The Future is Green: The Protein Transition

## NAV Symposium at location DSM, 16 May 2019

Sustainable protein sources and adequate nutrition for European consumers: new insights from the TIFN-SHARP project.

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Pressure on health & planet

Population growth

Global warming
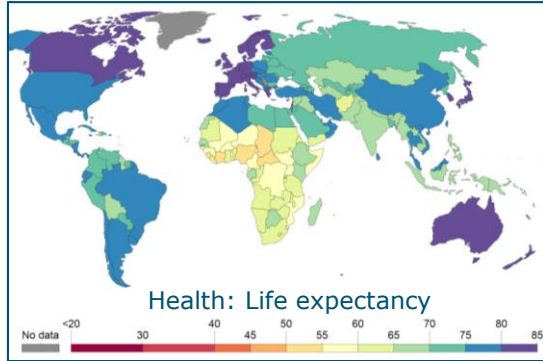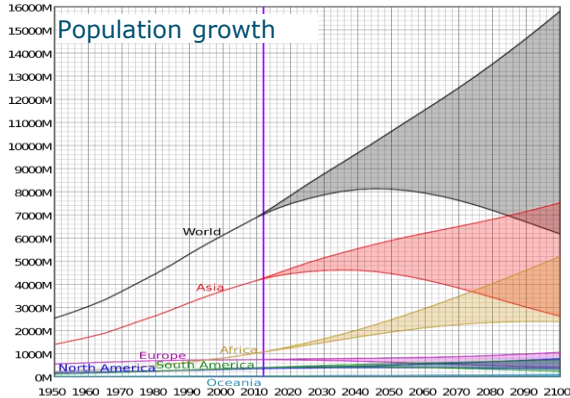
Elderly, urbanisation, malnutrition, obesity, NCDs, disparities, fair trade, animal welfare, zoönoses, GHGe, deforestation, land use, biodiversity, crop failure, eutrophic, acidific, sea level.

Health: Life expectancy

Food production & security
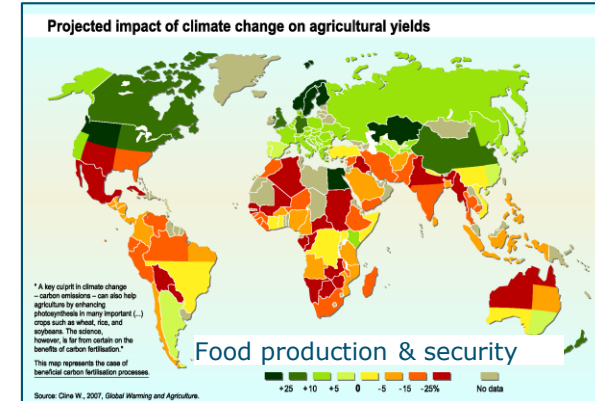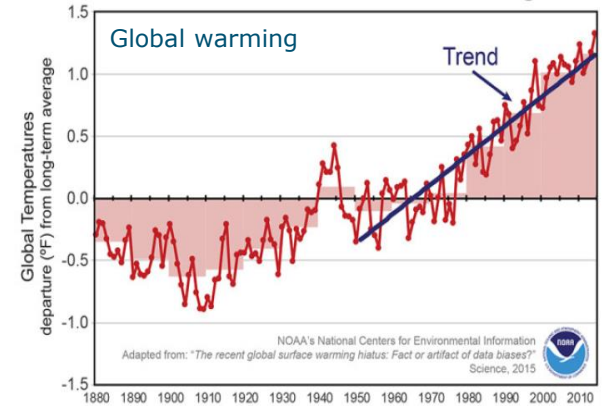
Safe and just space for humanity*: planetary boundaries & healthy diets
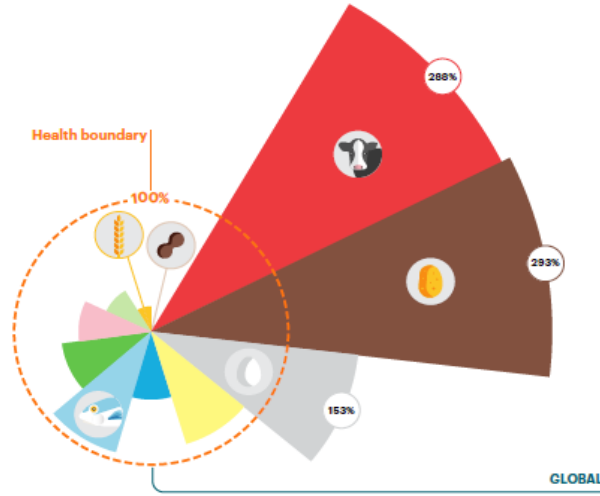
Optimal energy intake (BMI, physical activity)
Diversity of plant-based foods, low animal foods
Saturated fat → unsaturated fats
Limit refined grains & highly processed foods
Double fruits, vegetables, legumes and nuts
Halving added sugars and red meat

