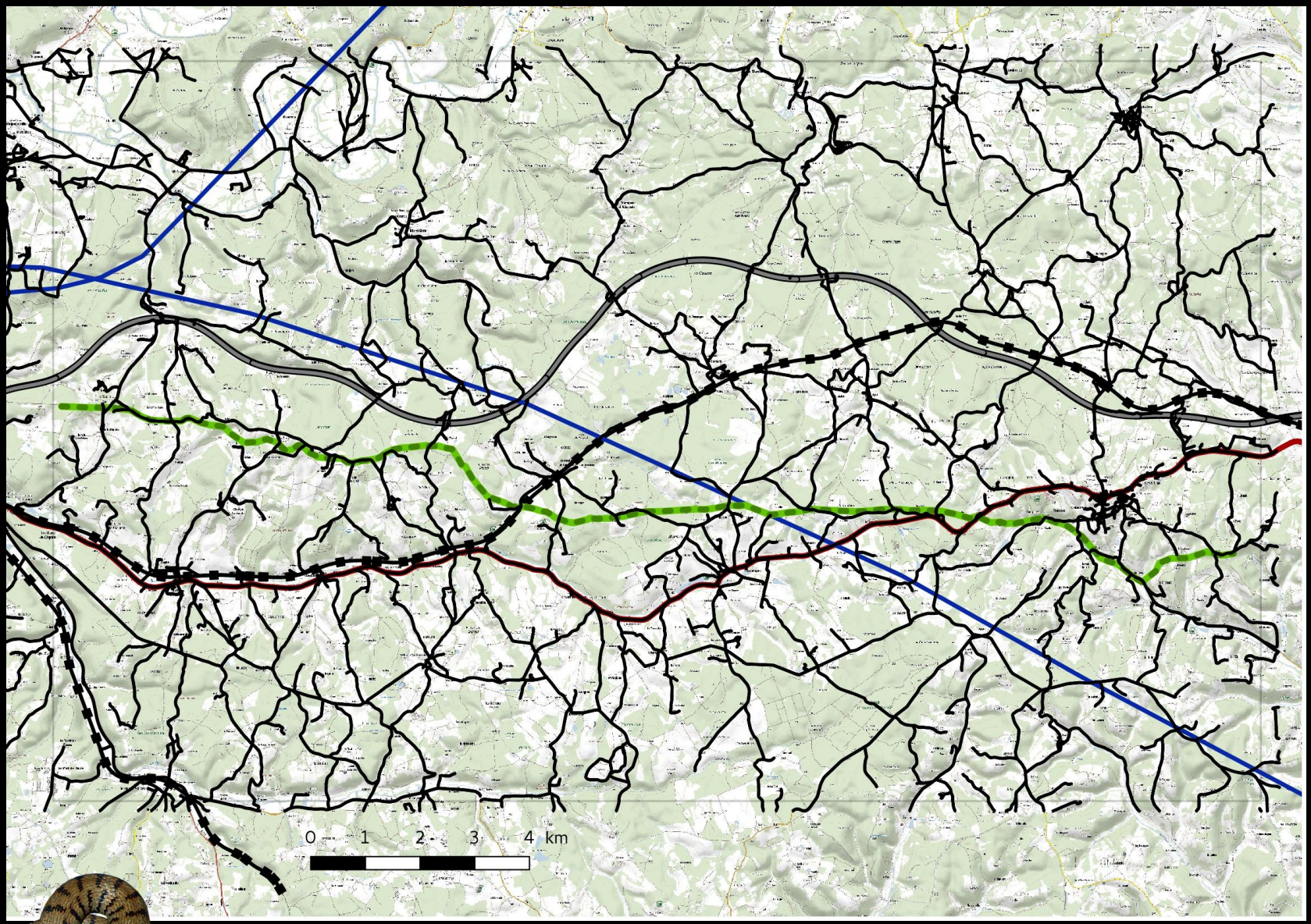
No effect

p = 0.017

spatial PCA

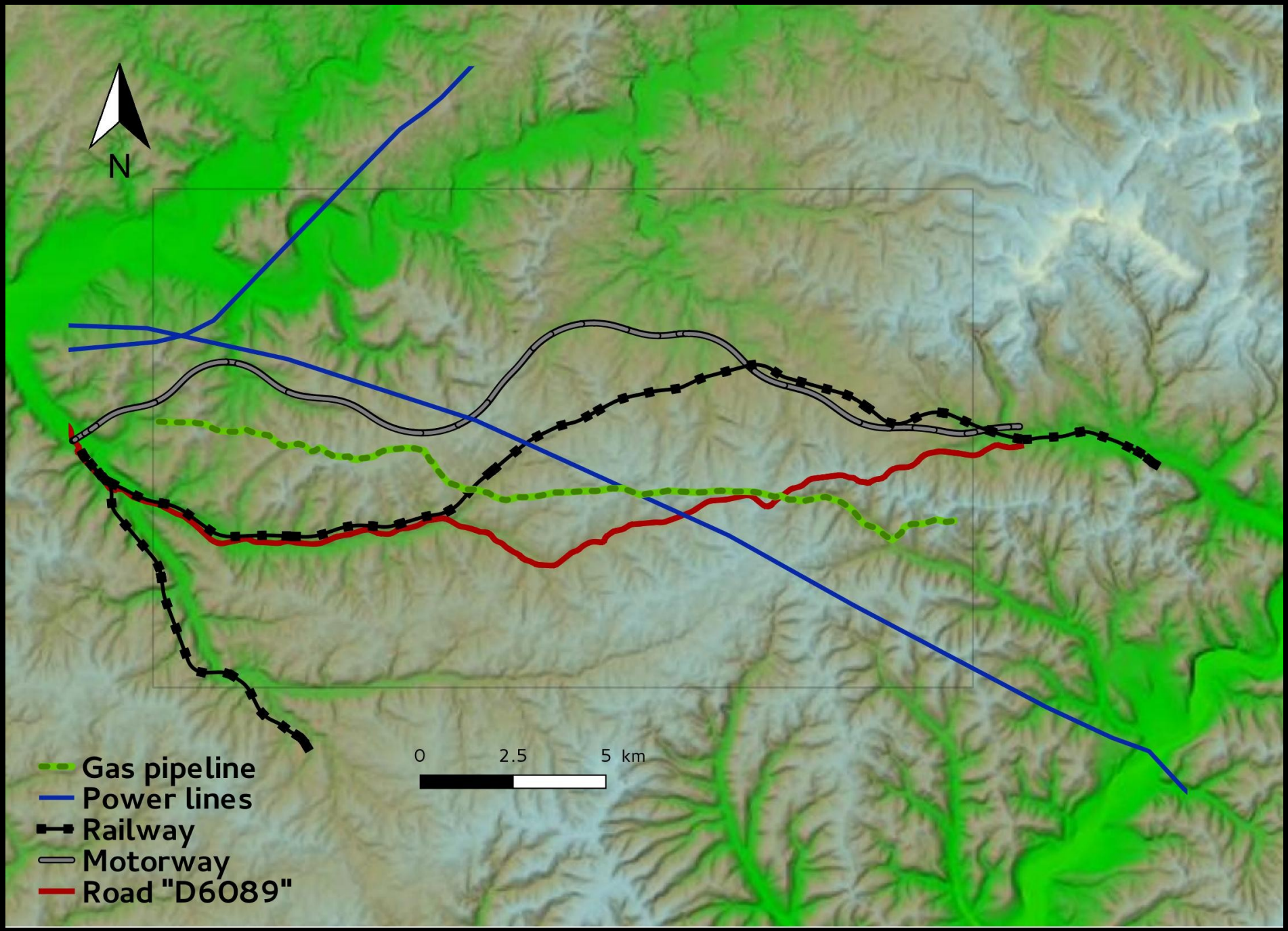



d = 5000
Gas pipeline
Power lines
Railway
Motorway
Road "D6089"
Eigenvalues
-0.5
-0.3
-0.1
0.1
0.3



P = 0.015

P = 0.076


N
0
2.5
5 km
Gas pipeline
Power lines
Railway
Motorway
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