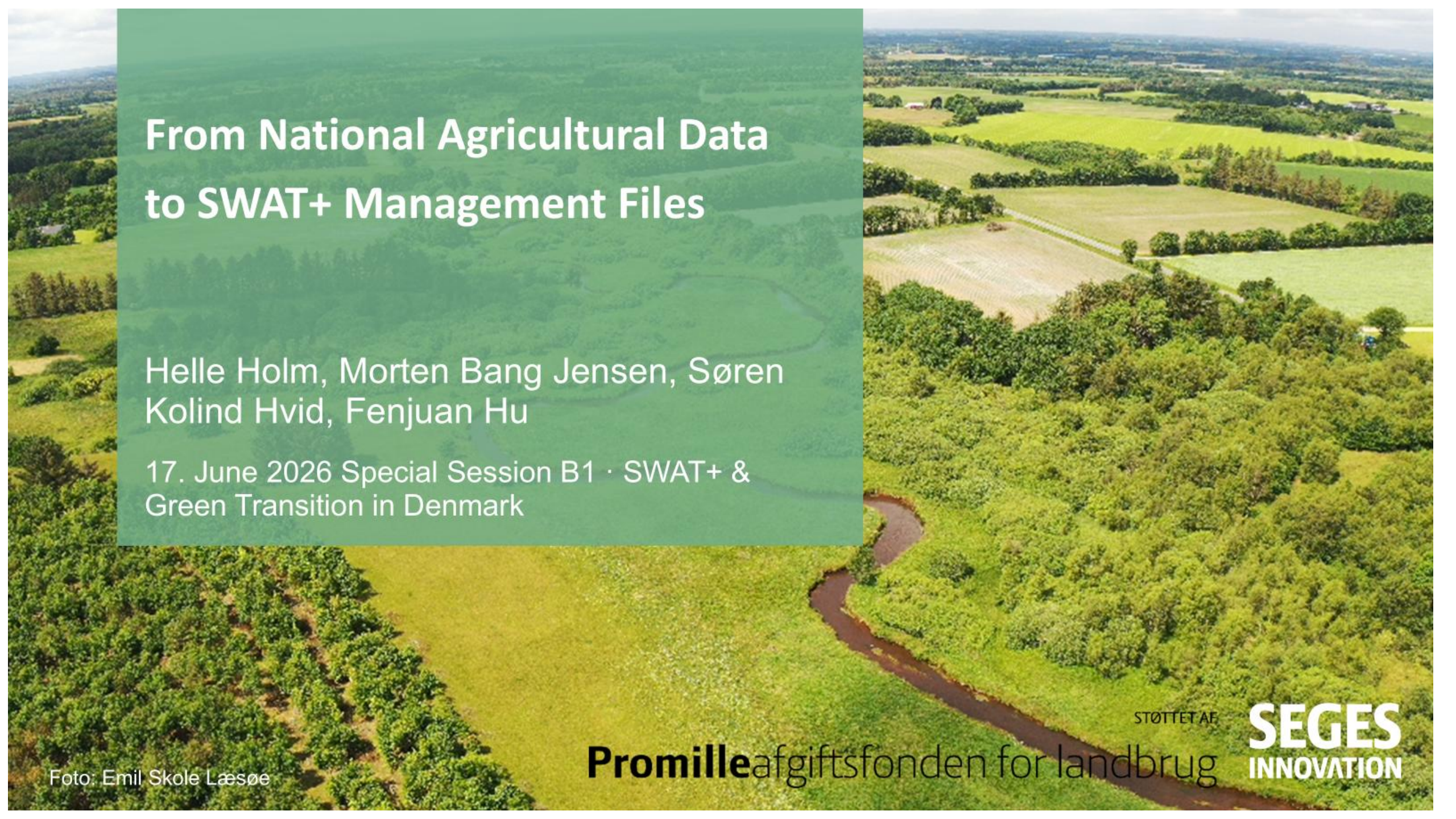


Agricultural management at field level

Helle Holm and Fenjuan Hu, SEGES Innovation



From National Agricultural Data to SWAT+ Management Files

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Kolind Hvid, Fenjuan Hu

17. June 2026 Special Session B1 · SWAT+ &
Green Transition in Denmark

Foto: Emil Skole Læsøe

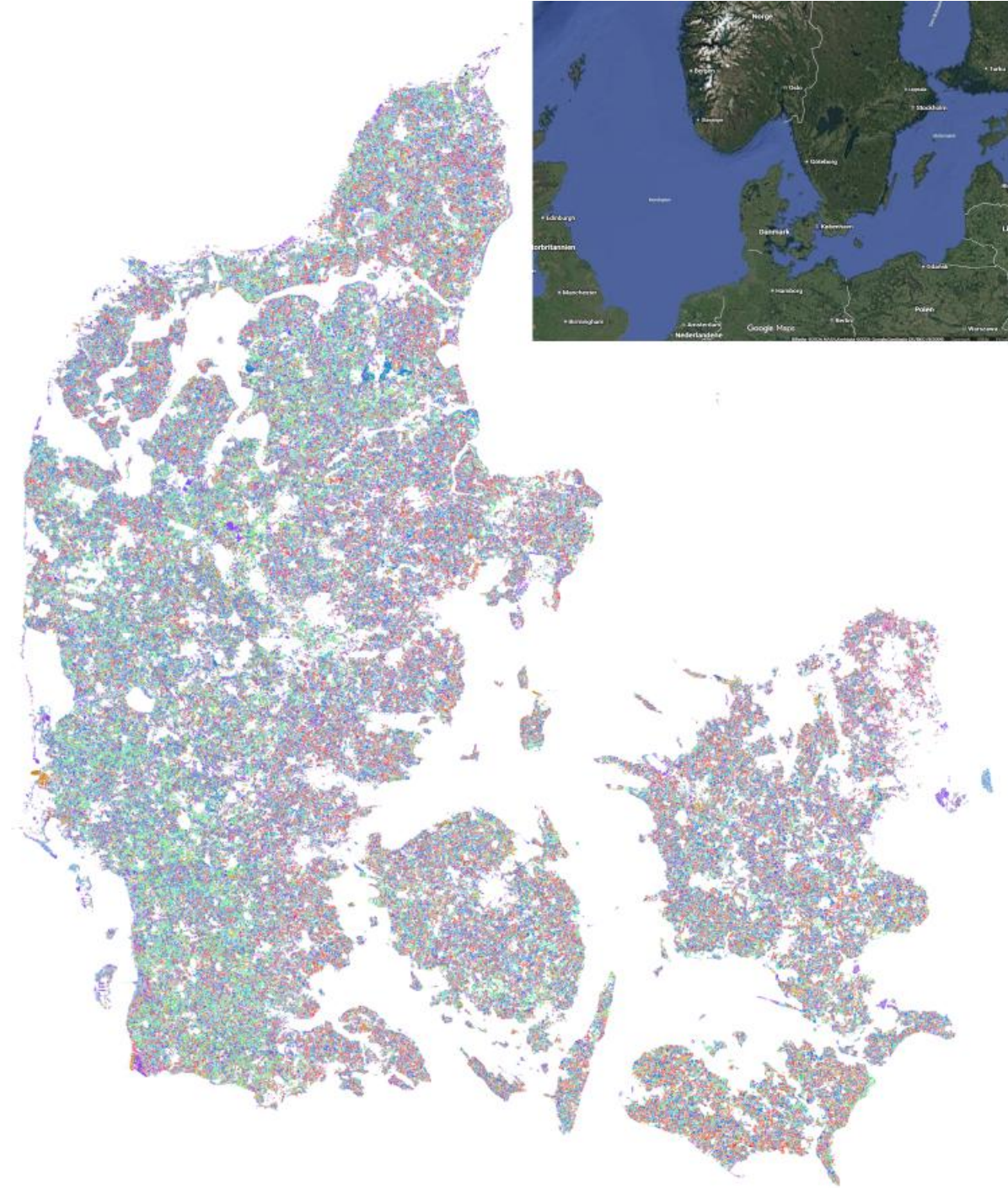
Promilleafgiftsfonden for landbrug

STØTTET AF

SEGES
INNOVATION

A bit about Denmark

- In Denmark, 60% of the country consists of cultivated fields
- 80% of the nitrate leaching in Denmark comes from agricultural areas.
- Many small and many-shaped fields in Denmark
- High complexity and high demand to find the right solutions – need precise model to describe where the nutrients leach from



Calgary, Canada

Claresholm

Woodhouse

Meadow Creek Road



Old Colony
Mennonite Church



Holckenhavn, Denmark



Denmark's agricultural register data

600,000 + registered
fields

Reliable continuous
timeseries from
2018 and on

100+ crop types

Each record contains:

Field boundary (polygon)

Crop type

Farmer ID

Area (ha)

Field ID

Year

Denmark's agricultural register data

600,000 + registered
fields

Reliable continuous
timeseries from
2018 and on

100+ crop types

**Our challenge is to transform this into
SWAT management table**

Area (ha)