Willett et al, Lancet 2019
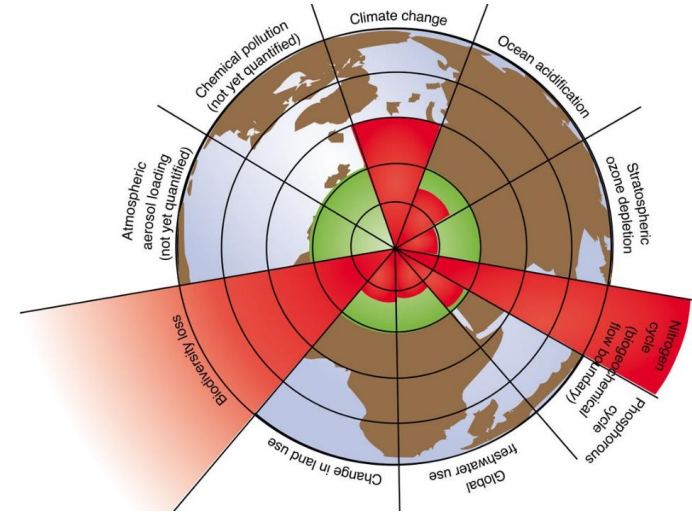
Biodiversity loss (animals, plants, land use, monocultures)
Nitrogen cycle (energy use, eutophication, dead zones)
Climate change (¼ GHGe agricult, acidification, sea level)

Rockström et al, Nature 2014

* Kate Raworth, 2017

3

Impact of isocaloric substitution of meat on health & sustainability indicators (4 EU countries, based on regression)
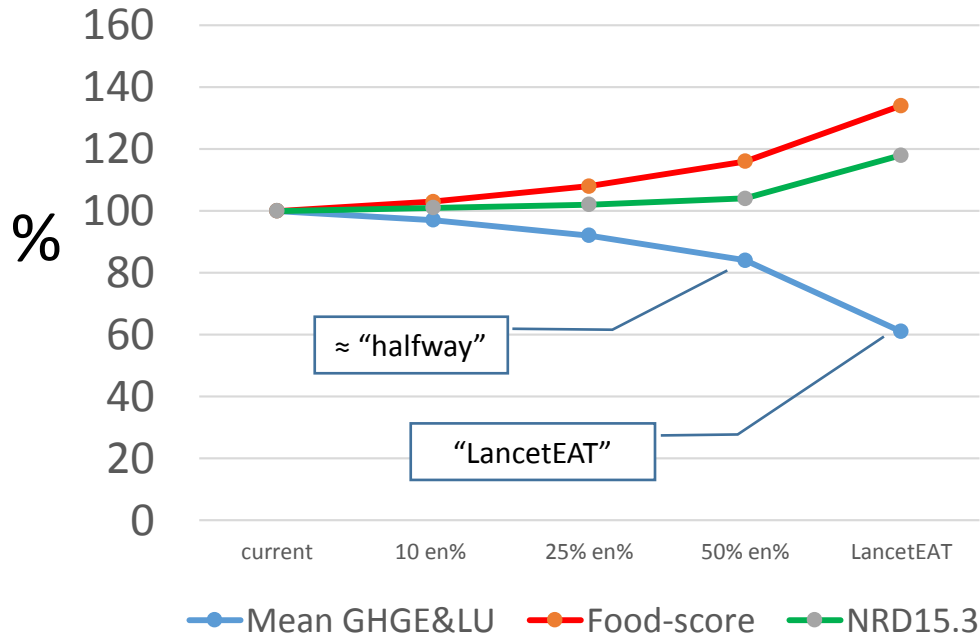
1. Meat replaced (10-25-50%) by fruits, vegetables, legumes & nuts (isocaloric)

