WATER FUTURE
sustainable solutions

Nitrogen crisis in NL

Problem & Solution(s)

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avans hogeschool

Your solution ?

1. Do not eat meat

2. Stop farming, close down farmers

3. Do not bother about nature, allow N emissions

4. Innovations should solve the problem

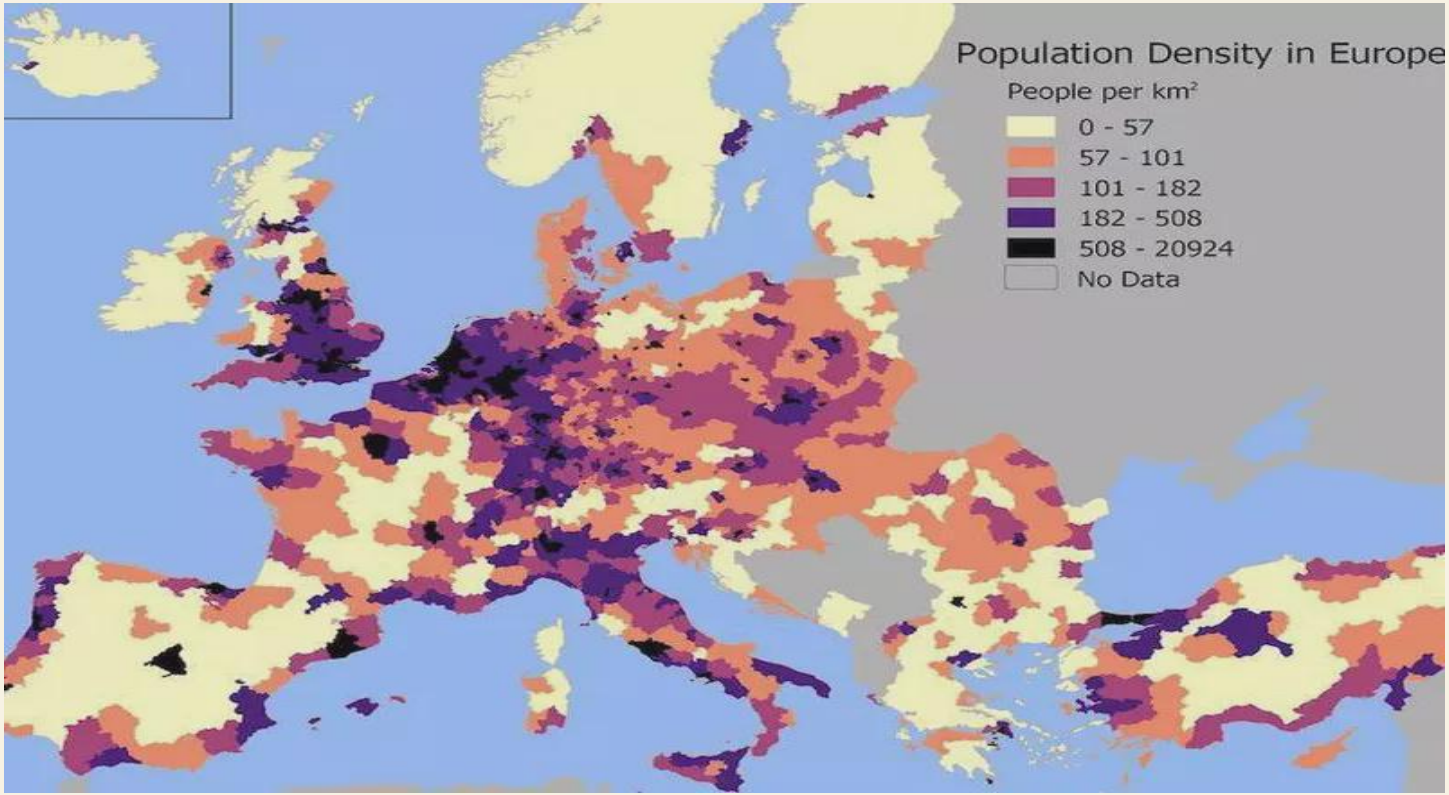
5. No opinion, not interested.

Sources

Nitrogen

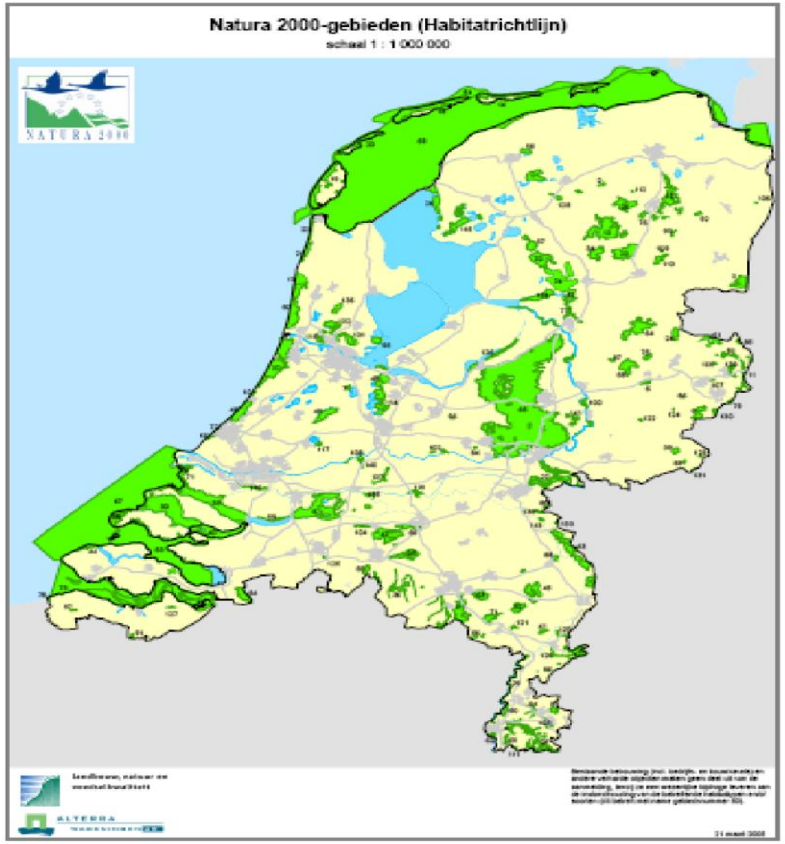
- problem
- cause
- crisis
- current
- ReNure
- solution

Problem – dense human population (NL)



Problem – dense cows & pigs population (NL)

Problem – nature 2000 protected area's (NL)



As of 2020, the Netherlands had a significant portion of its territory designated as protected nature areas.

