



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

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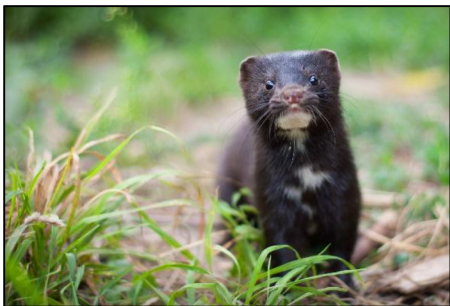
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Advisor:
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Prague, 2021







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

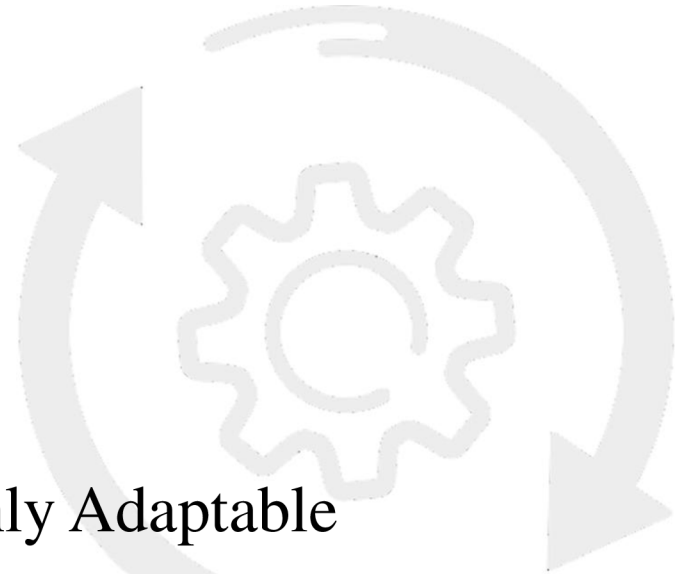
Europe, USA, New Zealand, Africa



Highly Adaptable

Thrive in non native environments

Invasive populations





Aims and Goals

Scientific Literature



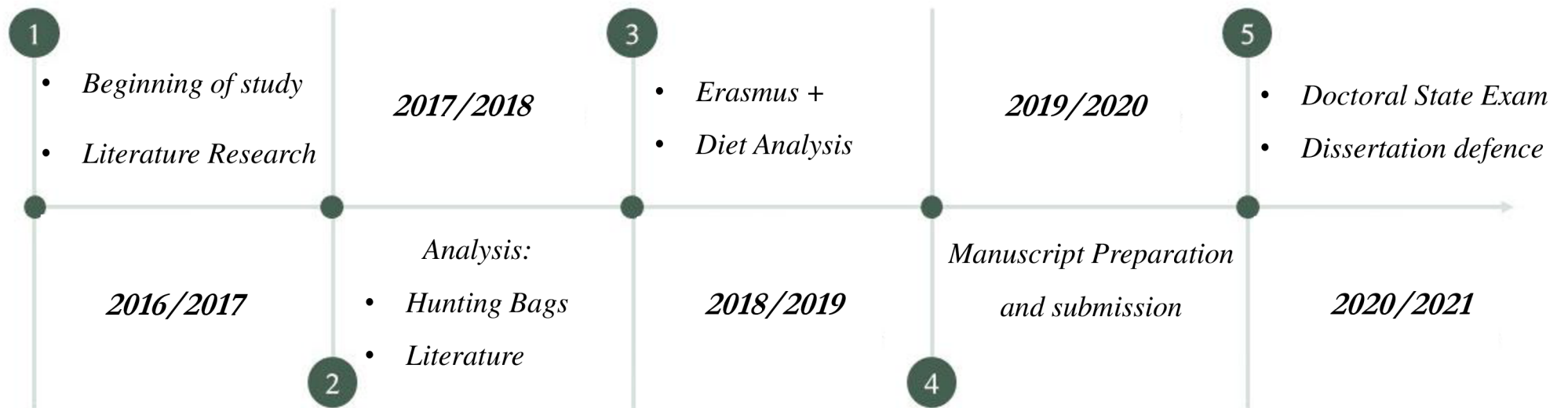
Diet Analysis



Management



Research Timeline



Bibliometric Analysis



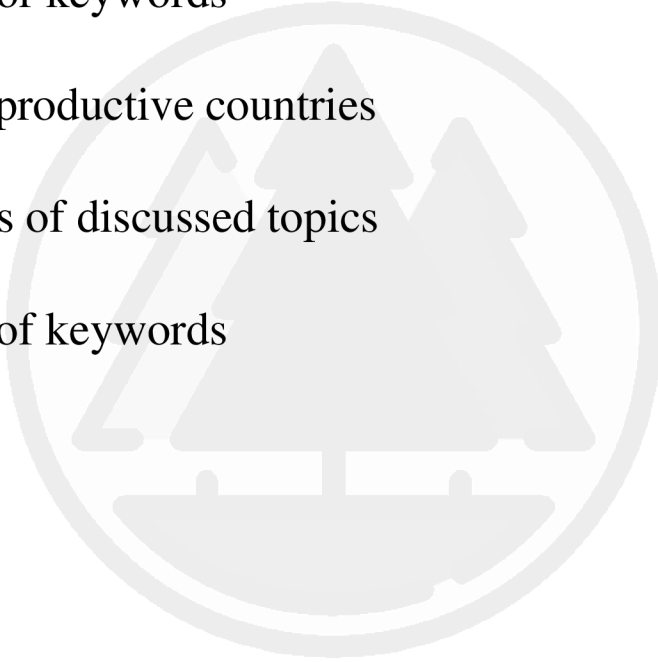


Bibliometric Analysis



Investigation of:

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





 VOSviewer

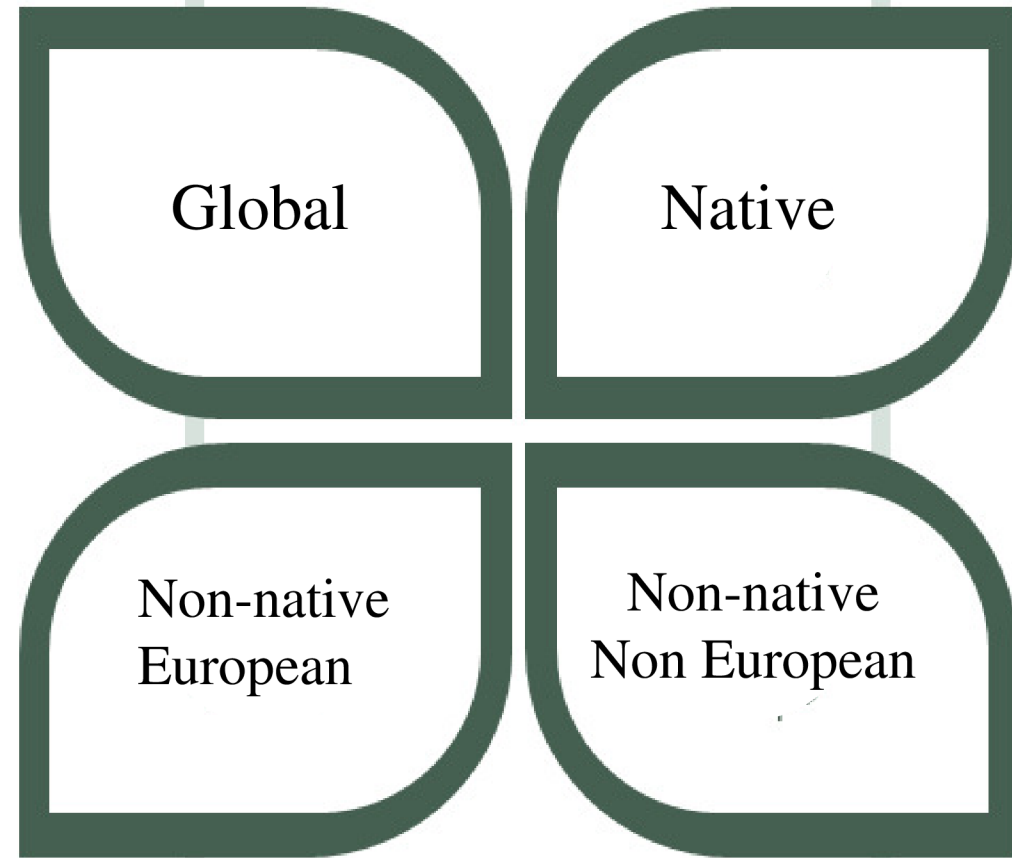
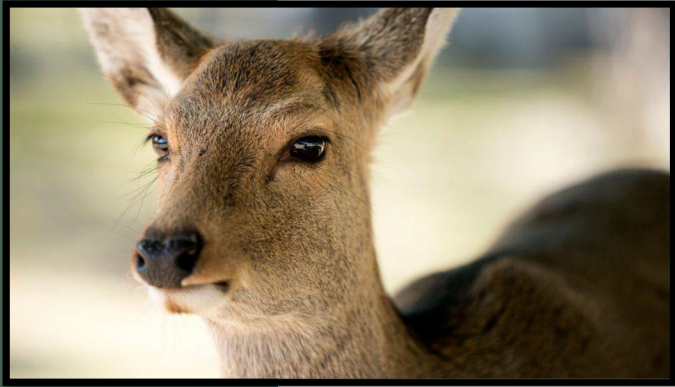
CiteSpace

