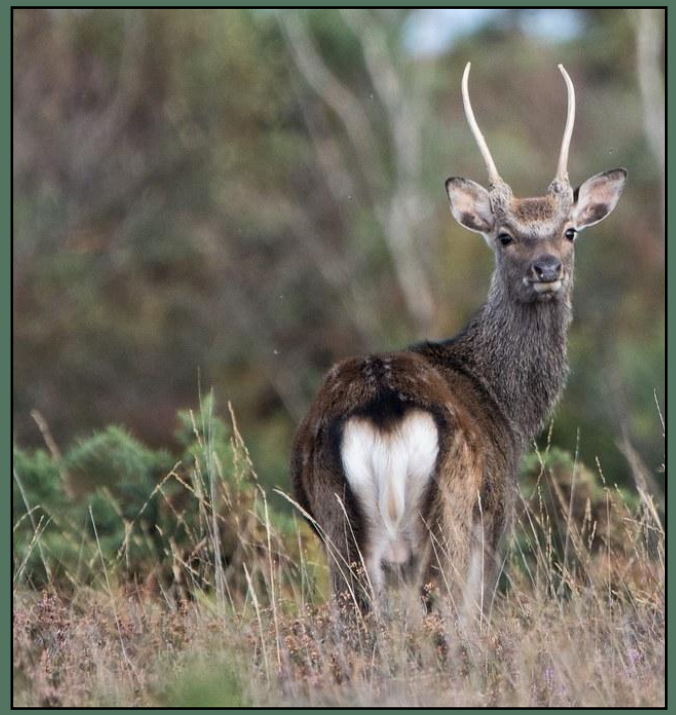


Sika deer as an alien species: Perception in scientific literature and ecological traits of non--native populations

Laura SAGGIOMO M.Sc.

Supervisor:
Prof. Ing. Jaroslav Červený

Advisor:
Ing. Miloš Ježek Ph.D

Prague, 2021

Alien Species

Worldwide problem

Second cause of biodiversity loss

Ecological issue

Intensifying process

Alien Species in Europe

Currently among the most urgent nature conservation issues

Important economic cost

Several alien species in Europe

*Hulme, 2009

Member of the Asian fauna

Native of:

Japan, China, Korea, Taiwan, Viet Nam, Russia

Brought to many other countries

Aesthetic reasons/Game species

Europe, USA, New Zealand, Africa

Highly Adaptable

Thrive in non native environments

Invasive populations

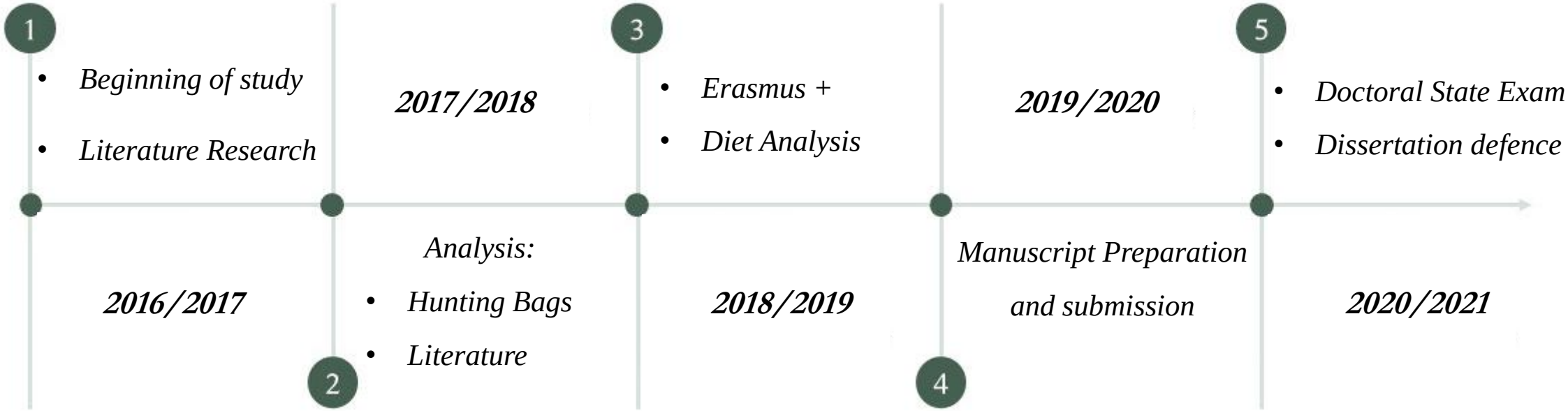
Aims and Goals

Scientific Literature

Diet Analysis

Management

Research Timeline

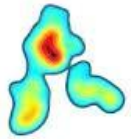


Bibliometric Analysis

Bibliometric Analysis

Investigation of:

- Most used author keywords
- Most and least productive countries
- Temporal trends of discussed topics
- Citation bursts of keywords



VOSviewer

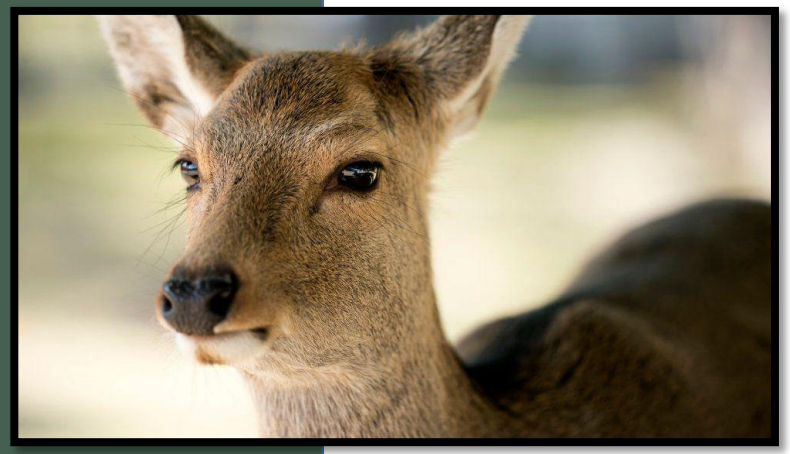
CiteSpace

Literature Search

Literature Analysis

Scopus®

WEB OF SCIENCE℠



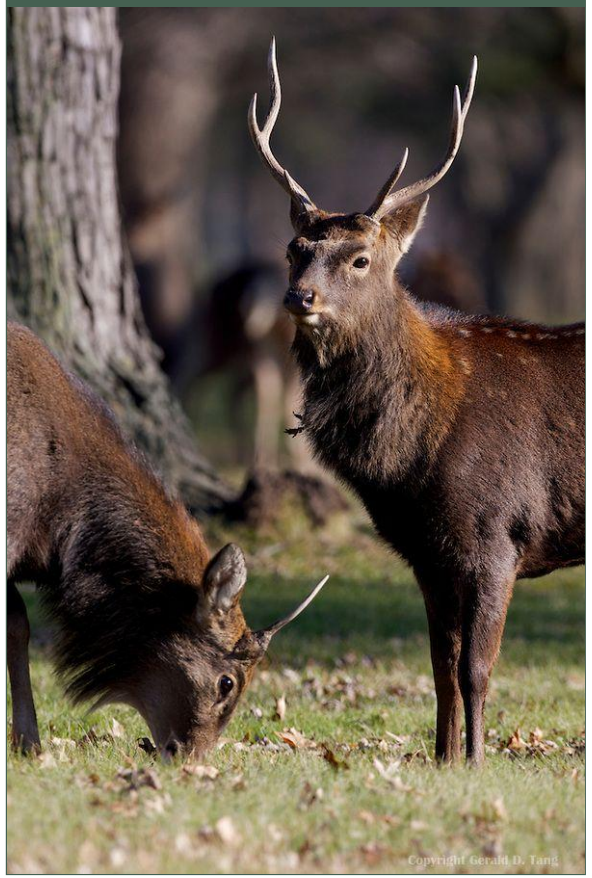
Global

Native

Non-native
European

Non-native
Non European

Results



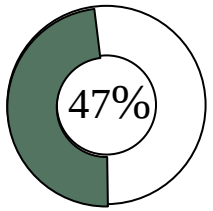
Global Literature

1.374 documents

71 countries

3.262 author keywords

Japan



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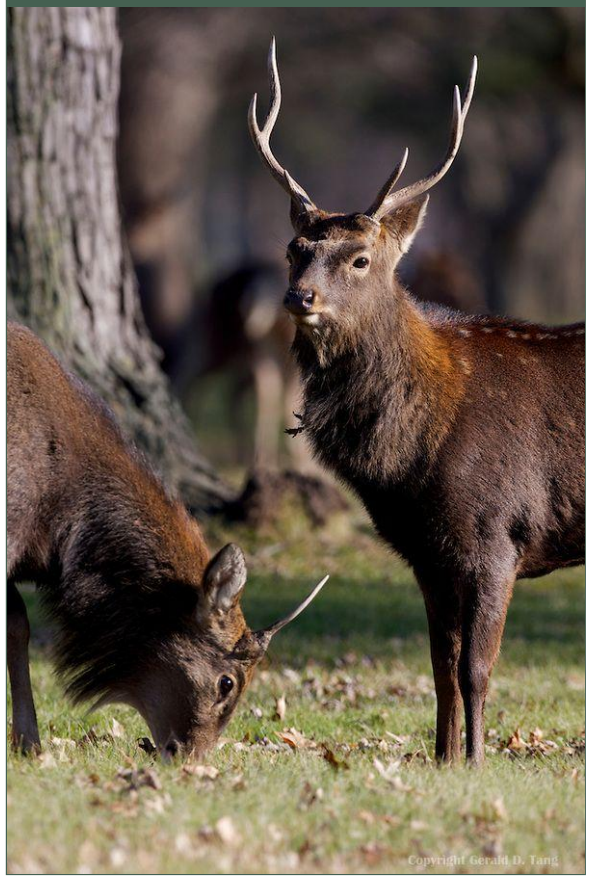


Global Literature

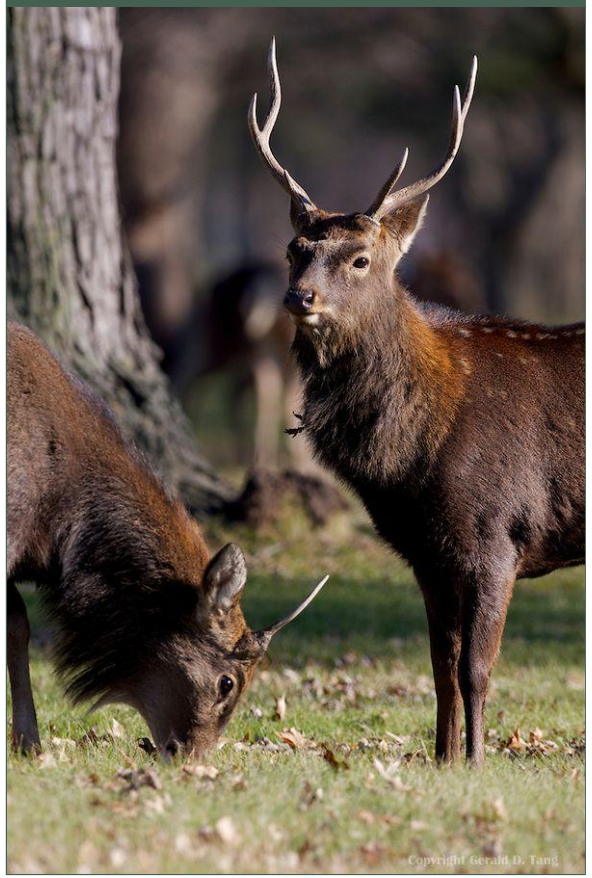
1.374 documents

71 countries

3.262 author keywords

Japan “”

