Duurzame landbouw –

Gezond voedsel - Vitaal platteland

Climate and agriculture

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April 2015

clm

Outline

1. CLM in a nutshell
2. Climate and ag
3. Carbon calculators at farm level

   Questions
4. More than carbon: wider scope for farm level tools

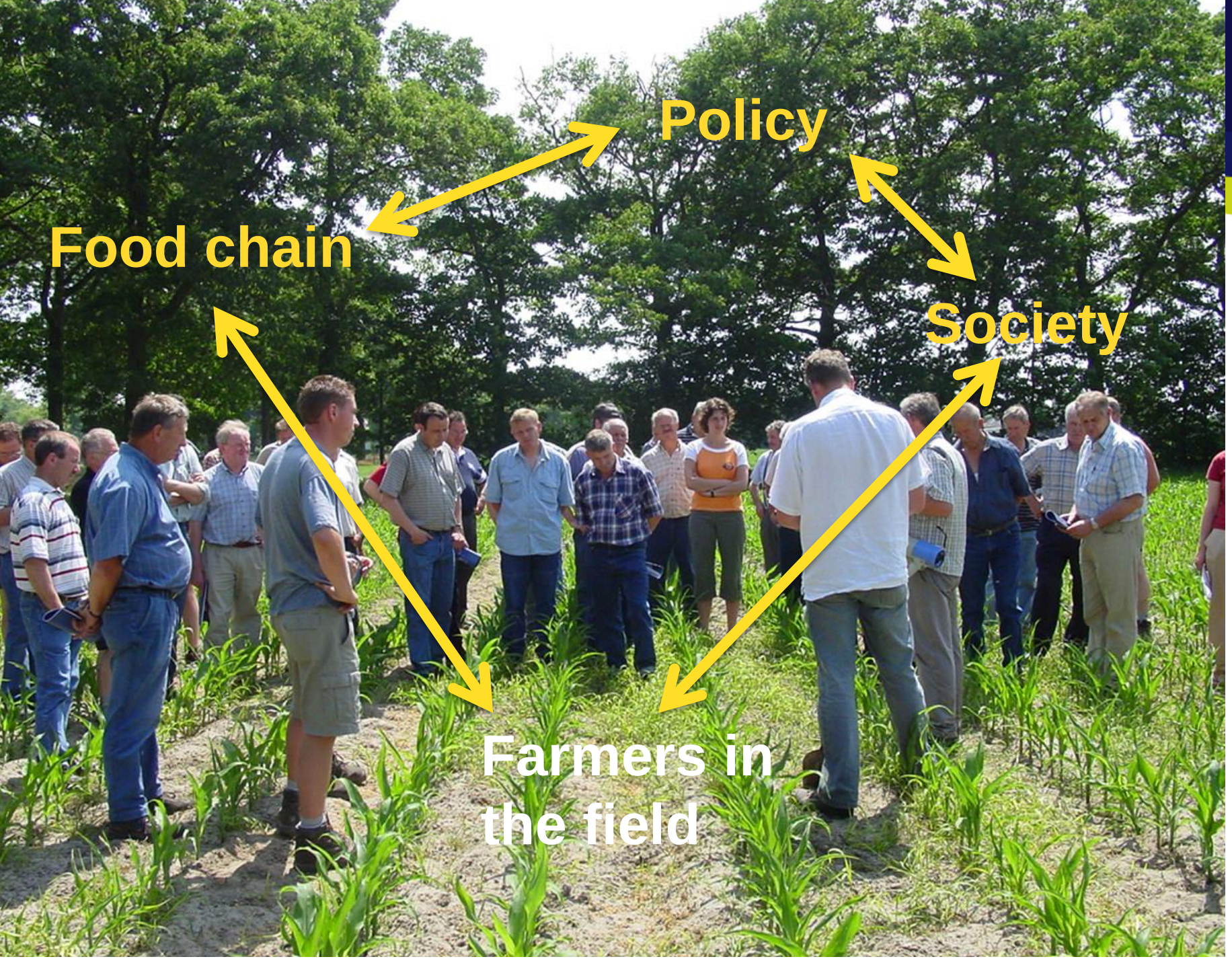
   More questions

1. CLM in a nutshell

- Sustainable food & farming, biodiversity, water, rural development
- Research, advice, bridge building
- Started >30 years ago
- Independent, self-owned
- Started out as non-profit, now plc + foundation
- Currently 22 people and network of partner organisations
- One specialty: Measuring, monitoring and benchmarking (standards, systems and tools)

Clients

- Governments: EU, ministries, regional and local authorities
- Retail, food and agri-business (SAI-Platform, Jumbo, Sodexo, Heineken, Cono/Ben&Jerry, Ardo, FrieslandCampina, McCain, Bayer)
- Farmers' organisations
- Environmental NGOs (FoE, Greenpeace, WWF)

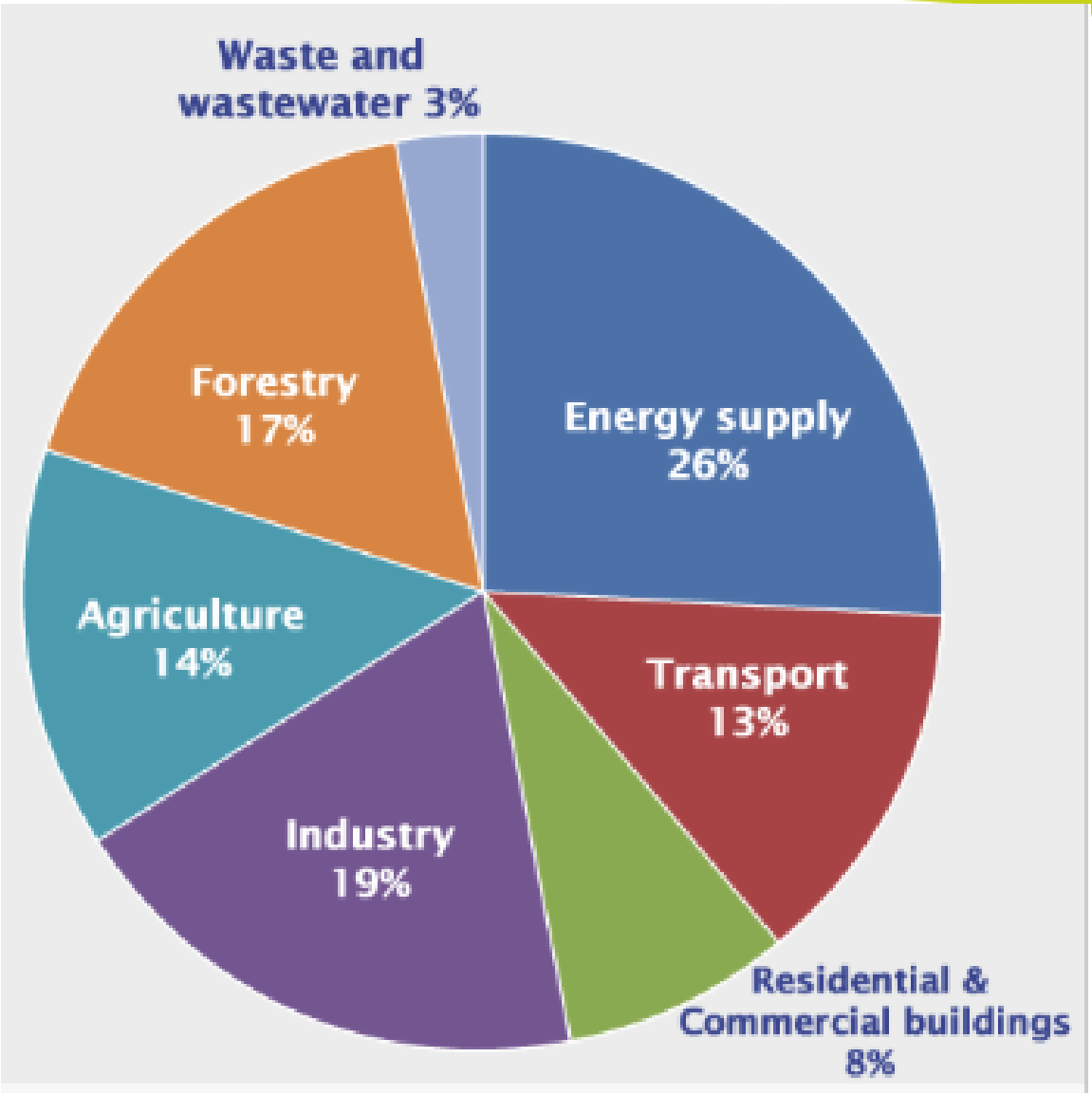

Policy
Food chain
Society
Farmers in the field

CLM´s scope

- Mainly Netherlands
- Some work at European level (EU research projects)
- Some international activities, e.g. with SAI-Platform, Cool Farm Alliance
- Contact with IATP since early years