Literature Search

Literature Analysis

Scopus®





Results

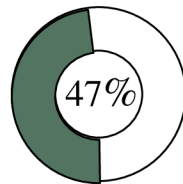
Global Literature

1.374 documents

71 countries

3.262 author keywords

Japan



Results

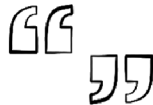
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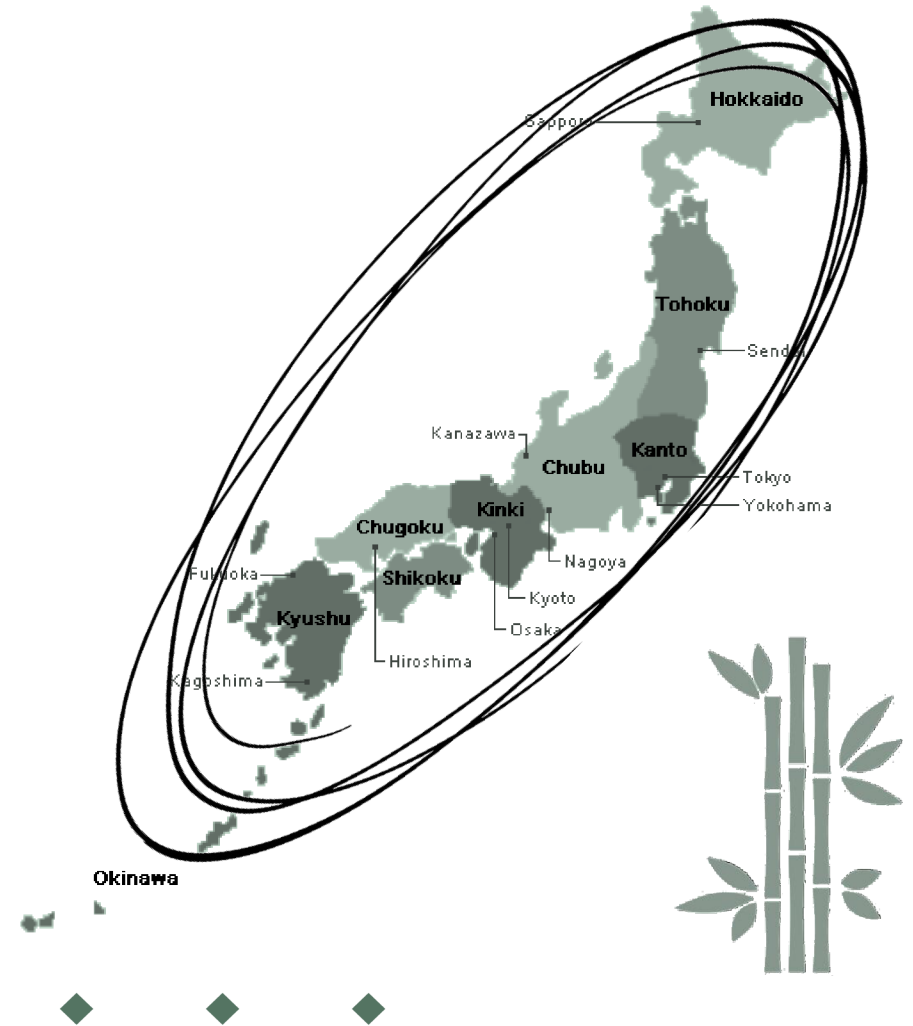
Global Literature

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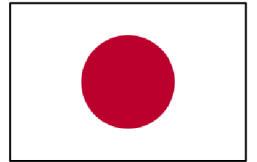
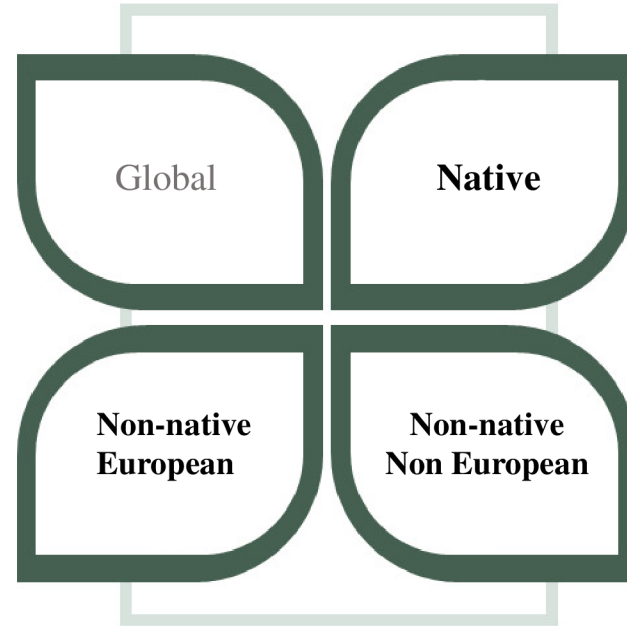
71 countries

