

# Comparing strategies to aggregate environmental performances of individual farms into a dairy sector score



Mark Dolman, Hans Vrolijk and Imke de Boer  
August 29<sup>th</sup>, EAAP Stavanger

# Content

- Introduction
  - Context
  - Farm level vs. IO LCA's → why should we use micro level data
- Methodology
  - FADN & strategies to scale up farms results
  - How to assess weighting strategies?
- The case: LCA FADN dairy farms
  - Goal & scope
  - Three weighting strategies
  - Results
- Wrapping up

# Introduction

- Some facts about Dutch dairy production

Variable	Value
Farms with cows (sector)	20,500
Specialized farms	18,000
- cows	76
- milk production per cow	8.000
- cultivated area	47
- milk production per ha	13.000

Source: agricultural census / FADN 2008

- High input of feed (~2 tonnes of concentrate per cow)

# Introduction

- Farm level LCA's vs. IO LCA's

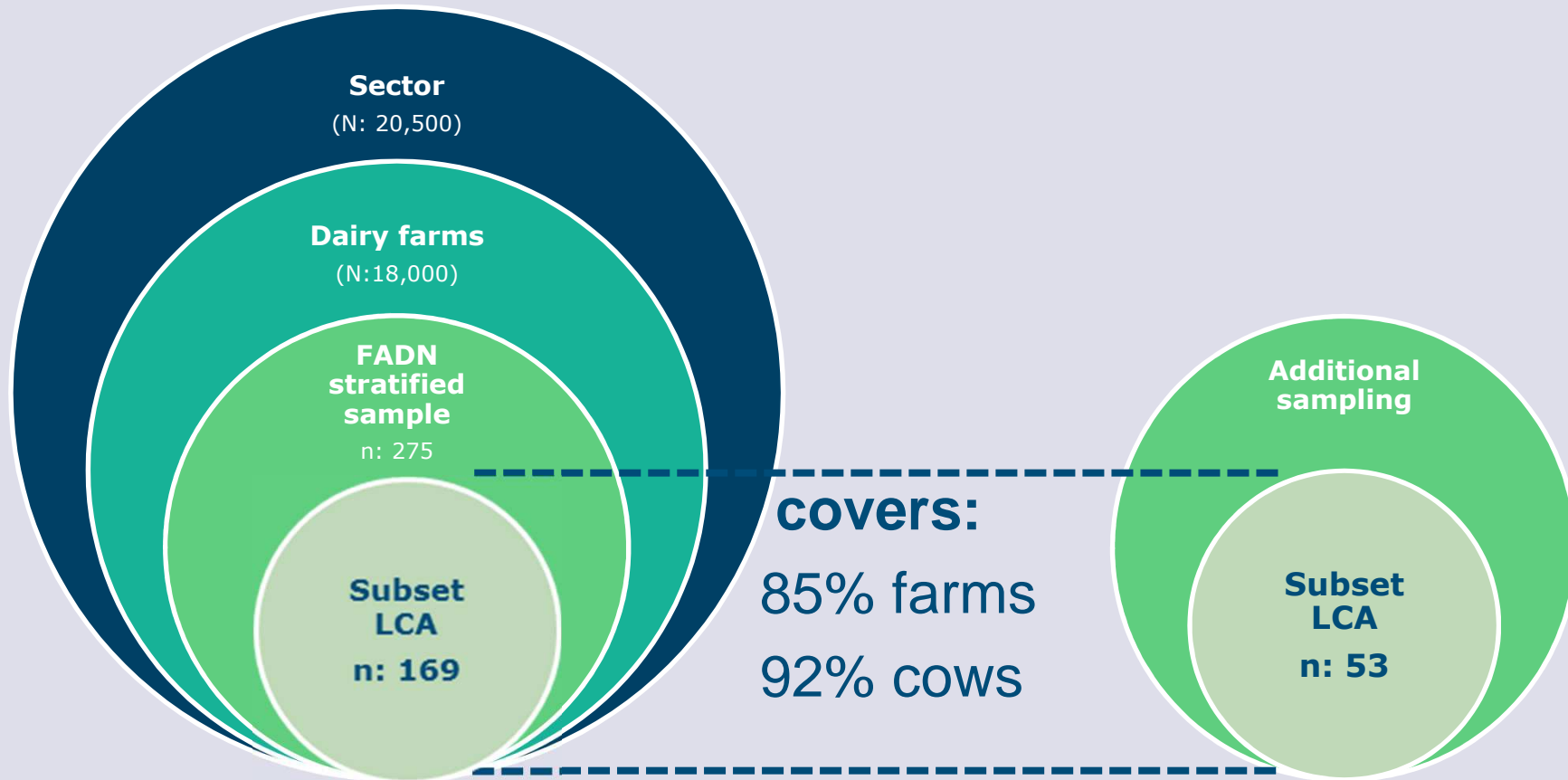
(Why use micro level data?)