2. Agriculture and climate change

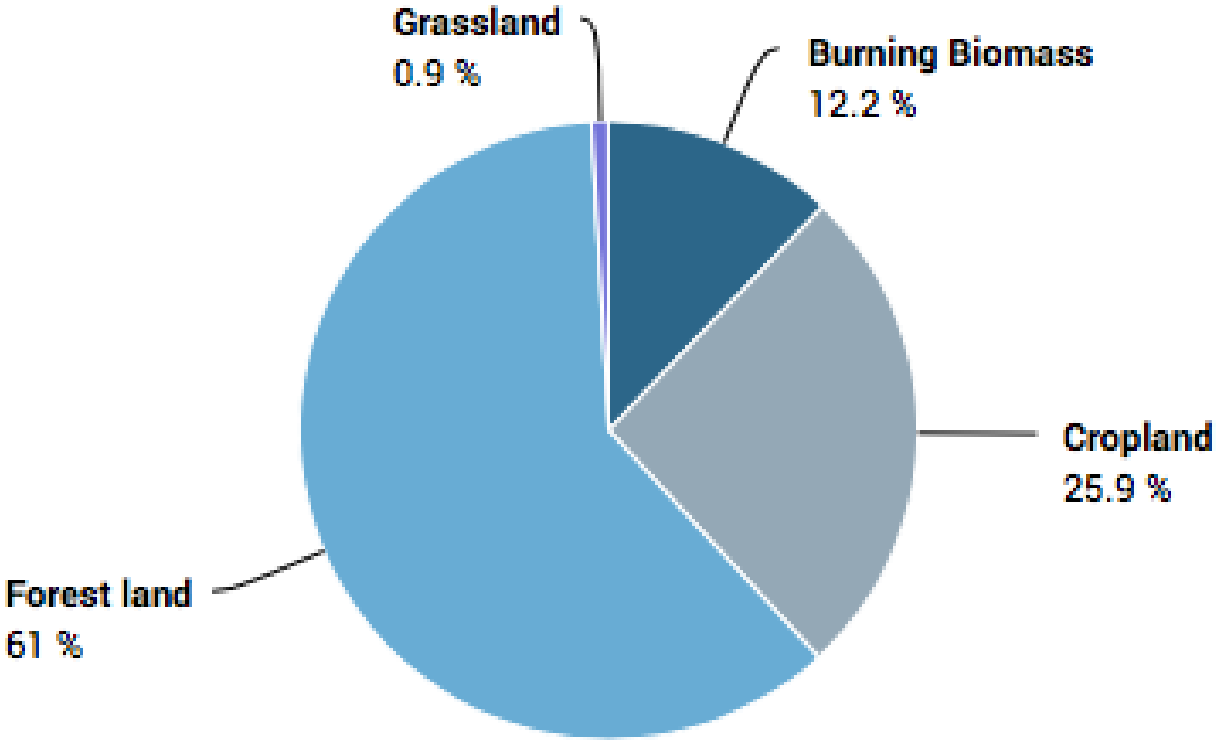
GHG emissions per sector, global, 2007



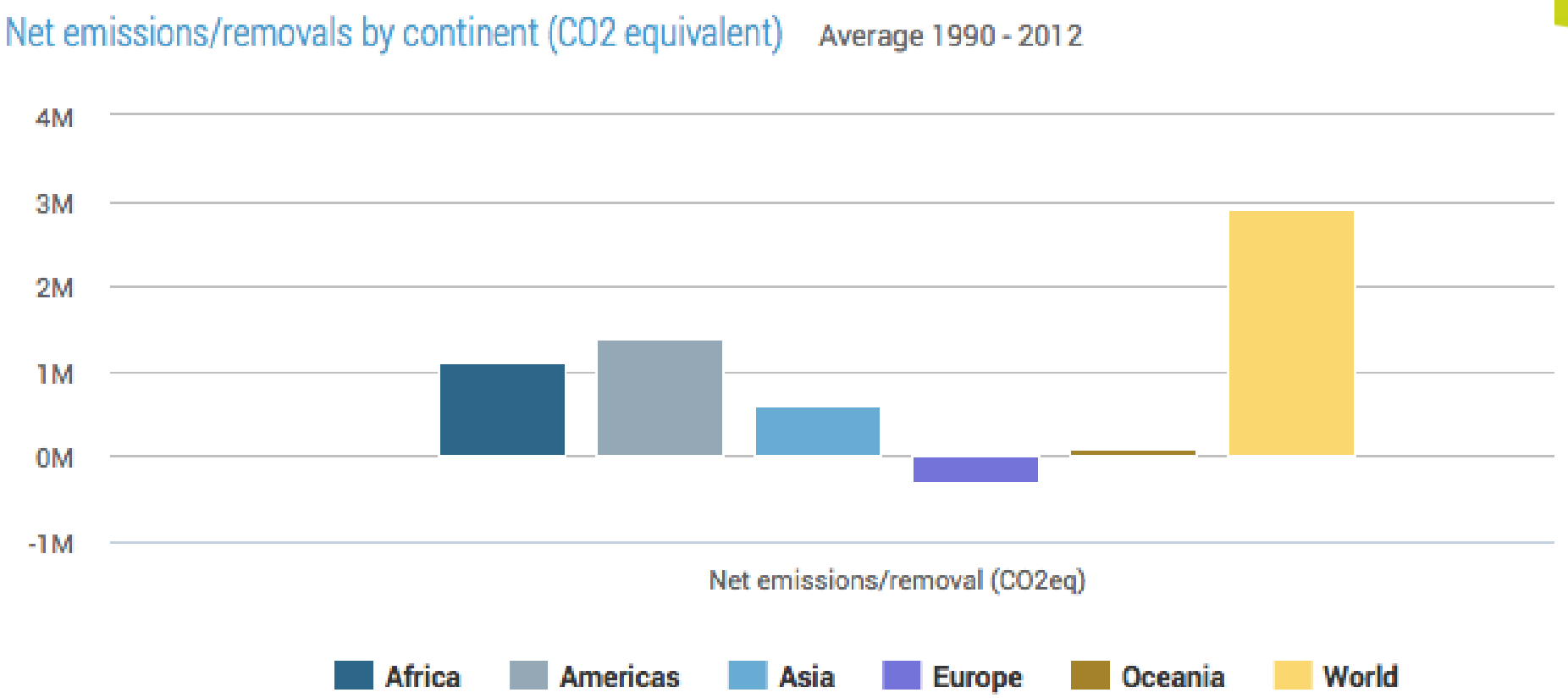
IPCC 2007

CO2 from land

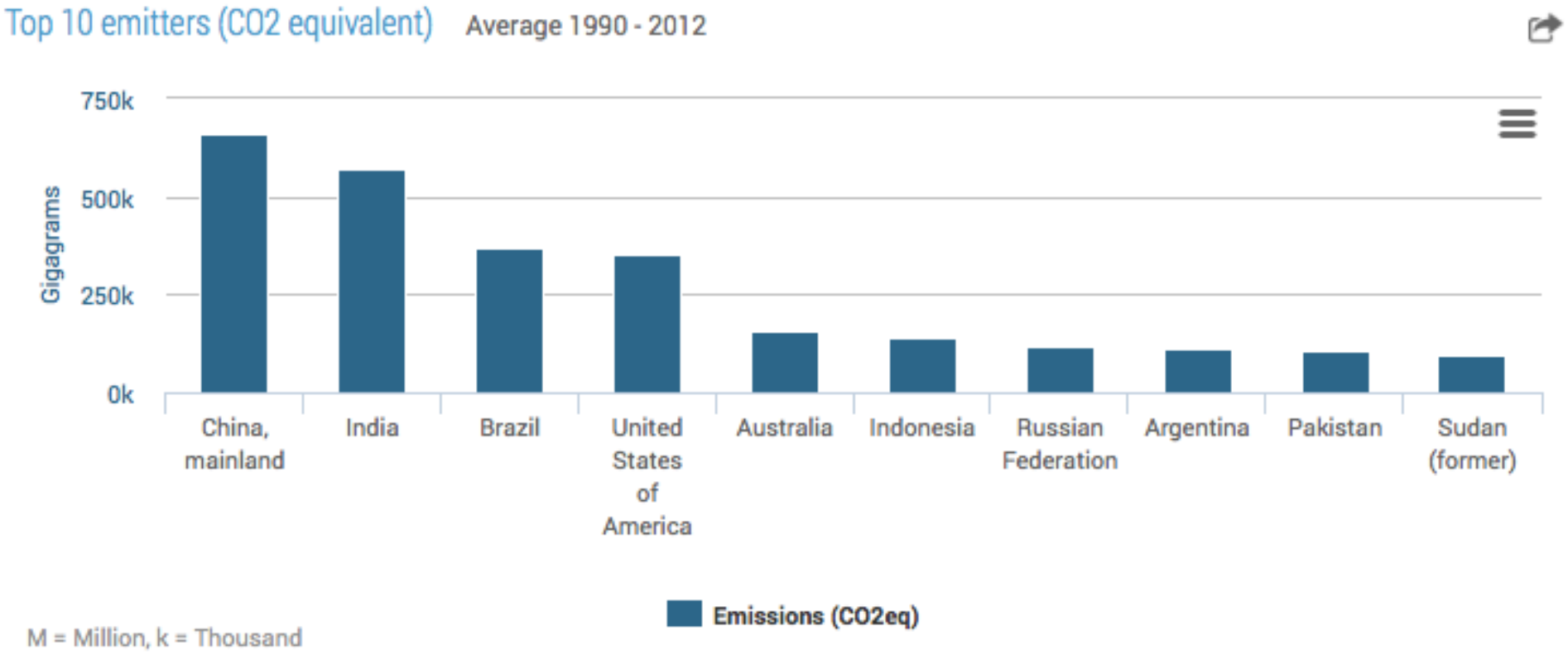
Net emissions/removals by land use Average 1990 - 2012



