2020 Report of the FABLE Consortium

Pathways to Sustainable Land-Use and Food Systems

Executive Summary
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The Food, Agriculture, Biodiversity, Land-Use, and Energy (FABLE) Consortium is convened as part of the Food and Land Use Coalition (FOLU). It is led by the International Institute for Applied Systems Analysis (IIASA) and the UN Sustainable Development Solutions Network (SDSN), working closely with EAT, the Potsdam Institute for Climate Impact Research (PIK), and many other institutions.

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We also thank Marion Ferrat for her comments and careful review of this report.
In this second report of the FABLE Consortium, country teams present 20 national pathways towards sustainable land-use and food systems (Figure A). The pathways have been significantly improved since the 2019 report to show how countries can meet mid-century objectives on food security, healthy diets, greenhouse gas emissions, biodiversity, forest conservation, and freshwater use. National FABLE Pathways are consistent with the Sustainable Development Goals (SDGs) and the objectives of the Paris Agreement. They ensure consistent trade flows and can inform long-term climate strategies towards net-zero greenhouse gas emissions under the United Nations Framework Convention on Climate Change (UNFCCC) as well as biodiversity strategies under the Convention on Biological Diversity (CBD).

Towards the “super year” 2021

In 2020, the world has seen unprecedented environmental, social, and economic crises underscoring how unsustainable land-use and food systems are. Business as usual is not an option, as underscored by unprecedented forest fires, coral bleaching, heat waves, and unrelenting biodiversity loss. Deforestation rates in many parts of the Amazon are dramatically increasing. Moreover, the COVID-19 pandemic is taking lives, increasing food insecurity, causing massive economic damage, and has temporarily disrupted logistics in key food supply chains, yet the global food system has shown a surprisingly high resilience.

Figure A  Countries represented in the FABLE Consortium and the Food and Land Use Coalition
exception might be the EU, which is launching the European Green Deal with a comprehensive Farm to Fork Strategy covering the entire food and land-use system, including international spillovers. The FABLE pathways described in this report are a method for problem solving for the design and implementation of integrated, long-term strategies towards sustainable land-use and food systems.

We are heading towards a “super year” for sustainable land-use and food systems in 2021 with China hosting the CBD COP15 in Kunming, the UN hosting a Food Systems Summit in New York, and the UNFCCC COP26 in Glasgow, UK. These three major meetings provide an opportunity to increase the level of ambition, raise the profile of land-use and food systems, and – critically – accelerate the implementation of integrated strategies. Three breakthroughs are needed for the “super year”:

At the same time, there have been encouraging policy commitments from major economies. Indonesia has achieved the third consecutive year of falling deforestation rates. China, the European Union, Japan, South Korea, the UK, and other countries have now committed to net-zero greenhouse gas emissions around mid-century (Figure B). Leaders from 77 countries and the EU have signed the Leaders’ Pledge to Nature, which commits to reversing biodiversity loss by 2030.

These pledges are highly commendable, but by and large they are not backed up by analysis and plans for meeting the targets in the land-use and food sector. Most countries do not have integrated policies and long-term strategies for sustainable land-use and food systems, as summarized by the three FABLE pillars (Figure D). This has been particularly apparent in relation to the conservation and restoration of biodiversity where ambitious targets have not been achieved. One emerging exception might be the EU, which is launching the European Green Deal with a comprehensive Farm to Fork Strategy covering the entire food and land-use system, including international spillovers. The FABLE pathways described in this report are a method for problem solving for the design and implementation of integrated, long-term strategies towards sustainable land-use and food systems.

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Figure B Countries committed to net-zero emissions around mid-century, as of November 2020

Source. Climate Home News (2020)
The FABLE Approach

FABLE pathways for sustainable land-use and food systems are a method for problem solving. Pathways work backwards from the mid-century targets and shed light on the major transformations that are needed to achieve them. They help in three critical ways: (1) they provide a framework for engaging stakeholders (governments, businesses, civil societies and the scientific community), to review, pose questions, and suggest improvements for how to achieve the targets, which can build a societal consensus for the transformations; (2) without a long-term perspective countries risk locking themselves into unsustainable infrastructure and land-use systems, which would make achieving the mid-century targets far more costly if not impossible; (3) they help identify mid-term technology benchmarks needed to achieve the targets, such as increases in agricultural productivity or efficiency gains in livestock, which can then guide business action and innovation challenges. Long-term pathways are critical for success, and FABLE’s mission is to develop the tools to prepare them.

1. Governments must adopt a bold post-2020 Biodiversity Framework that sets out ambitious goals for the protection and restoration of nature.

2. All must accelerate the design and implementation of integrated strategies, particularly through more ambitious climate strategies that integrate land-use and food systems. In particular, this will require the inclusion of biodiversity and maps for long-term land-use design in climate strategies, drawing on recent experiences in China and many other countries.

