

Testing of goose damage detection by using remote sensing data

Dr. B. Holsten

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Schleswig-Holstein
Ministry for Energy Transition,
Agriculture, Environment,
Nature and Digitalization

Background

Geese damage on agricultural crops is a wide spread phenomenon on the west coast and the lower Elbe in Schleswig-Holstein.

The feeding damage varies annually. There are no current information about the actual spatial distribution and the extent of damage available.

The question was, weather satellite image data can be used for a country-wide estimate of geese damage intensity and it's spatial distribution.



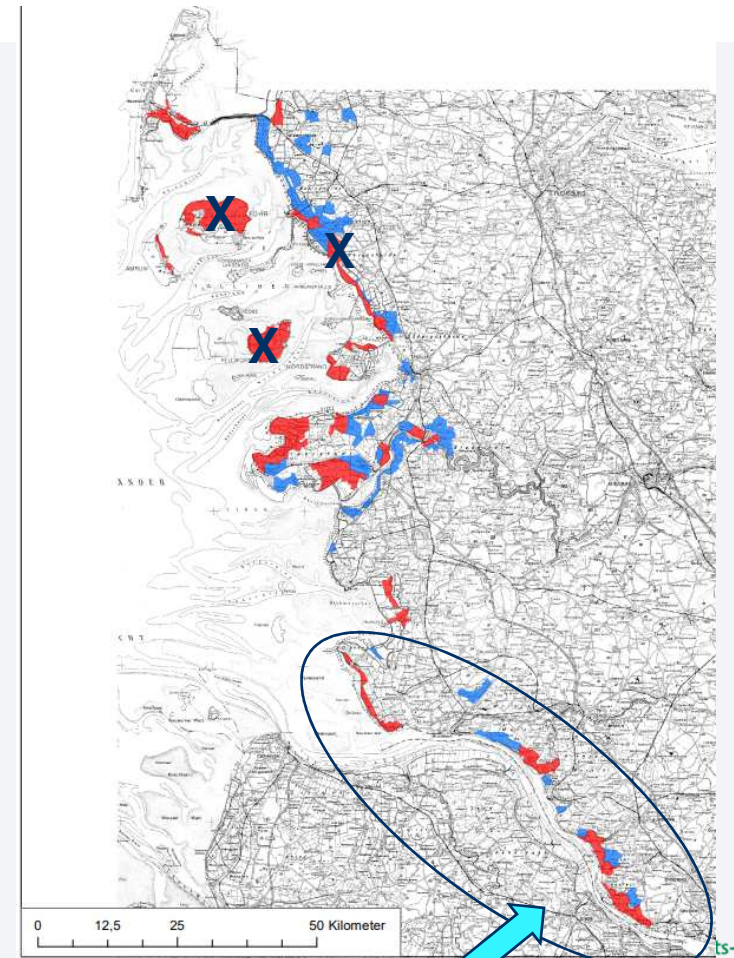
Project Coperni.Goose 2021

Chamber of Agriculture SH

Survey of feeding damage in March and May on approx. 2,000 ha in the vicinity of the Hauke-Hain-Koog on the mainland, on the islands Pellworm and Föhr (X).

Earth Observation and Modelling (EOM) Group of the Christian-Albrechts-University of Kiel (CAU)

Provision of remote sensing data for the field surveys, conversion of the field maps into digital data, development of algorithms to detect geese damage, transfer of the results to the agricultural areas within the main winter and spring resting areas of barnacle geese (red areas on the map).



Clouds in May, no data for geese damage

Project description

Objective:

Testing of the possibilities to detect geese damage by remote sensing data.

Project implementation:

Every 5 days images by Sentinel mission of European Space Agency (ESA) available.

Development of algorithms to detect geese damage by Earth Observation and Modelling (EOM) Group of the CAU Kiel, based on the survey of biomass loss by geese grazing on the ground by the Chamber of Agriculture of Schleswig-Holstein.

Project of the Ministry of Energy, Agriculture, the Environment, Nature and Digitalization (MELUND)

Contractor: Chamber of Agriculture Schleswig-Holstein

Area:

- About 2,000 ha
 - 1,000 ha on the mainland, Hauke-Haien-Koog
 - 600 ha island of Pellworm
 - 400 ha island of Föhr

Data collection:

- March:
 - Start: 15.03.2021 on the mainland
 - Start: 22.03.2021 on the islands
- May:
 - Start: 06.-12.05.2021 on the mainland
 - Start: 17./21.05.2021 on the islands

Project description

Approaching the geese damage on agricultural fields:

- Yield losses vs. biomass loss
- Biomass loss in % as an approximation to geese damage
- Biomass loss is determined by an estimation of the potential for an undisturbed biomass development of the field which is compared to the current situation after geese grazing.