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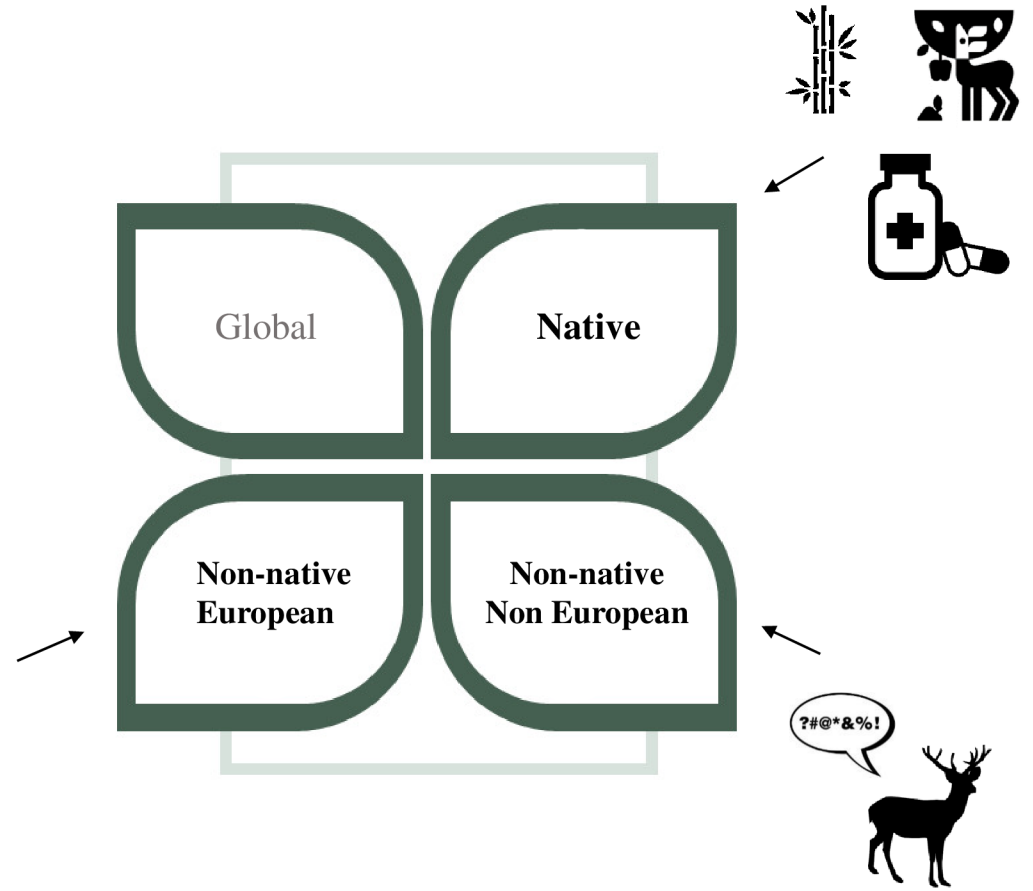
Japan



Results



Results



Keywords	Year	Strength	Begin	End	1990 - 2020
cervidae	1990	4.3934	1990	2005	
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	

CiteSpace

management 1990 3.9473 2016 2020

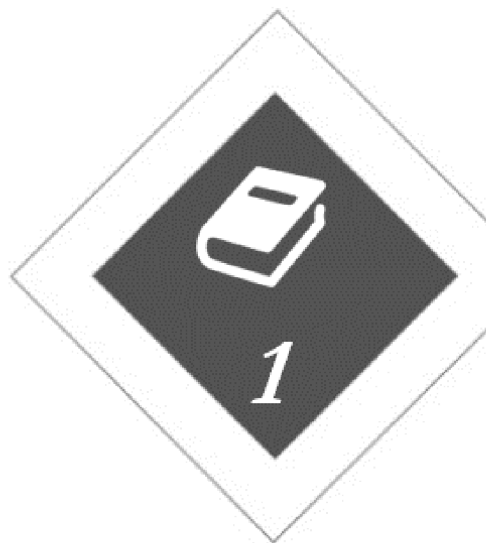
model	1990	4.5353	2013	2018
diversity	1990	3.936	2013	2017
china	1990	4.7325	2014	2018
community	1990	4.1261	2014	2018
identification	1990	8.885	2015	2020
prevalence	1990	5.0241	2015	2020
management	1990	3.9473	2016	2020
genetic diversity	1990	4.3072	2017	2020
apoptosis	1990	4.7048	2017	2020
sika deer antler	1990	3.6186	2018	2018
regeneration	1990	4.1725	2018	2020
velvet antler	1990	3.766	2018	2020





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





CORINE LAND COVER

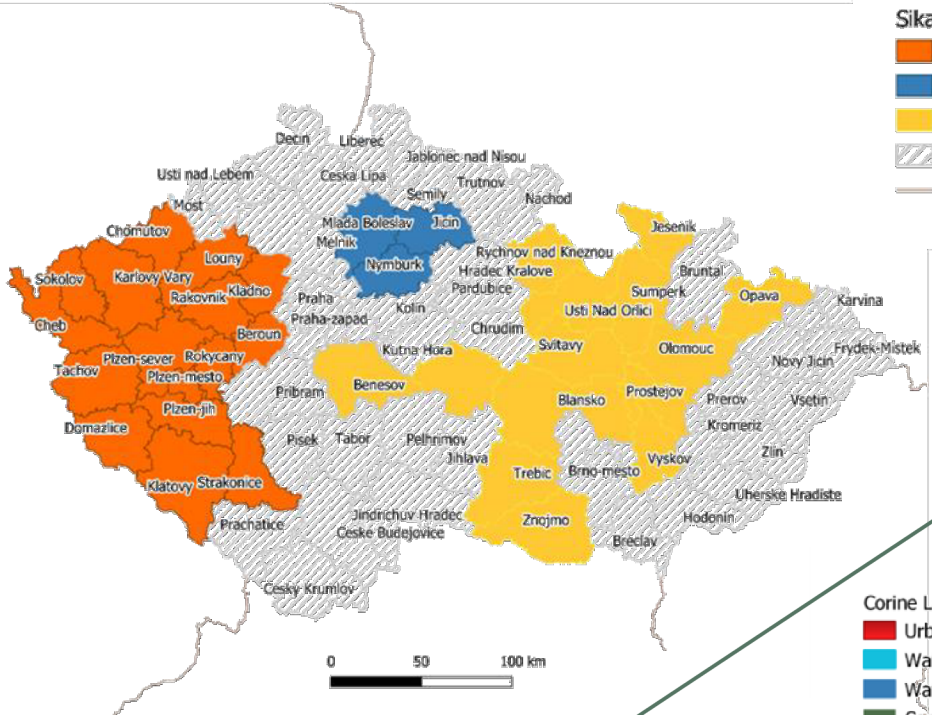


MINISTRY OF AGRICULTURE OF THE CZECH REPUBLIC



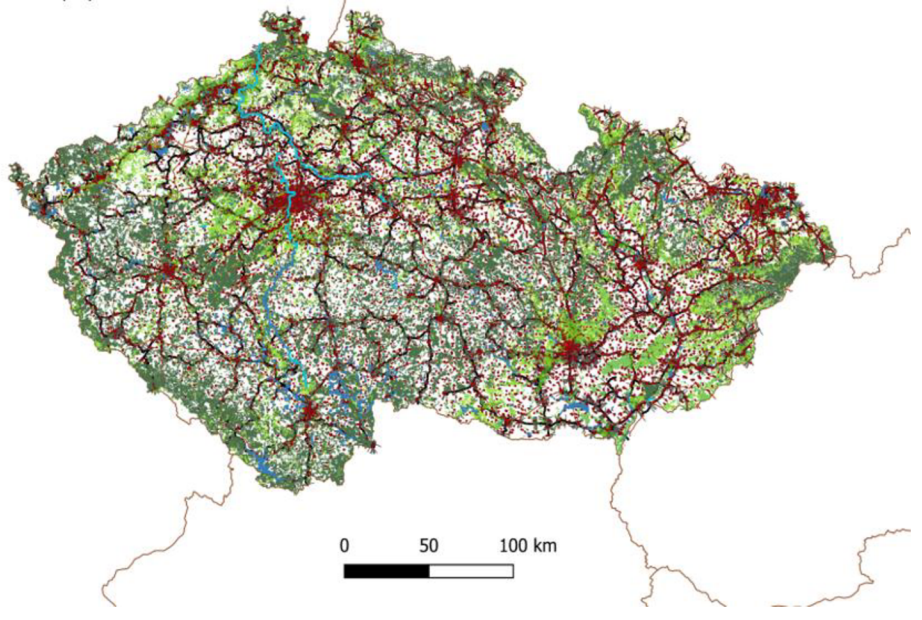
Sika Populations in the Czech Republic

- 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 forest
- Roads
 - Motorways
 - Primary Roads
- Railways
 - Construction
 - Railways
- Countries' borders



