



Viticulture in a changing Scandinavia

A Case study of Odsherred

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Integrated International Projectwork
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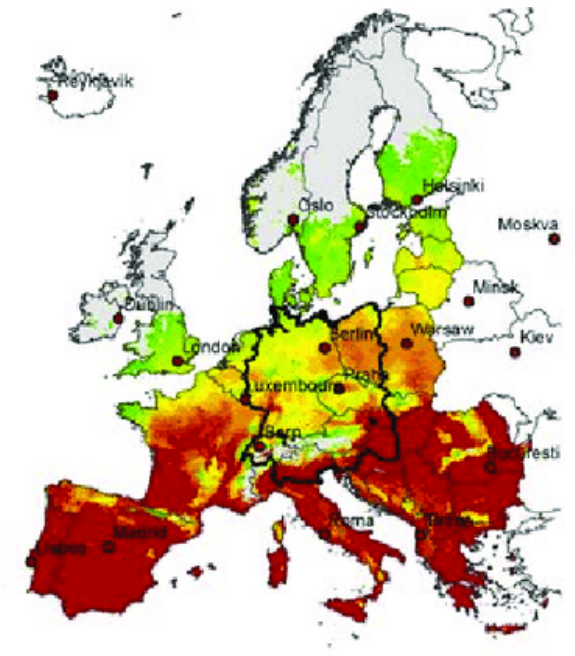
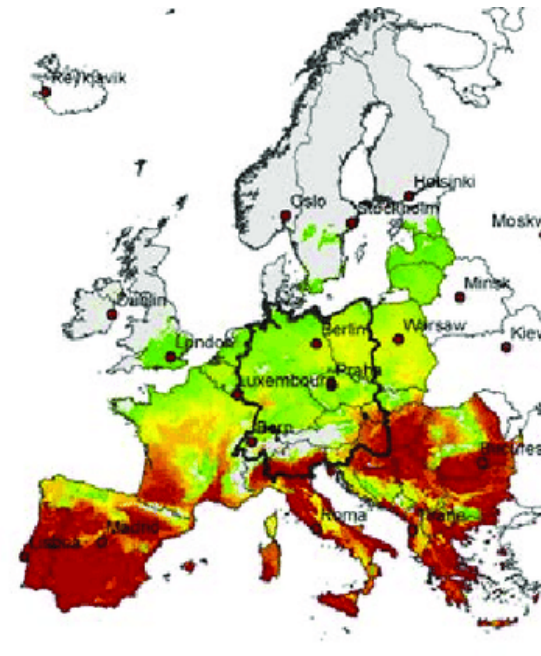
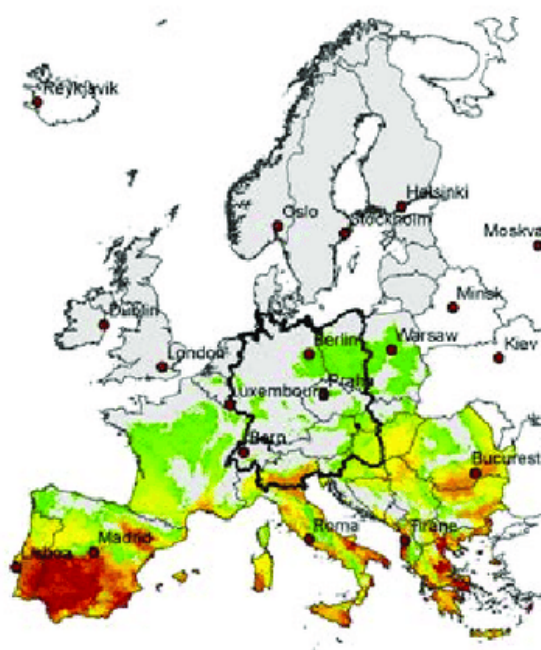
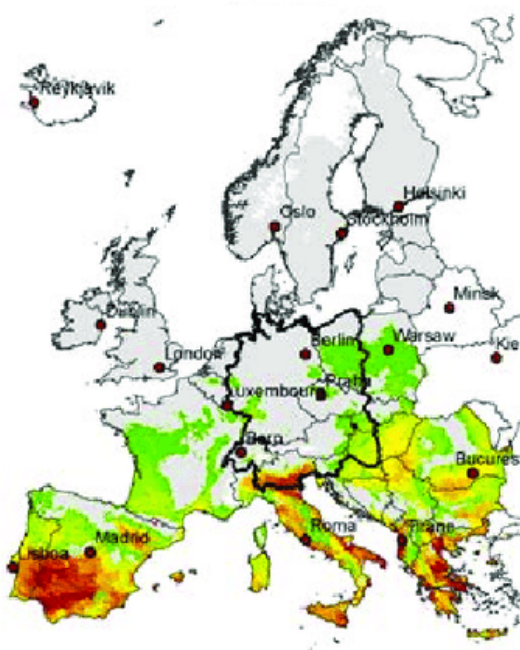
“The idea of making wine in Denmark sounded absurd”

