Pathways for food and land-use systems in Sweden

2023 Scenathon results
About FABLE
The Food, Agriculture, Biodiversity, Land-Use, and Energy (FABLE) Consortium is a collaborative initiative to support the development of globally consistent mid-century national food and land-use pathways that could inform policies towards greater sustainability. The Consortium brings together teams of researchers from 24 countries and international partners from the UN Sustainable Development Solutions Network (SDSN), the International Institute for Applied Systems Analysis (IIASA), the Alliance of Bioversity International and CIAT, and the Potsdam Institute for Climate Impact Research (PIK). https://www.fableconsortium.org/

About the authors
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Recommended citation
Our food and land-use systems are critical for staying within our planetary boundaries and the Earth’s system resilience. Among the six Transformations required to achieve the Sustainable Development Goals (SDGs), the fourth Transformation—focusing on food, land, and water—is crucial. This Transformation is key to achieving SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land). Moreover, it significantly supports the remaining SDGs, underscoring its crucial role in fostering a sustainable future.

In this document, we present the results of the 2023 ‘Scenathon’, a modelling exercise by the FABLE Consortium exploring three alternative futures for national and regional food and land-use systems. The term ‘Scenathon’ stands for ‘a marathon of scenarios’ and refers to FABLE’s iterative process for ensuring that national and regional pathways have coherent trade assumptions and align with global sustainability targets (see the 2024 Sustainable Development Report for more information).

Through these long-term pathways, we can identify trade-offs and synergies between different goals and see the impact of various actions, as well as key levers for guiding sustainable development policies through 2030 and 2050. These results, together with our modelling tools and methods, are designed to support decision-making and the development of better policies and targets to drive the transformation of our food and land-use systems.

Figure 1. Historical share of GHG emissions from Agriculture, Forestry, and Other Land Use (AFOLU) to total AFOLU emissions and removals by source in 2020

Figure 2. Daily average kilocalorie intake per capital per food category in 2020

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### Methods

**Model**
Using the open-access FABLE Calculator and the FABLE decentralized modelling infrastructure, we have developed three alternative pathways —Current Trends, National Commitments, and Sustainable Pathway— to explore the impact of various practices and policies on achieving sustainability targets through 2050. We compare our results with targets across food security and nutrition, GHG emissions reduction, forest and biodiversity conservation, and sustainable use of water, nitrogen, and phosphorus.

For each of these pathways, we have established various assumptions regarding the evolution of several model parameters. These parameters include population growth, dietary patterns, food waste, food import and export levels, crop and livestock productivity, agricultural expansion, afforestation, livestock density, protected areas expansion, post-harvest losses, biofuel demand, urban expansion, agricultural practice coverage, and irrigation area expansion. These assumptions detail the extent to which these factors will drive changes in food and land systems from 2020 to 2050.

**Pathway narratives**

**Current Trends:** Represents a low-ambition trajectory primarily shaped by historical trends and existing policies, offering a glimpse into a future heavily reliant on the current level of implementation and enforcement.

**National Commitments:** Attempts to predict how food and land systems will evolve if national strategies, pledges, and targets concerning climate, biodiversity, and food systems are met. This is based on a review of policy documents that describe the national climate and biodiversity strategies, the UN food system pathway, the national dietary guidelines, and other relevant policy documents for food and land systems.

**Global Sustainability:** Identifies additional actions to help closing the gap between the collective outcome of the National Commitments pathway and the global sustainability targets. There may be large overlaps between the ‘National commitments’ pathway and the Global Sustainability pathway, depending on how ambitious country teams and local stakeholders think the current national commitments are.

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**Figure 3. Assumptions on the levers for change in each pathway**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CT</th>
<th>NC</th>
<th>GS</th>
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<tbody>
<tr>
<td>Population</td>
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<td>0.10</td>
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<tr>
<td>Calories per Capita</td>
<td>0.00</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
<td>Crops Productivity</td>
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<td>0.00</td>
<td>0.05</td>
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<tr>
<td>Livestock Productivity</td>
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<td>0.02</td>
<td>0.04</td>
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<tr>
<td>Ruminant Density</td>
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<td>0.00</td>
<td>0.1</td>
</tr>
<tr>
<td>Exports (kcal)</td>
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<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>Imports (kcal)</td>
<td>0.00</td>
<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>Agricultural expansion (i)</td>
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<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Afforestation (Mha) (ii)</td>
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<td>0.25</td>
<td>0.50</td>
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<tr>
<td>Share of Food Waste (iii)</td>
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<td>0.05</td>
<td>0.1</td>
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<tr>
<td>Protected Areas (iv)</td>
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<td>0.6</td>
</tr>
<tr>
<td>Irrigated Area</td>
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<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Area under agroecological practices</td>
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<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Biofuels use</td>
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<td>-0.08</td>
<td>-0.04</td>
</tr>
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</table>

**Notes:**
(i) Results are expressed in code, taking the value 1 for ‘Free expansion scenario’, -0.5 for ‘No deforestation’ and -1 for ‘No Agricultural expansion’.

(ii) Results are expressed in a net increase rather than relative change.

(iii) Results are expressed % of consumption that is wasted.

(iv) Results are expressed % of total land in 2050.
Results

Figure 4. Computed daily average intake per capita over 2000-2050

Figure 5. Comparison of the computed daily average kilocalorie intake per capital per food category across the three pathways and the prevalence of undernourishment in 2050

PoU kcal/cap/day

Current Trends National Commitments Global Sustainability

- Max. Recommended
- Min. Recommended

Cereals
Eggs
Fruits and Veg
Milk
Nuts
Pulses
Pork
Roots
Sugar
Veg. Oils and Oilseeds

PoU %

Current Trends National Commitments Global Sustainability

<2.5% 4.9% 3.4%

2764 2588 2575

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Figure 6. Evolution of land cover 2000-2050

Figure 7. Evolution of the cropland composition 2000-2050
Agroecological practices included: Cover crops, cultivar mixtures, diversified farming systems, embedded natural, organic farming, no/minimal tillage.
Results

Figure 11. Nitrogen application

Figure 12. On farm production costs

For more detailed results and visual data, visit www.scenathon.org