- Better insight in the range of performance
- Decisions on farm level are key in many environmental problems
- What is the effect on other aspects of sustainability?

....how to translate farm results into a sector score?

# Methodology (FADN)

- Data from national FADN



# Methodology (scaling up)

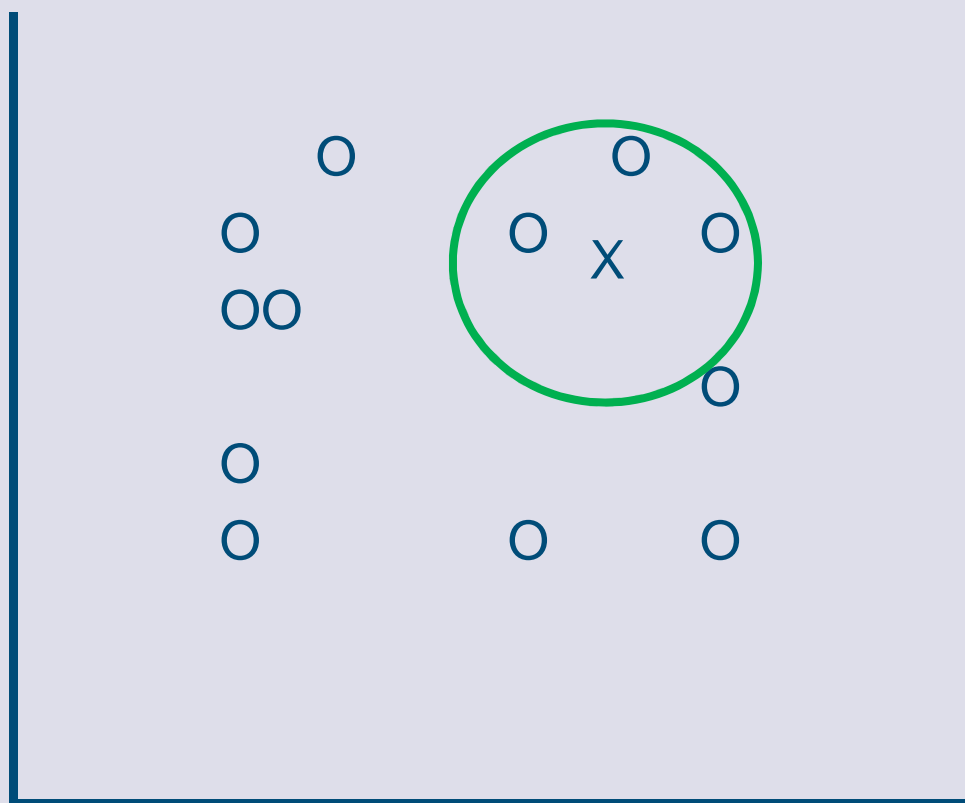
- The 'FADN way'
  - Three strata (equal weights per stratum)
  - Weighting factor based on economic size
  - Problem: we excluded some farms, and we have farms outside the FADN sample
  - Problem: environmental performances are related to other factors than economic size only
- The 'simple way'
  - Equal weight per farms (WF=1)
  - All farms are used
  - Problem: doesn't fit the sampling strategy (heterogeneity)
- The 'alternative way: statistical matching'