CO2 from land use change



GHG top-10 emitters (FAOstat)

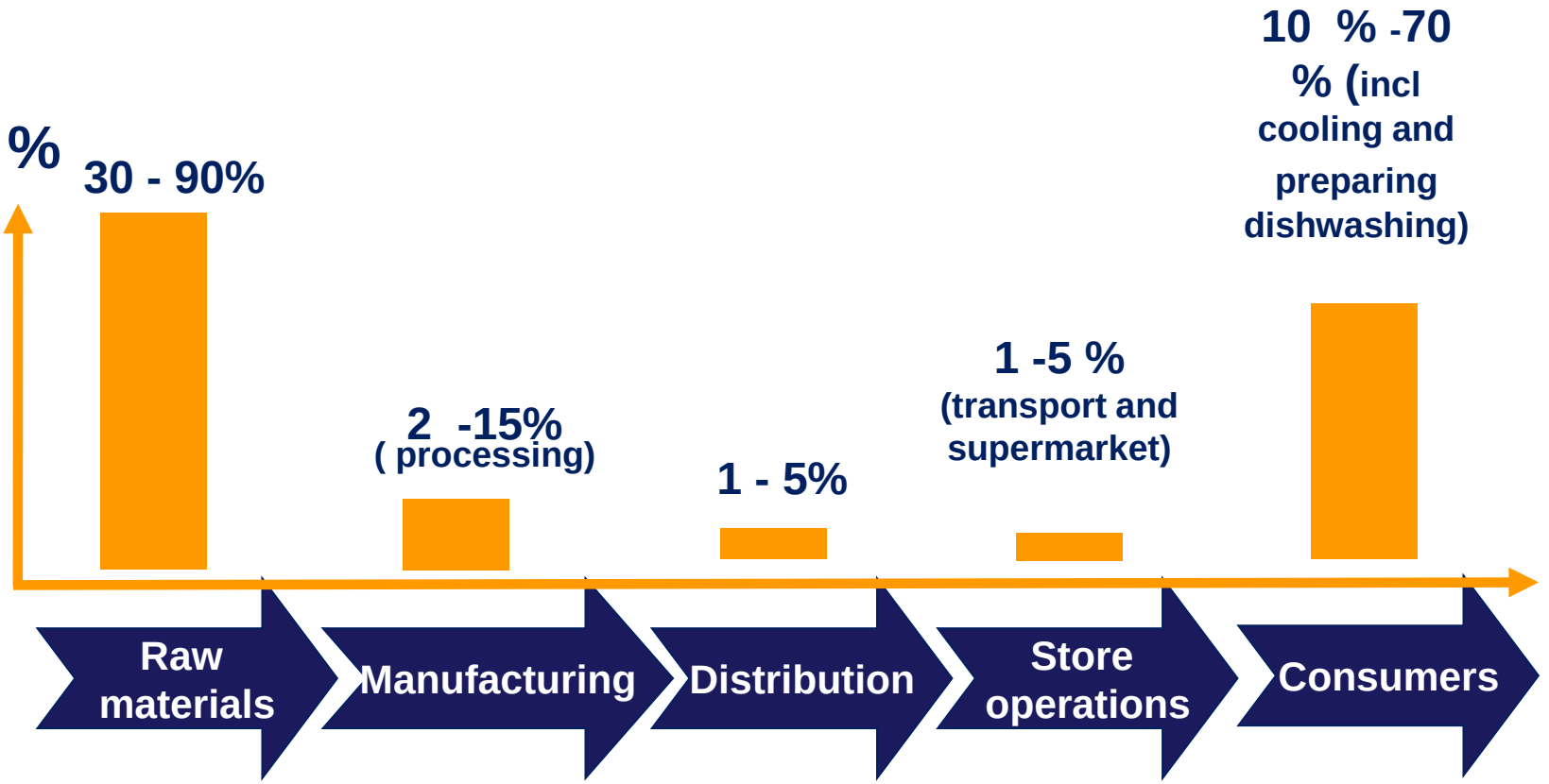


Deliniation: farm level

Today's focus:

- Farm level only
- Agriculture only (not afforestation or clearing of land)
- Not consumer phase, e.g.reduced meat consumption
- Not about food waste (33% is lost, say FAO)

Delination: farm level



Climate change and the farm

- Part of the cause of climate change
- One of the sectors most hit by consequences
- And part of the solution

Climate change and the farm

- Cause: emissions of CO2, N2O and CH4
- Consequences: droughts, weather extremes, shifting patterns of pests and diseases, longer growing seasons
- Solution: fixing carbon in soils (and in landscape elements). Producing biomass.

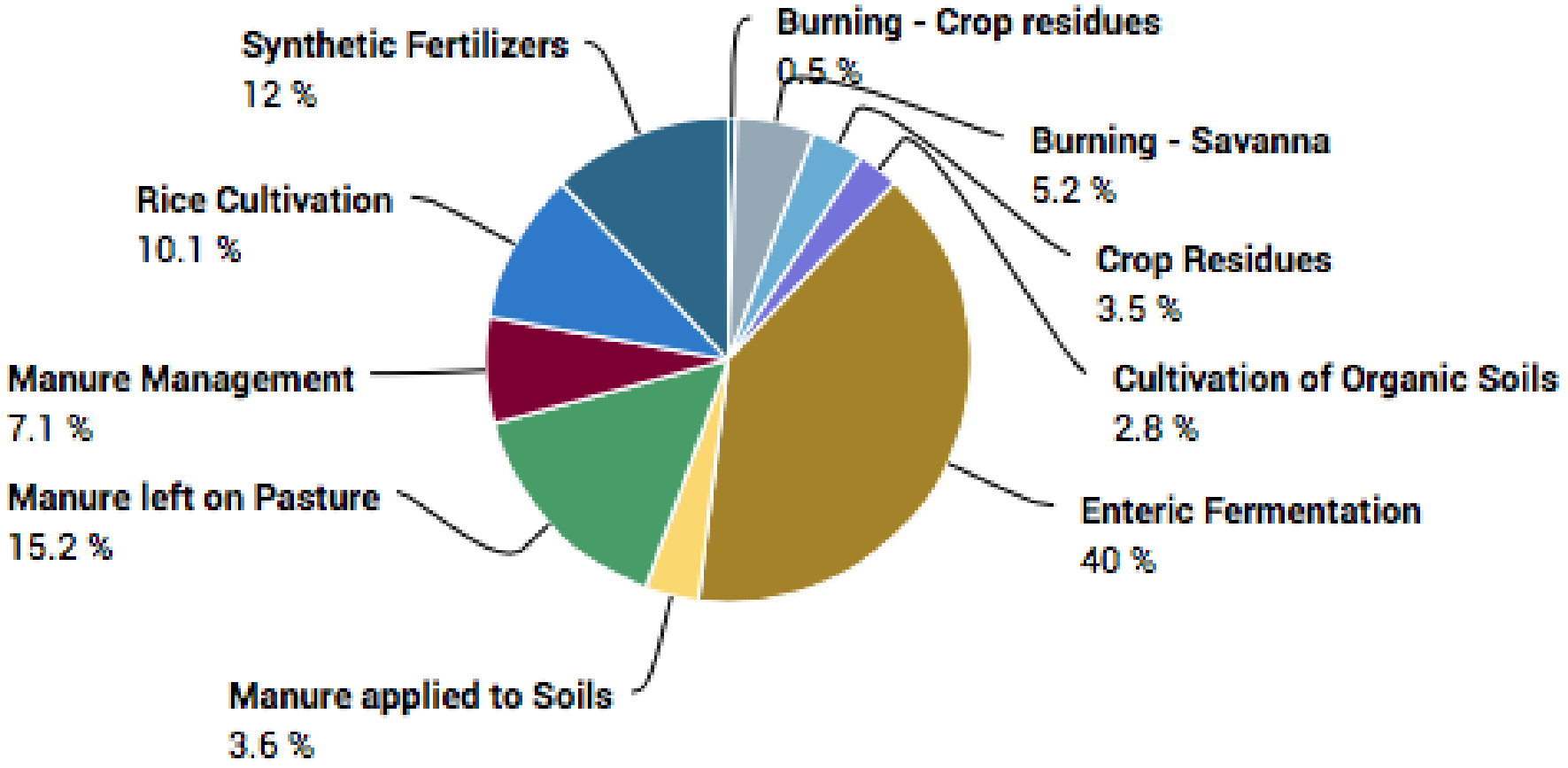
Climate change and the farm

- Cause: emissions of CO2, N2O and CH4.
  Reduce
- Consequences: droughts, weather extremes, shifting patterns of pests and diseases, longer growing seasons
  Adapt
- Solution: fixing carbon in soils (and in landscape elements). Producing biomass.
  Optimise