1901-1930

1961-1990

2041-2050

2071-2080



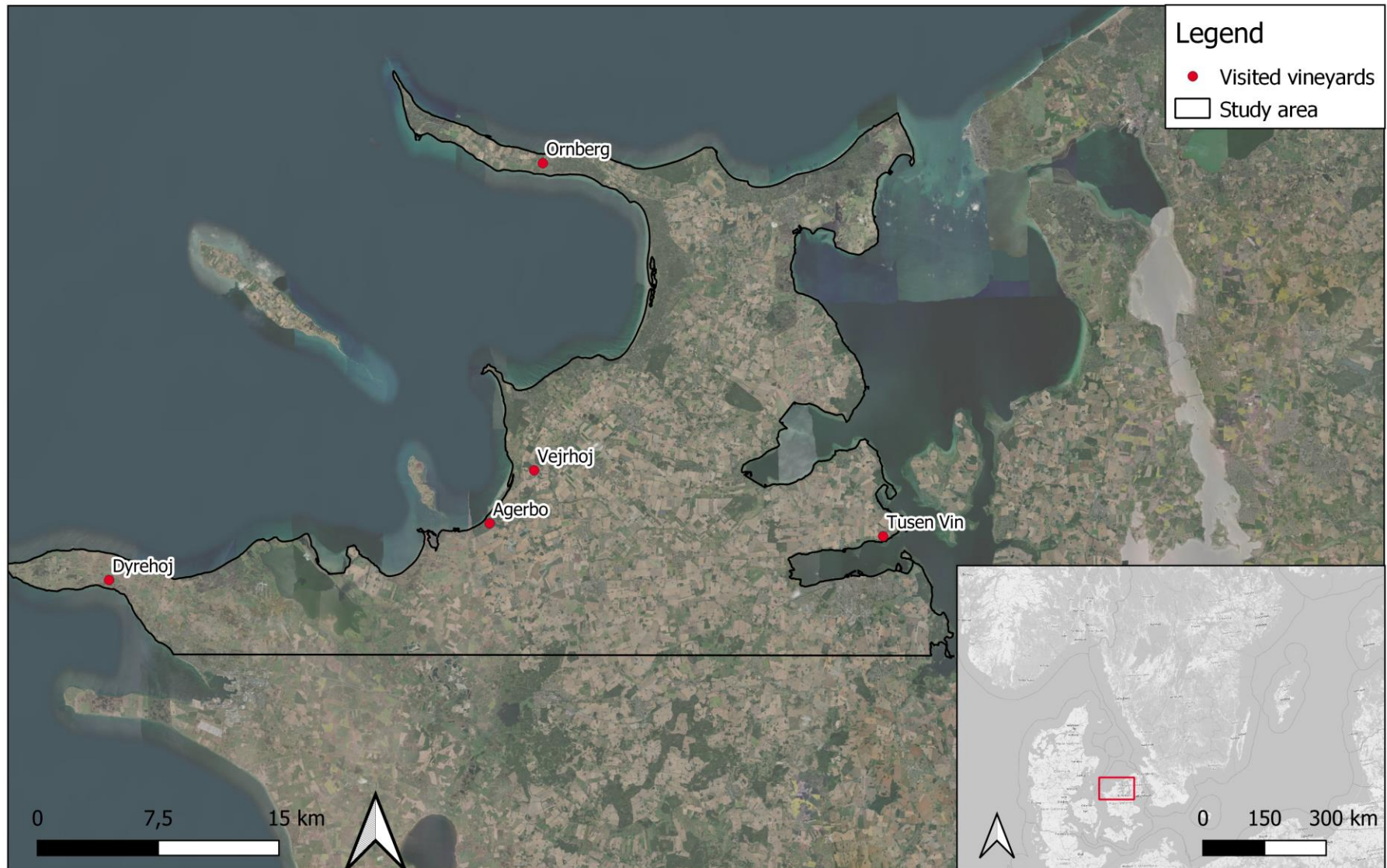
HUGLIN Index



0 500 1,000 2,000 km
(Design: Thaler, Berechnung: Simola, 2008)

Hugling Index (Lalic et al., 2018)

