Sustainable and healthy diets: Trade-offs and synergies

FiBL: Matthias Stolze (PI), Christian Schader, Adrian Müller, Anita Frehner
Flury & Giuliani: Birgit Kopainsky
Rütter Sococo: Carsten Nathani, Julia Brandes
Uni Zürich: Sabine Rohrmann, Jean-Philippe Krieger, Giulia Pestoni
ZHAW: Christine Brombach, Stefan Flückiger, Matthias Stucki
Treeze: Rolf Frischknecht, Martina Alig

22 October 2020
Elements of sustainable diets

Source: Johnston et al., 2014, Advances in Nutrition
Contribution of agriculture to the planetary boundaries

Source: Campbell et al., 2017, Ecology and Society
Project approach

Assessment of dietary patterns and health impacts

Participatory definition of interventions and scenarios

Model-based integrated analysis

NFP69-Phase 1 Model
- Dynamic simulation model
- EE-IOM

Global mass-flow model
- SOLm

Trade-offs and synergies of dietary patterns

Dietary and policy recommendations
Scenarios (1/2)

Reference scenario 2050

- Consumption per person as in base year 2008 (menuCH-data)
- Share organic: doubling the share from base year

SFP 2050

- 100% of the population follow the Swiss Food Pyramid recommendations
- Share organic: doubling the share from base year
Scenarios (2/2)

**Sustainability / Feed No Food 2050**

- Feed no food, closed cycles, reduction in nitrogen surplus
- Remaining feed:
  - Grass resources
  - By-products of the production (e.g. milling industry, brewery, oil production, sugar manufacture, dairy processing)
- Share organic: fourfold the share from base year
- Pulses are increased until protein supply of SFP scenario is reached

Source: Van Zanten et al., 2019, *Global Food Security*
Impact assessment of dietary scenarios

**Environmental impact assessment:** EE-IOM, SOLm
   Indicators: land use, GHG emissions, biodiversity loss potential, eutrophication, nitrogen surplus, phosphorus surplus, non-renewable energy demand, ...

**Social and health impact assessment:** EE-IOM, SOLm
   Indicator: Social Hotspot Index, AHEI, production-related DALYs

**Economic impact assessment:** EE-IOM
   Indicators: gross value added, employment, household expenditure
Integrated Modelling Approach: Linking the three models
Predefined scenarios

SDM
- **Input:** explicit specifications for consumption patterns
- **Output:** economically motivated behaviour (according to decision structure in SDM) of the agents leads to production structure of the agricultural sector

SOLm
- **Input:** production structure of the agricultural sector (areas, animal numbers, feeding rations, ...), explicit specifications for consumption patterns
- **Output:** environmental impacts from agricultural production in Switzerland and in countries of origin of imported goods

EE-IOM
- **Input:** production structure of the agricultural sector, explicit specifications for consumption patterns
- **Output:** production structures of the other sectors, further environmental impacts from agricultural production and the other sectors
SOLm model structure: food systems view

Food system

Plant production
- Production systems
- Resource use: land, fertilizers etc.
- Crop products

Animal production
- Production systems
- Resource use: feed etc.
- Animal products

Feeding rations

Environmental impacts:
- Energy (CED)
- GHGs
- N-Eutrophication
- P-Eutrophication
- Area use
- Deforestation pressure
- Soil erosion
- Toxicity

Food availability:
- Calories
- Protein
- Etc.

Imports
Exports

Utilisation
Human health impacts: Alternate Healthy Eating Index (AHEI-2010)