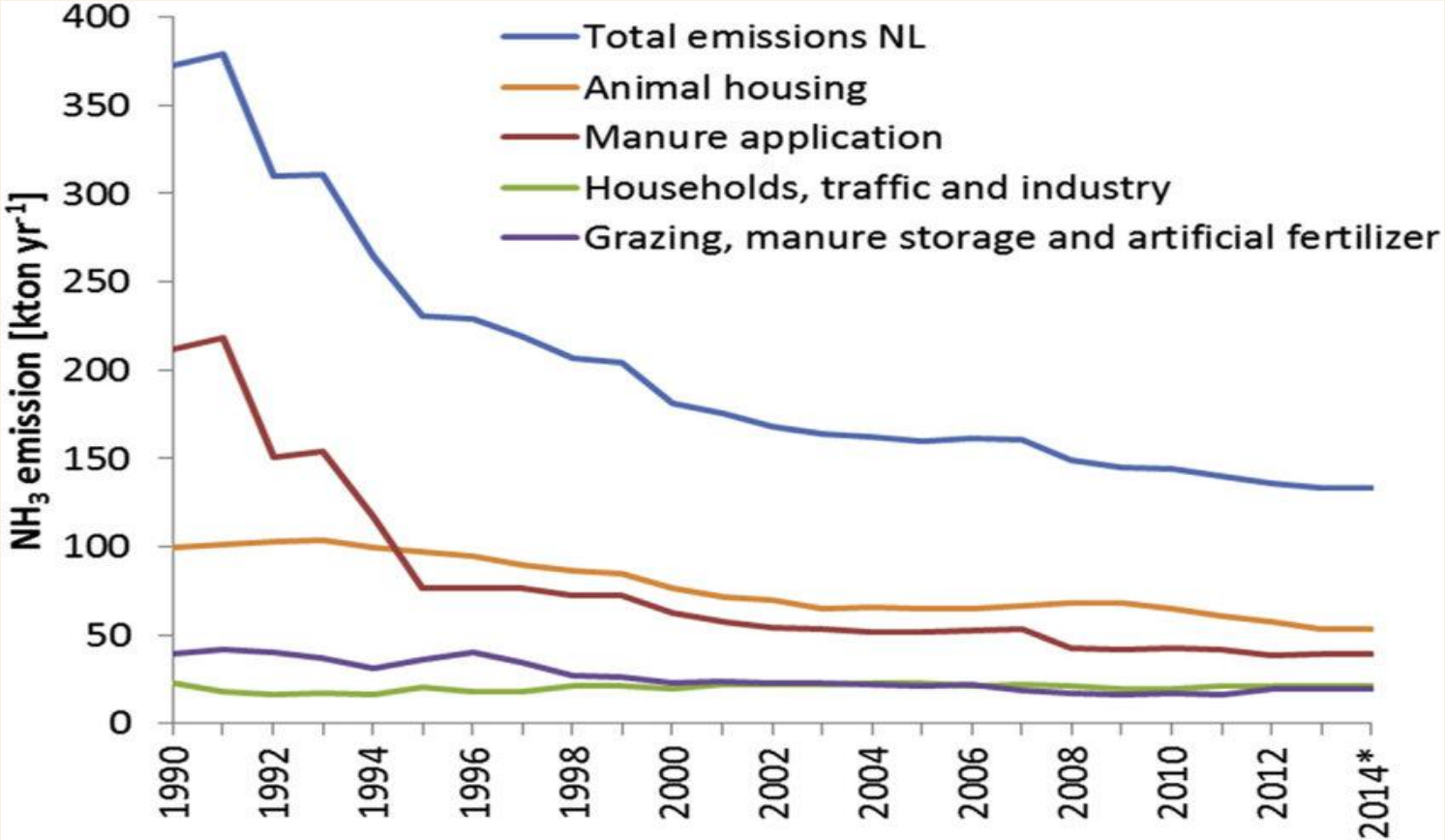
Terrestrial protected areas covered 20% of the land surface, with almost all of this area lying within the national ecological network1.

Of this, 9% consisted of statutory protected Natura 2000 sites

Problem – biodiversity in Nature 2000 areas by high Nitrogen emission

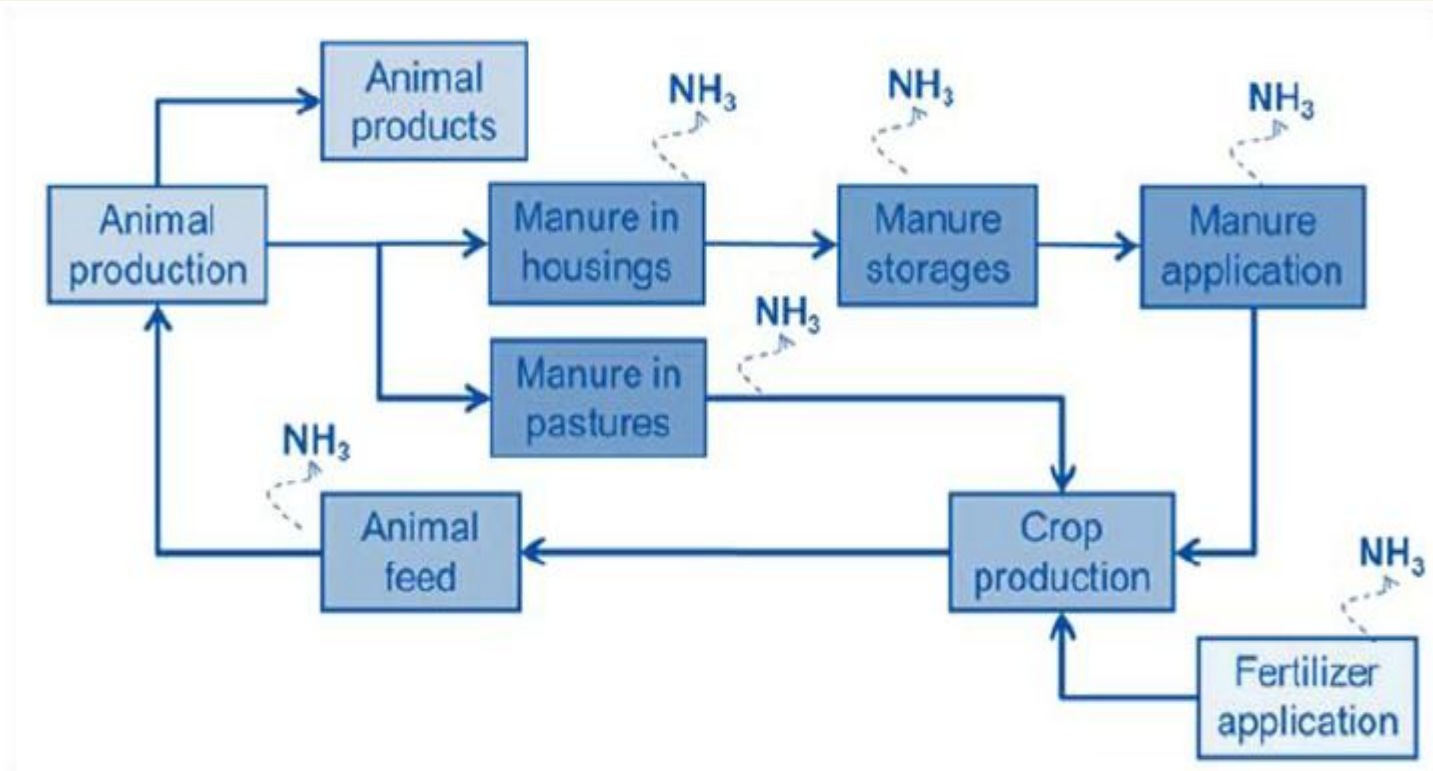
- Loss of rare plant species
  - do we have them?
- Eutrophication
- Ecosystem quality degradation
- Soil and water quality