2. LancetEAT reference diet (how derived?)

- **Food score**: Fruit, vegetables, fish, red and processed meat, sweetened beverages

- **NRD15.3**: Sum of 15 qualifying nutrients (capped) minus sum of 3 disqualifying nutrients

- **GHGe and LU** – NB. decrease ≈10% extra when BMI reduces by 10% (BW 10% less)

Mertens et al (2019) - submitted

SHARP PROJECT

The SHARP diet: Concept, Data and Model

The CONCEPT

Healthy
prevent NCDs, obesity, nutrient deficiency.
Indicators: FBDGs & nutrient (in)adequacy

Affordable, reliable & preferable
price, socio-economic gradient, diet habits.
Indicators: SES, EDU, age, sex, day-menu's meals

Sustainable
global warming, biodiversity, eutrophication, …
Indicators: Land use & Greenhouse gas-emissions

The DATA

Description, analysis, modelling

Nutrition surveys
- 8000 people in the EU
- Foods & nutrients
- Footprint GHGe, LU
Linked to agro-production in SUSFANS project

The MODEL

Realistic and likely dietary changes towards future diet for EU-citizens

Scope of the SHARP model

The challenge: *likely and realistic dietary changes*.

- Healthier and reduced footprint.
- Iso-caloric exchange: substitution of foods.
- Demographics: age, sex, edu, height & weight, ...

Modelling change: Individual is "decision making unit"

- Observed diet is apparently preferred (in demogr context)
- Variation in observed range is possible.
- The smaller the change, the more likely.
- Substitution remains iso-caloric, but depends on taste, price, convenience, ... , not proportional for foods
- Preferability: min-dev from current → "people like you also choose" (.. big data approach ....)
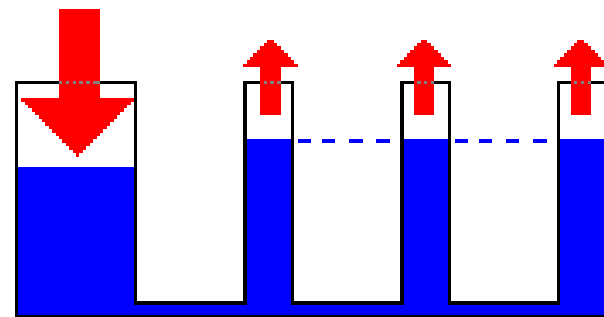
Isocaloric substitution
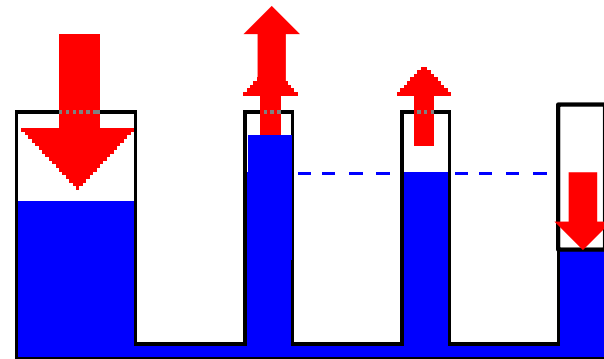
Preferred substitution