# Methodology

- Statistical matching
  - Choose the best variables to match
  - Usages all available farms
  - Problem: doesn't fit the sampling strategy (heterogeneity)
- Variables used for matching
  - Economic size
  - Soil type region
  - % of maize silage
  - Animals (LU) per hectare

# Methodology (Statistical matching)

size



X = population farm

O = sample farm

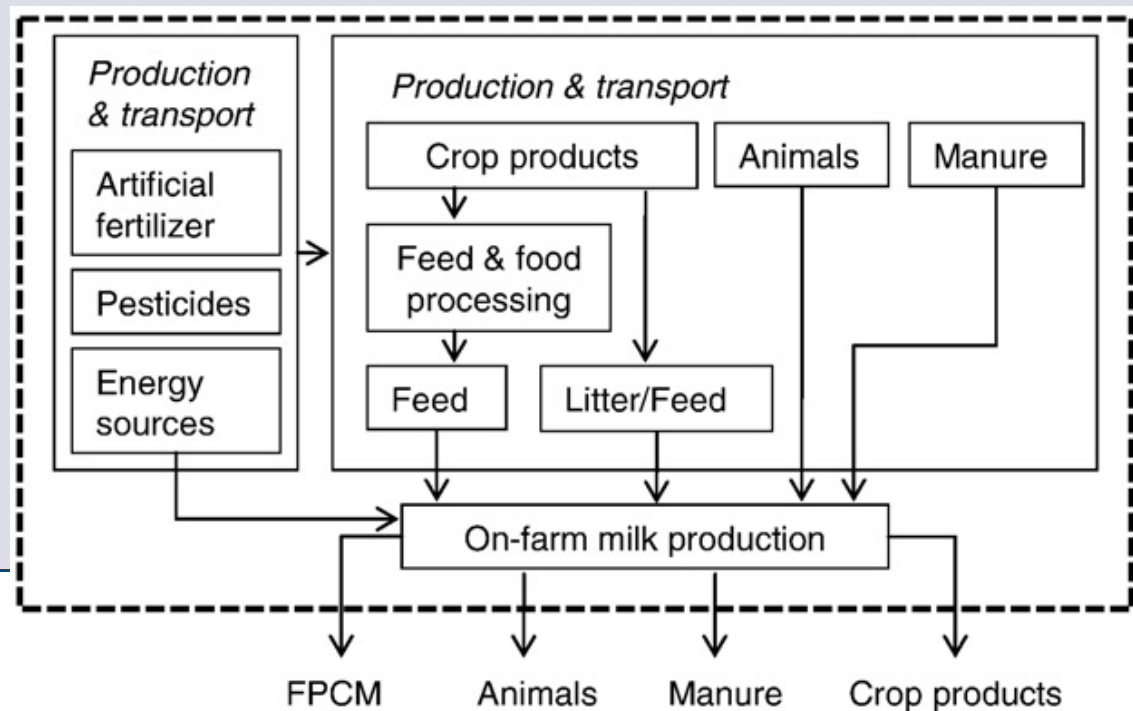
cows per ha



# The case: LCA FADN dairy farms

## ■ Goal and scope

- Cradle to farm gate assessment
- FU: 1 kg of FPCM
- Impact categories: Land use, climate change, Non-renewable energy use, **eutrophication** and acidification