Cause – N (=NH_3) emission in NL



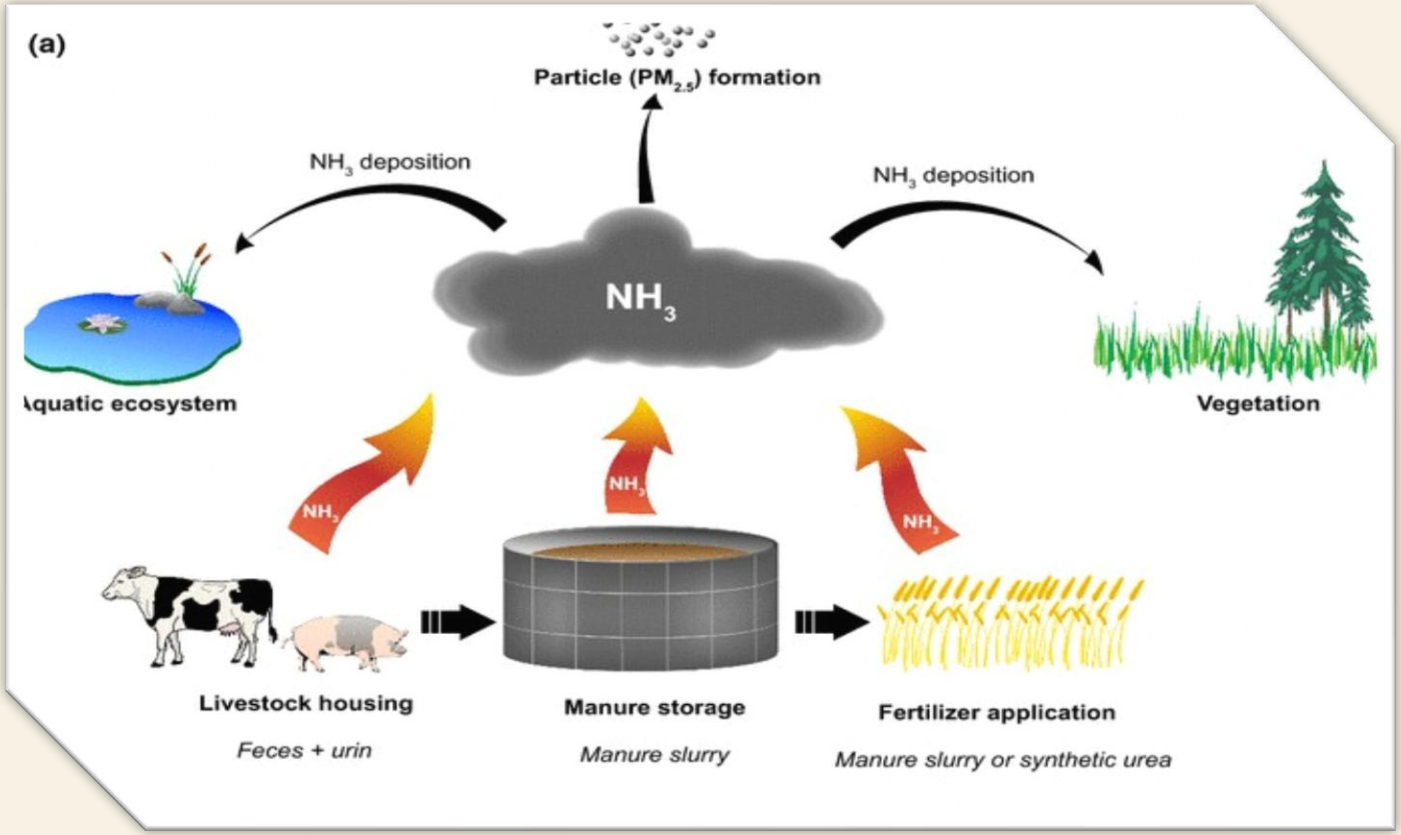
Sources: https://www.cbs.nl

Cause -Volatile ammonia (NH_3) emission



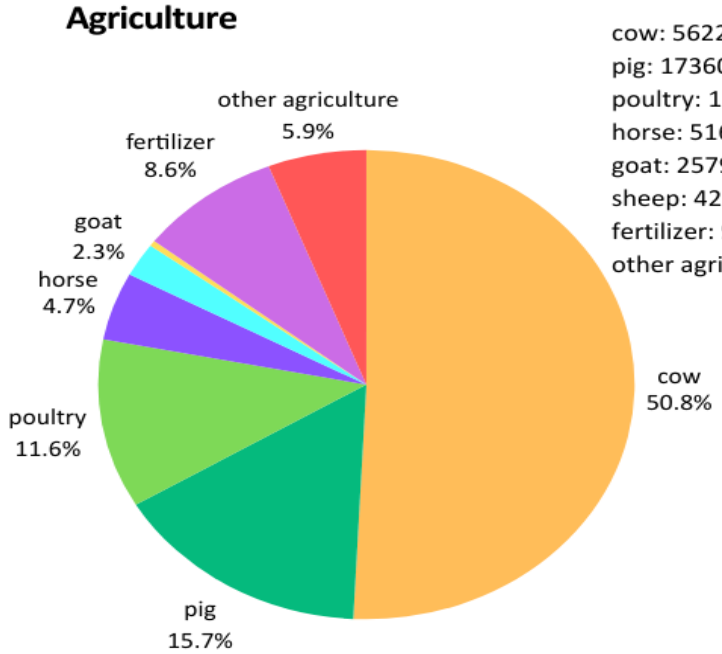
Sources: https://www.cbs.nl

Cause - ammonia (NH_3) emission

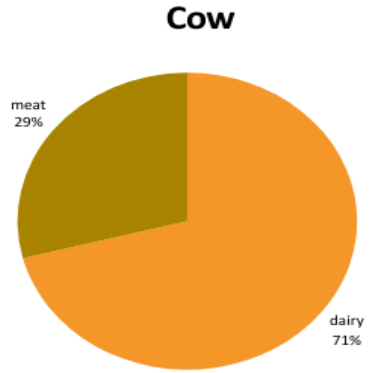


Sources: https://www.cbs.nl

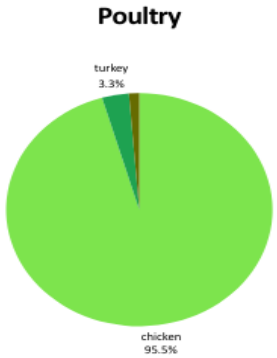
Cause – NH_3 emission from animals



cow: 56229 tonnes
pig: 17360 tonnes
poultry: 12892 tonnes
horse: 5167 tonnes
goat: 2579 tonnes
sheep: 421 tonnes
fertilizer: 9503 tonnes
other agriculture: 6572 tonnes