Mapping methodology



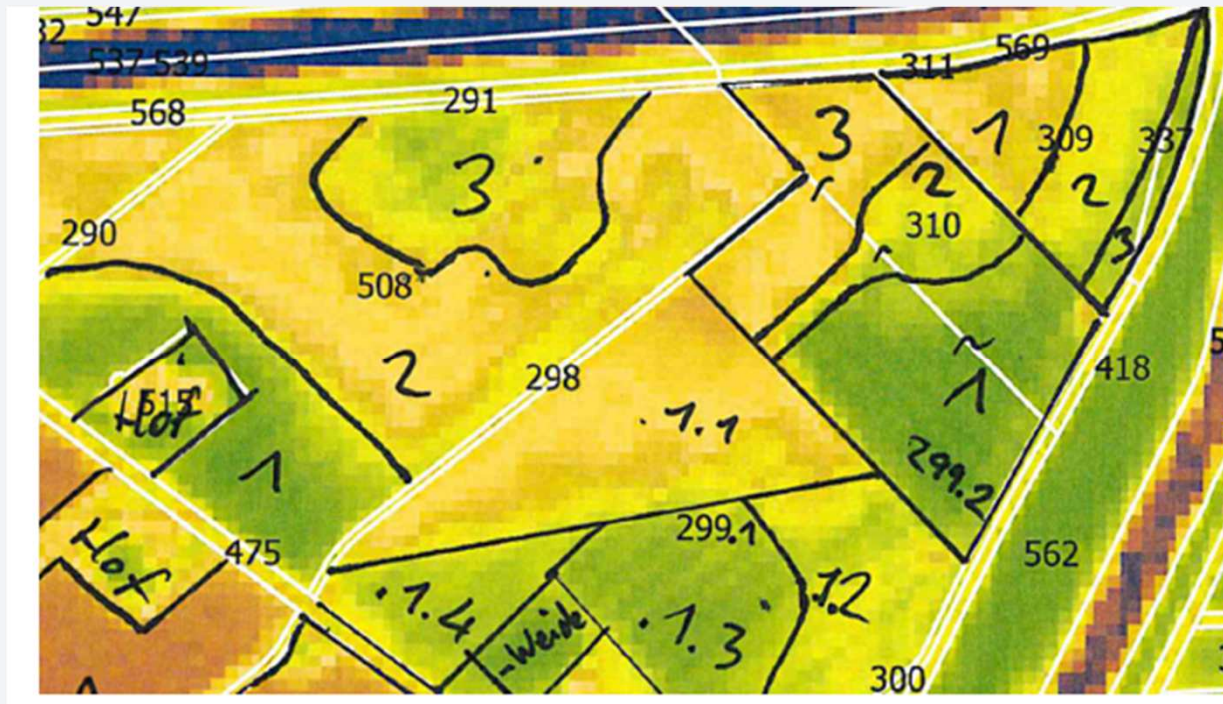
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- Maps with field boundaries and area codes
- Creation of management units
- If necessary, creation of subunits of the field
- Identification of special structures
- Registration form
- Date, area code, culture, remarks
- Estimation of area shares in % of the subunits
- Estimation of biomass loss in % and cause of damage



Mapping methodology

Example of an edited map



Results March



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- No mapping of grassland (according to contract)
- High losses of biomass in all areas (> 50%)

	Ø Biomass loss		
	Mainland	Föhr	Pellworm
Winter cereals	62%	64%	95%
Winter rape	35%	95%	99%
Oat	-	60%	-
Catch crops	-	-	95%
Sum	53%	67%	96%

Results March



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Biomass loss and causes

Mainland Hauke-Haien-Koog

	Fields total			Cause of biomass loss		
	Number	ha total	Ø Biomass loss	Geese	G+O*	Others
Field grass and clover grass	2	6	42%	14%	0%	86%
Winter cereals	39	330	62%	73%	21%	6%
Winter rape	17	160	35%	69%	9%	23%
Sum tillage	58	495	53%	72%	19%	9%