Results



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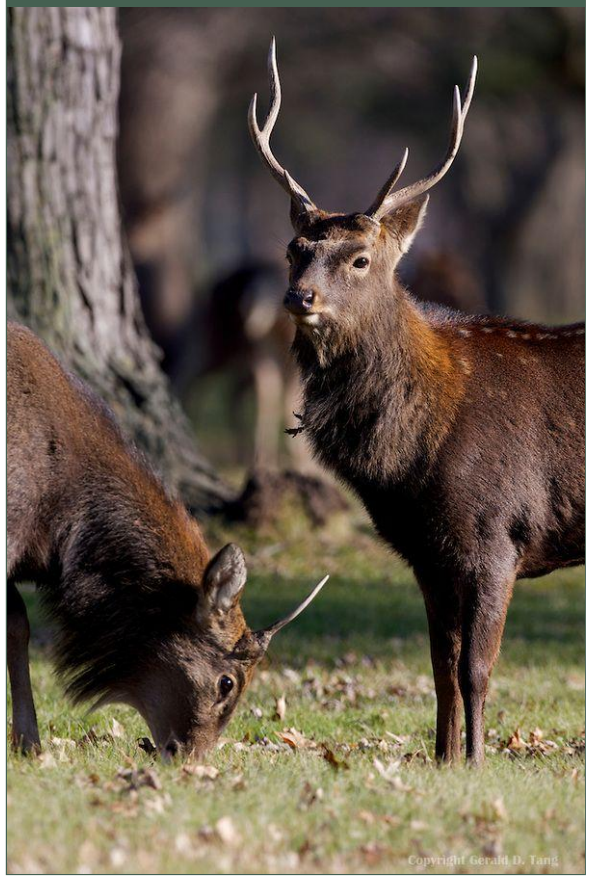

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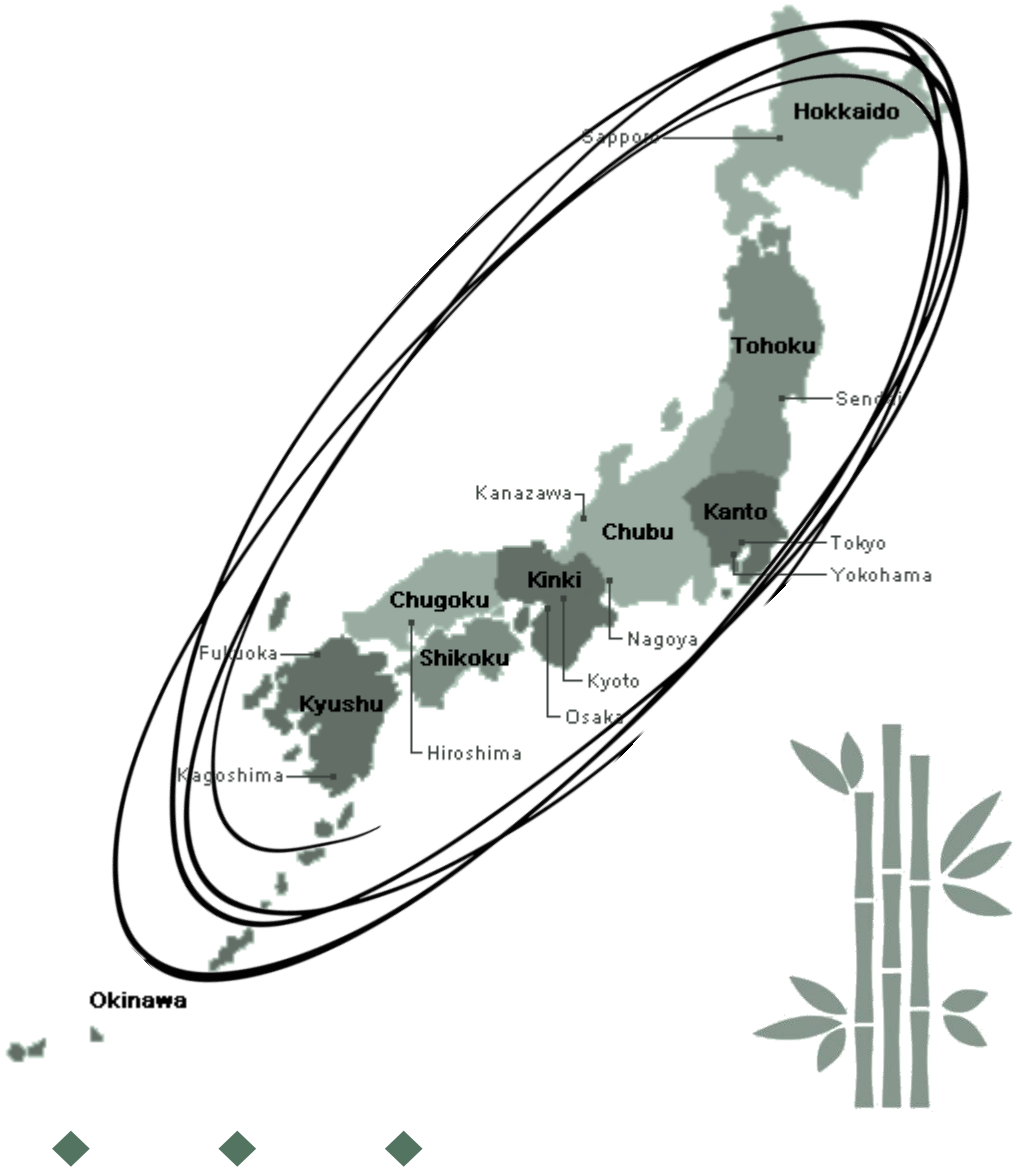

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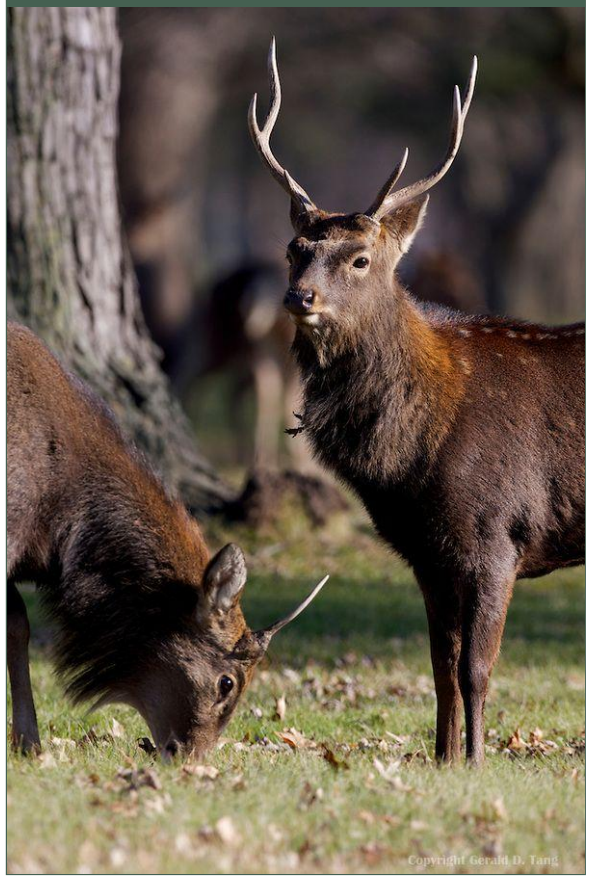
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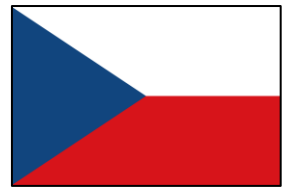
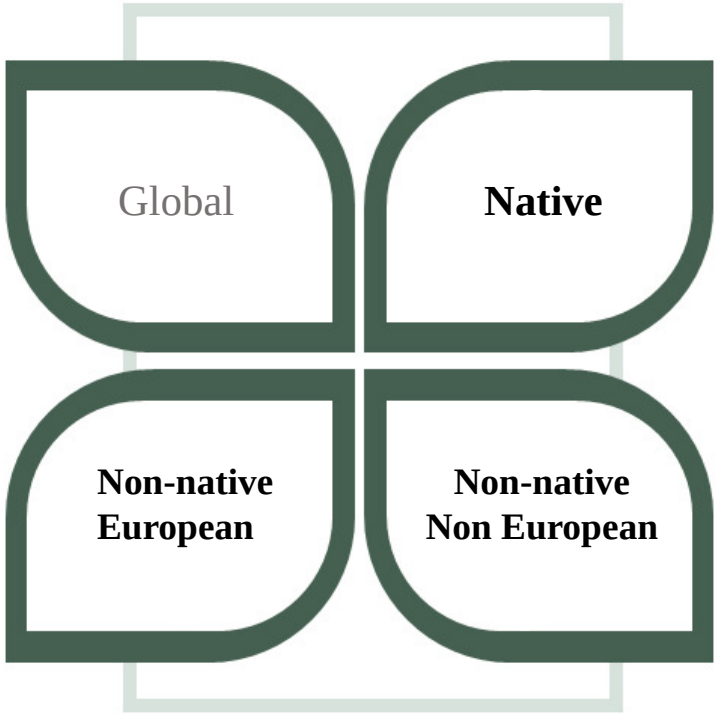
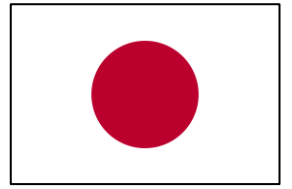
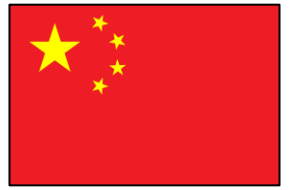