DESCRIPTIVE: DIET QUALITY & FOOTPRINTS

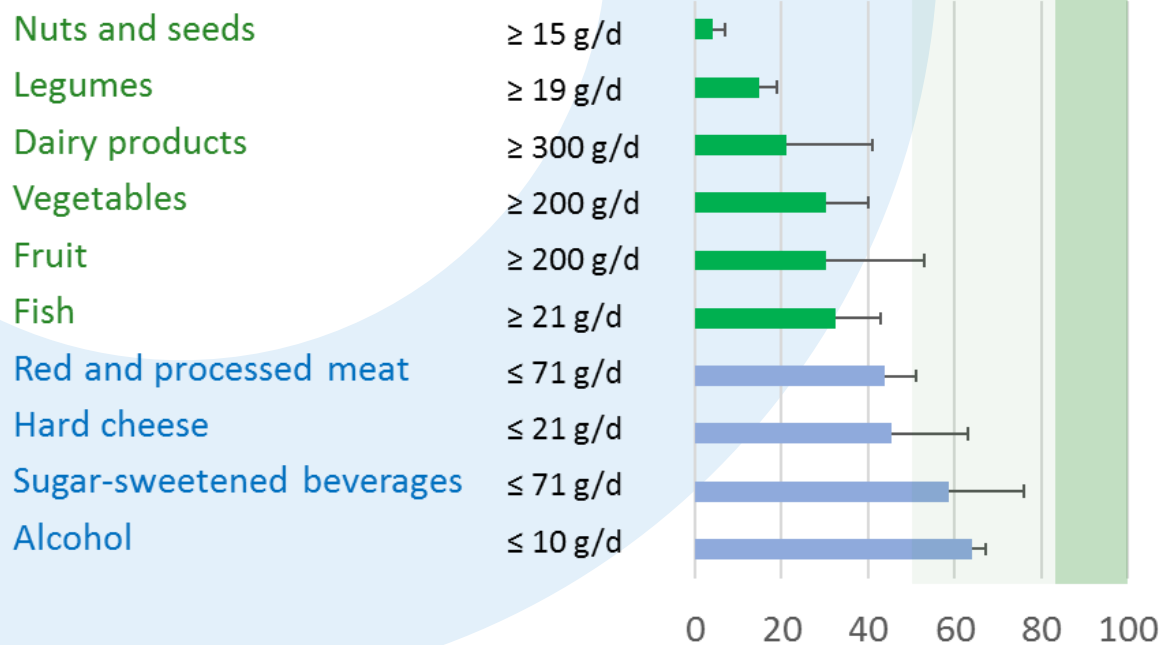# Meeting FBDGs in 4 EU countries? (SUSFANS project)

% Meeting Food based dietary guidelines
Average 4 countries (& range countries)

Food	Guideline
Nuts and seeds	≥ 15 g/d
Legumes	≥ 19 g/d
Dairy products	≥ 300 g/d
Vegetables	≥ 200 g/d
Fruit	≥ 200 g/d
Fish	≥ 21 g/d
Red and processed meat	≤ 71 g/d
Hard cheese	≤ 21 g/d
Sugar-sweetened beverages	≤ 71 g/d
Alcohol	≤ 10 g/d

0   20   40   60   80   100

- **Low adherence to** food-based dietary guidelines **(FBDGs)**
- Foods to increase 4-33% adherence
- Foods to decrease 44-64% adherence
- Large differences between countries

Mertens et al (2018) Geographic and socioeconomic diversity of food and nutrient intakes: a comparison of four European countries (Table 2)

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Diet quality & environmental sustainability

Between-country variation

Mertens et al (2019) - submitted

Legend:
- Meat, Fish, Eggs
- Milk & Cheese
- Fats & Oils
- Grains
- Fruit & Vegetables
- Beverages
- Miscellaneous