GLOBAL WARMING AXIS OF EVIL

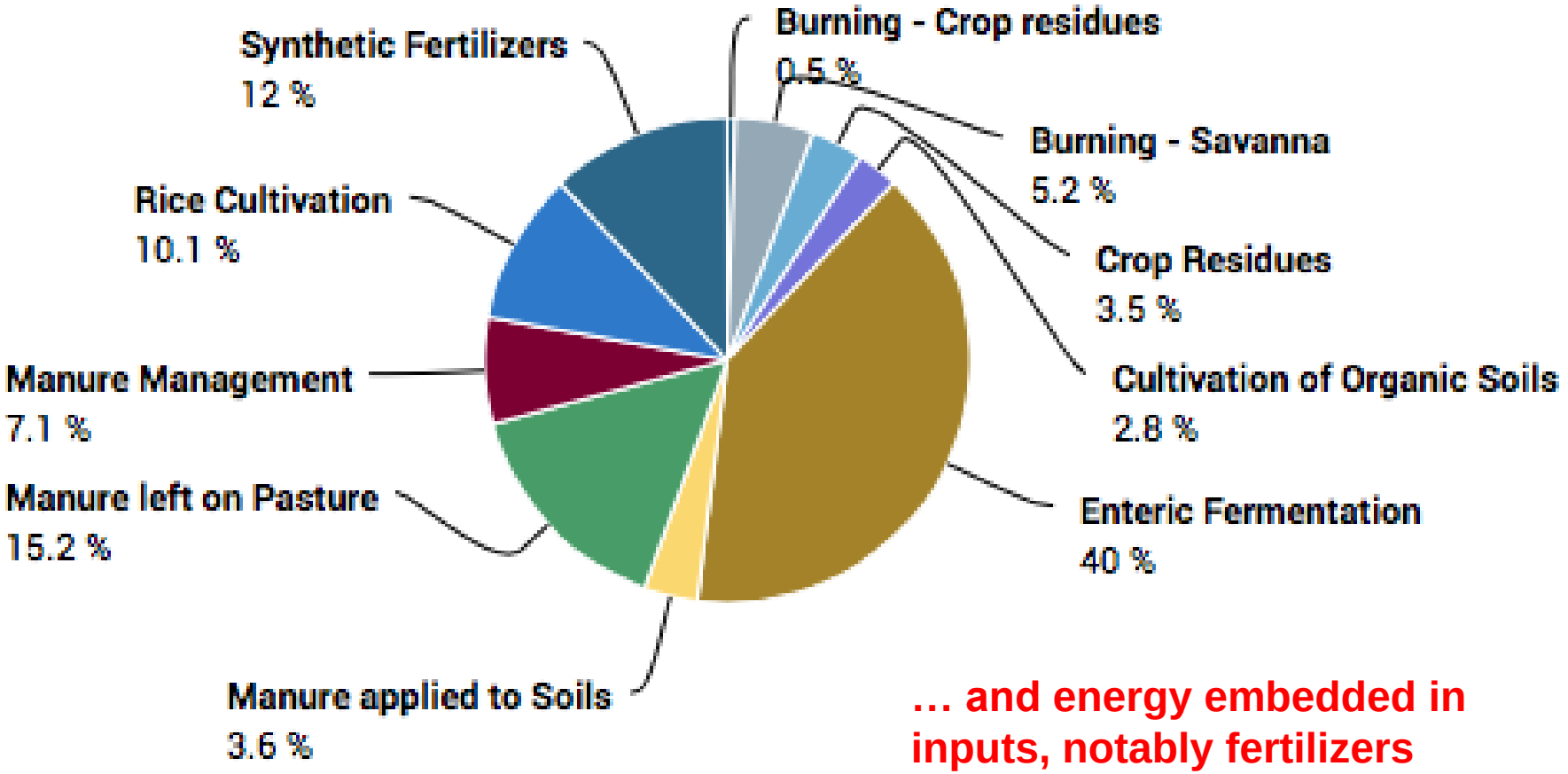
GHG emissions from farming (FAOstat)

Average 1990 - 2012



GHG emissions from farming (FAOstat)

Average 1990 - 2012



… and energy embedded in inputs, notably fertilizers

Reduce emissions: increase efficiency

Example efficiency:

- Dairy: reduce number of heifers
- Crops: split application of fertiliser
- Increase production per ha with precision farming

Scope for reduction (order of magnitude):

- Modern dairy farm: 10%
- Extensive arable farm: 25%

Sequestration

A rough though promising estimate

- World agriculture area is about 48 billion square kms, or 4800 billion hectares.
- Assume some 4000 bn hectares can fix CO2
- A farmer can fix ½ tonne CO2 per ha per year
- On all the world´s hectares this equals 2 billion tonnes of CO2
- That is around 5% of global emissions (34,5 billion tonnes in 2012)

Sequestration

Fix carbon in the soil (and landscape elements)

- Leave stubble and crop residue
- Apply manure and compost
- Reduce soil tillage
- Cover crops / green manure
- Maintain grasslands
- Not cut down hedges and trees
- ….

Where it comes together

In a nutshell, advice to the farmer is:

- Produce more efficiently…
- …while caring for the soil

Contradiction?

Efficiency ⇔ Resilience

Climate smart agriculture (CSA)

Global Alliance on Climate Smart Agriculture

- Launched (by government of the Netherlands) at UN Climate Summit September 2014.
- Backed by 75 countries and organizations, such as the World Bank.
- Sourcebook
- http://www.fao.org/climate-smart-agriculture/72611/en/

Climate smart agriculture

- Often translated to: sustainable intensification
- However, FAO: “Efficiency and resilience should be pursued together”
- Resilience:
  - increasing diversity in the field, e.g. from slash-and-burn to agroforestry
  - More productive livestock more vulnarable to disease and heatwaves
  - Same for plant production: high performance means high maintenance, delicate balance
  - Diversity beyond field level: the farm, the region, the system (ecologic, watershed, economic and social)

So what's new?

CSA sounds like single issue, though with direct relations to water avalability, soil quality, nutrient efficiency, diversity (social and environmental).

Sustainable farming all over again?

So what's new?

However

- CSA is provides a new driver: a "new", additional direct risk to farming (in addition to soil loss, disease pressure etc).
- Nutrient loss, soil degredation, water shortage can be partly solved (and masked) by technological fixes. Not so with climate.
- CSA is another driver for the `landscape approach`: ecosystems, watersheds, social and economic context (note: easier for govts and local stakeholders than for food companies)
- So: not so much news on the contents, but new driver for change.

Climate smart agriculture: the food chain

Why do food companies worry about sustainability?

- Security of supply
- Company reputation
- Genuine concern

Climate smart agriculture: the food chain

Why do food companies worry about sustainability?

- Security of supply
- Company reputation
- Genuine concern

Why do they publish tools?

- Help farmer understand and improve
- Provide companies insight into (their) actual sustainability impact
- Aggregate results for company reporting…
- …. and eventually benchmarking

Climate smart agriculture: the food chain

- Virtually all food companies and retailers say climate change is priority
- Moving up the chain to farm level (beacuse that is where most of the impact is):
  - asking farmer for his carbon footprint.
  - Farmer: What is it, why should I, and how can I?
  - Food company: here is a calculator – please use it
- Prime focus is efficiency

Walmart

PEPSICO

Unilever

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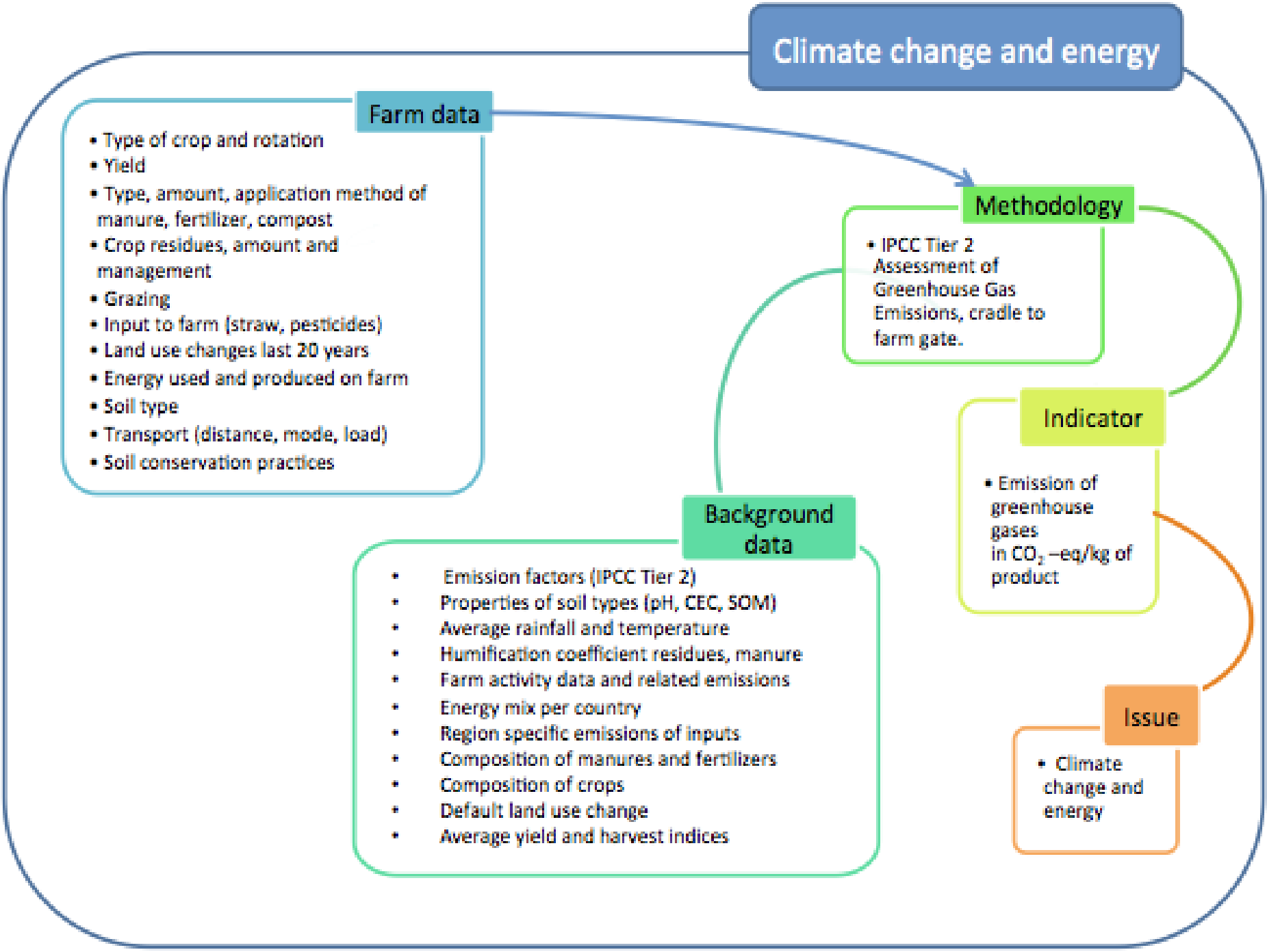
3. Carbon calculator tools