Global
Native
Non-native
European
Non-native
Non European





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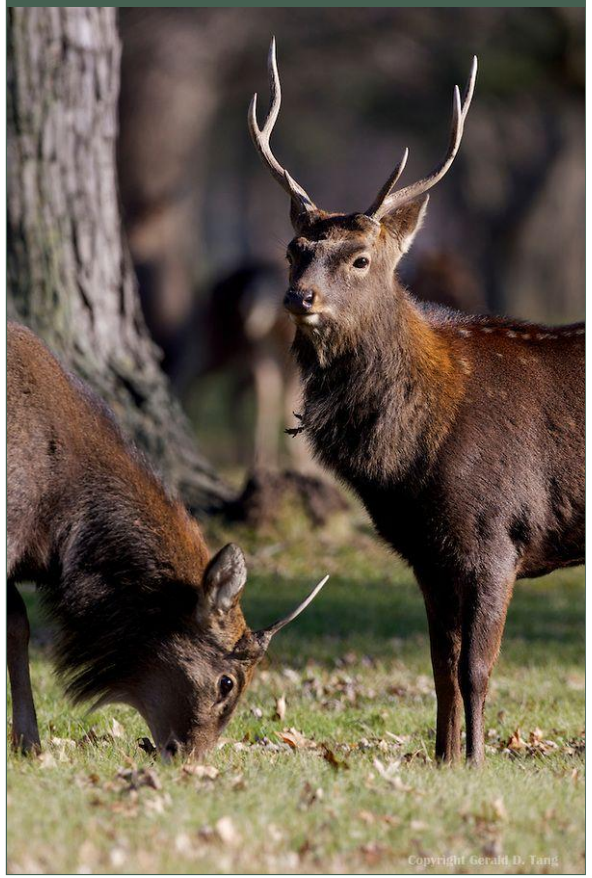
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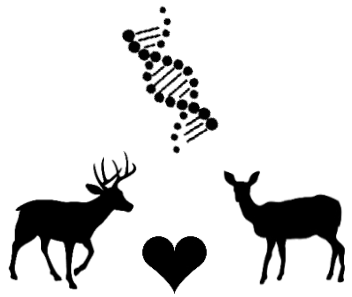
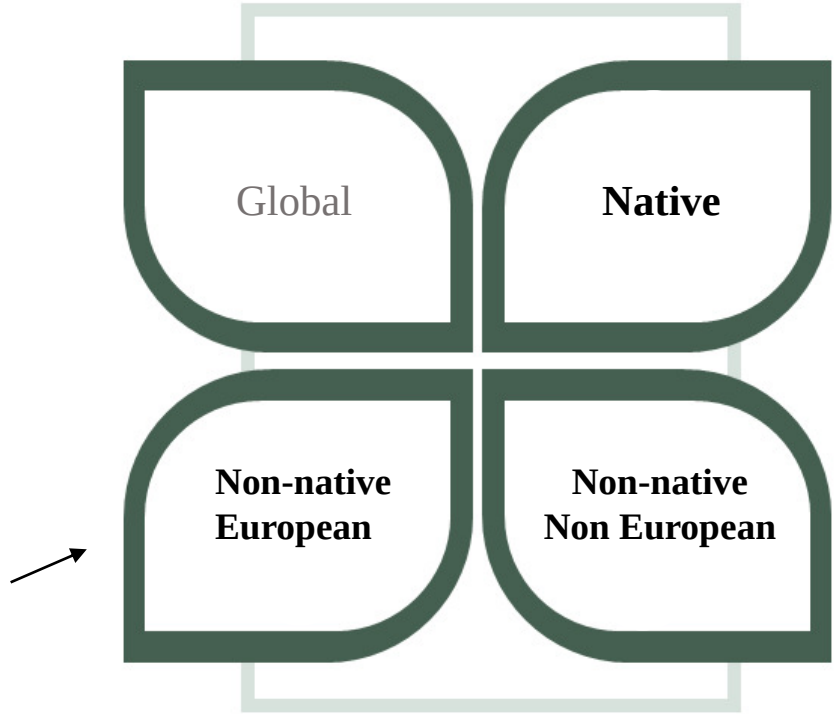
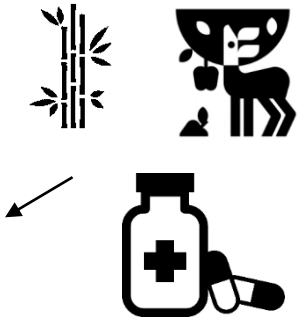



Global
Native
Non-native
European
Non-native
Non European

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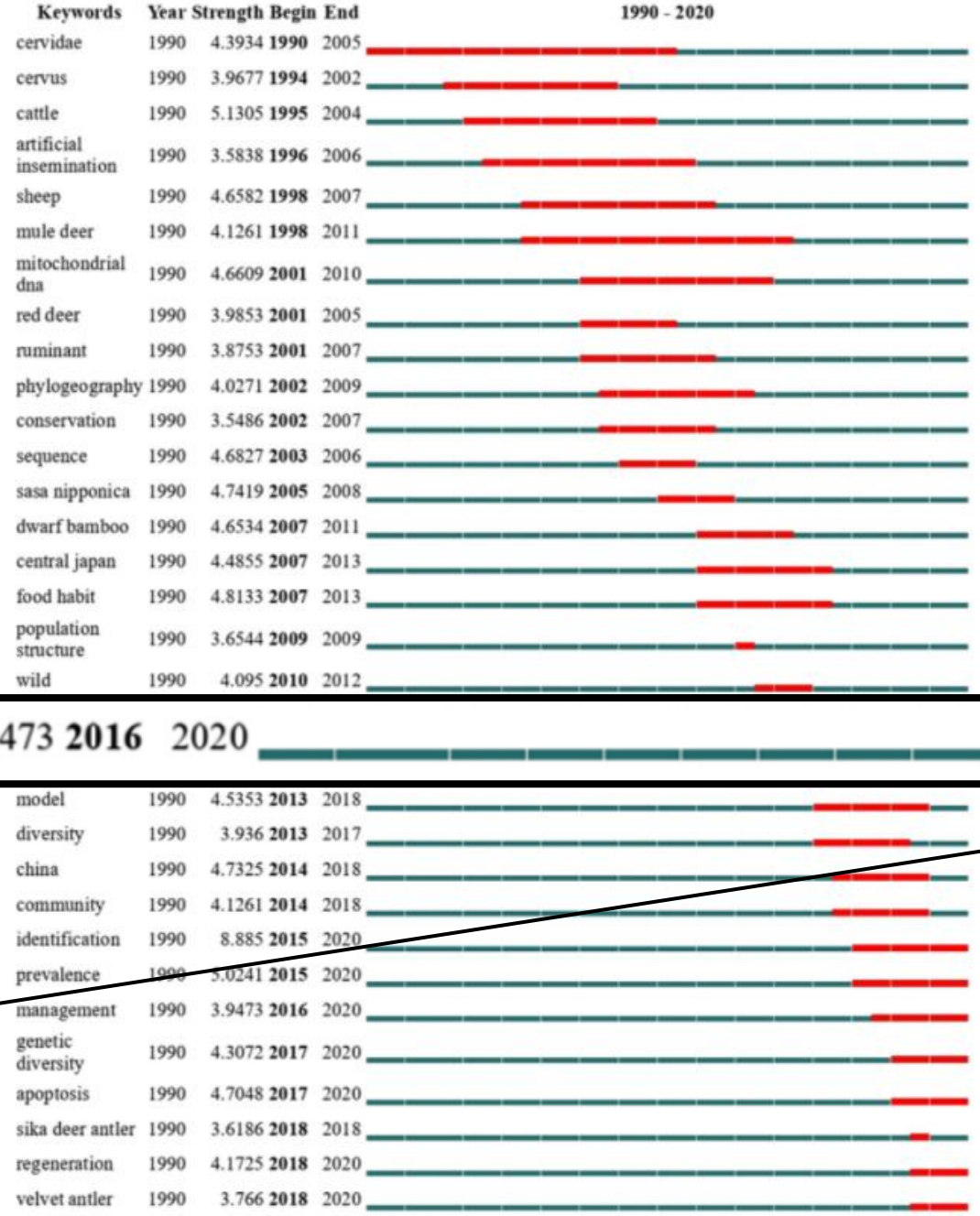
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cervus 1990 3.9677 1994 2002
cattle 1990 5.1305 1995 2004
artificial insemination 1990 3.5838 1996 2006
sheep 1990 4.6582 1998 2007
mule deer 1990 4.1261 1998 2011
mitochondrial dna 1990 4.6609 2001 2010
red deer 1990 3.9853 2001 2005
ruminant 1990 3.8753 2001 2007
phylogeography 1990 4.0271 2002 2009
conservation 1990 3.5486 2002 2007
sequence 1990 4.6827 2003 2006
sasa nipponica 1990 4.7419 2005 2008
dwarf bamboo 1990 4.6534 2007 2011
central japan 1990 4.4855 2007 2013
food habit 1990 4.8133 2007 2013
population structure 1990 3.6544 2009 2009
wild 1990 4.095 2010 2012
management 1990 3.9473 2016 2020
model 1990 4.5353 2013 2018
diversity 1990 3.936 2013 2017
china 1990 4.7325 2014 2018
community 1990 4.1261 2014 2018
identification 1990 8.885 2015 2020
prevalence 1990 3.0241 2015 2020
management 1990 3.9473 2016 2020
genetic diversity 1990 4.3072 2017 2020
apoptosis 1990 4.7048 2017 2020
sika deer antler 1990 3.6186 2018 2018
regeneration 1990 4.1725 2018 2020
velvet antler 1990 3.766 2018 2020

CiteSpace

Aims and Goals

Scientific Literature

Diet Analysis

Management

Evaluation of Czech Management

- Identification of hunting subpopulations
- Number of culled deer
- Assessments of vegetation types
- Analysis of available data

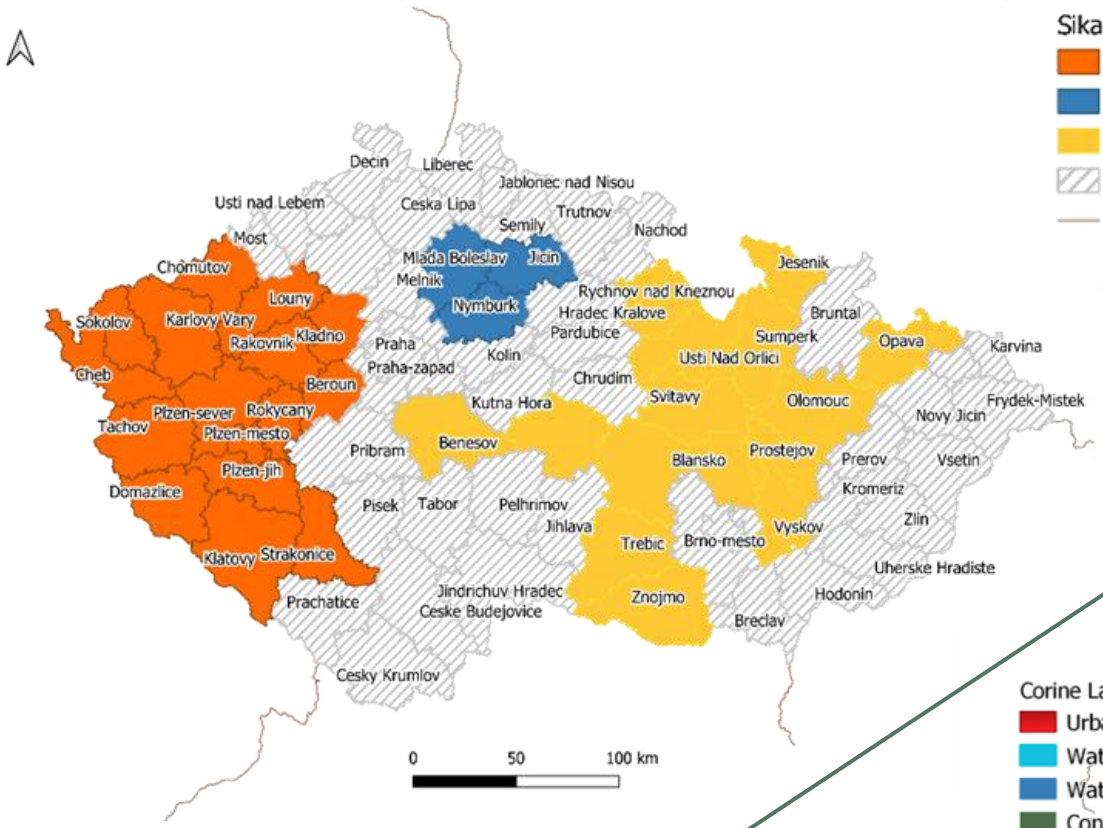
QGIS

CORINE LAND COVER

Google earth

R Studio®

MINISTRY OF AGRICULTURE
OF THE CZECH REPUBLIC



Sika Populations in the Czech Republic

- SubPopulation 1
- SubPopulation 2
- SubPopulation 3
- No Sika Populations
- Countries' borders