Red & processed meat: 32-45%

Milk 5-12%, chees 7-14%

Grains 6-9%

Vegetables 3-5%

Coffee & tea 2-11%
Alcohol 2-12%
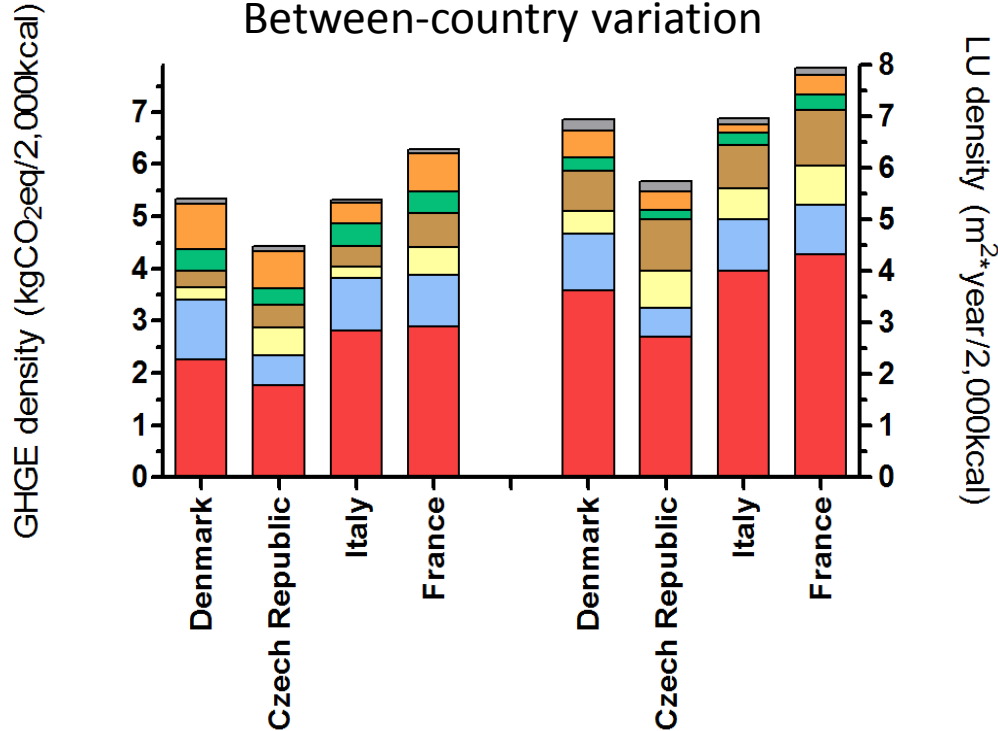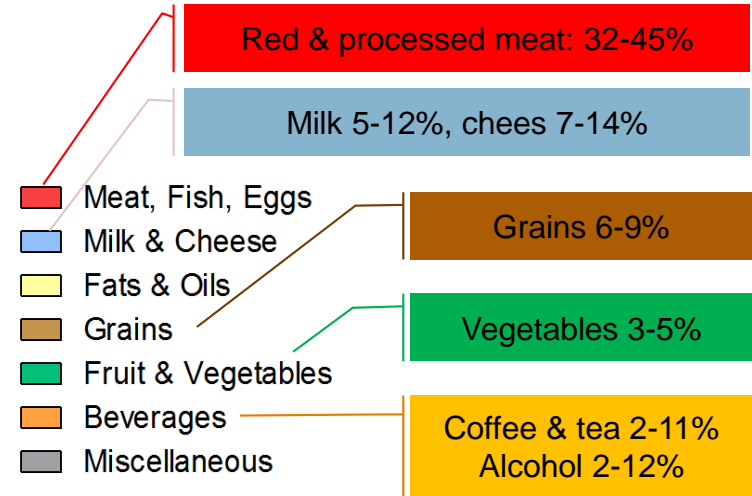
Healthier diets: FBDG-based approach (prelim model)