Study Area Odsherred and Surroundings



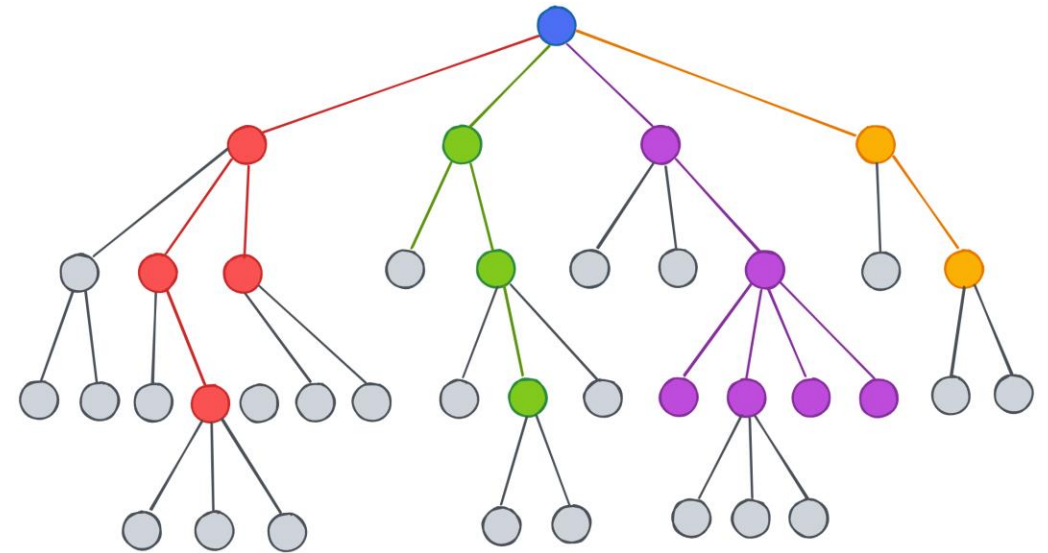
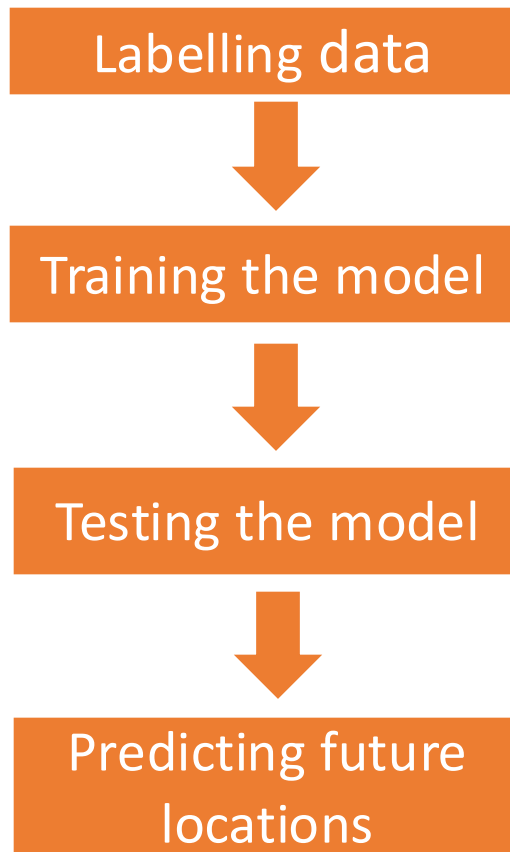
Research questions

- Why are vineyards where they are and what are the influencing factors?
- Where are possible future locations for vineyards?
- What is the role of climate change?



- Understanding the current situation
- New industry & future outlook

Methodology: GIS & Machine Learning



Methodology: Variables in model

General variable	Subdivision
Soil	Fine Sand
	Coarse Sand
	Silt
	Clay
	Humus
	Carbon
Sun	Sun hours
	Total insolation
Wind	Wind exposure
Distance to sea	Eastern coastline
	Western coastline
	Northern coastline
Land use	Agriculture

Methodology: Interviews

Interviews with 5 vineyard owners

- Why these locations?
- Relevant physical factors?
- Future plans?
- Climate change?



Owners' motivations

“It started for fun, now it is a reality”

Owner	Why?	When?	Output?	Grape?
Vineyard 1	As a hobby	2012	1,200 bottles	Solaris, Cabernet Cantor
Vineyard 2	As a hobby	2009	20,000 bottles	Solaris, Muscaris, Fukaris
Vineyard 3	Professional Already farmer	2008	35,000 (+ 15,000) bottles	Solaris, Sauvignet Gris, Muscaris
Vineyard 4	Professional Already farmer	2007	15,000 bottles	Solaris, Sauvignon Blanc, Fenix
Vineyard 5	Professional Passion for fermentation	2020	(15,000 bottles) Prediction for next year	Solaris, Muscaris, Cabernet Cantor, Sauvigner Gris

Results: Input experts

- Different reasons:
 - Leisure
 - Economic
- Microclimate is the most important factor:
 - Distance to the sea
 - Sun
 - Wind
- Less important than thought:
 - Soil
 - Slope



Results: Random Forest Algorithm

Accuracy: 0.99

Confusion Matrix:

```
[[533238    87]
 [      8   180]]
```

Classification Report:

	precision	recall	f1-score	support
0.0	1.00	1.00	1.00	533325
1.0	0.67	0.96	0.79	188
accuracy			1.00	533513
macro avg	0.84	0.98	0.90	533513
weighted avg	1.00	1.00	1.00	533513

Number of zeros: 1777406

Number of ones: 285

Possible locations for vineyards in Odsherred and surroundings



Example of the prediction of the Random Forest Model



Own research using QGIS



Conclusion

- Why are vineyards where they are and what are the influencing factors?
 - Physical factors: microclimate
 - Motivation: economic or leisure
- Where are possible future locations for vineyards?
 - Close to the sea
- What is the role of climate change?
 - Resilient hybrid vines + warmer climate
 - Positive outlook but not on extremes

Take home message

- Selected variables were good but not sufficient
 - Is microclimate even modellable?
- Spatial resolution could be finer
- Leave certain regions out of the analysis
- Are vineyards desirable?
- Wine is complex



Thank you/ Tak