Field ID

Year

Two National Registers → One Management File

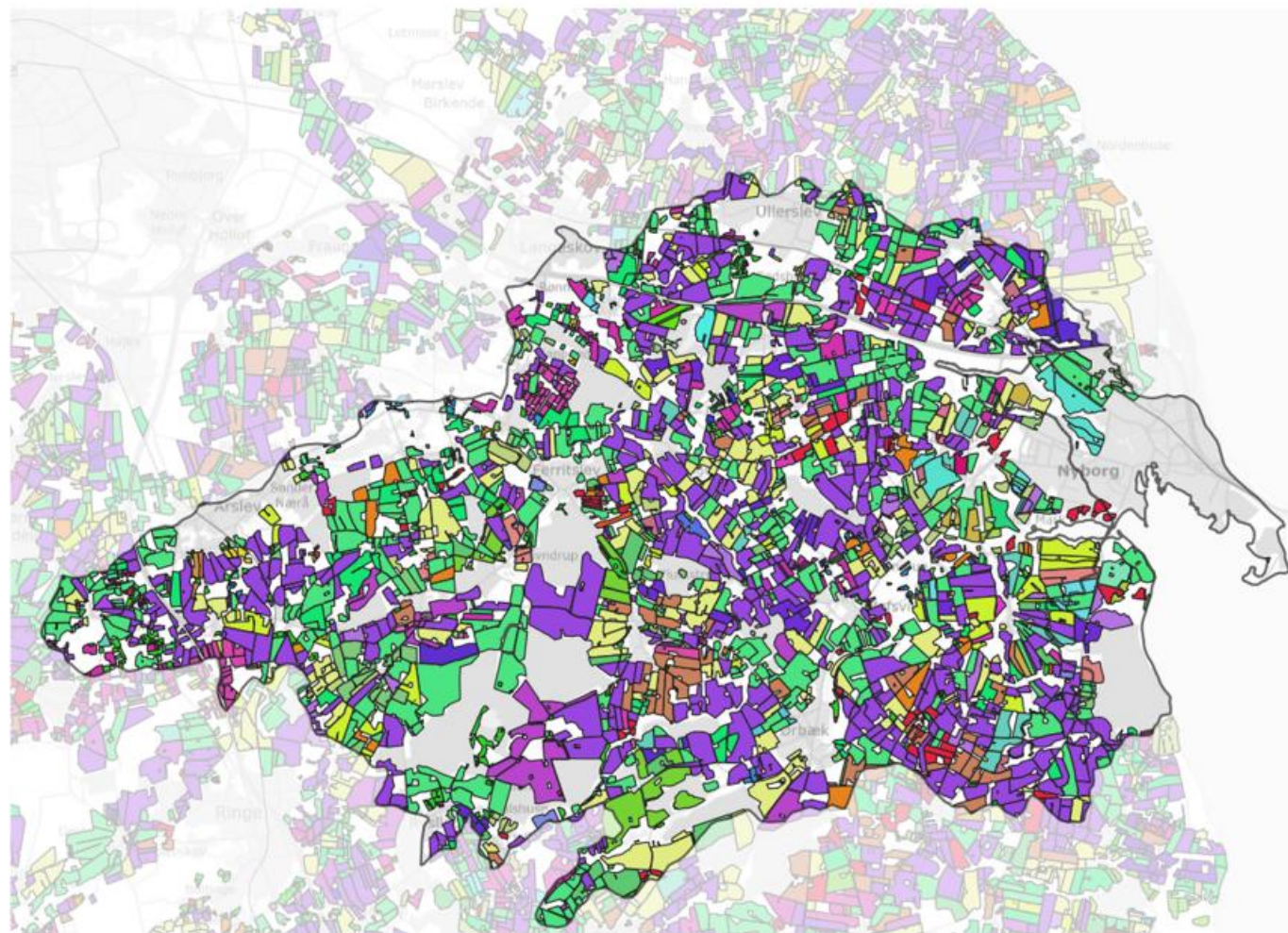
Field Block Register

- Crop type per field parcel
- Annual data — all arable land from 2018-2023



Fertilizer Accounts

- Total N per farm per year
- Manure + mineral fertilizer
- Distribute farm total N → individual fields



The Crop Lookup Table — Agronomic Expert Knowledge in a Spreadsheet

- **One row per Danish crop type**

Covers all major crops: winter cereals, spring cereals, maize, rapeseed, sugar beet, grass types, legumes, catch crops...

- **Each crop defines:**