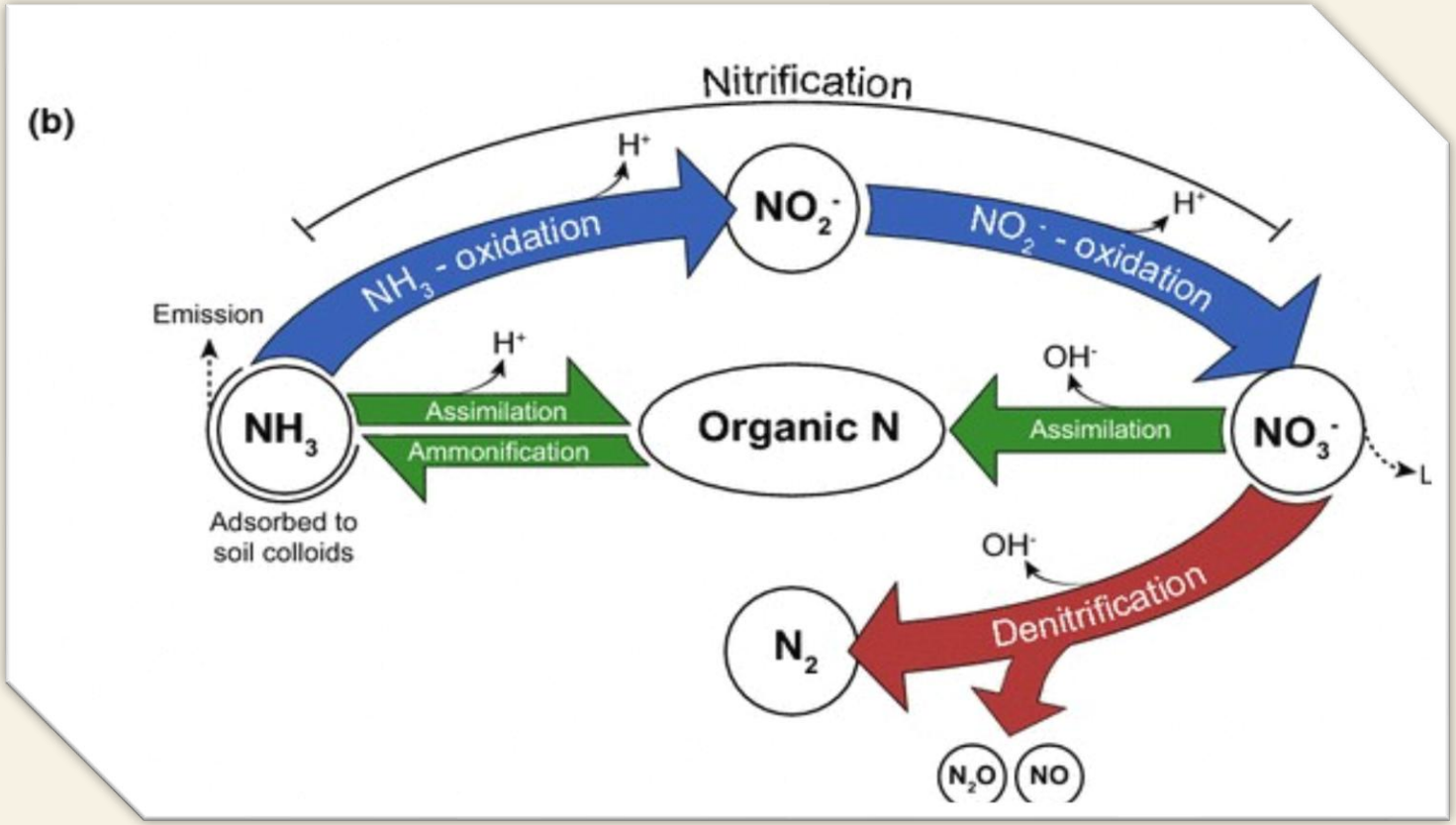
dairy: 39943 tonnes
meat: 16286 tonnes



chicken: 12323 tonnes
turkey: 422 tonnes
duck: 161 tonnes

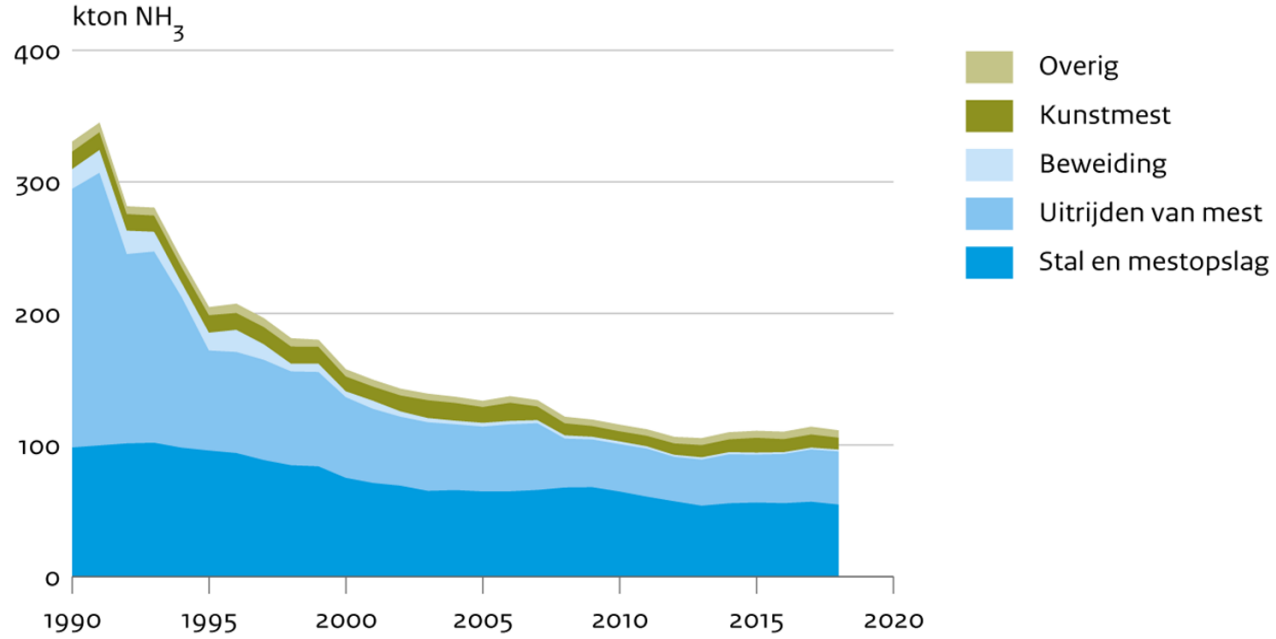
Sources: https://www.cbs.nl

Cause - NH_4^+ and NO_3^- a fertiliser



Crisis – longlasting emission, no progress !

Emissie ammoniak (NH_3) door land- en tuinbouw per bron



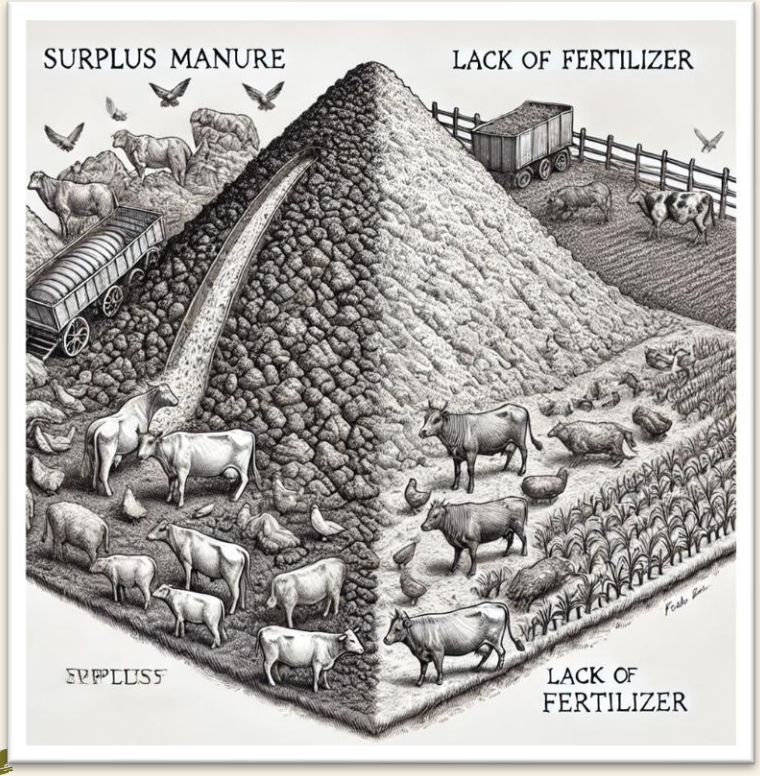
Bron: RIVM/Emissieregistratie

RIVM/okt20
www.clo.nl/nl010117

Sources: https://www.cbs.nl

Crisis – derogation exemption NL stops !!

- Limit of **170 kg N/ha/yr** from manure