- CLM's climate yardstick
- Cool Farm Tool
- Farm smart tool

3. Carbon calculator tools

- Easy to use for farmer solo
- Input basic farm data
- Provide farm level calculations
- Offer relevant measures to farmer
- Provide immediate results, graphs and tables
- Interactive: scenarios and comparison
- Science based
- Focus on emissions, with some attention to soil carbon (emissions or fixing)


Climate change and energy
Farm data
• Type of crop and rotation
• Yield
• Type, amount, application method of manure, fertilizer, compost
• Crop residues, amount and management
• Grazing
• Input to farm (straw, pesticides)
• Land use changes last 20 years
• Energy used and produced on farm
• Soil type
• Transport (distance, mode, load)
• Soil conservation practices
Methodology
• IPCC Tier 2 Assessment of Greenhouse Gas Emissions, cradle to farm gate.
Indicator
• Emission of greenhouse gases in CO_2 –eq/kg of product
Issue
• Climate change and energy
Background data
• Emission factors (IPCC Tier 2)
• Properties of soil types (pH, CEC, SOM)
• Average rainfall and temperature
• Humification coefficient residues, manure
• Farm activity data and related emissions
• Energy mix per country
• Region specific emissions of inputs
• Composition of manures and fertilizers
• Composition of crops
• Default land use change
• Average yield and harvest indices

CLM climate yardstick

Highlights CLM:

- Very user friendly structure and look-and-feel
- Particularly good animal production data and methodology
- Farm-level focus
- Used in Netherlands and Denmark (background data Dutch and Danish)

Climate Yardstick

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Dairy farm
Livestock and stables
Soil and land use
Feed
Energy
Results
Arable farm
Pig farm

Save form

Livestock

- *Give the average quantity of animals per category (animal category)*

Dairy cows	100	**(Number)**
Weaners 0-1 years	33	**(Number)**
Yearlings 1-2 years	30	**(Number)**
Culled cows		**(Number)**

Purchase/sale

- *Indicate number of animals bought or sold*

Type of animal	*Purchase/sale*	*Number/year*
Weaners 0-1 years		
Yearlings 1-2 years		

Milk production

Fill in the requested values

Per cow	8000	**kg/year**
Urea number	25	**mg/100g**

CLM Climate Yardstick

Stable type dairy cattle

- *Indicate which stable type is used for your dairy cattle*

If your stable type is not listed please choose the one that fits best

Stable type Free stall cubicle dairy barn with slatted floor

Outdoor grazing

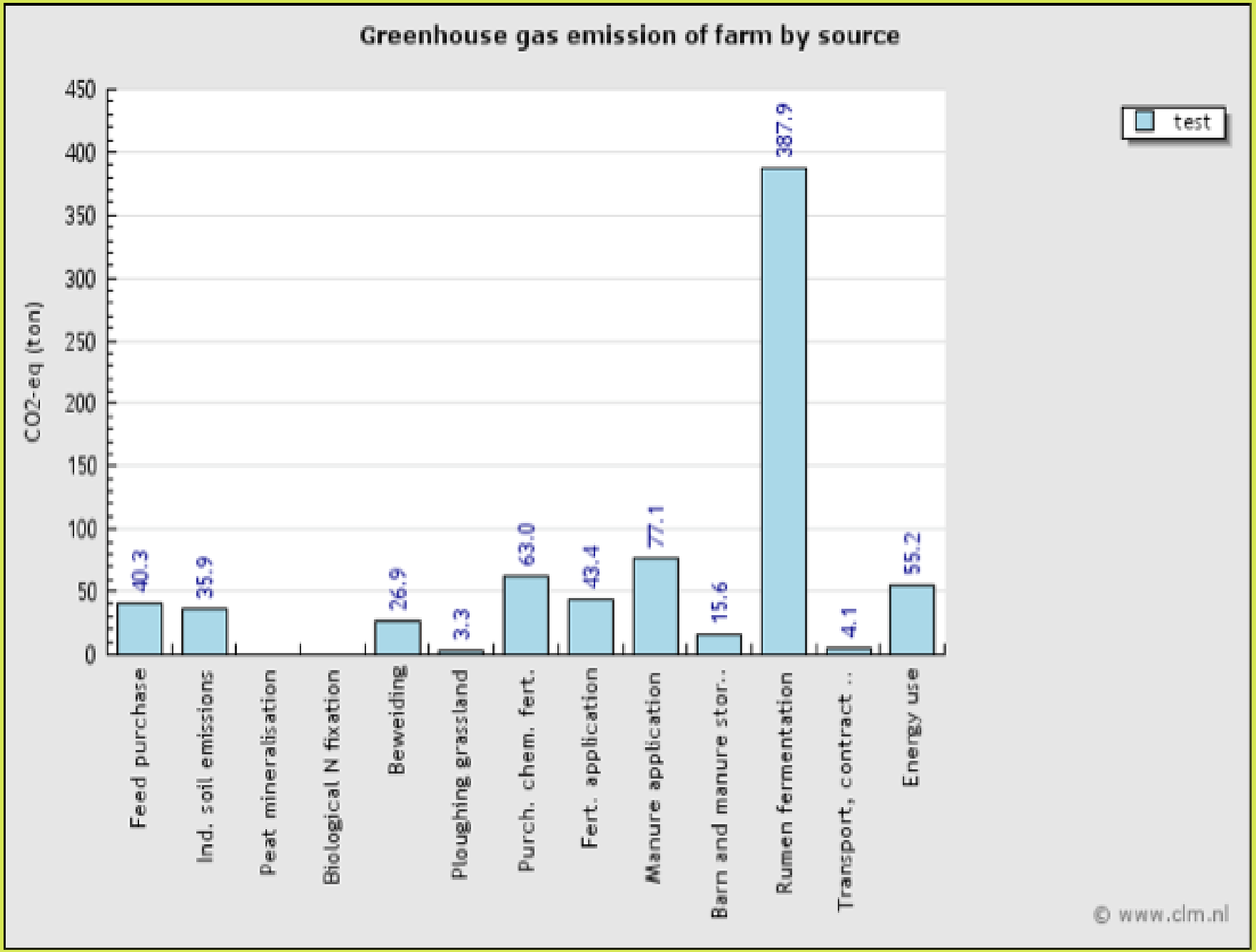
- *Indicate the period of outdoor grazing (in months) and the number of hours of outdoor grazing per day*

Type of animal	*Grazing period (months/year)*	*Time at pasture (hours/day)*
Dairy cows	6	12
Weaners 0-1 years	10	20
Yearlings 1-2 years	10	24
Culled cows	6	24