Annual Average increase

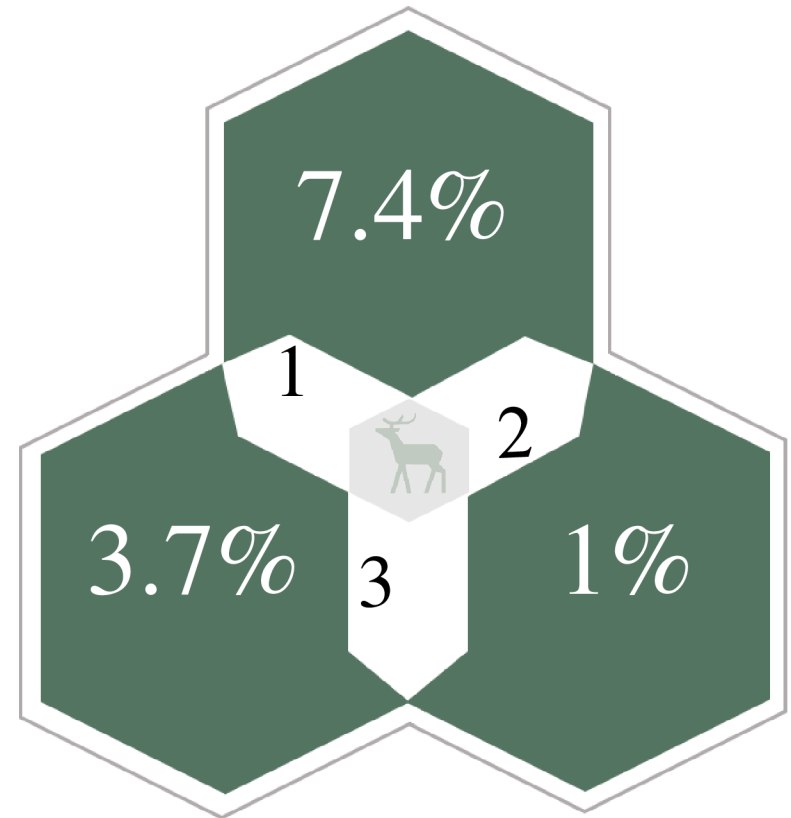
$$A. a. i = \left(\frac{x}{y}\right)^{\frac{1}{n}} - 1$$



x number of the deer culled in that subpopulation in 2018

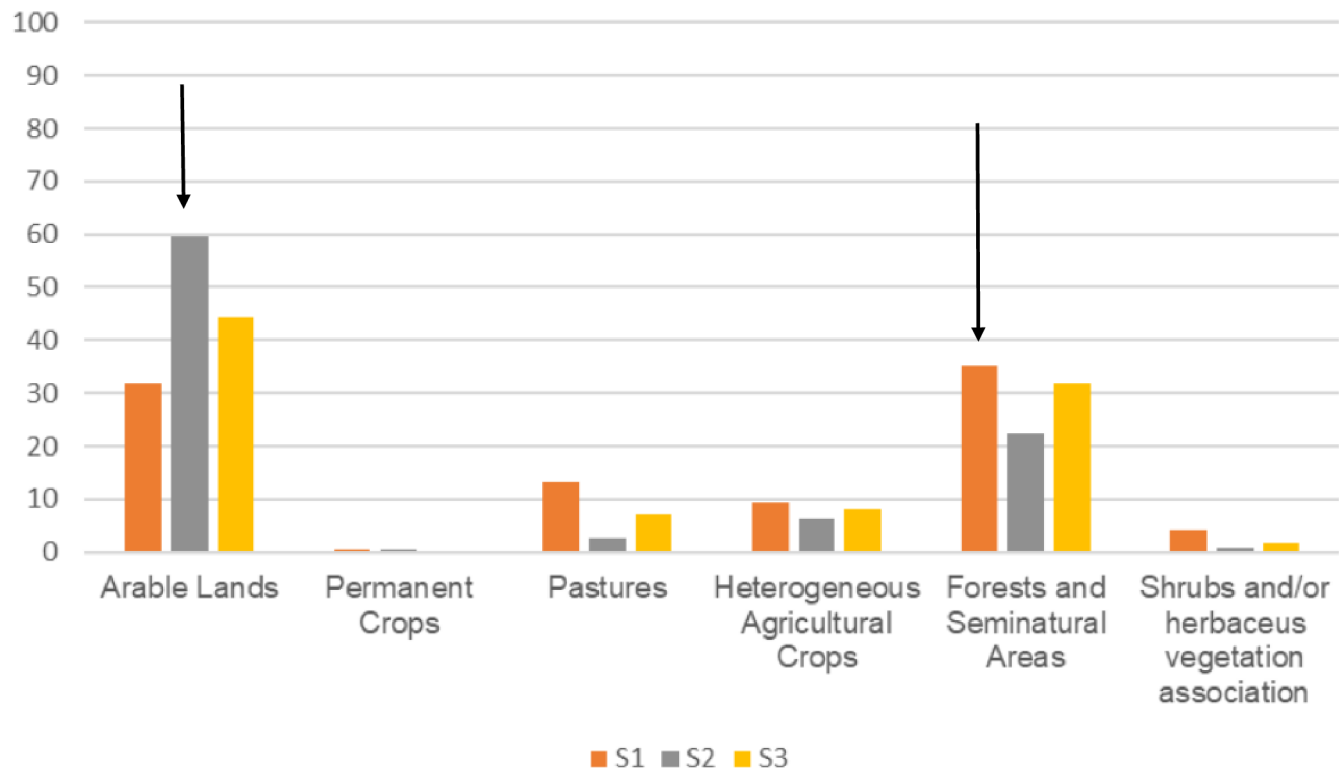
y number of deer culled in that subpopulation in 1994

n number of years in the considered timeframe (25)





Percentage of vegetation cover by subpopulation





Other sources of mortality

WVC

Predation





Other sources of mortality

WVC

Predation



Results

Rapidly Increasing Population

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

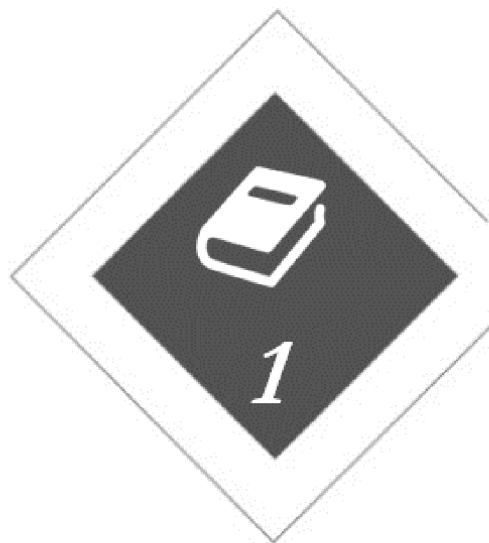
Better resources are impelling need for the Czech Republic.