Corine Land Cover 2012

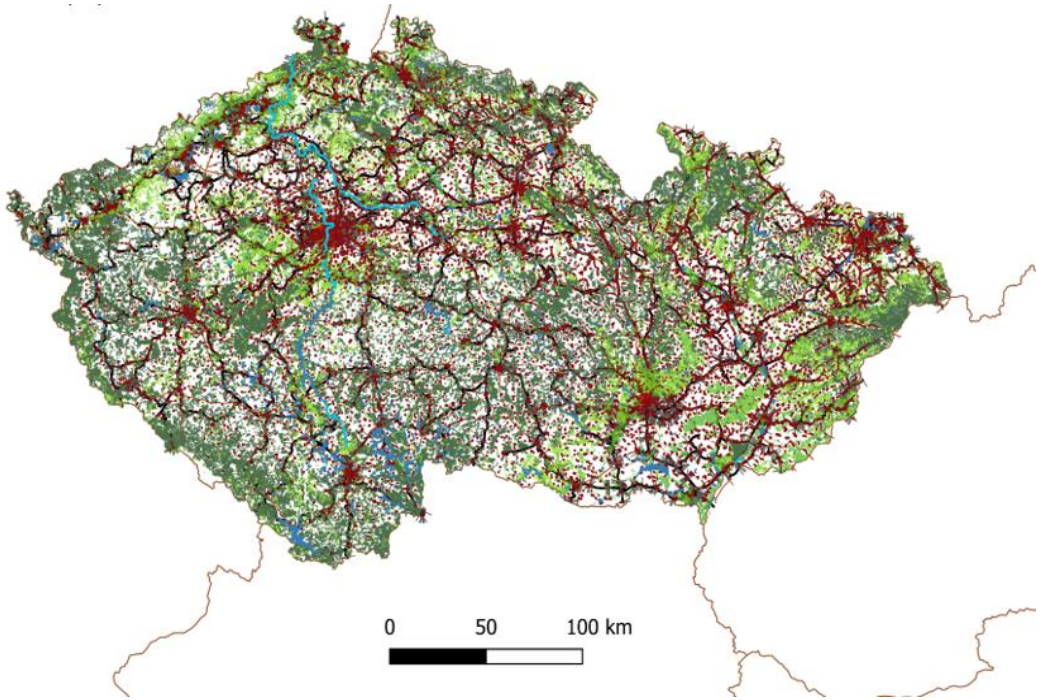
- Urban fabric
- Water courses
- Water bodies
- Coniferous forest
- Mixed forest
- Broad-leaved foresrt

Roads

- Motorways
- Primary Roads

Railways

- Construction
- Railways
- Countries' borders



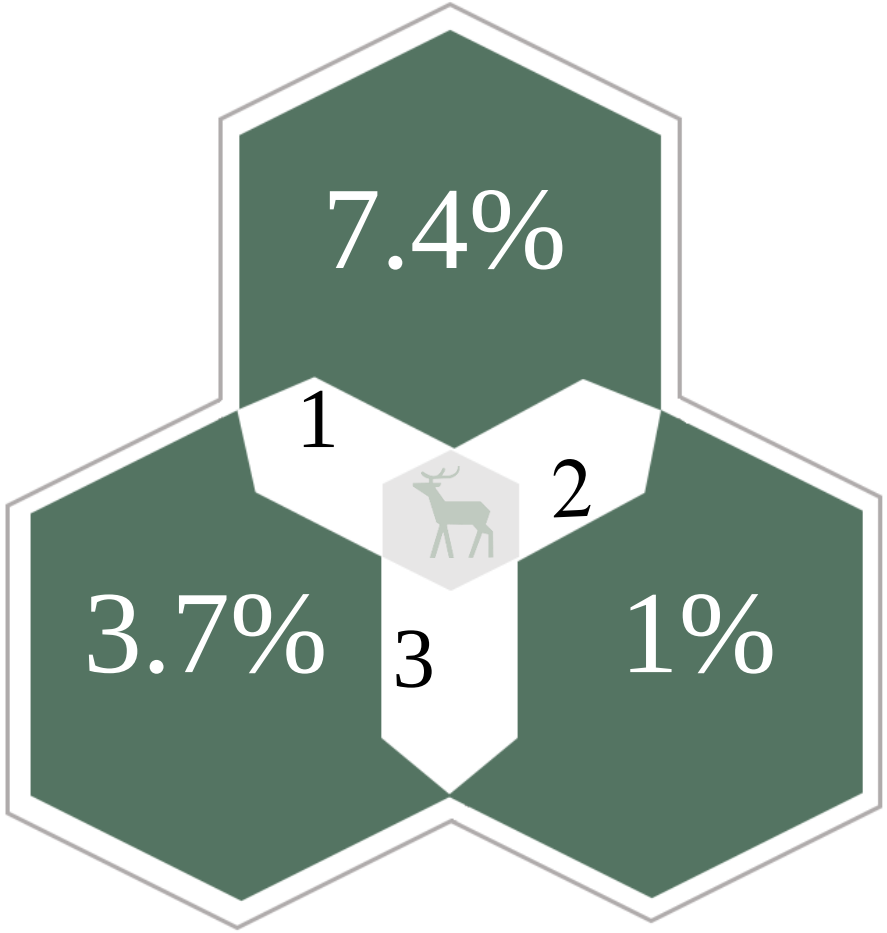
Annual Average increase

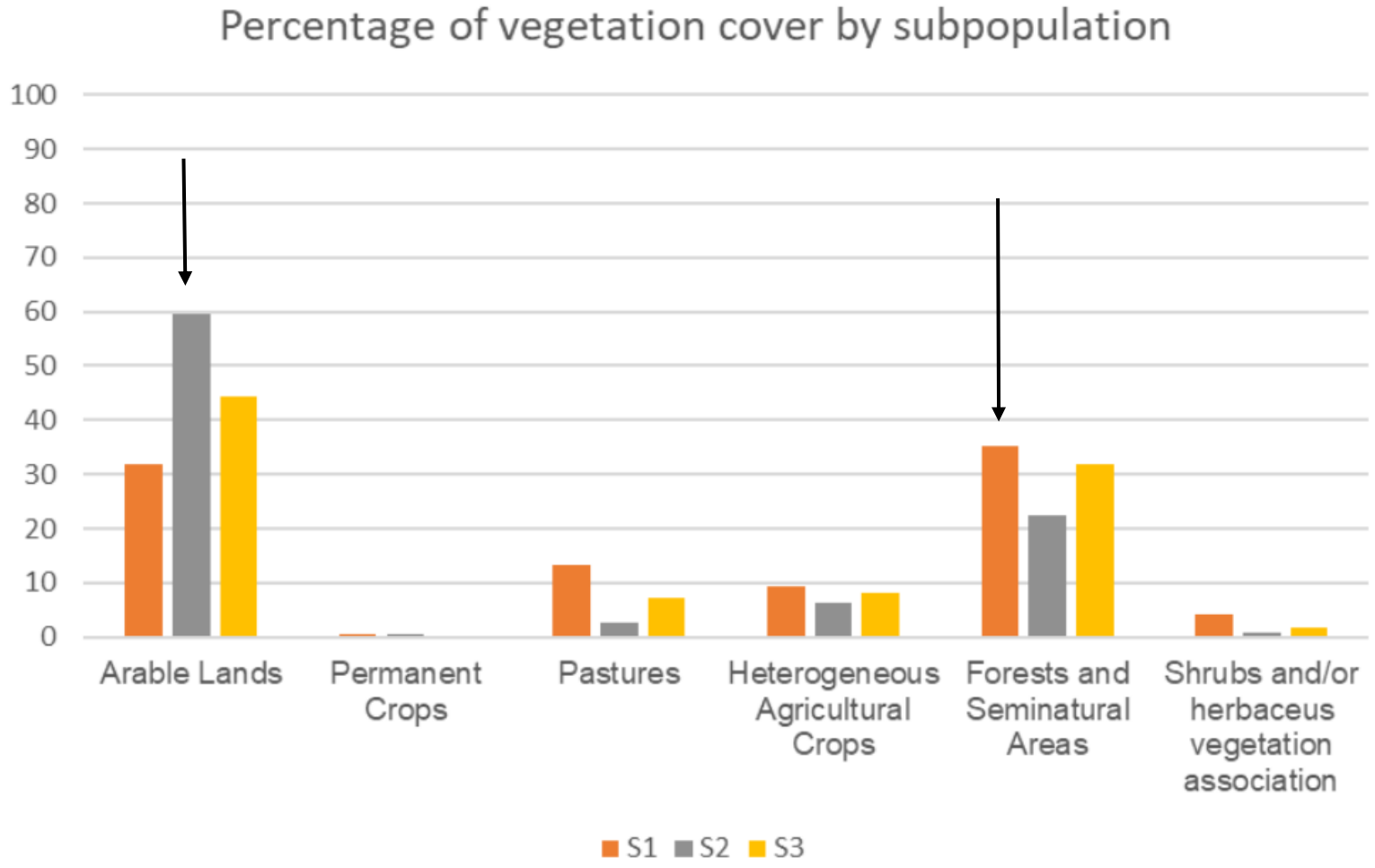
$$A.a.i = \left(\frac{x}{y}\right)^{\frac{1}{n}} - 1$$

x number of the deer culled in that subpopulation in 2018

y number of deer culled in that subpopulation in 1994

n number of years in the considered timeframe (25)




Percentage of vegetation cover by subpopulation
100
90
80
70
60
50
40
30
20
10
0
Arable Lands
Permanent Crops
Pastures
Heterogeneous Agricultural Crops
Forests and Seminatural Areas
Shrubs and/or herbaceus vegetation association
S1
S2
S3