- Past **230 to 250 kg/ha/yr. under derogation rules** livestock manure on farms.
- This forced the use of **more artificial fertilizer**
  - additional costs farmer
- The **remaining manure** has to be treated and discarded
  - additional costs farmer.



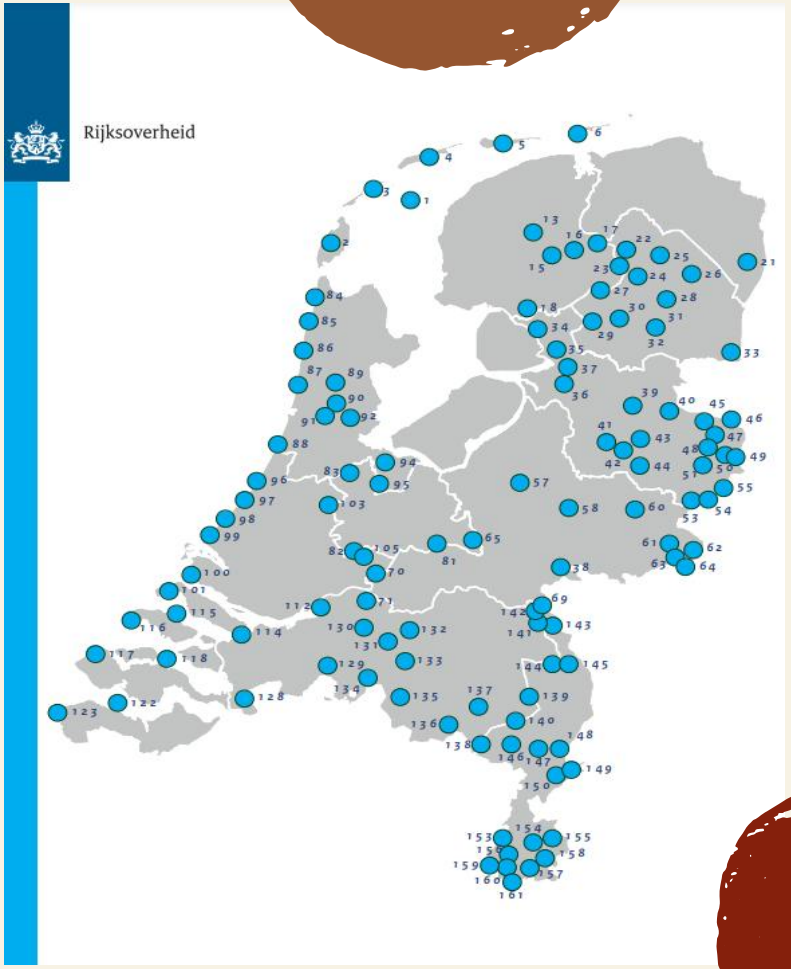
Sources: https://www.theguardian.com https://www.dutchnews.nl

Crisis – Stop Farming

- **40 % of the nitrogen** excess in Natura2000 areas comes from agriculture!

- Farmers located near these zones are at risk!

- This year, **3,000 of the most polluting farms** were invited to stop their activities with financial compensation.