# Preliminary results – Eutrophication

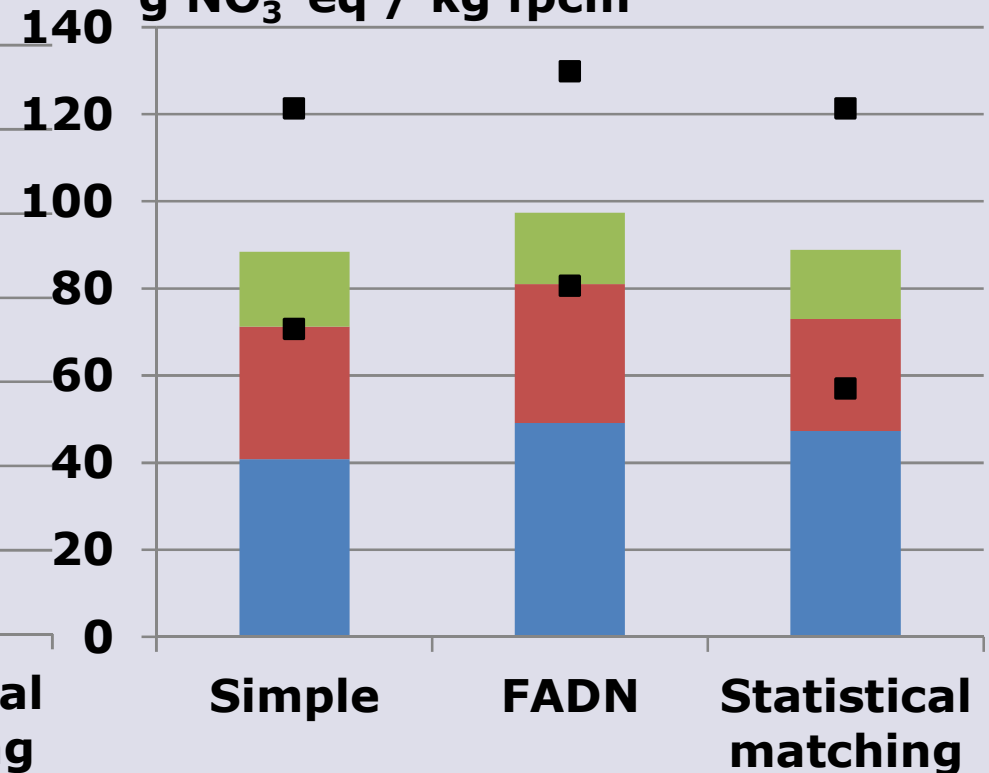
## Netherlands

g NO<sub>3</sub><sup>-</sup> eq / kg fpcm



## Peat region

g NO<sub>3</sub><sup>-</sup> eq / kg fpcm



■ Blue=on-farm leaching; Red=concentrates, Green=rest

# How to assess?

- Sensitivity of the weighting factor
- Compare weighted variables with population average
- Leave- one-out analysis

# Sensitivity of the weighting factor?

Parameter	Simple NL	FADN NL	S.Match NL	Simple Peat	FADN Peat	S.Match Peat
N	17,737	17,737	17,737	3,588	3,588	3,588
n	222	222	222	36	36	36
N-wf	222	11,846	17,737	36	1,734	3,588
n-wf	222	159	222	36	22	36
wf-mean	1.0	74.5	79.9	1.0	70.2	99.7
wf-max	1.0	40.6	5.3	1.0	40.6	8.3
wf-min	1.0	96.4	357.2	1.0	96.4	247.3
wf-max/wf-mean	1.0	1.3	4.5	1.0	1.4	2.5

## Comparison with population average

Parameter	Simple NL	FADN NL	S.Match NL	Simple Peat	FADN Peat	S.Match Peat
Economic size	118	101	99	139	122	100
% of maize silage	109	114	103	129	116	116
No. LU per ha	90	91	89	103	100	96

- 100 = equal
- 105 = 5% overestimated
- 95 = 5% underestimated

# Leave-one-out analysis eutrophication

- Statistical matching: sample vs. sample\*
- Compare computed value with the estimate based on statistical matching

Parameter	NL	Peat region
On-farm	103	113
Off-farm	96	92
Total	100	103

# Wrapping up

- How to scale-up your results does matter!!
- Statistical matching is a promising method to scale up results in to a sector score.

...however,

- Which variable to choose for matching?
- What about the non-specialized farms?
- Number of sample farms could be a problem?
  
- Next step: compare with IO LCA