Food groups to increase	Capping values
Fruit	200g/2,000kcal
Vegetables	200g/2,000kcal
Legumes	No
Nuts and seeds	No
Fish	21g/2,000kcal
Whole grains	No
Unsaturated fatty acids	At 20E%
Calcium	750 mg/d
Zinc	7.5 mg/d for men; 6.2 mg/d for women
Vitamin B12	4 µg/d
Vitamin E	13 mg/d for men; 11 mg/d for women
Food groups to decrease	Capping values
Red and processed meat	No
Sweet beverages	No
Refined grains	No
Alcohol	No
Saturated fatty acids	No

SHARP-model: benchmarking → realistic diets, likely changes

Realistic diets: Benchmark model (Data Envelopment Analysis) within range of observed diets

F&V

Healthy & sustainable diet (e.g., Lancet EAT, sustainable FBDGs)

②

Nutrients or foods to increase
(Output variables or benefits)

Observed diets ①

③

F_3

F_1

F_2

Nutrients or foods to decrease ②
(Input variables, or costs)

energy% SAFA
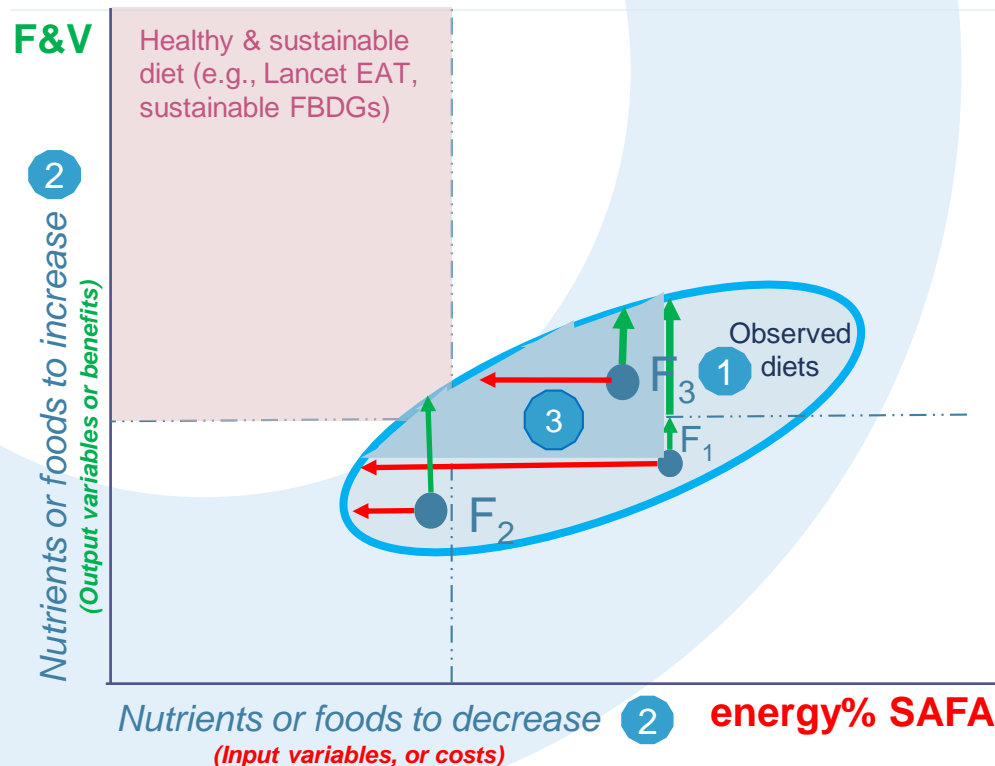
Alternative diets need be at least equally healthy as observed diet, within population range