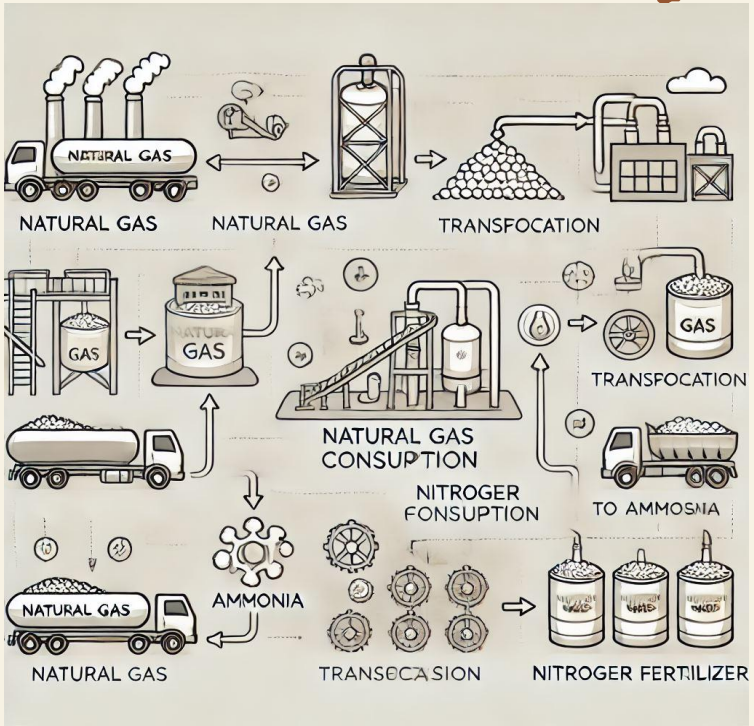


Crisis – many farmer protest

- Rules unclear
- High penalties on their income
- Farmer existence
- Fear that they are forced to stop farming
- **No farmers, no food !**

Crisis – artificial fertiliser, not sustainable!

- Farmers **forced** to use artificial fertilisers !
- **Industrial process: N fertiliser**
  - **natural gas**
  - **energy intensive.**
- High **CO2 emission.**
- Highly sponsored by government
.



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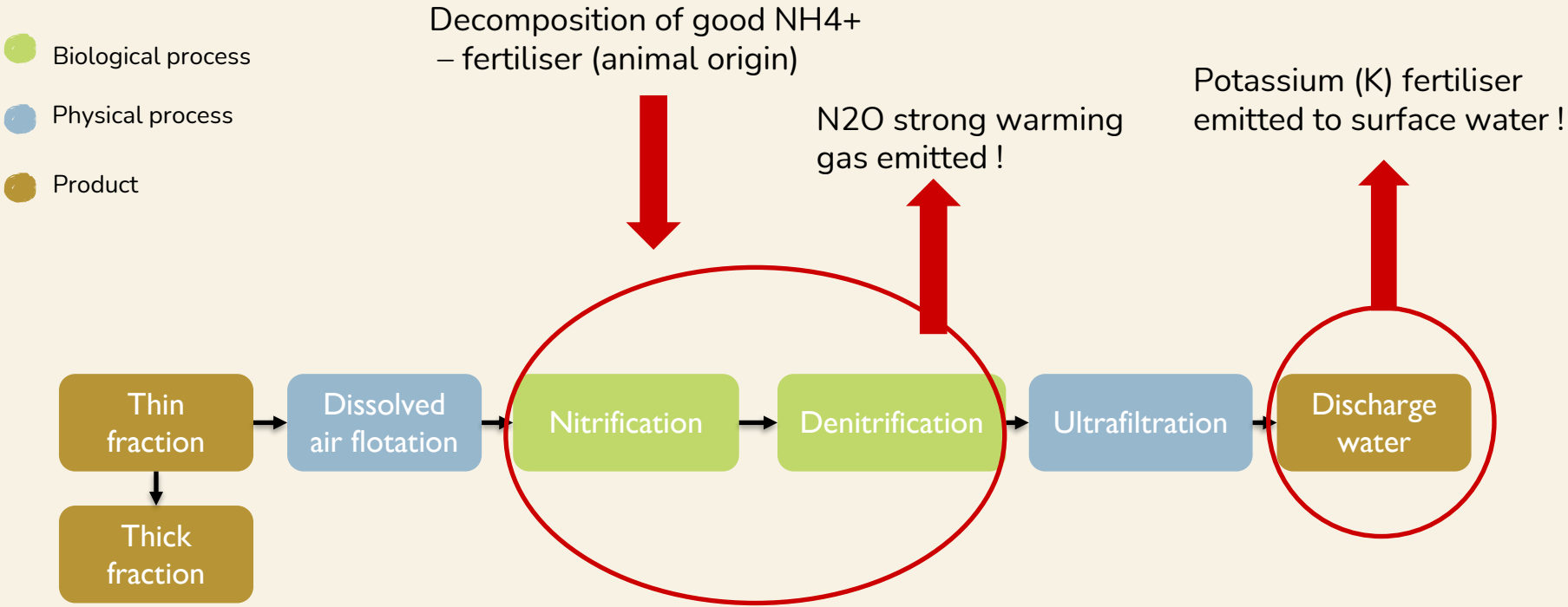
Current - Manure (N) treatment

Current manure and RWZI processing: not sustainable



RENURE = solution?

“artificial” fertiliser from

animal origin

RENURE

Recovered **N**itrogen from Man**ure**, refers to nitrogenous fertilisers derived from animal manure.

The Proposal:

I. The safe use of RENURE above the threshold of 170 kg N/ha/yr (or 230 to 250 kg/ha under derogation) prescribed in the Nitrates Directive

II. To allow RENURE to be used as artificial nitrogen fertiliser.

RENURE

The benefits:

I. Reduce reliance on energy intensive fertilisers

II. Reduce nitrate leaching

III. provides similar benefits as to **synthetic fertilisers from natural gas**

RENURE - Criteria

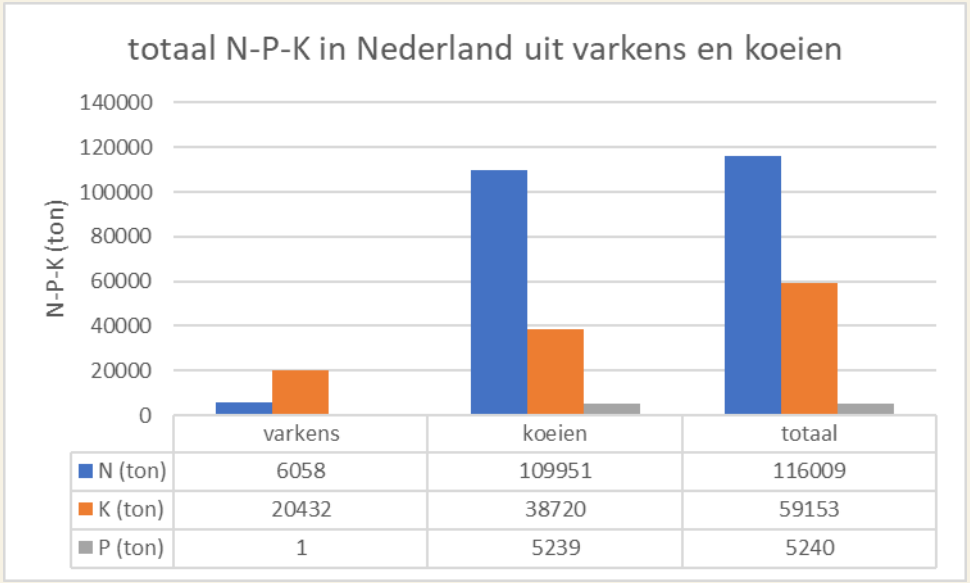
Focus on:

I. Process production
II. RENURE composition (TOC:TN≤ 3) or (mineral N:TN ≥ 90)
III. Zinc (800 mg/kg) and copper (300 mg/kg) limit

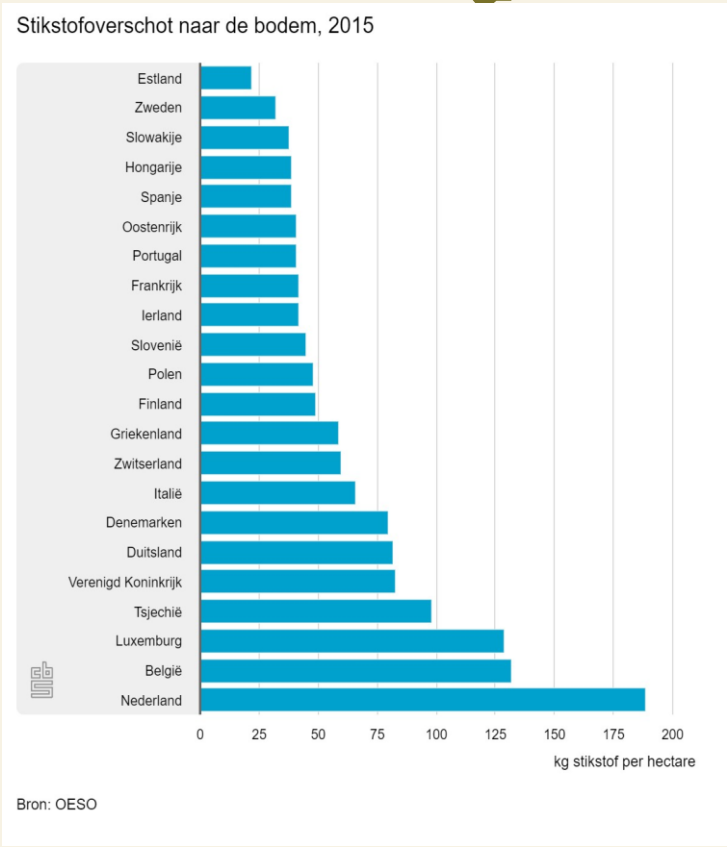
Other RENURE criteria:

- Application
- Content (NPK) specification to consumer
- Storage
- Leaching & emission prevention

RENURE - potential?



	varkens	koeien	totaal
N (ton)	6058	109951	116009
K (ton)	20432	38720	59153
P (ton)	1	5239	5240



Solutions

how can RENURE be produced ?

Solution 1– NH3 stripping

Process

- heating up
- evaporate
- acid treatment
- highly concentrated ammoniumsulphate fertiliser