Other sources of mortality

WVC

Predation

Other sources of mortality

WVC

Predation

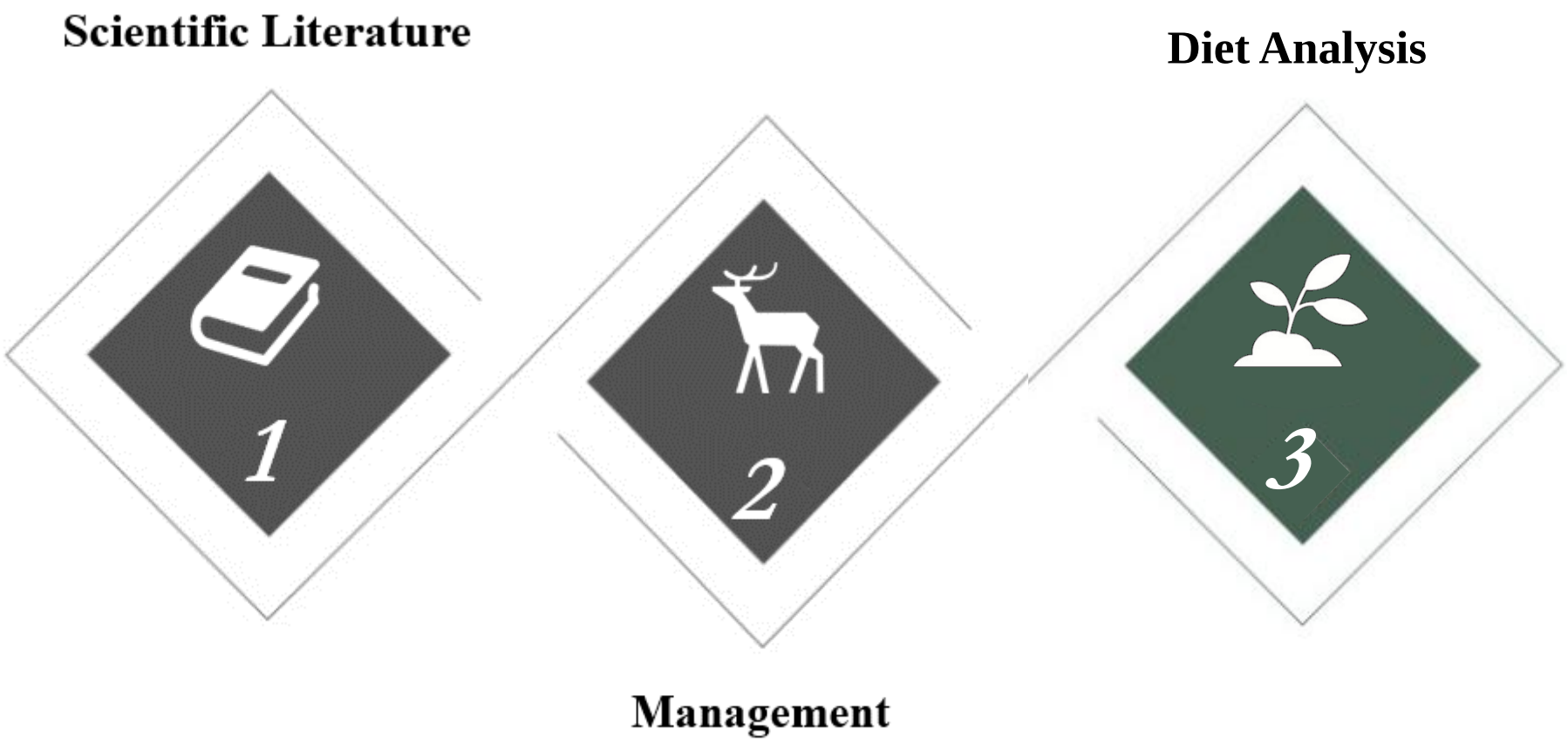
Results

Rapidly Increasing Population

Current management not suf-ficient to keep the population stable and contained, especially in the Western part of the country.

Better resources are impelling need for the Czech Republic.

Aims and Goals



Feeding

Japan

Preferred plants

Adaptability

Sika Deer Diet

Out-competing other species

Damaging the vegetation

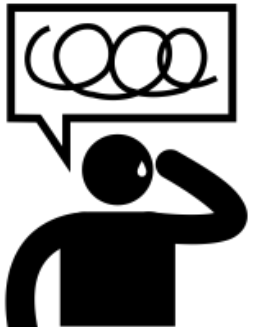
Expensive and time consuming methods

Sika Deer Diet

Out-competing other species

Damaging the vegetation

Expensive and time consuming methods



Preliminary study on sika deer diet

- Faecal sample collection

Preliminary study on sika deer diet

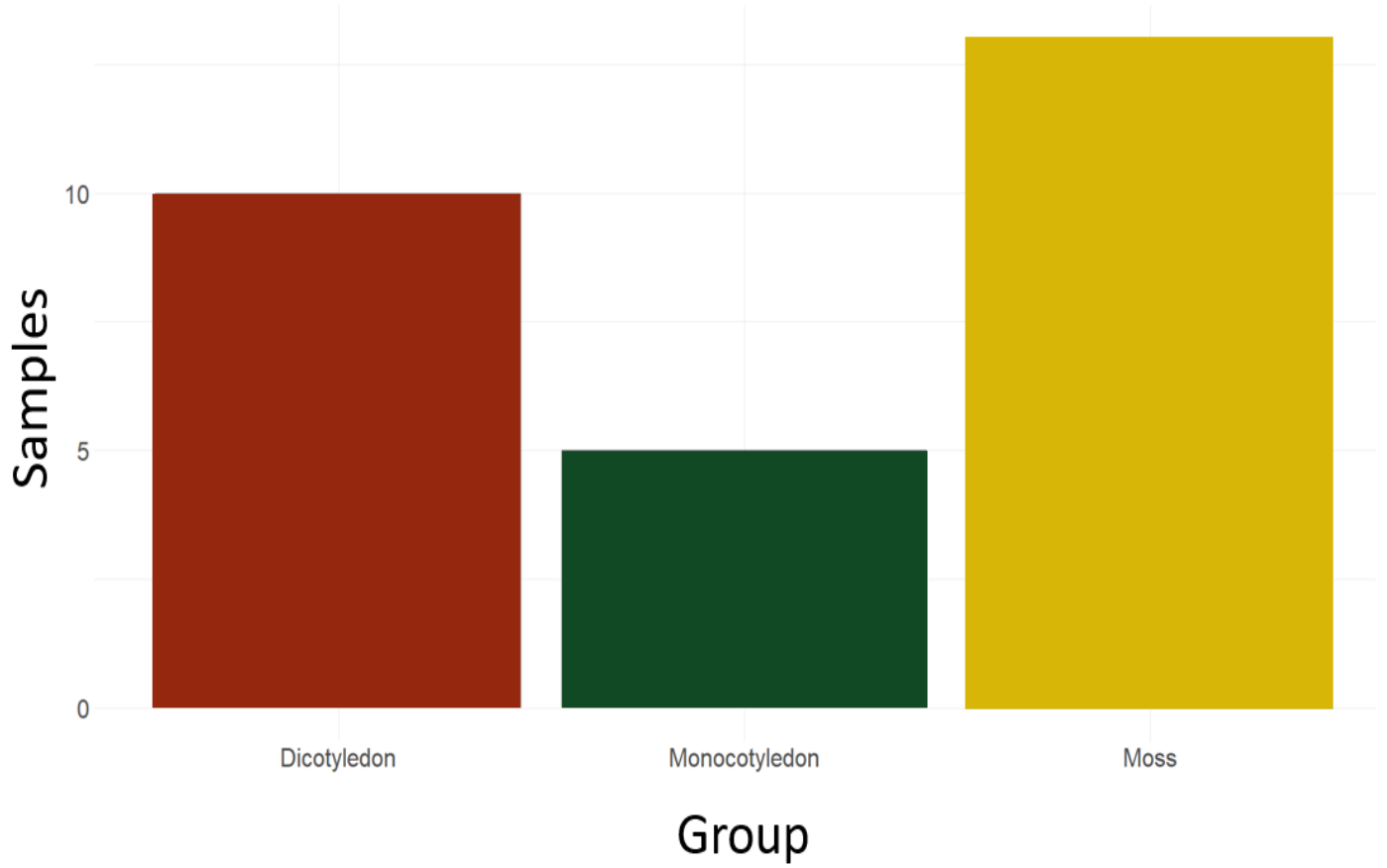
- Faecal sample collection
- DNA metabarcoding