* Geese and others - not differentiated



Results March

Biomass loss and causes

Pellworm

	Fields total			Cause of biomass loss		
	Number	ha total	Ø Biomass loss	Geese	G+O*	Others
Winter cereals	15	48	95%	52%	48%	0%
Winter rape	2	8	99%	14%	86%	0%
Catch crops	1	3	95%	0%	100%	0%
Sum tillage	18	58	96%	45%	55%	0%

* Geese and others - not differentiated

Results March



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Pellworm winter wheat



Pellworm oat – winter wheat



Landwirtschafts-
kammer
Schleswig-Holstein

Results May

- Mapping of grassland
- Biomass loss in May lower than in March
- Grassland assessment dependent on various factors

	Ø Biomass loss		
	Mainland	Föhr	Pellworm
Pasture	39%	68%	93%
Grassland	49%	45%	90%
Field grass and clover grass	53%	21%	93%
Winter cereals	40%	20%	63%
Winter rape	23%	51%	-
Summer cereals	21%	52%	15%
Oat	1%	8%	3%
Legumes	0%	0%	5%
Catch crops	-	2%	-
Sum	33%	43%	82%

Results May



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Biomass loss and causes

Mainland Hauke-Haien-Koog

	Fields total			Cause of biomass loss		
	Number	ha total	Ø Biomass loss	Geese	G+O*	Others
Pasture	3	9	39%	100%	0%	0%
Grassland	46	138	49%	88%	12%	0%
Field grass and clover grass	11	41	53%	36%	26%	38%
Winter cereals	32	233	40%	90%	5%	5%
Winter rape	18	152	23%	83%	17%	0%
Summer cereals	12	104	21%	100%	0%	0%
Oats	6	37	1%	100%	0%	0%
Legumes	2	19	0%	-	-	-
Sum tillage	130	733	33%	85%	9%	6%

* Geese and others - not differentiated



Results May



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Biomass loss and causes

Föhr

	Fields total			Cause of biomass loss		
	Number	ha total	Ø Biomass loss	Geese	G+O*	Others
Pasture	15	71	68%	51%	46%	3%
Grassland	107	410	45%	96%	4%	0%
Field grass and clover grass	7	14	21%	81%	19%	0%
Winter cereals	9	45	20%	30%	25%	45%
Winter rape	3	12	51%	100%	0%	0%
Summer cereals	7	32	52%	100%	0%	0%
Oat	6	16	8%	100%	0%	0%
Legumes	1	3	0%	-	-	-
Catch crops	4	14	2%	100%	0%	0%
Sum tillage	159	616	43%	86%	12%	2%

* Geese and others - not differentiated



Results May

Pellworm clover grass / thistles



Pellworm oat - wheat



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Change to

Projectresults_CoperniGoose CAU.pdf

Approach to a total of (barnacle) geese damage in SH

Results of biomass loss in % in winter wheat and grassland in main winter and spring resting areas

Culture	Sum area in ha	evaluated in ha	No/low damage (up to 30%) in ha	Medium damage (>30-70%) in ha	High damage (> 70%) in ha
Winter wheat total	4.038	2.669	290	755	1.624
Agri environmental scheme (AES) for fields: „resting areas”		581	82	205	294
Grassland total (without Halligen)	18.657	13.932	4.022	3.266	6.644
Share of public areas ¹ und nature conservation areas ²		1.968	201	421	1.346
AES-grassland contracts		2.719	882	753	1.085
Share of private land without AES		9.245	2.940	2.092	4.213

¹: Public areas (municipalities, federal state, state)

²: Nature foundations and nature conservation associations (f.e. Stiftung Naturschutz, Schrobachstiftung, NABU, BUND etc.)

Conclusions

- With the help of remote sensing data, crop species-specific goose damage can be detected in winter wheat and in grassland.
- The accuracy of the predictions is higher for winter wheat than for grassland.
- It is possible to determine three levels of damage on individual fields.
- Unfavorable weather conditions like longer cloud covers can limit satellite image use.
- A complete assessment of feeding damage for Schleswig-Holstein is not yet possible, because specific algorithms are not available for all crops.
- Geese damage can't be detected independent for data about cultivated crops.
- The connection between biomass losses and monetary losses requires further analysis.

Thank you for your attention!