Disadvantages

- Costs
- Potassium fertilisers emission

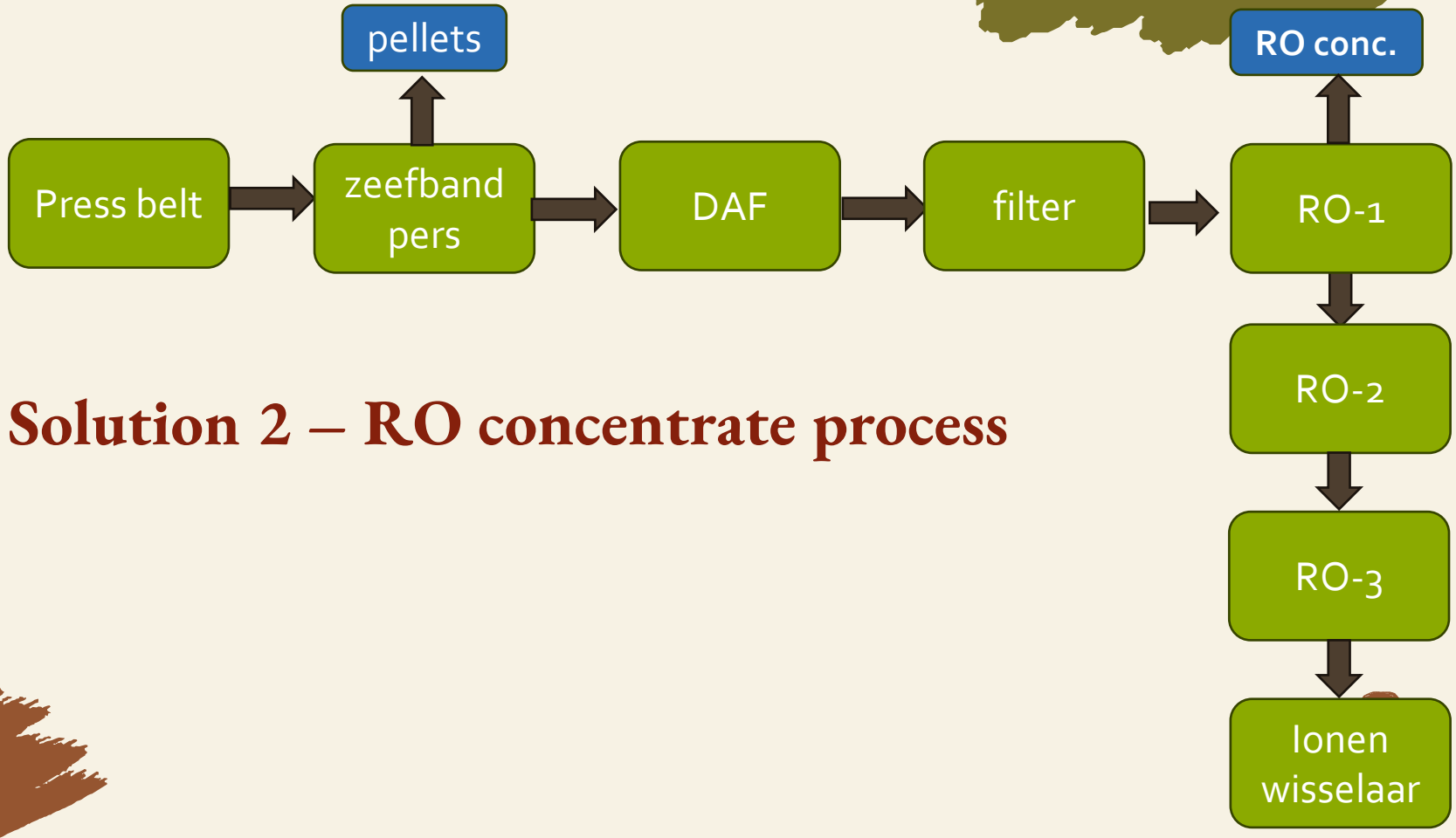
Solution 2 – RO concentrate

Process

- separation thick and thin
- thin fraction purification
- Reverse Osmosis (RO)
- RO concentrate and water

Disadvantages

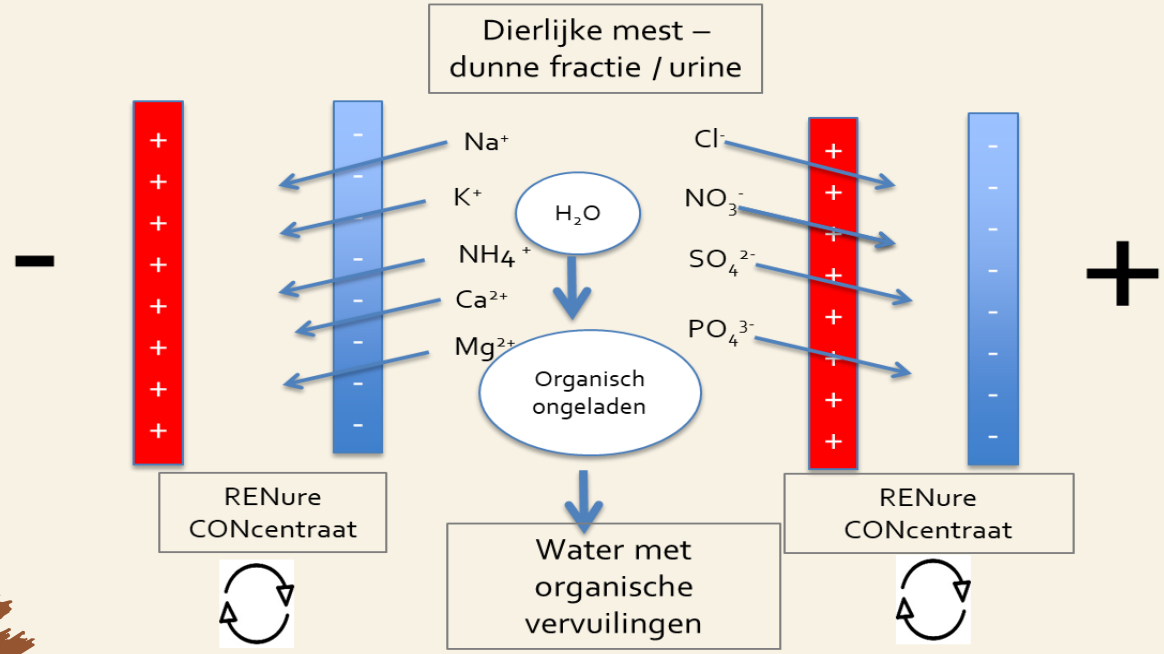
- Low N and K concentration
- No purification



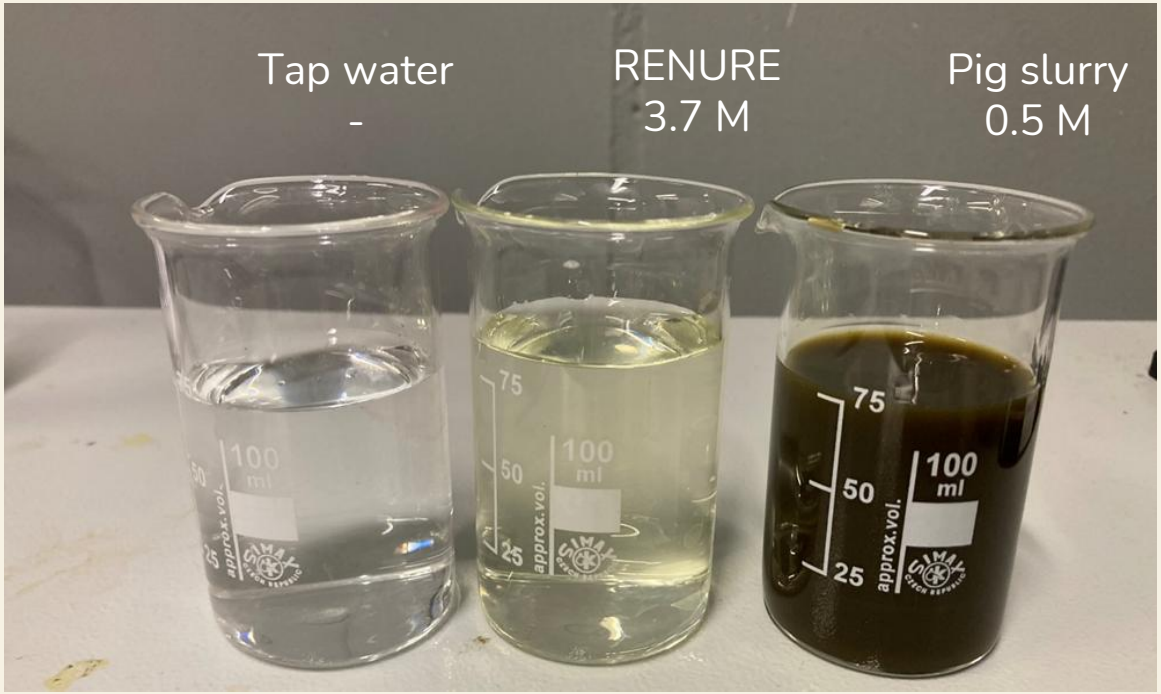
Solution 2 – RO concentrate process

Solution 3 – ReNure Concentrate
RENCON concept

Fundament - dichte membranen, alleen elektricieit
(geen porieen, geen waterverlies, geen druk)



Solution 3– RENCON



Have you changed your mind?

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Inspired ?

- Internship position(s) at Water Future

- from September 2025 onwards
- reserve your position