Based on FBDGs: food groups to in / decrease
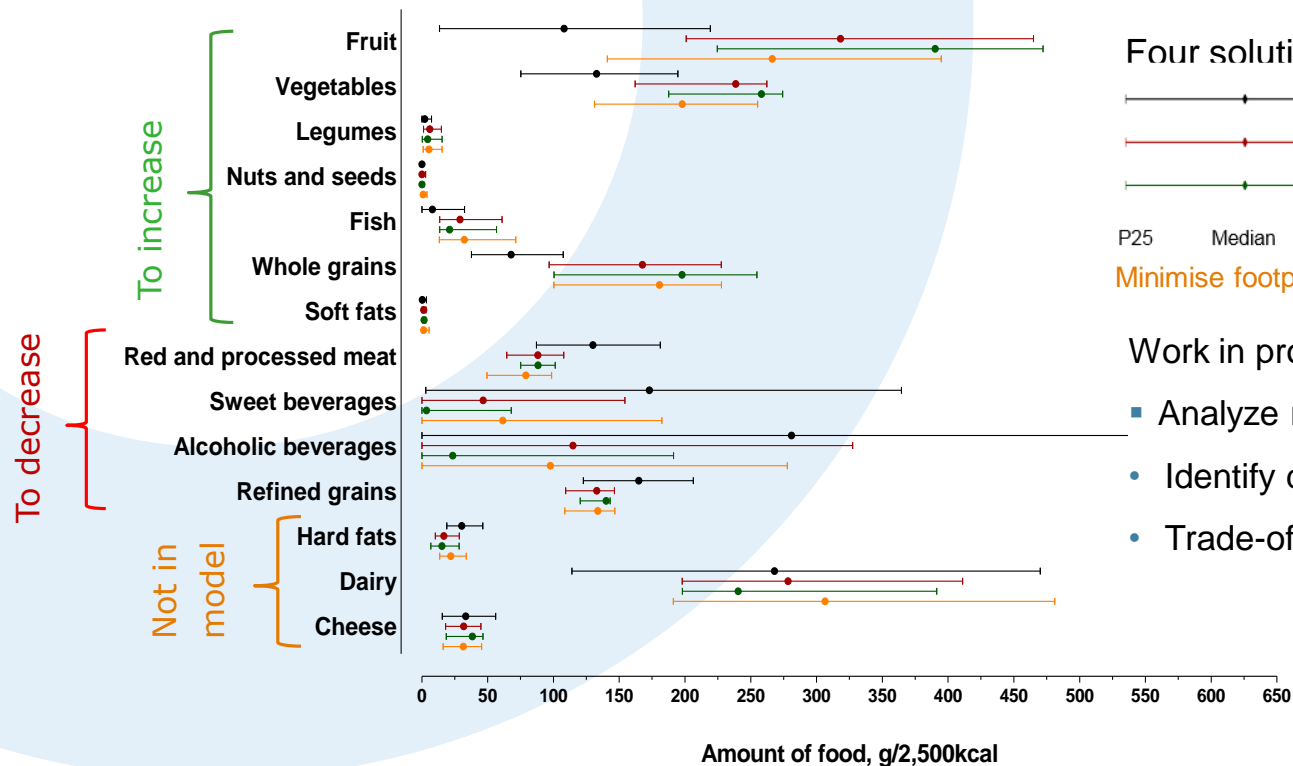1. Observed diets, projected on X, Y, Z, .. axes
2. FBDGs: groups to increase, to decrease

Steps in analysis (3)
- High ratio "in vs decrease" = solution space
- Check adverse changes in nutrients.
- Use e.g. NRD15.3 as healthy-diet indicator
- Trade-offs: Most sustainable/healthy solution

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Results, a random example (men, in one of the countries)

Four solutions for each food group

- Observed diet
- Calculated diet focussed on foods to decrease
- Calculated diet focussed on foods to increase

P25   Median   P75

Minimise footprint (S, fourth line)

Work in progress:

- Analyze men & women in 4 countries
- Identify diet with max Preferability
- Trade-off Min footprint vs Max Preferability

Amount of food, g/2,500kcal

To increase

To decrease

Not in model

Fruit
Vegetables
Legumes
Nuts and seeds
Fish
Whole grains
Soft fats
Red and processed meat
Sweet beverages
Alcoholic beverages
Refined grains
Hard fats
Dairy
Cheese