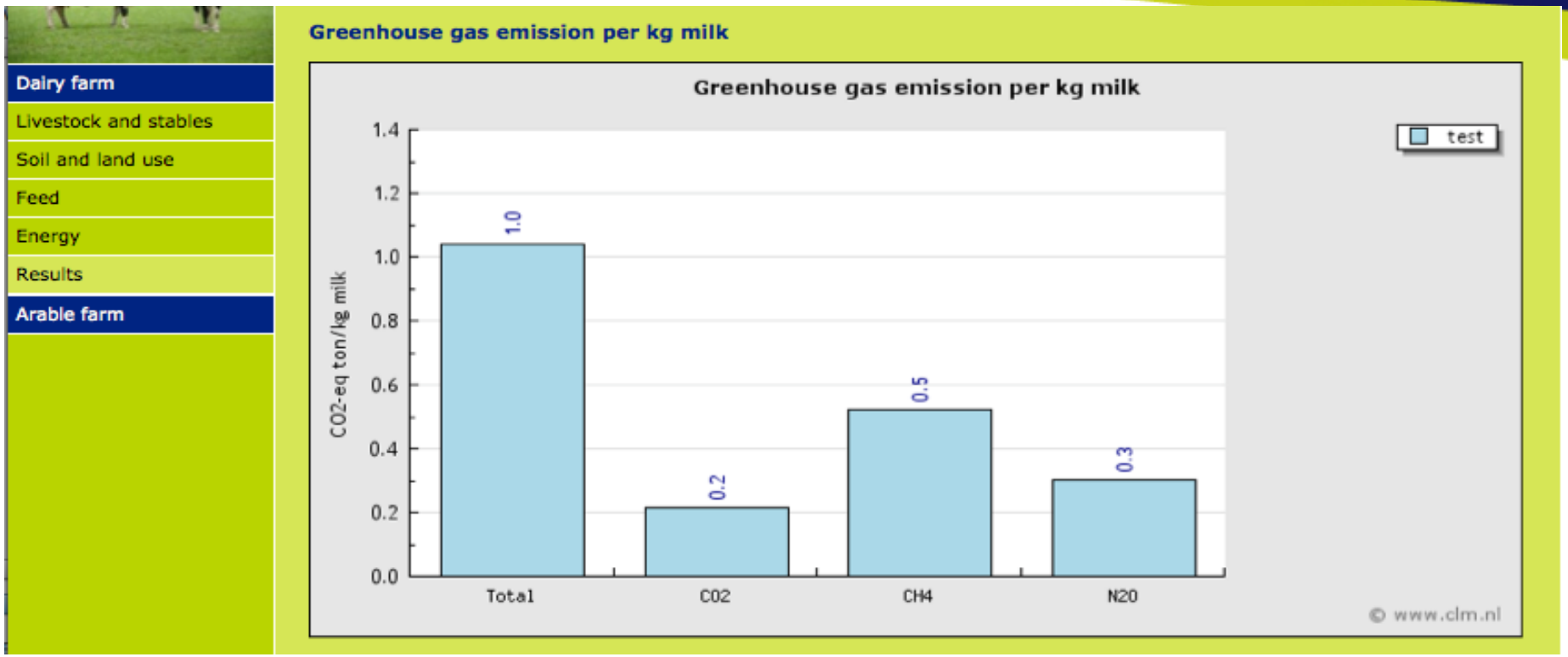
Save form

clm

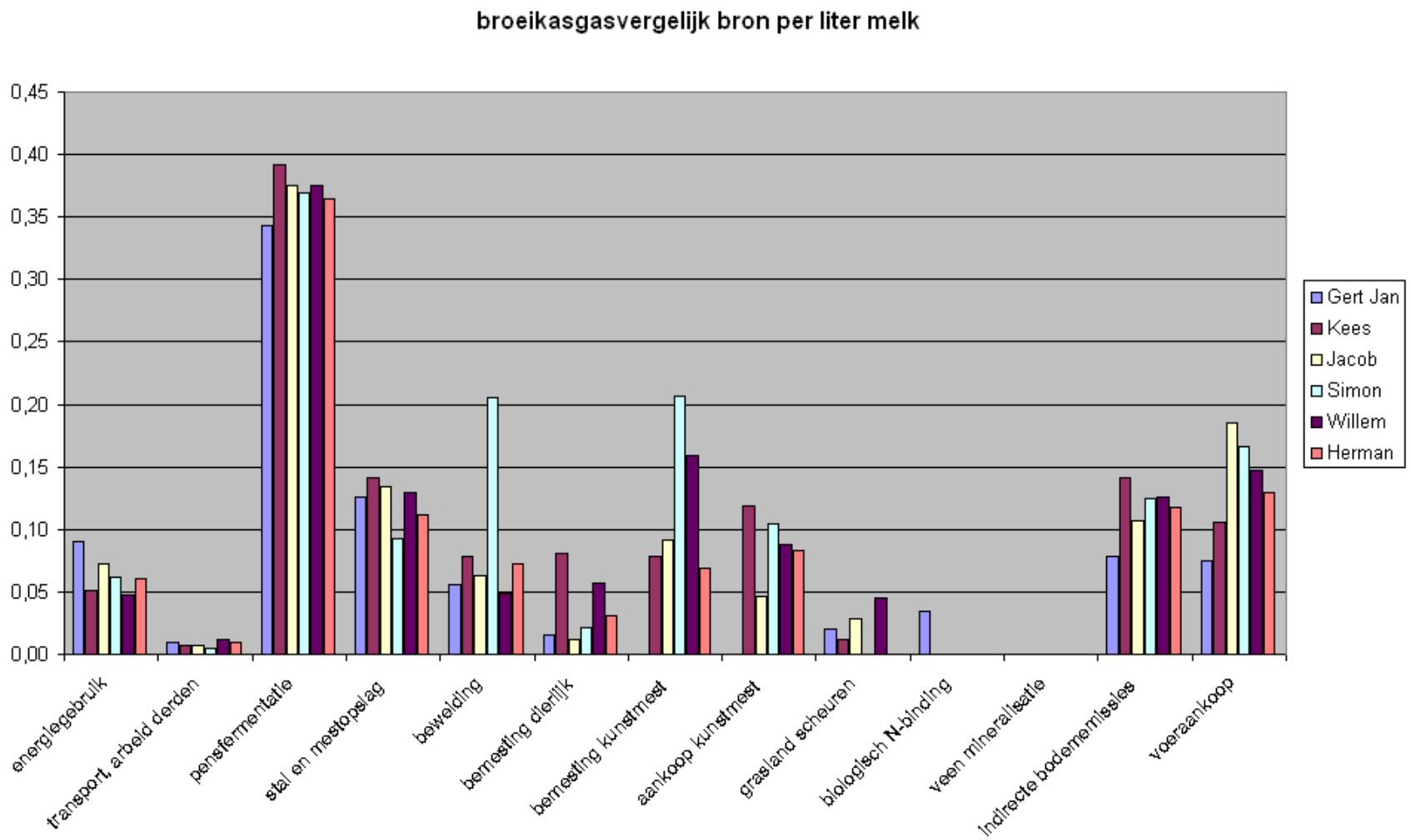
Greenhouse gas emission of farm by source



CLM Climate Yardstick



Climate Yardstick - workshops



FarmSmart

- Online tool, GHG emissions and energy
- Specifically for dairy farmers
- USA based (US Geo data)

INNOVATION CENTER FOR U.S. DAIRY

HEALTHY PEOPLE • HEALTHY PRODUCTS • HEALTHY PLANET

Cool Farm Tool

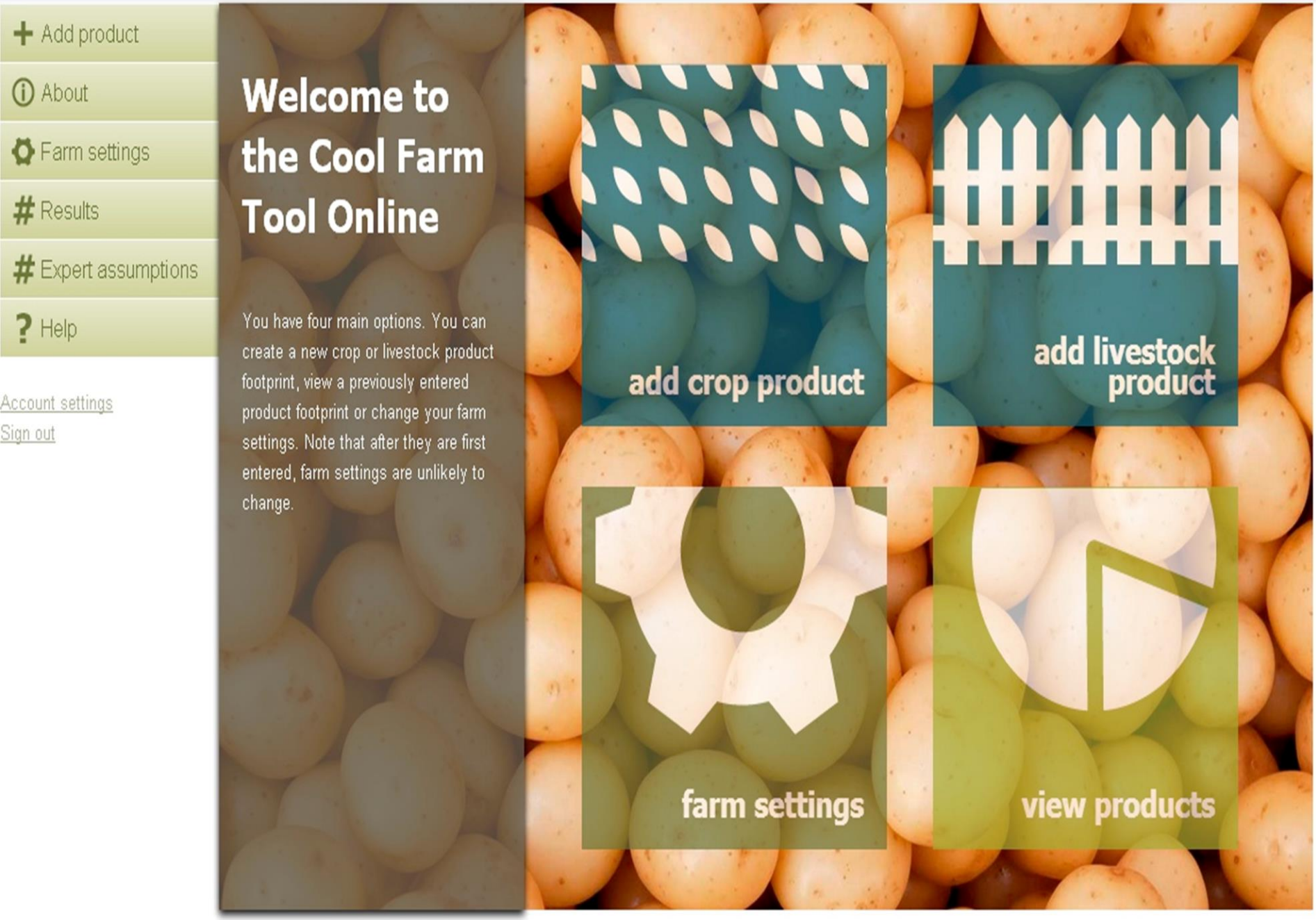
- Worldwide coverage: all crops and regions
- Product-based
- Very broad support base from industry
- Scope for more themes to be covered