Aims and Goals

Scientific Literature



Diet Analysis



Management





Feeding

Japan

Preferred plants

Adaptability





Sika Deer Diet

Out-competing other species

Damaging the vegetation

Expensive and time consuming methods

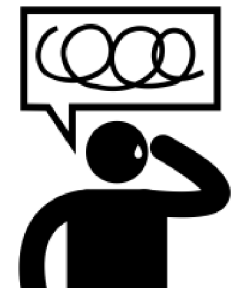


Sika Deer Diet

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

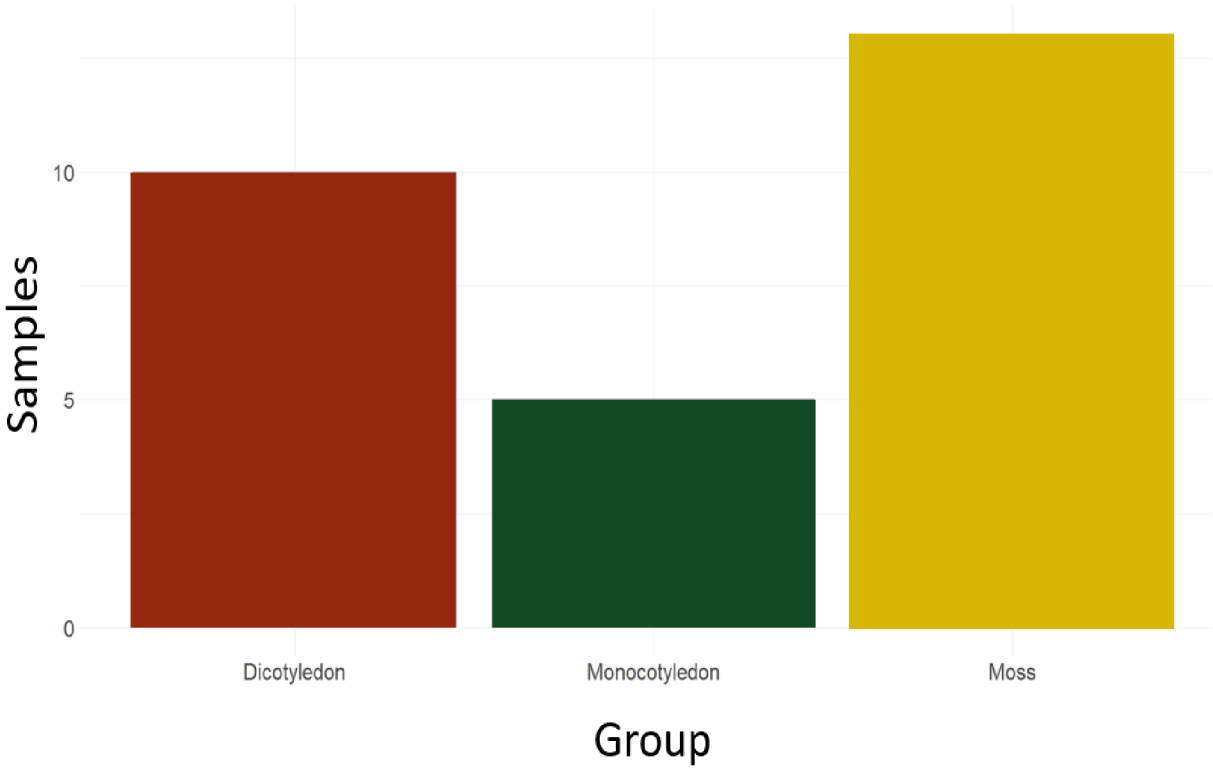
- Faecal sample collection
- DNA metabarcoding
- FTIR spectroscopy analysis