0 50 100 150 200 250 300 350 400 450 500 550 600 650

Trade-offs: decrease footprint, or increase health

F&V, D, B12, Zn

Healthy & sustainable diet (e.g., Lancet EAT, sustainable FBDGs)

Nutrients or foods to increase

maxH

Increased health

Trade-off H vs S

Observed diet

maxS

Decreased footprint

Nutrients or foods to decrease

energy% SAFA, sugar, red meat
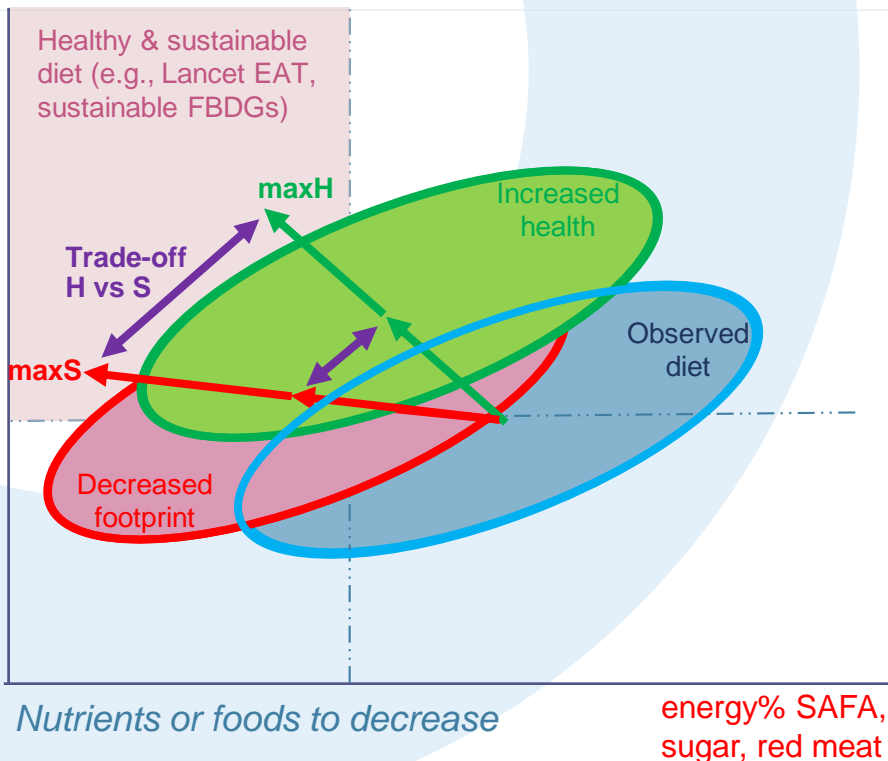
Current diet and H&S diet
- Observed diet (very few are H&S)
- H & S diet (LP or QP) far from current

Changing the diet (iso-caloric substitution)
- Decreased footprint (GHGe = $\sum \beta_i x_i$)
- Increased health (NRD9.3 = $\sum \alpha_i x_i$)
- Trade-offs between H and S (as 2nd step)
- Smaller difference with observed likely more preferable

SHARP-model:
- Realistic range (benchmarking)
- Likely changes: First steps, linear combinations of existing diets

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CONCLUSION

Key points & next steps

SHARP model
- Consumer diets & FBDGs as starting point, not foods & nutrient requirements
- Realistic diets as benchmark, likely changes for consumers
- Solutions at least as healthy: FBDG-based, nutrients safeguarded

Limitation
- Dietary exposure, as good as we can assess it
- Protein quality, bioavailability, matrix effects

Next steps
- Consumer: algorithms preferability & big data, test diet advise by qualitative res, day to meal.
- Public health: More EU countries, children, elderly, use risks instead of NRDx.y
- Industry: case studies on new product categories, e.g., meat replacers (incl enrichment)
- Nutritional health: Trial sust diets, exposure markers, nutritional status, risk factors NCDs

THANKS

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