Cool Farm Alliance

www.coolfarmtool.org

Cool Farm Tool

- Overseen by University of Aberdeen
- Tool draws on established research, e.g.:
  - Livestock: IPCC Tier 1 and 2 calculations
  - Field N_2O: Bouwman model (used in IPCC)
  - Soil: Ogle model
  - Fertilizer emissions: Fertilizer's Europe
  - Energy: GHG Protocol, IEA and EPA
  - SAI Platform compliant


Add product
About
Farm settings
Results
Expert assumptions
Help
Account settings
Sign out
Welcome to the Cool Farm Tool Online
You have four main options. You can create a new crop or livestock product footprint, view a previously entered product footprint or change your farm settings. Note that after they are first entered, farm settings are unlikely to change.
add crop product
add livestock product
farm settings
view products

General information

Enter basic crop properties to get started.

Crop type: Dry Bean

Year: 2014

Name: dry_bean_2014

Fresh product weight: 1 tonnes

Finished product weight: 1 tonnes

Co-products

Are there any marketable by-products of this crop that you use or sell?

Other comments

Add comments about this section

Back

Save & continue

Field treatment

This page allows you to specify your farming methodology. In the following sections, provide as much information as possible on fertiliser and pesticide applications and crop residue management.

Fertiliser applications

Type: Monoammonium phosphate - 11% N / 52% P2O5

Production: Estimate production impact from region of origin

Source region: World (2007)

Rate: 65.38 lbs / acre

Rate measure: product

Method: Incorporate

Emissions inhibitors: None

beta CFT online

- Add product
- About
- Farm settings
- View products
- Results
- Expert assumptions
- Help

carmel mcquaid

Si

Product result

dry_bean_2014

dry_bean_2014

Crop type	**Dry Bean**	Reporting year	**2014**
Fresh product	**1.00 tonne**	Finished product	**1.00 tonne**
Product yield	**2,470.00 kg / ha**	Growing area	**1.00 acres, medium, moist**

Summary

Total emissions	Emissions per hectare	Emissions per product
262.87 kg CO2e	**649.28** kg CO2e	**262.87** kg CO2e

Total emissions

kg	CO2	N2O	CH4	Total CO2eq	Per hectare	Per tonne	Per tree
Energy use (processing)	-			-	-	-	-
Energy use (field)	40.20			40.20	99.29	40.20	-
Fertiliser production	64.92			64.92	160.34	64.92	-
Soil / fertiliser	25.96	0.27		105.66	260.97	105.66	-
Carbon stock changes	-			-	-	-	-
Paddy methane			-	-	-	-	-
Pesticides	41.50			41.50	102.50	41.50	-
Crop residue mgmt		0.04	-	10.60	26.18	10.60	-
Off-farm transport	-			-	-	-	-
Waste water			-	-	-	-	-
Total	172.57	0.30	-	262.87	649.28	262.87	-

Co-products emissions

Field management emissions

Machinery operations

Transport


Questions?

4. More than carbon

4. More than carbon

Farmer's concern is primarily with yield, margin, soil, inputs like N, P and pesticides.

In addition, food companies and retail interested in climate change, water and biodiversity

Include all into the tool: much more interesting

4. More than carbon

Cool Farm Tool now adding

- Water footprint
- Biodiversity score
- Farm economy

Other tools like FarmSmart, Field to Market and Stewardship Index for Specialty Crops also aim to cover most essential issues.

Biodiversity in the Cool Farm Tool

Measuring biodiversity on the farm

Pressure factors

Land use, GHG, toxic-, eutrophic-, acidic emissions, use of water etc.

Natural conditions and management effort

Conditions: surface of natural area, landscape elements etc.

Management: e.g. delayed mowing, field-margins

Number of species / abundance

Counting species

Measuring biodiversity on the farm

Pressure factors
Basic conditions for biodiversity; indirect / abstract

Natural conditions and management effort
Habitats and their condition; visible on farm / concrete