Results

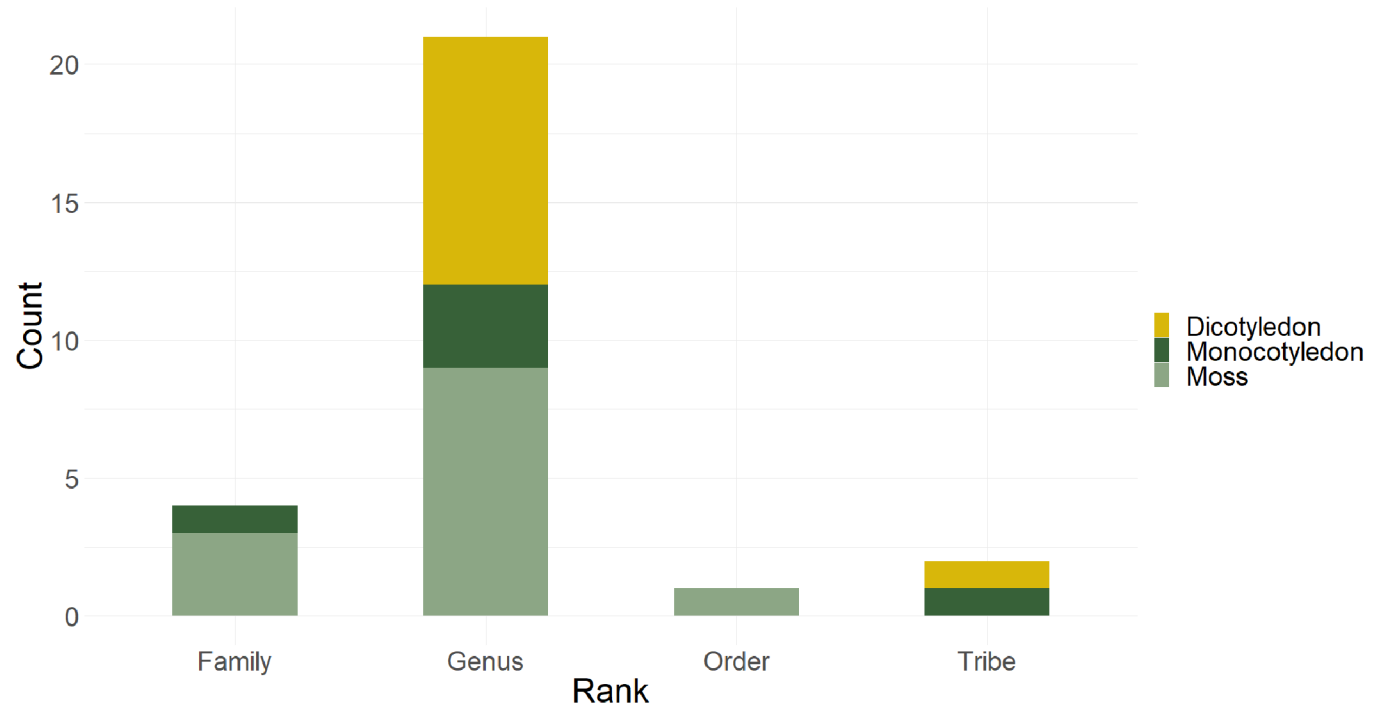
40 samples, 23 sequenced



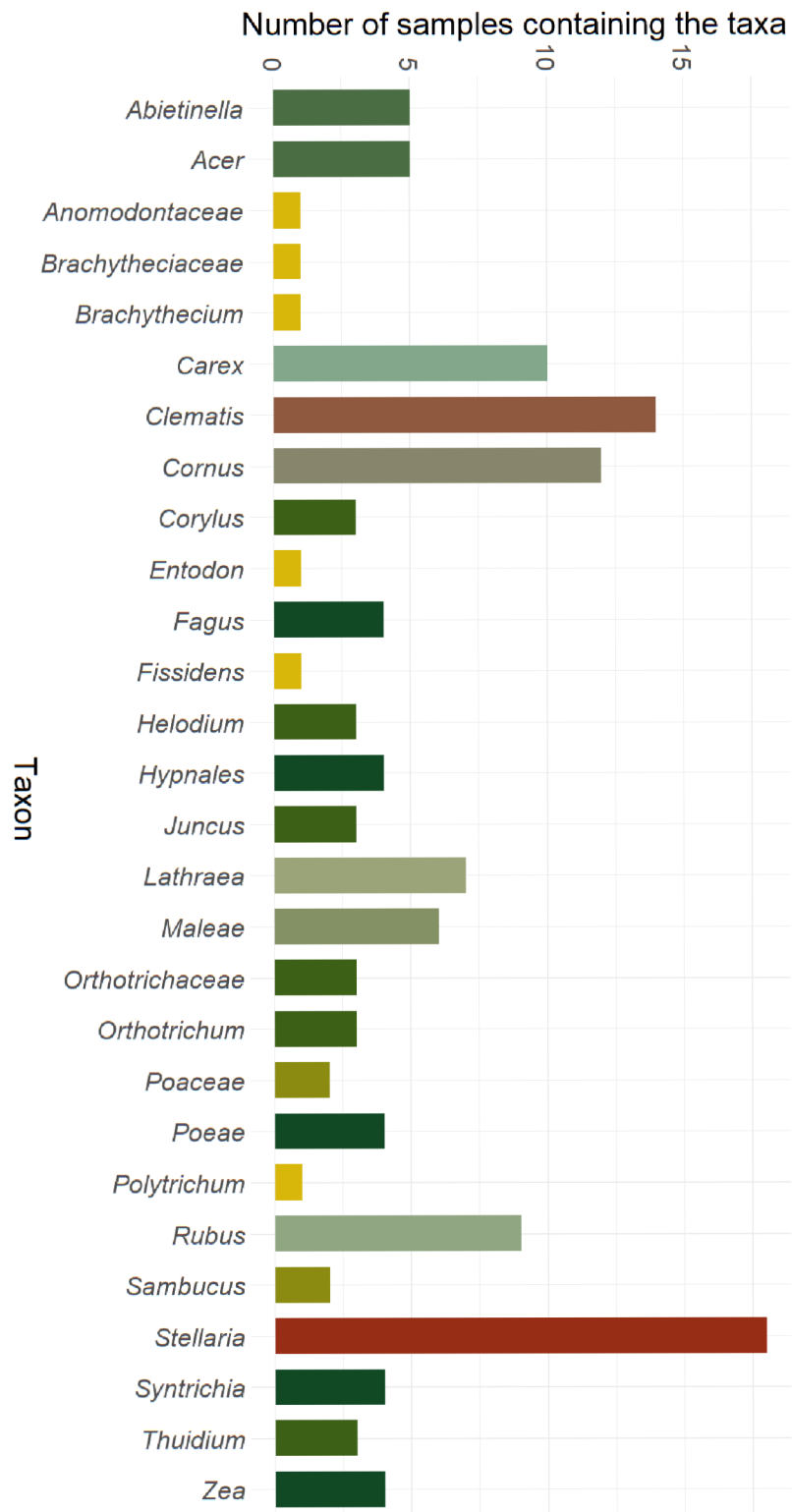
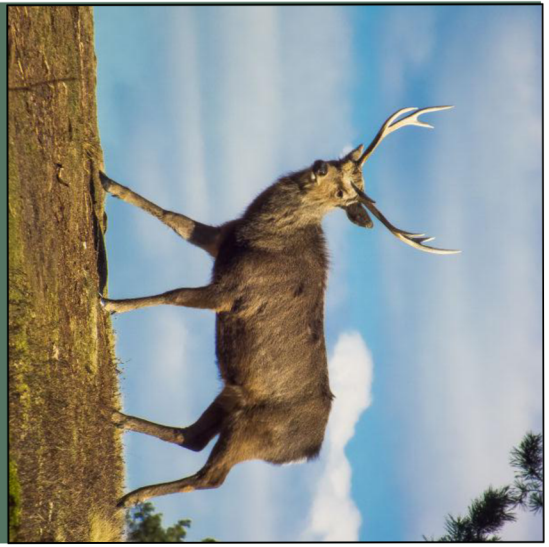
28 taxa



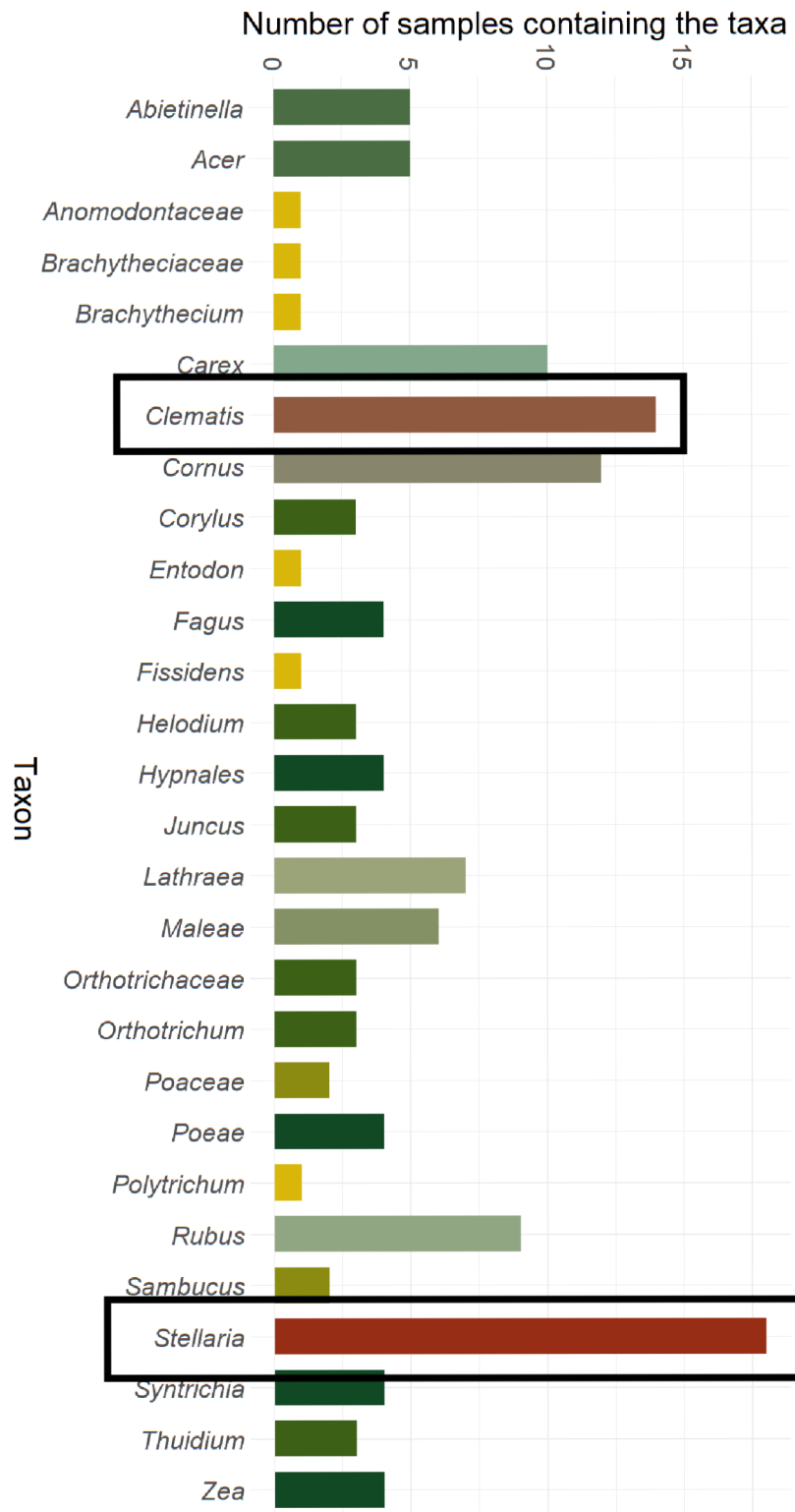
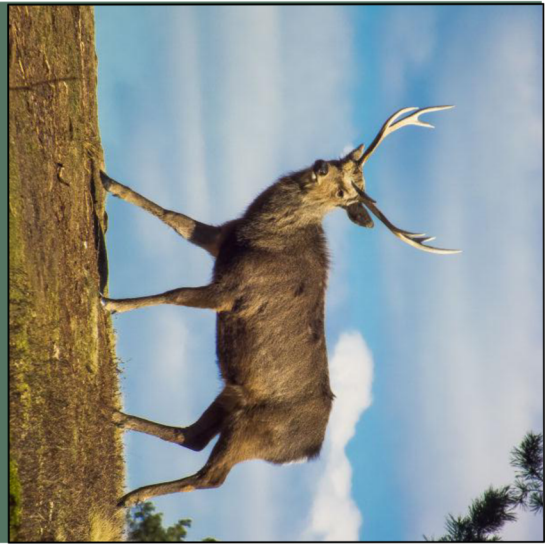
Results