- Tillage date
- Sowing/Planting date
- Fertilizer application dates (1–3 splits)
- Maximum N amount per application
- Harvest date

- **Based on Danish agronomic practice**

Example: Winter Wheat

Operation	Date	Amount
Tillage	Sep 15	—
Plant	Sep 20	—
Fertiliser 1	Mar 1	≤ 60 kg N/ha
Fertiliser 2	Apr 10	≤ 60 kg N/ha
Fertiliser 3	May 15	≤ 30 kg N/ha
Harvest	Jul 25	—

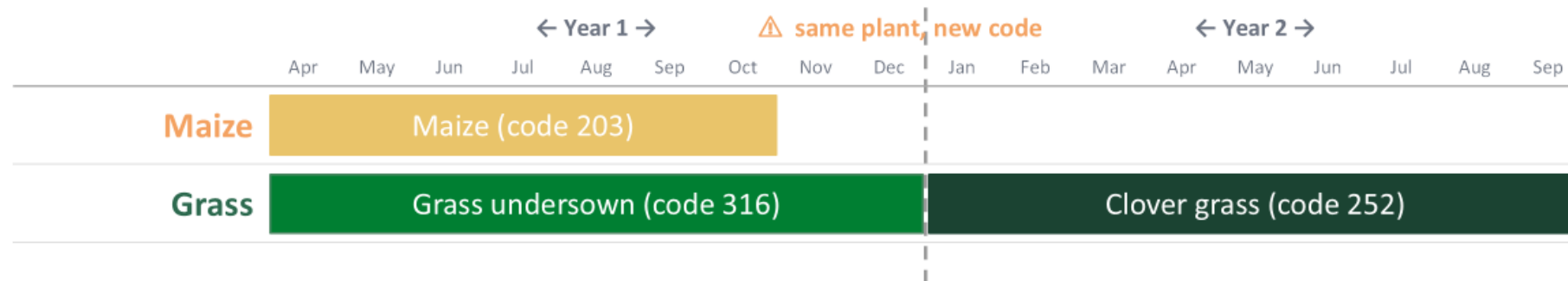
Problematic crops: Undersown Crops & perennial grass

① Undersown crops (e.g. grass in maize)

Two simultaneous crops. Grass continues growing after maize harvest → carried over to Year 2.