- Score from 0 to 110 points
- 11 groups à 10 points

<table>
<thead>
<tr>
<th>Component</th>
<th>Criteria for minimum score (0)</th>
<th>Criteria for maximum score (10)</th>
<th>AHEI-2010 in women</th>
<th>AHEI-2010 in men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables,(^2) servings/d</td>
<td>0</td>
<td>≥5</td>
<td>5.4 ± 2.4</td>
<td>5.6 ± 2.6</td>
</tr>
<tr>
<td>Fruit,(^3) servings/d</td>
<td>0</td>
<td>≥4</td>
<td>3.4 ± 2.4</td>
<td>3.7 ± 2.6</td>
</tr>
<tr>
<td>Whole grains,(^4) g/d</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td>75</td>
<td>1.8 ± 1.7</td>
<td>2.4 ± 2.0</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar-sweetened beverages and fruit juice,(^5) servings/d</td>
<td>≥1</td>
<td>0</td>
<td>3.0 ± 3.6</td>
<td>2.6 ± 3.5</td>
</tr>
<tr>
<td>Nuts and legumes,(^6) servings/d</td>
<td>0</td>
<td>≥1</td>
<td>2.7 ± 2.5</td>
<td>4.1 ± 3.2</td>
</tr>
<tr>
<td>Red/processed meat,(^7) servings/d</td>
<td>≥1.5</td>
<td>0</td>
<td>3.5 ± 3.1</td>
<td>3.1 ± 3.0</td>
</tr>
<tr>
<td>trans Fat,(^8) % of energy</td>
<td>≥4</td>
<td>≤0.5</td>
<td>6.0 ± 1.7</td>
<td>7.8 ± 1.4</td>
</tr>
<tr>
<td>Long-chain (n-3) fats (EPA + DHA),(^9) mg/d</td>
<td>0</td>
<td>250</td>
<td>6.2 ± 3.2</td>
<td>7.6 ± 3.1</td>
</tr>
<tr>
<td>PUFA,(^10), % of energy</td>
<td>≤2</td>
<td></td>
<td>5.6 ± 2.0</td>
<td>4.7 ± 1.8</td>
</tr>
<tr>
<td>Sodium,(^11) mg/d</td>
<td></td>
<td>Highest decile</td>
<td>5.0 ± 3.2</td>
<td>5.0 ± 3.2</td>
</tr>
<tr>
<td>Alcohol,(^12) drinks/d</td>
<td>≥2.5</td>
<td>0.5–1.5</td>
<td>5.1 ± 3.1</td>
<td>5.8 ± 3.3</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>≥3.5</td>
<td>0.5–2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>110</td>
<td>47.6 ± 10.8</td>
<td>52.4 ± 11.5</td>
</tr>
</tbody>
</table>

Source: Chiuve et al. 2012
Overview of trade-offs and synergies of the SwissFoodPyramid and the FeedNoFood scenario

Note: inverse scale for AHEI
Threshold for ‘desired’ GHG impacts: -30% of current impacts (according to Klimastrategie 2011)

Threshold for ‘desired’ AHEI score at 2/3 of total score

**Human health and environmental impacts of scenarios**

**GHG emissions and AHEI Scenarios (year 2050)**
Improvement options and potential trade-offs

**Improvement options**

- Partly substitute animal-source foods with pulses or other potential adequate protein sources
- Reduce sugar consumption
- Increase vegetables and fruits consumption
- Consistent proportions between coupled products from a production perspective (e.g. cattle meat and milk)
- Reduce food waste

**Potential trade-offs**

- Type of meat (e.g. chicken vs. cattle meat)
- Nose-to-tail
- Fatty fish
Nachhaltiger geniessen – So kann’s gehen!


Was wir essen und einkaufen, hat Einfluss auf unsere Gesundheit, auf die Umwelt, die Wirtschaft, auf Menschen und Tiere — in der Schweiz und in anderen Ländern. Wie können wir die Auswirkungen möglichst positiv beeinflussen? Wie können wir uns gesund und nachhaltig ernähren? Hier einige Anregungen …

Der Teilzeit-Vegetarier – Remo, 39 Jahre

Seit drei Jahren esse ich bewusst weniger Fleisch als früher. Auslöser war damals ein Video auf Youtube. Natürlich wusste ich schon vorher, dass ein hoher Fleischkonsum schlecht für die Umwelt und das Klima ist. Aber mir war nicht klar, dass die Auswirkungen so krass sind …
What type of consumer are you?

Sarah
the food waste avoider

One third of global food production is either thrown away or wasted as it makes its way along the food chain. The resources used to produce it are therefore also wasted. This has made 51-year-old Sara sit up and think. Nowadays, she and her family take much greater care to ensure they don’t leave food to rot or simply throw it away. As a result, Sara has been able to reduce household waste, and the family is saving money too.

http://healthyandsustainable.ch/en/simulator
Questions?

Anita Frehner
PhD Student
FiBL Research Institute of Organic Agriculture / Wageningen University & Research
Department of Socioeconomics / Animal Production Systems

anita.frehner@fibl.org
www.fibl.org / www.wur.nl

Thank you!