Preliminary study on sika deer diet

- Faecal sample collection
- DNA metabarcoding
- FTIR spectroscopy analysis

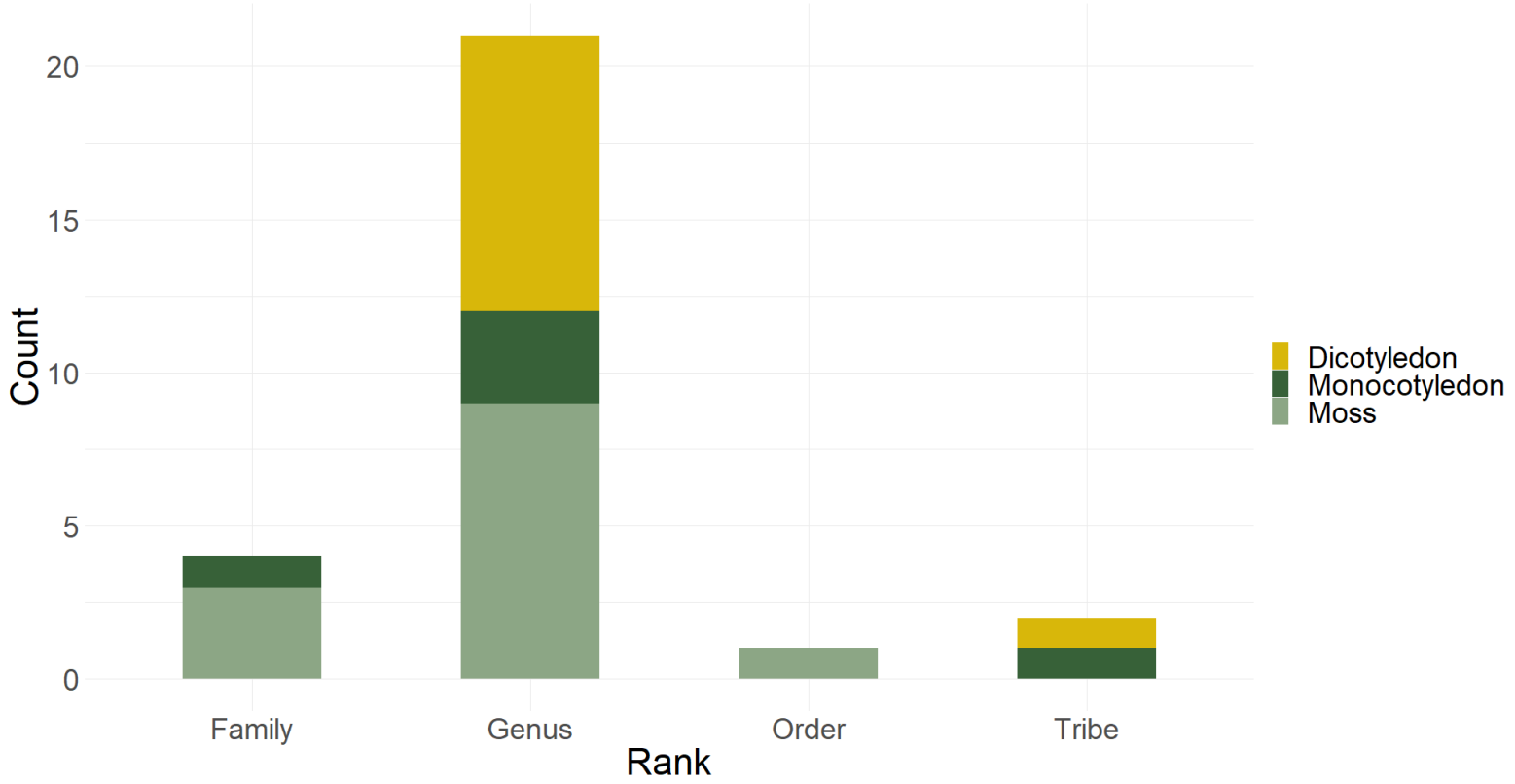
Results

40 samples, 23 sequenced

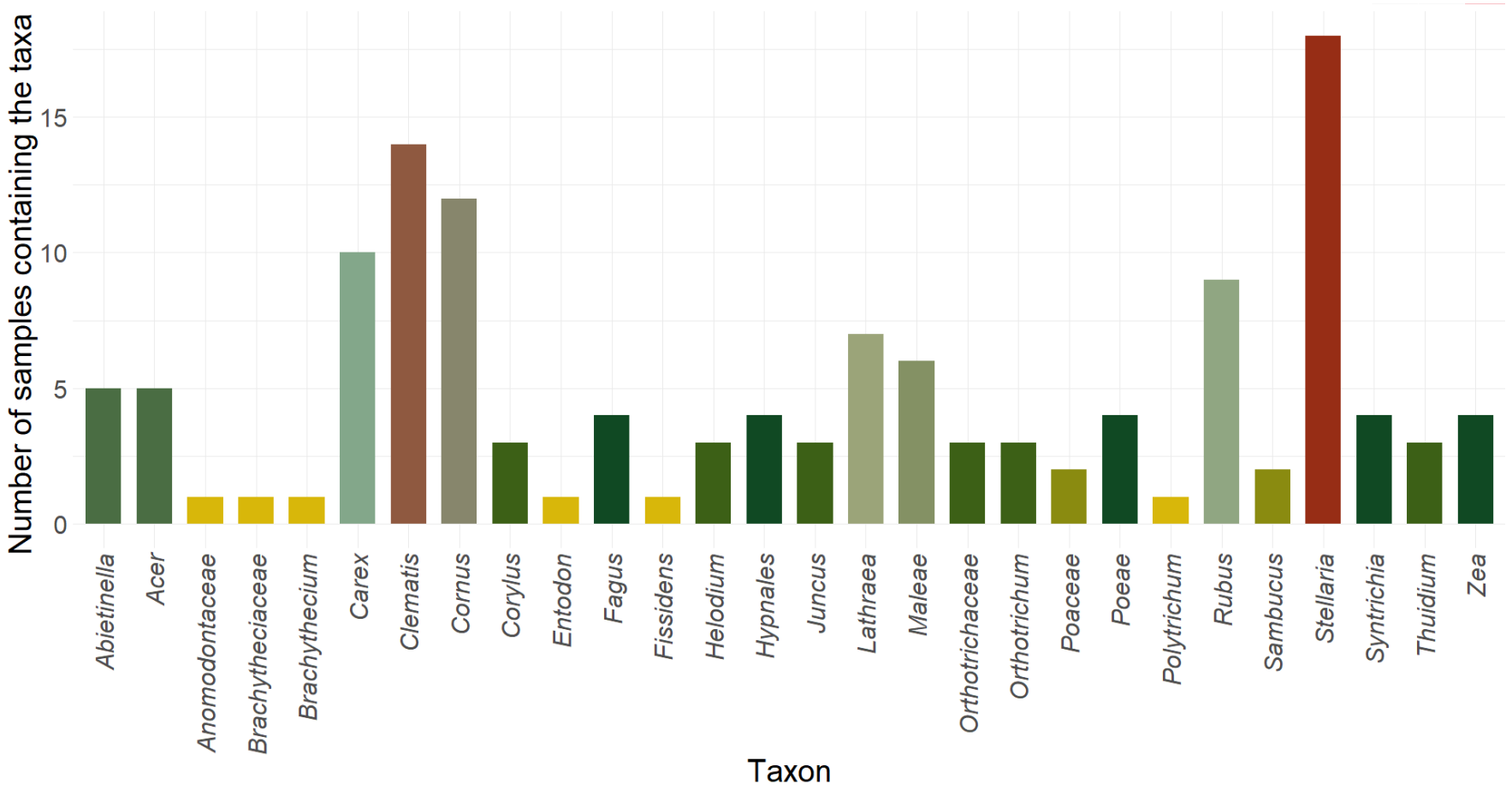


28 taxa

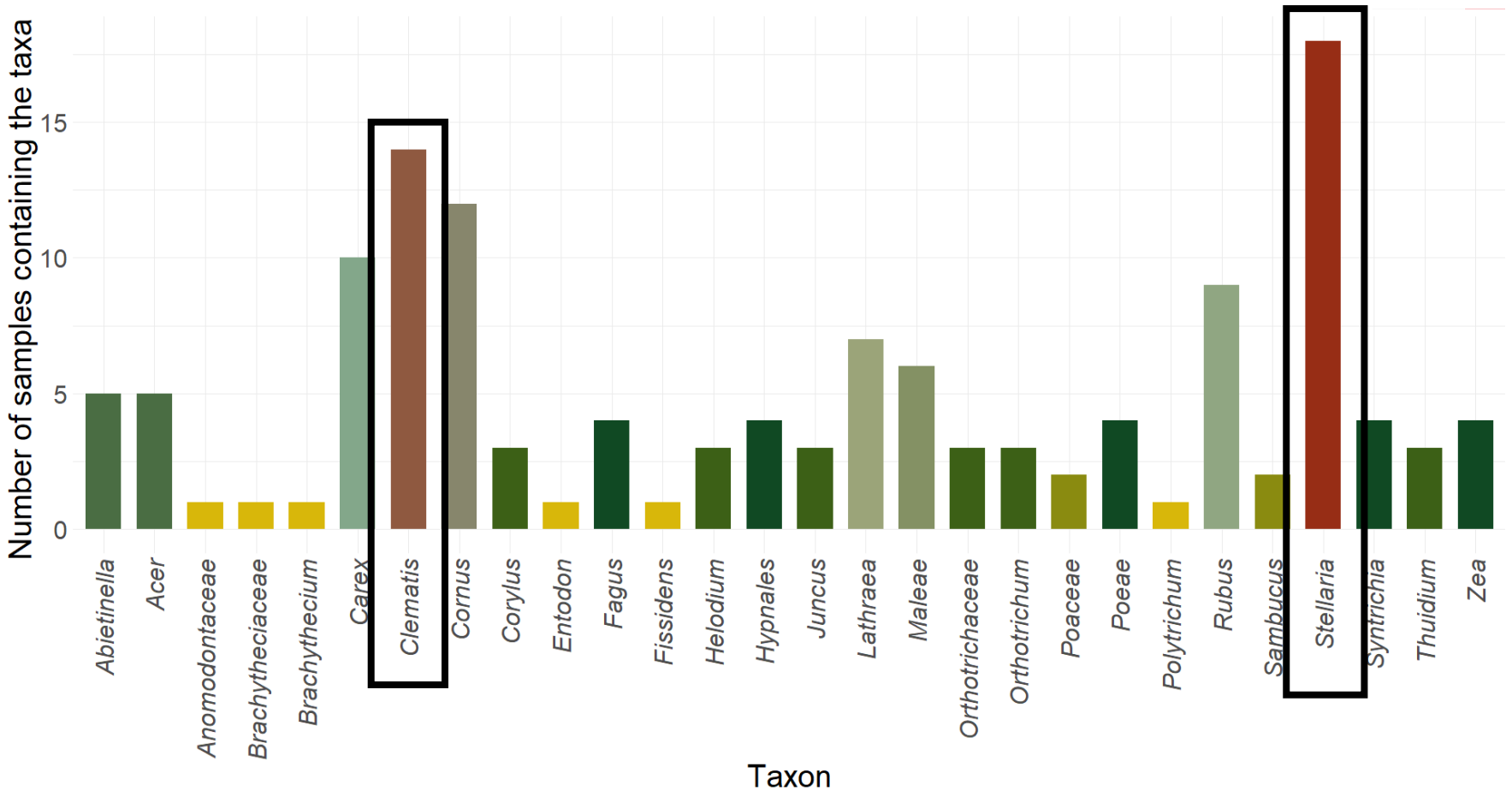
Results


20
15
10
5
0
Count
Family
Genus
Order
Tribe
Rank
Dicotyledon
Monocotyledon
Moss

Results


Number of samples containing the taxa
0
5
10
15
Abietinella
Acer
Anomodontaceae
Brachytheciaceae
Brachythecium
Carex
Clematis
Cornus
Corylus
Entodon
Fagus
Fissidens
Helodium
Hypnales
Juncus
Lathraea
Maleae
Orthotrichaceae
Orthotrichum
Poaceae
Poeae
Polytrichum
Rubus
Sambucus
Stellaria
Syntrichia
Thuidium
Zea
Taxon