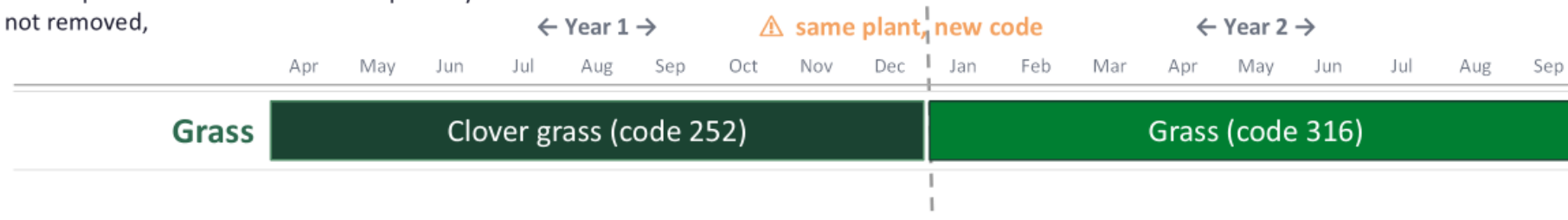
Undersown crop must survive winter — do NOT plough at main crop harvest.

The same plant has different crop names and codes in Year 1 and Year 2 — which breaks a simple carry-over rule.



② Perennial grass

Catch crop are sown after the main crop — they are killed but biomass is not removed,



What This Enables



Real data, not assumptions

Management files generated directly from Danish agricultural registers — every field, every year.



N inputs vary by field, year and soil type

Based on total N input per farm.



Scales to national coverage

The same pipeline runs across all 600,000+ registered fields with no manual input.

management.sch: file written by Python script Agridata_SWAT.py on 2025-12-23 08:17:27. Agridata for Opland ['Holckenhavn Fjord', 'Nyborg Fjord'] for years 2018 to 2023 (ir													
name	numb_ops	numb_auto	op_typ	mon	day	hu_sch	op_data1	op_data2	op_data3				
agrr_rot	1	1											
		pl_hv_summer1	agrr										
wetland	1	1											
		forest_cut	wetn										
cr0001_rot	94	0											
			fert	3	15	0.000	elem_n	broadcast	70.35832				
			fert	3	15	0.000	elem_p	broadcast	3.51792				
			fert	3	28	0.000	elem_n	broadcast	60.00000				
			fert	3	28	0.000	elem_p	broadcast	3.00000				
			fert	3	28	0.000	org_n	broadcast	20.00000				
			fert	3	28	0.000	org_p	broadcast	3.60000				
			till	4	1	0.000	fallplow	null	0.00000				
			plnt	4	2	0.000	dk_bar1	null	0.00000				
			fert	4	28	0.000	elem_n	broadcast	5.82819				
			fert	4	28	0.000	elem_p	broadcast	0.29141				
			fert	4	28	0.000	org_n	broadcast	1.94273				
			fert	4	28	0.000	org_p	broadcast	0.34969				
			harv	8	10	0.000	dk_bar1	grain	0.00000				
			kill	8	10	0.000	dk_bar1	null	0.00000				
			till	9	19	0.000	fallplow	null	0.00000				
			plnt	9	20	0.000	dk_wght	null	0.00000				
			skip	0	0	0.000	null	null	0.00000				
			fert	3	10	0.000	elem_n	broadcast	60.00000				
			fert	3	10	0.000	elem_p	broadcast	3.00000				

What we still need to work on



Management dates tied to climate

Link management timing directly to climate data.