Number of species / abundance
Actual measurement of biodiversity

From abstract → concrete

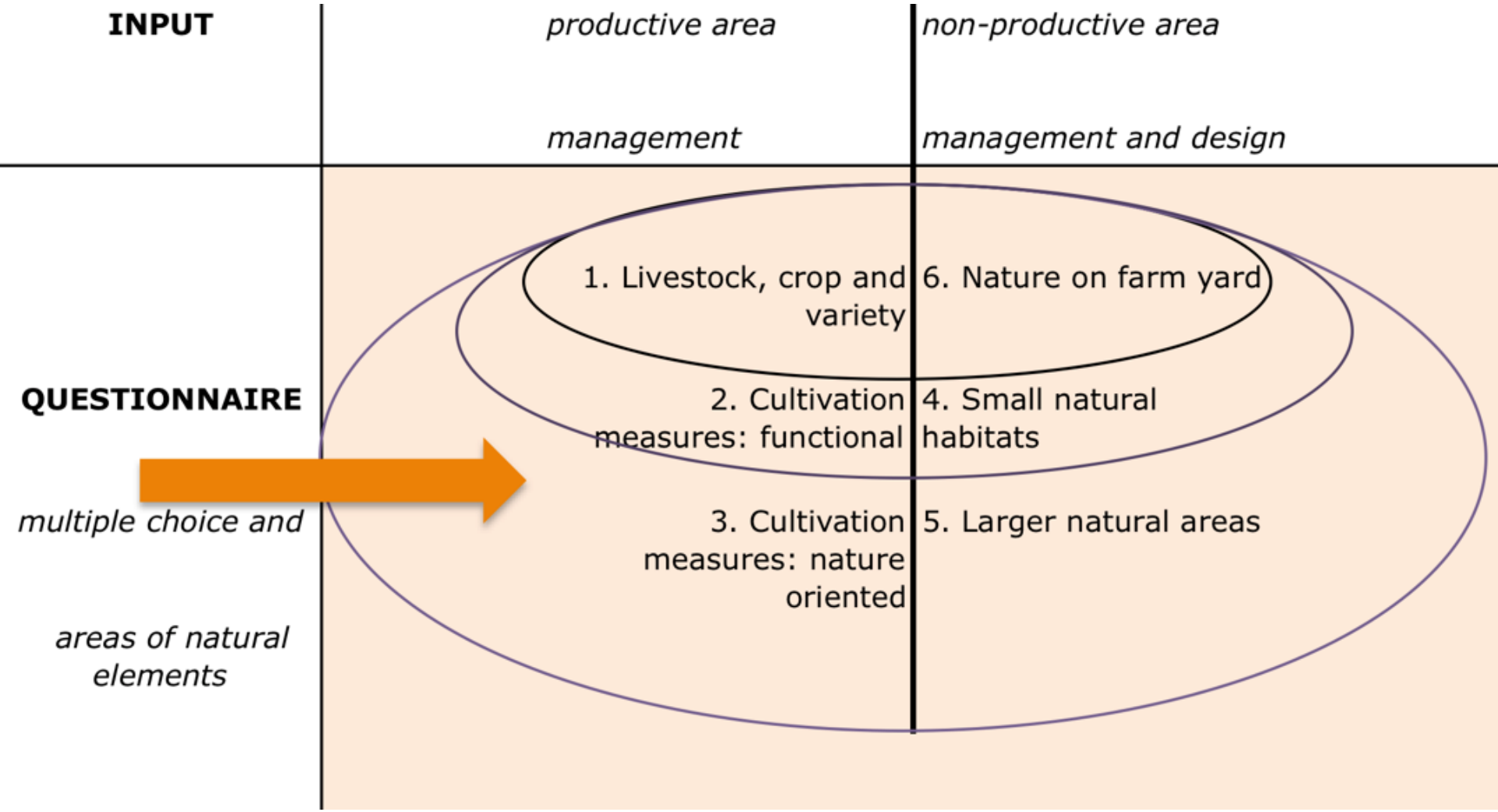
Measuring biodiversity on the farm

Pressure factors
Not accurate enough

Natural conditions and management effort
Workable proxy

Number of species / abundance
Too complex, not feasible

Biodiversity in the Cool Farm Tool



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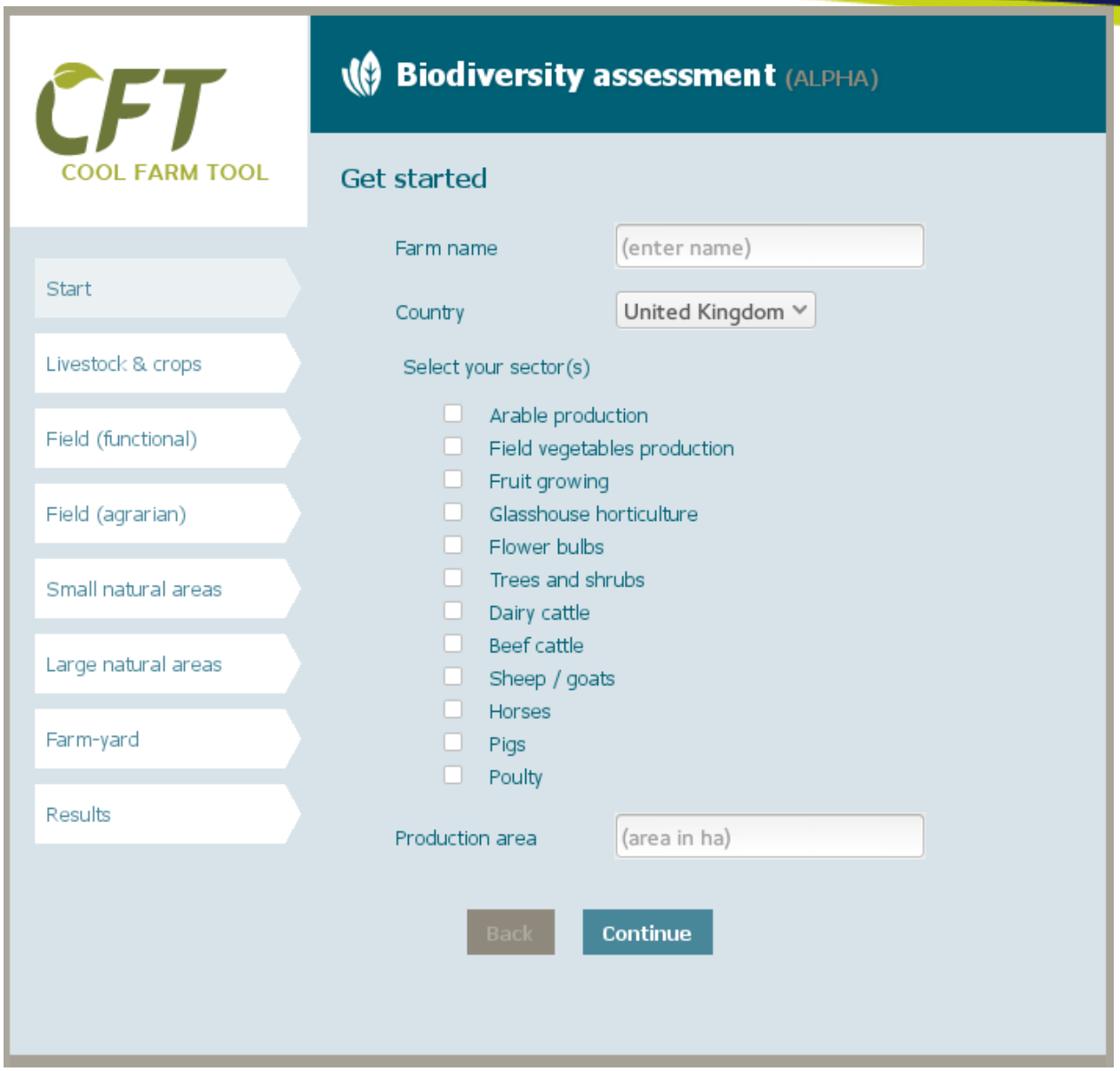

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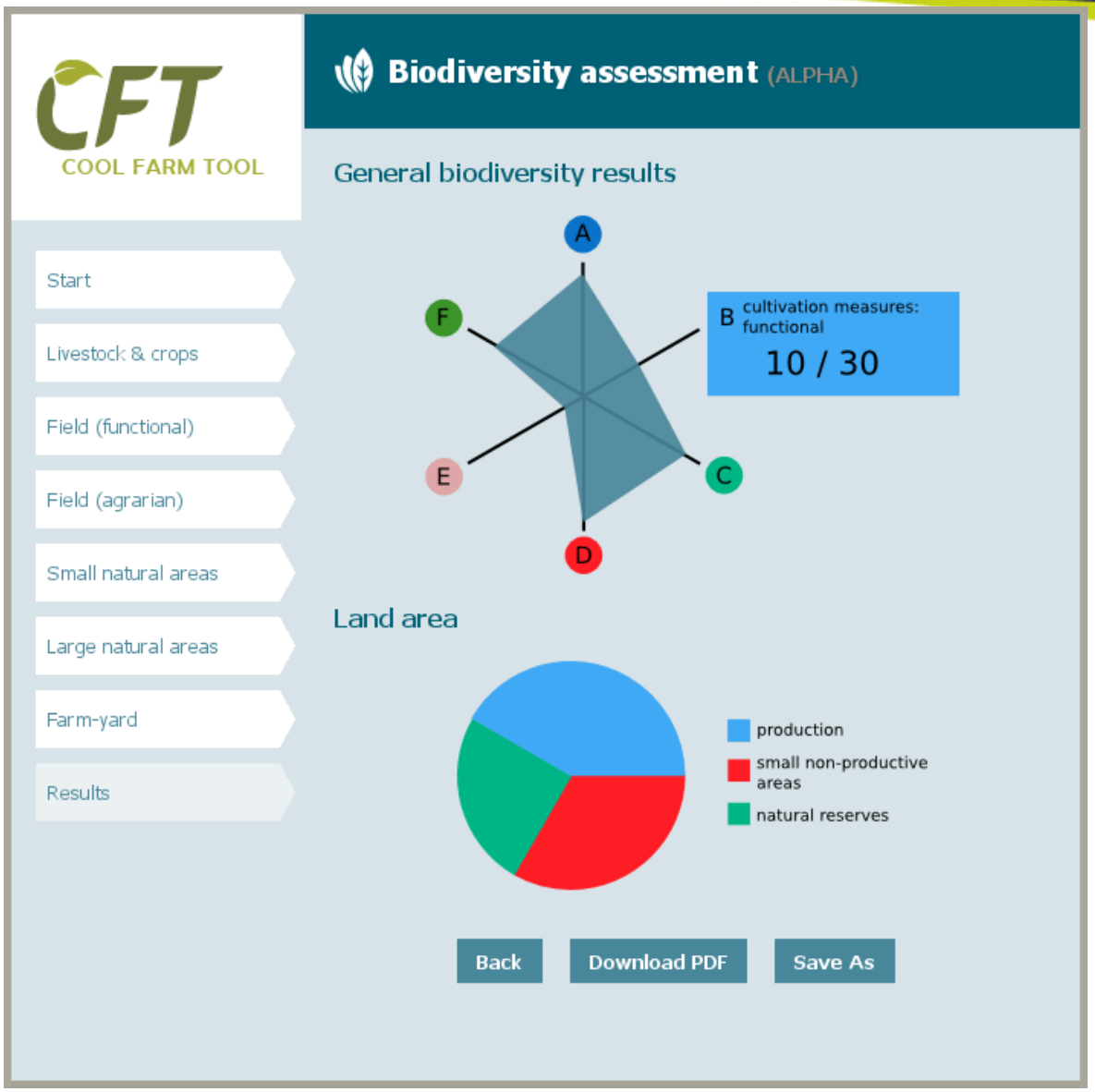

Biodiversity in the Cool Farm Tool

clm yardstick
Gaia biodiversity

3.3 Which measure do you take in favour of the field fauna or flora?

For a part of the plot (at least 0.5 ha), or margins at least 3 m wide

You can select multiple answers.

- [x] Artificial fertiliser not used when grain grown
- [ ] No mechanical and chemical weed control during the cropping period
- [x] Grain (other than maize) grown for at least 3 of the 6 years on a plot
- [ ] The grain stubble is left standing until the next spring
- [ ] A (small) part of the field is not harvested (feed for fauna)
- [ ] None of the above

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Biodiversity in the Cool Farm Tool

clm yardstick
Gaia biodiversity

3.3 Which measure do you take in favour of the field fauna or flora?

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EASY, BUT UNSURE OF OUTCOMES

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Farm Tool

NERC SCIENCE OF THE ENVIRONMENT

clm yardstick
Gaia biodiversity

+

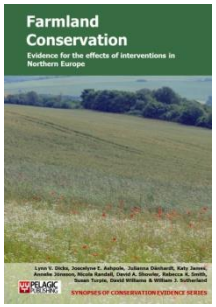
→

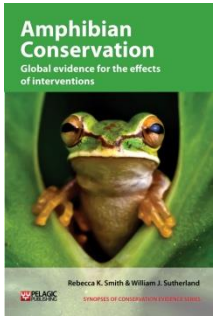
CFT
COOL FARM TOOL

UNIVERSITY OF CAMBRIDGE

EASY, WITH EVIDENCE OF OUTCOMES

Biodiversity in the Cool Farm Tool





Measure	Median effectiveness score	Median certainty score	Category	Category value
Plant nectar flower mix	>60	>60	Beneficial	2
Raise water levels in grassland	>60 40-60	40-60 40+	Likely to be beneficial	1
Take field corners out of management		<40	Unknown effectiveness	0
Create beetle banks	<40	40-60	Unlikely to be beneficial	-
Reduce grazing intensity	<40	>60	Likely to be ineffective or harmful	Excluded

www.conservationevidence.com

Wish list

Ideal tool includes (in this order)

- Farm economy
- Nutrient balances
- Pesticide scores
- Soil quality
- Water use score
- Biodiversity
- GHG emissions


Thank you for
your attention
www.clm.nl