Results


Number of samples containing the taxa
0
5
10
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Abietinella
Acer
Anomodontaceae
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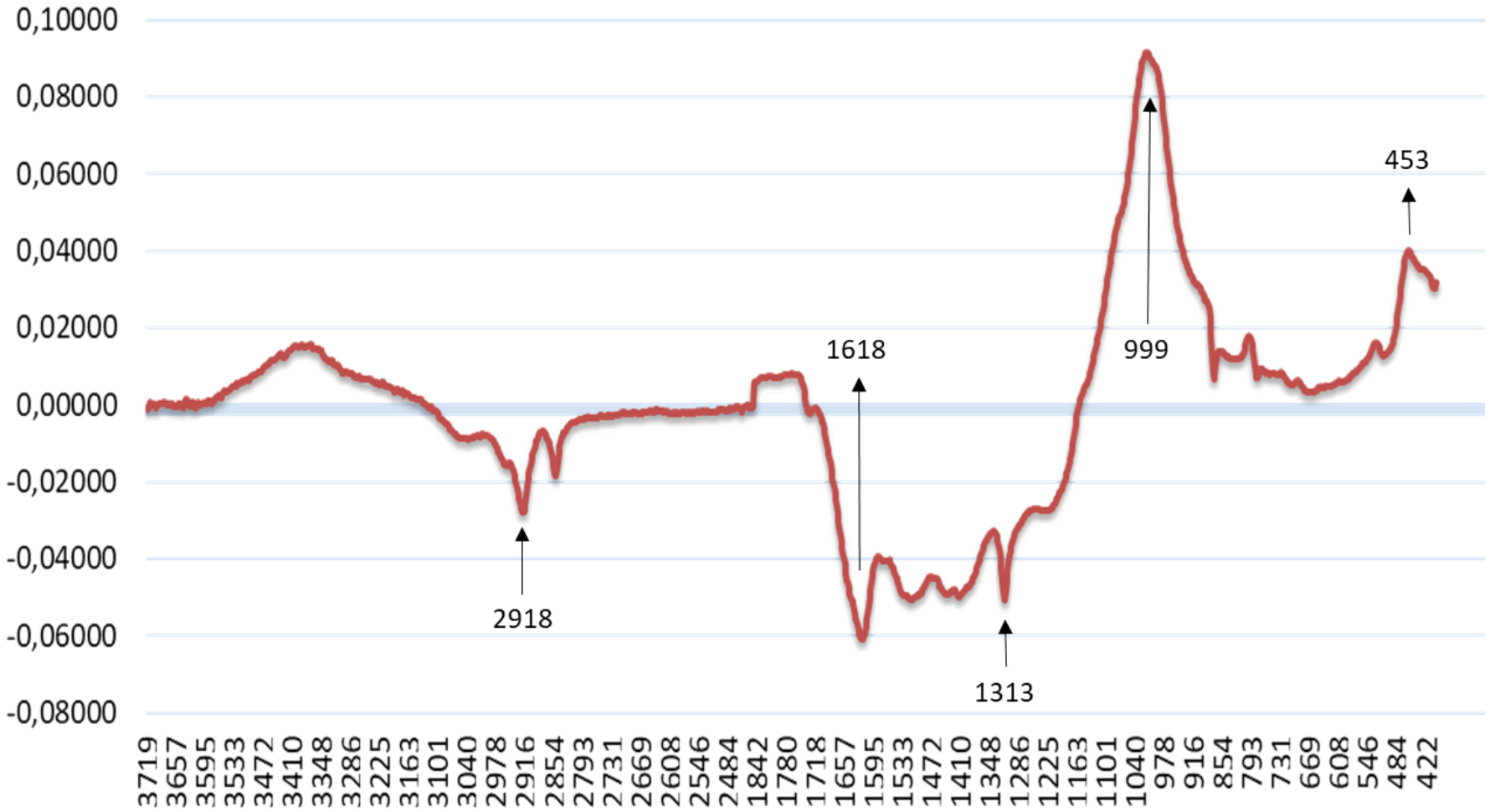
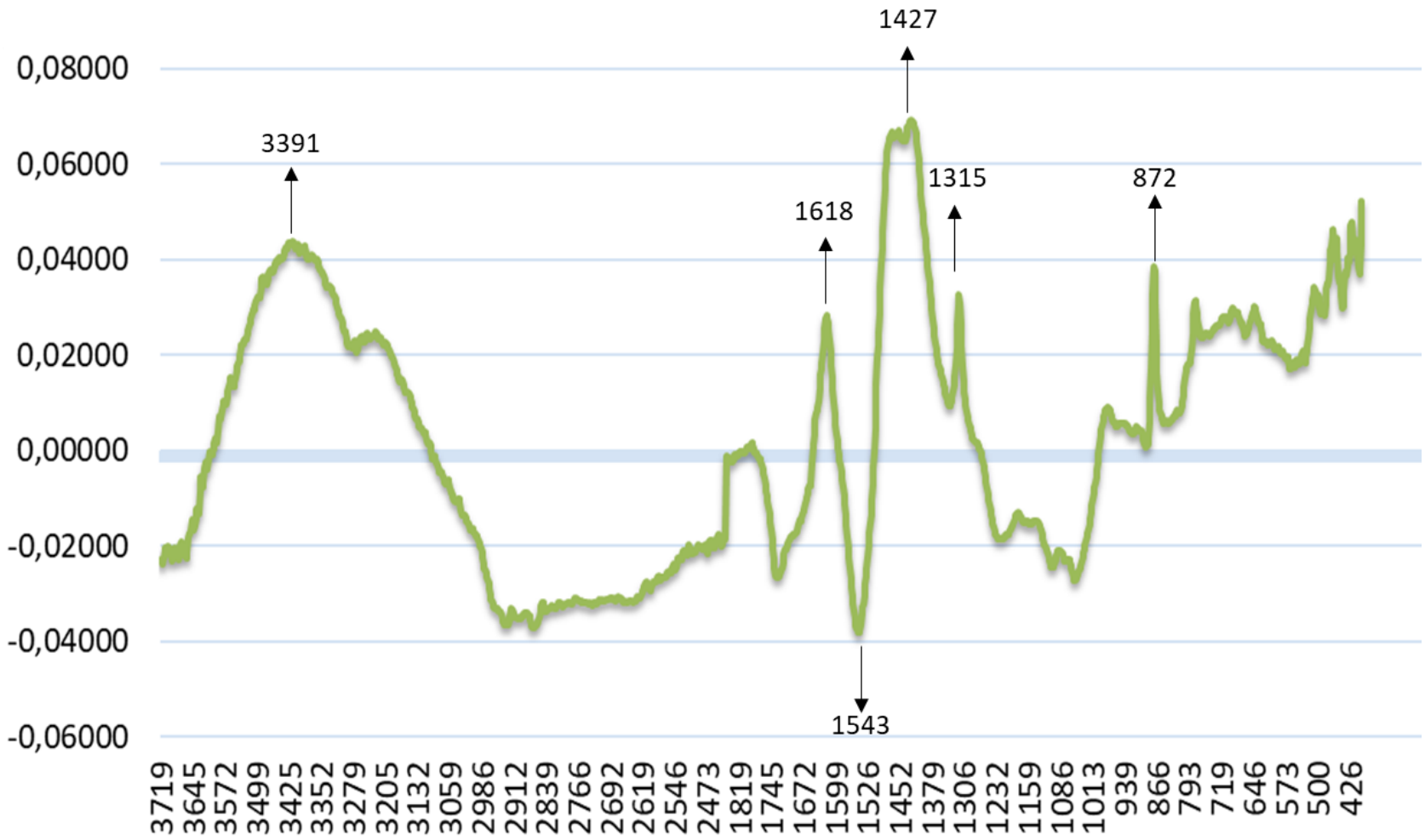
Brachythecium
Carex
Clematis
Cornus
Corylus
Entodon
Fagus
Fissidens
Helodium
Hypnales
Juncus
Lathraea
Maleae
Orthotrichaceae
Orthotrichum
Poaceae
Poeae
Polytrichum
Rubus
Sambucus
Stellaria
Syntrichia
Thuidium
Zea
Taxon

Results


0,10000
0,08000
0,06000
0,04000
0,02000
0,00000
-0,02000
-0,04000
-0,06000
-0,08000
2918
1618
1313
999
453
3719 3657 3595 3533 3472 3410 3348 3286 3225 3163 3101 3040 2978 2916 2854 2793 2731 2669 2608 2546 2484 1842 1780 1718 1657 1595 1533 1472 1410 1348 1286 1225 1163 1101 1040 978 916 854 793 731 669 608 546 484 422

Results


1427
0,08000
3391
0,06000
1315
872
0,04000
1618
0,02000
0,00000
-0,02000
-0,04000
1543
-0,06000
3719
3645
3572
3499
3425
3352
3279
3205
3132
3059
2986
2912
2839
2766
2692
2619
2546
2473
1819
1745
1672
1599
1526
1452
1379
1306
1232
1159
1086
1013
939
866
793
719
646
573
500
426

Results

Preliminary Study

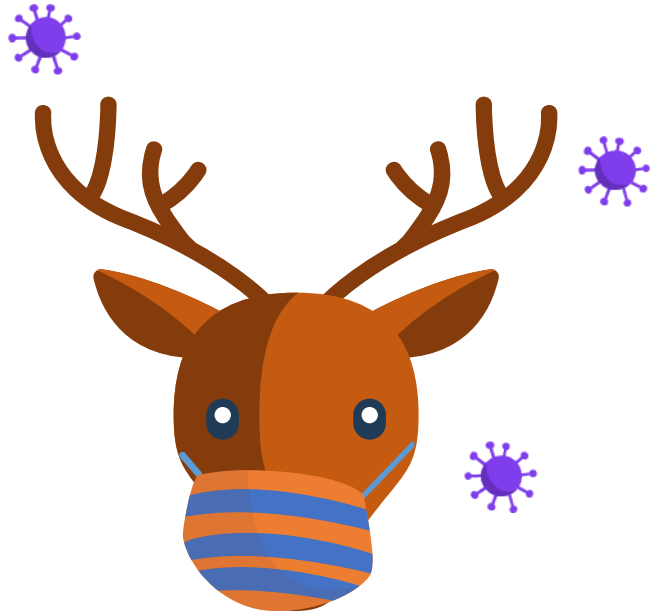
Preferred taxa**?**

Suitable methods

Comparison of spectra with undigested vegetation

Comparison with faecal matter of sika from a second subpopulation

Comparison with faecal matter of other ungulates



Need of more samples

Cleaner samples for FTIR

General Discussion

Highly detrimental species

Literature does not cover all the aspects of the species ecology and management

Management is not a widely discussed topic

Management of the species needs improvement

Ad hoc studies are necessary when describing the species' diet and food habits.

General Conclusions

i) research trends and discussed topic

ii) blind spots and unexplored issues related to the species

iii) the management of one of the biggest and most invasive populations of Europe

iv) the diet of a severely unobserved alien population

v) the testing of methods of analysis for future studies

vi) possible future perspectives.

General Conclusions

Ongoing issue

Importance of causes of death reports for the species

Implement the utilization of hunting bags

Necessity of *ad hoc* studies for the diet

Suitability of more modern and rapid methods of analysis

- **Saggiomo, L.**, F. Picone, B. Esattore, A. Sommese. “An Overview of Understudied Interaction Types amongst Large Carnivores.” *Food Webs*, vol. 12, 2017, pp. 35–39., doi:10.1016/j.fooweb.2017.01.001.

- Mori, E., G., Mazza, **L. Saggiomo,** A Sommese, B. Esattore. “Strangers Coming from the Sahara: An Update of the Worldwide Distribution, Potential Impacts and Conservation Opportunities of Alien Aoudad.” *Annales Zoologici Fennici*, vol. 54, no. 5-6, 2017, pp. 373–386., doi:10.5735/086.054.0501.

- Urošević, M. I., B. Esattore, **L. Saggiomo,** Z. A., Ristić, & N. I. Stojanac, “Animal Welfare Standards in Red Deer (*Cervus elaphus*) Farming.” *Archives of Veterinary Medicine*, vol. 11, no. 2, 2019, pp. 11–20., doi:10.46784/e-avm.v11i2.22.