Results

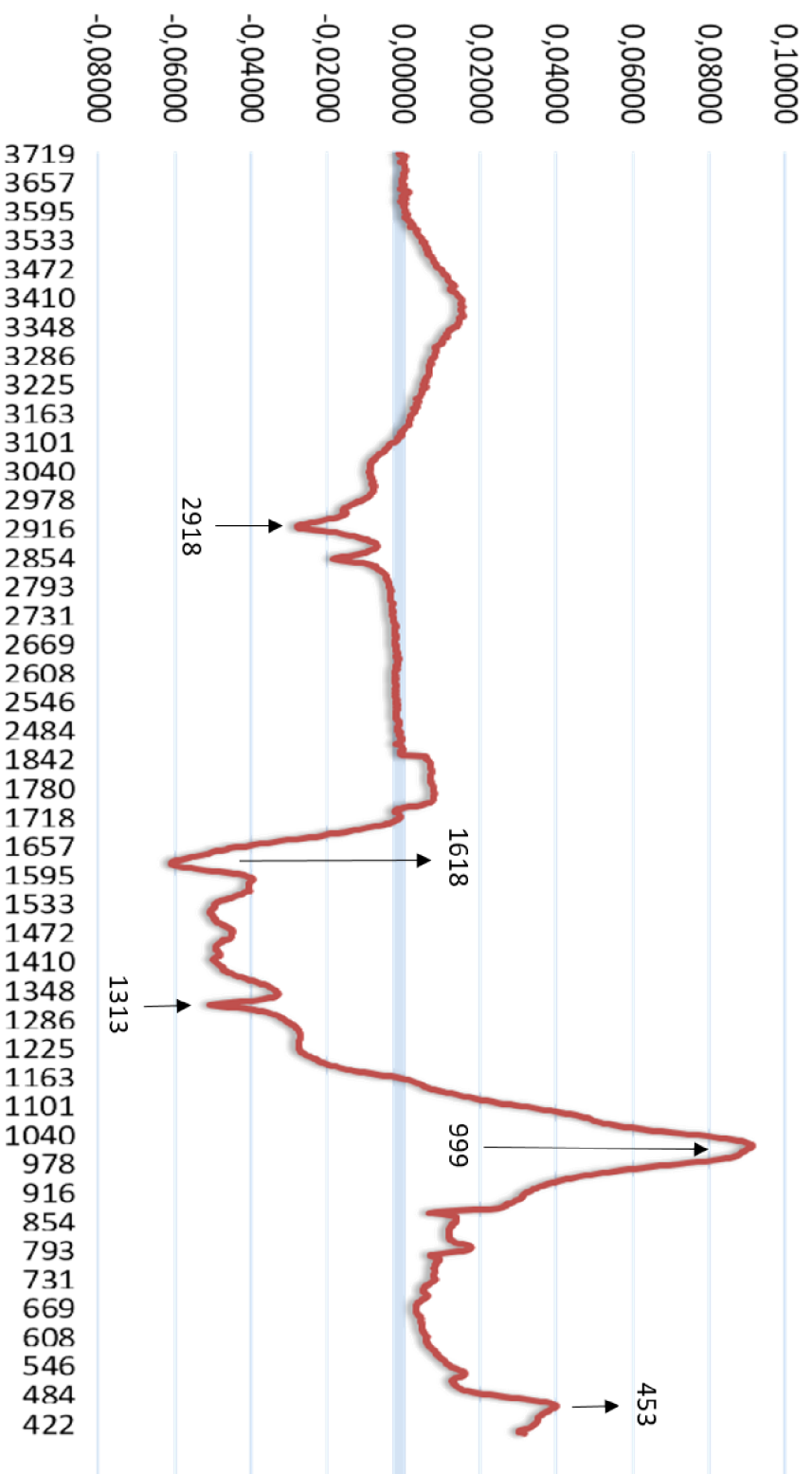


Results



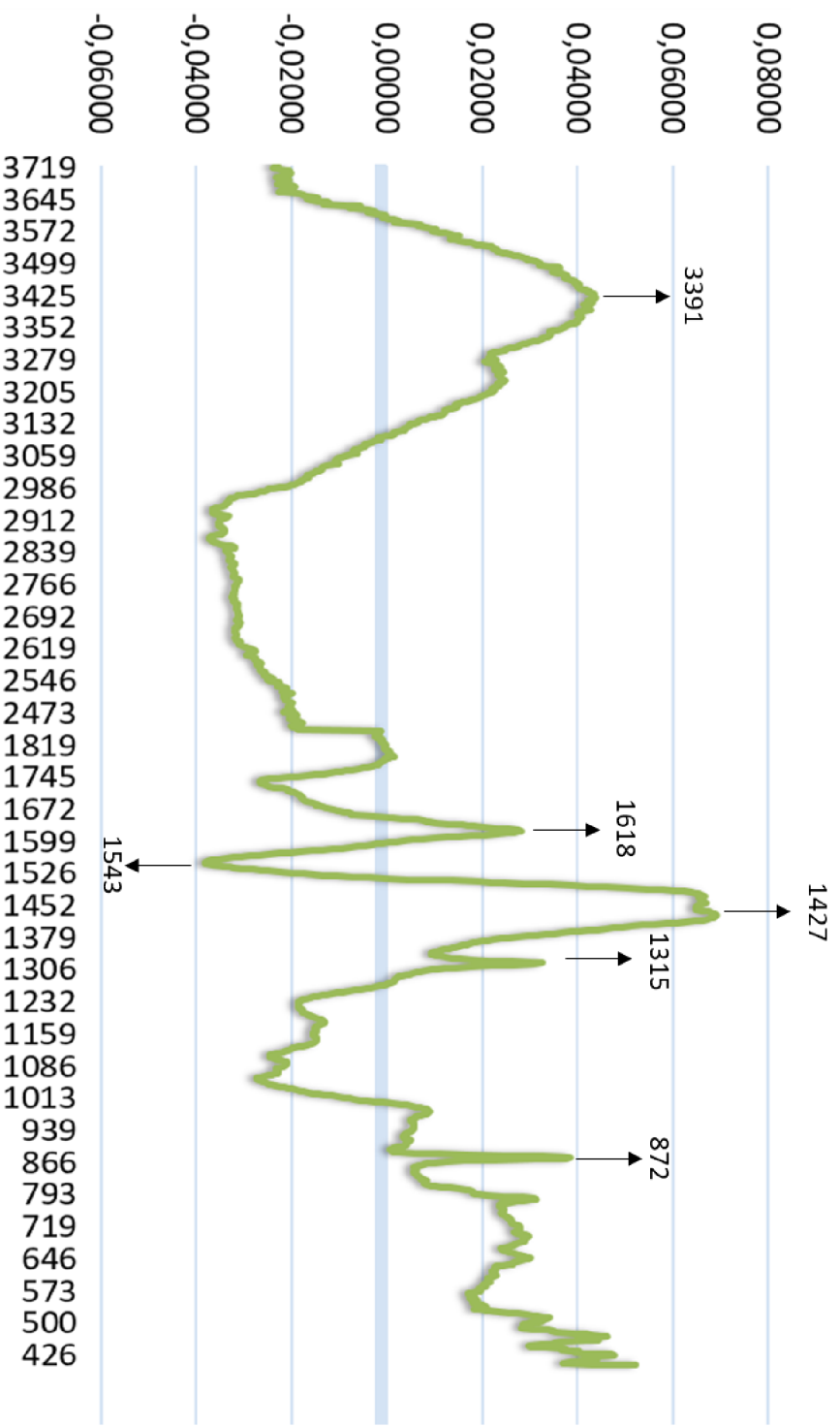


Results





Results



Results

Preliminary Study

Preferred taxa?

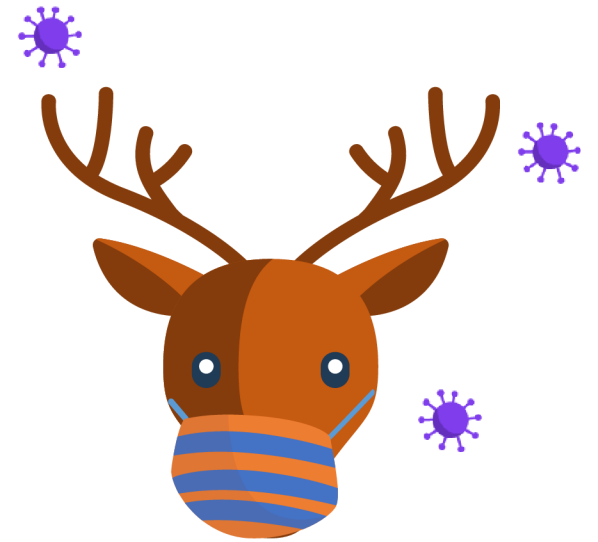
Suitable methods



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. Sommesse. “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 Sommesse, 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 Mendeliana 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 [Zoologické dny](#). *Prague, Czech Republic*

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



Special Thanks

- *Dr. Flavio Picone,*
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- *Prof. Miroslav Urosevic,*
- *Prof. Zoran Ristic,*
- *Dr. Nenad Stojanac,*
- *Dr. Dejan Beukovic,*
- *Marco Sensi,*
- *Valentina Bar,*
- *Vanessa Francia*



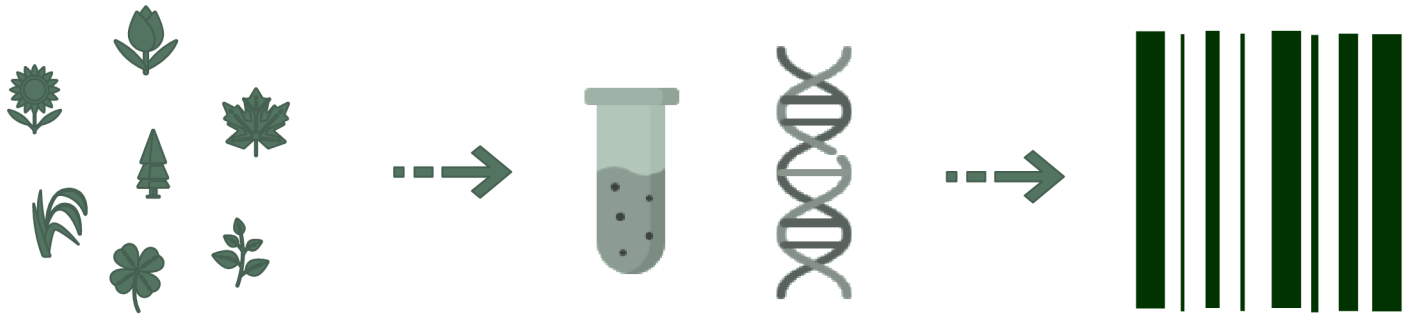
PRAGUE



Thank You

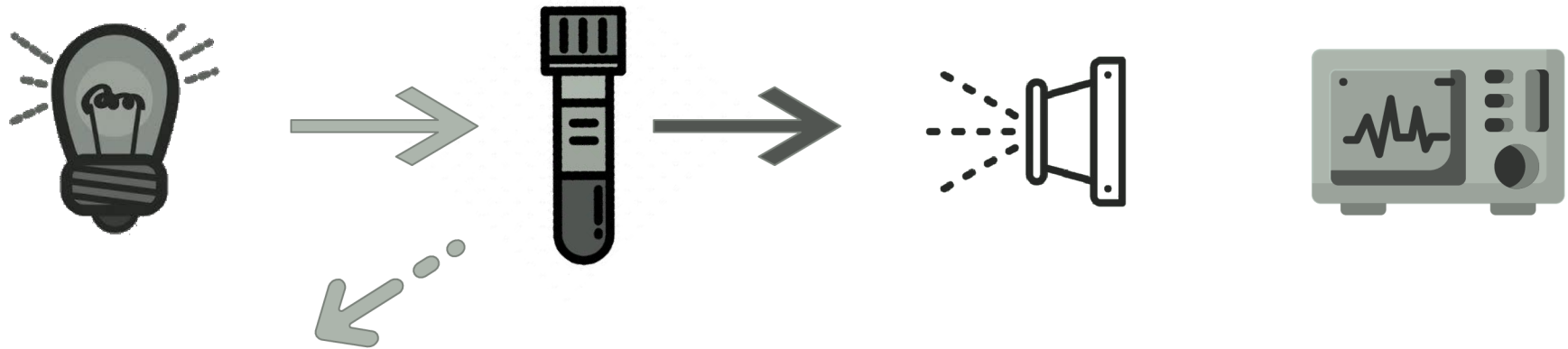


DNA barcoding



Multi-Species samples = *DNA Metabarcoding*

Spectroscopy

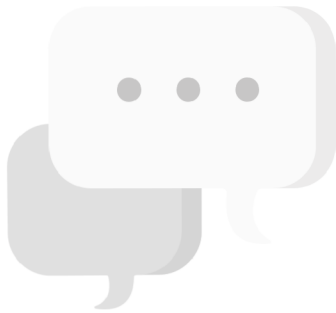


Absorption spectroscopy= FTIR



Scopus®

(“Cervus nippon” OR “Sika deer”)



Co-authorship of countries

Co-occurrence of keywords



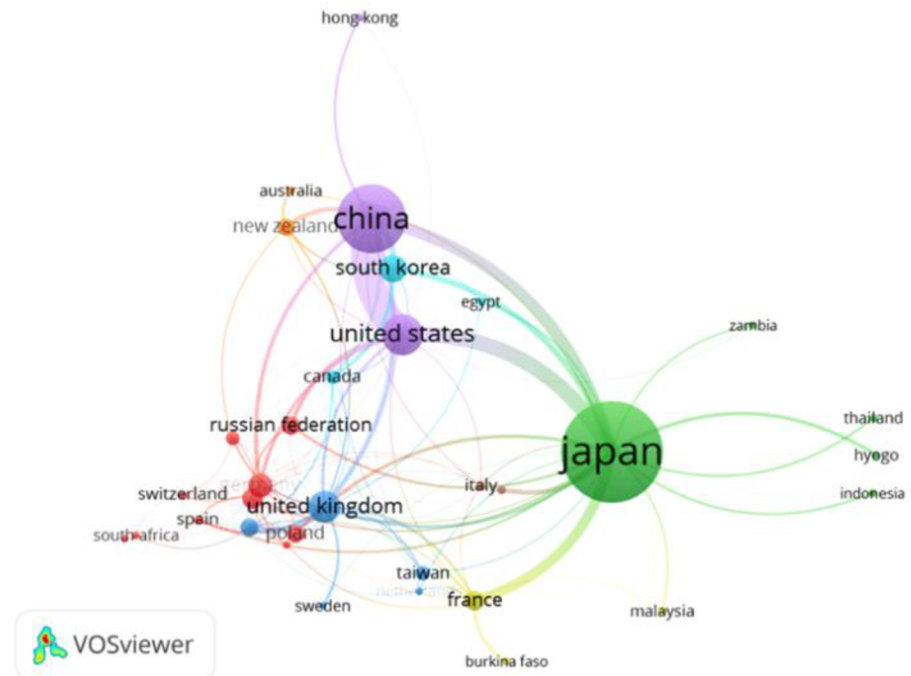
VOSviewer

VOSviewer



Network Map

- Clusters
- Link Strength
- Productivity



VOSviewer



Network Map

- Clusters
- Link Strength
- Productivity



Overlay Map

- Old and new topics
- Increased or decreased productivity