- **Saggiomo, L.**, Esattore, B. and Picone, F. “What Are We Talking about? Sika Deer (*Cervus nippon*): A Bibliometric Network Analysis.” *Ecological Informatics*, vol. 60, 2020, p. 101146., doi:10.1016/j.ecoinf.2020.101146.

- Esattore, B., V. Slipogor**, L. Saggiomo**, M. Seltmann, “How Not to Judge a Deer by Its Cover”: A Personality Assessment Study on Captive Adult Red Deer Males (*Cervus elaphus*).” *Behavioural Processes*, vol. 186, 2021, p. 104361., doi:10.1016/j.beproc.2021.104361.

- **Saggiomo L.,** B Esattore, L Bartoš. “Evaluating the Management Success of an Alien Species Through Its Hunting Bags: The Case of the Sika Deer (*Cervus nippon*) in the Czech Republic.” *Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis*, vol. 69, no. 3, 2021, pp. 327–336., doi:10.11118/actaun.2021.030.

- **Saggiomo L.,** B. Esattore, V., Bar. “The fox who cried wolf: A keywords and literature trend analysis on the phenomenon of mesopredator release” (Under review – Journal: Ecological Complexity)

4/2021 BEE 2021 (Online)

Contribution with an oral presentation: “Alien and Native Sika deer (*Cervus nippon*) : A bibliometric network analysis”

11/2020 Kostelecké inspirování (Online)

Contribution with an oral presentation: “Evaluating the management success of an alien species through its hunting bags: the case of the sika deer (*Cervus nippon*) in the Czech Republic”

09/2019 93rd Annual Meeting of the German Society for Mammalian Biology. *Dresden, Germany*

Contribution with an oral presentation: “Mid Infrared Spectroscopy, Micro Histological analysis, and DNA Barcoding of Sika Deer Faecal Samples in Lower Austria”

09/2019 5th European Student Conference on Behaviour and Cognition. *Vienna, Austria*

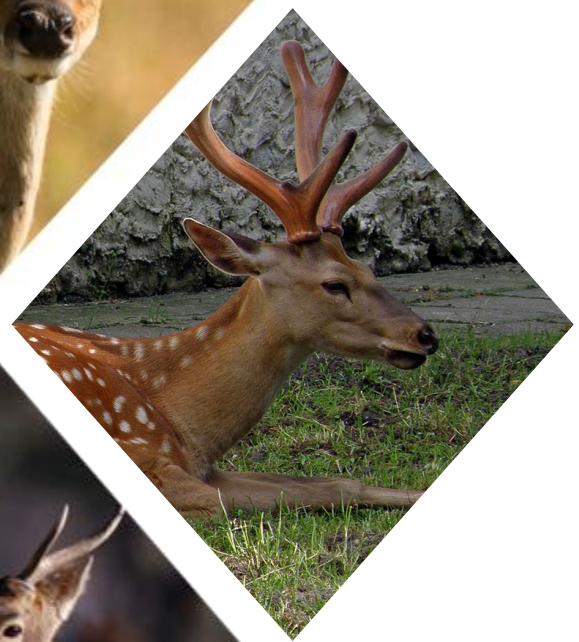
Presentation of the Scientific Poster: ”Should I Stay or Should I go? Sika Deer Presence and Spreading in the Western Czech Republic”

02/2018 Zoologicke dny. *Prague, Czech Republic*

Presentation of the Scientific Poster: ”Sika deer presence and spreading in the western Czech Republic”

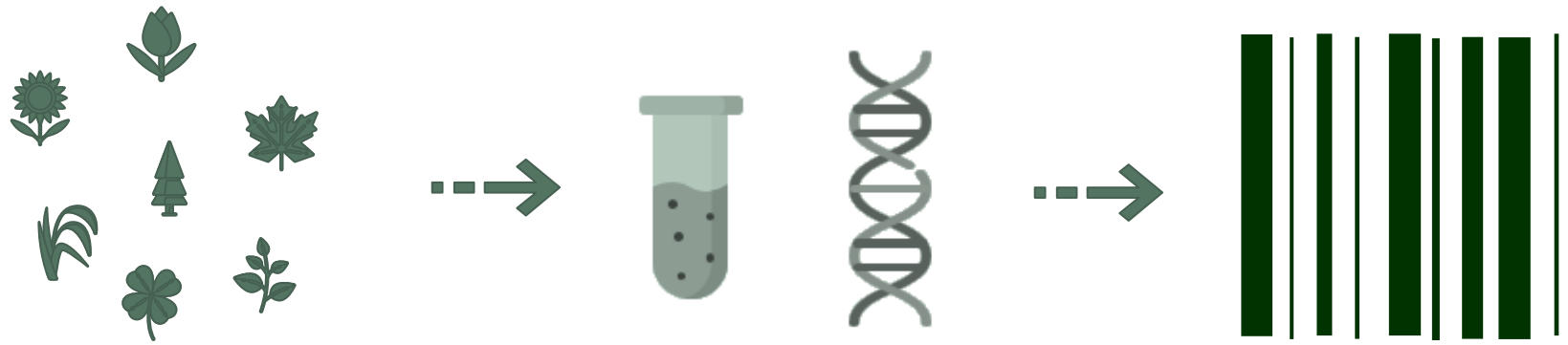
Special Thanks

- *Dr. Flavio Picone,*
- *Dr. Bruno Esattore,*
- *Dr. Andrea Sommese*
- *Professor Luděk Bartoš*
- *Dr. Emiliano Mori,*
- *Dr. Giuseppe Mazza,*
- *Dr. Vedrana Slipogor,*
- *Dr. Martin Seltmann,*
- *Prof. Miroslav Urosevic,*
- *Prof. Zoran Ristic,*
- *Dr. Nenad Stojanac,*
- *Dr. Dejan Beukovic,*
- *Marco Sensi,*
- *Valentina Bar,*
- *Vanessa Francia*



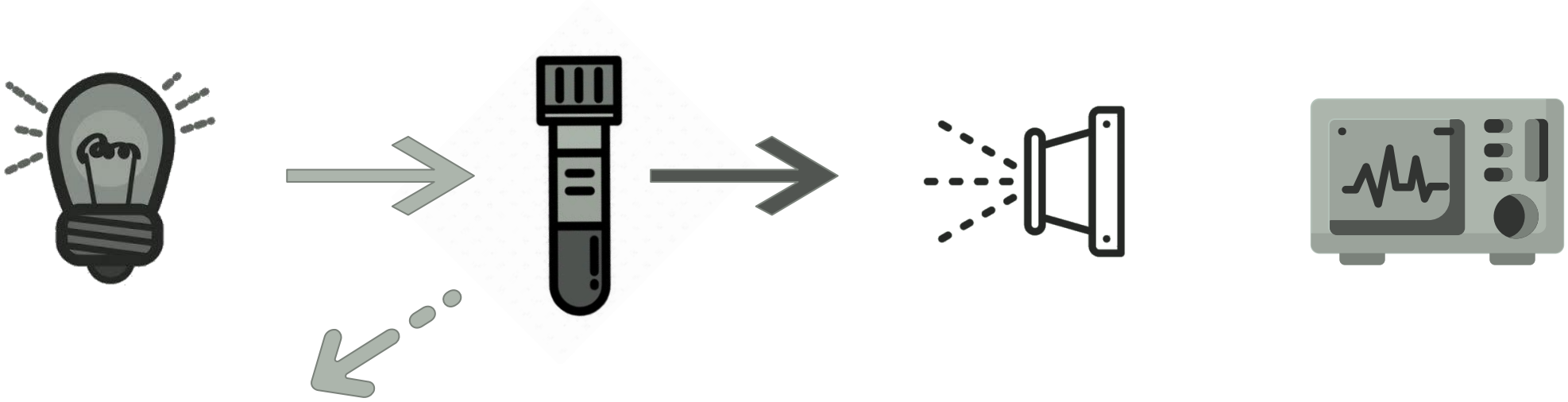
Thank You

DNA barcoding



Multi-Species samples= *DNA Metabarcoding*

Spectroscopy



Absorption spectroscopy= FTIR

Scopus®

(“Cervus nippon” OR “Sika deer”)

Co-authorship of countries

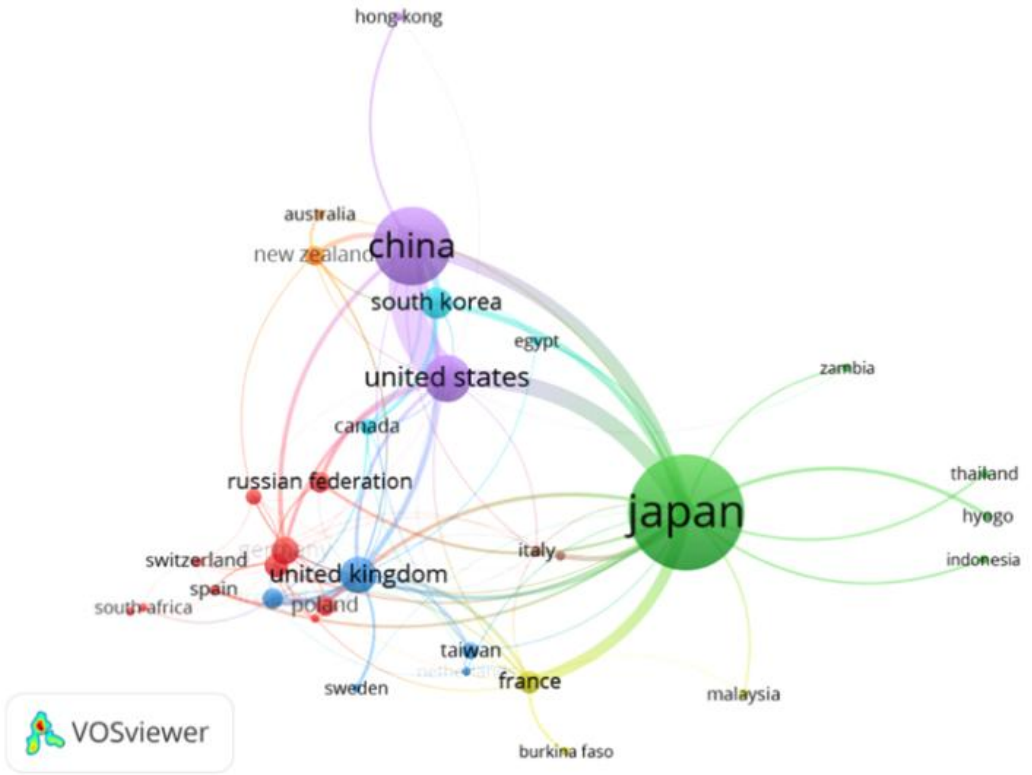
Co-occurrence of keywords

VOSviewer

VOSviewer

Network Map

- Clusters
- Link Strength
- Productivity



VOSviewer

Network Map

- Clusters
- Link Strength
- Productivity

Overlay Map

- Old and new topics
- Increased or decreased productivity