3. Developed countries must mobilize additional finance, for example through greater climate finance with a particular focus on nature-based solutions and biodiversity co-benefits.

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**Figure C: Step-by-step FABLE methodology**

1. **Global targets**
   - Achieving the SDGs, the Paris Climate Agreement, and ensuring the stability of the Earth system

2. **National pathways and databases**
   - Collect and harmonize socio-economic and biophysical data, compute the evolution of key variables of the land-use and food system by mid-century using appropriate models

3. **Scenathon**
   - Aggregation of country results at the global level and iterations to solve trade balance and increase the level of ambition towards achievement of the global targets

4. **Stakeholder engagement**
   - Shared understanding of the system and collective review of the feasibility of the pathways and develop shared ownership

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**Notes:**
- Trade adjustment, Gaps with global targets
- Report on key assumptions and results
- Review, critique, provide input
- Database on land use and food systems
- Integrated Model
- Verification tool
FABLE pathways are developed by each FABLE country team in four steps (Figure C). First, country teams adopt global targets (Table A) covering the entire land-use system that are consistent with the SDGs and the Paris Agreement. Second, teams develop national pathways using locally appropriate modeling tools. To this end, the FABLE Consortium has developed a simplified FABLE Calculator to complement more complex models. Third, in an iterative process (“Scenathon”) country teams adjust their assumptions and pathways to ensure balanced trade flows and to aim towards achieving the global FABLE targets. Throughout the process, country teams engage stakeholders to review assumptions, seek technical advice, and build a shared vision of how to transform land-use and food systems.

<table>
<thead>
<tr>
<th>AREA</th>
<th>GLOBAL TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land and Biodiversity</td>
<td>A minimum share of earth’s terrestrial land supports biodiversity conservation. No net loss by 2030 and an increase of at least 20% by 2050 in the area of land where natural processes predominate.</td>
</tr>
<tr>
<td></td>
<td>A minimum share of Earth’s terrestrial land is within protected areas. At least 30% of global terrestrial area by 2030</td>
</tr>
<tr>
<td></td>
<td>Zero net deforestation. Forest gain should at least compensate for the forest loss at the global level by 2030</td>
</tr>
<tr>
<td>Greenhouse gas emissions from AFOLU</td>
<td>Greenhouse gas emissions from crops and livestock compatible with keeping the rise in average global temperatures to below 1.5°C, which we interpret as below 4 GtCO₂e yr⁻¹ by 2050 (3.9 Gt for non-CO₂ emissions and 0.1 Gt for CO₂ emissions)</td>
</tr>
<tr>
<td></td>
<td>Greenhouse gas emissions and removals from Land-Use, Land-Use-Change, and Forestry (LULUCF) compatible with keeping the rise in average global temperatures to below 1.5°C. Negative global greenhouse gas emissions from LULUCF by 2050</td>
</tr>
<tr>
<td>Food security</td>
<td>Zero hunger. Average daily energy intake per capita higher than the minimum requirement in all countries by 2030</td>
</tr>
<tr>
<td></td>
<td>Low dietary disease risk. Diet composition to achieve premature diet related mortality below 5%</td>
</tr>
<tr>
<td>Freshwater</td>
<td>Water use in agriculture within the limits of internally renewable water resources, taking account of other human water uses and environmental water flows. Blue water use for irrigation &lt;2,453 km³yr⁻¹ (global estimates in the range of 670-4,044 km³yr⁻¹) given future possible range (61-90%) in other competing water uses</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Nitrogen release from agriculture within environmental limits. N use &lt;69 Tg N yr⁻¹ total Industrial and agricultural biological fixation (global estimates in the range of 52-113 Tg N yr⁻¹) and N loss from agricultural land &lt;90 Tg N yr⁻¹ (global estimates in the range of 50-146 Tg N yr⁻¹) by 2050</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>Phosphorus release from agriculture within environmental limits. P use &lt;16 Tg P yr⁻¹ flow from fertilizers to erodible soils (global estimates in the range of 6.2-17 Tg P yr⁻¹) and P loss from agricultural soils and human excretion &lt;8.69 Tg P yr⁻¹ flow from freshwater systems into ocean by 2050</td>
</tr>
</tbody>
</table>
This year, FABLE has made several improvements to the design of national pathways. First, all countries now present at least one Current Trends Pathway and one Sustainable Pathway to assess how far and how quickly improved policies can make land-use and food systems sustainable. Second, we have broadened the scope of the analysis to include freshwater, future climate-change impacts on crops, a richer discussion of biodiversity targets, and a more detailed trade analysis. Third, we have incorporated feedback on last year’s pathways. As a result, we now have greater confidence in the robustness of the FABLE pathways.

Key findings and policy implications

Current Trends Pathways lead most countries towards unsustainable land-use and food systems, but through decisive action governments and other stakeholders can meet the related SDGs and objectives of the Paris Agreement. The Sustainable Pathways concurrently meet the objectives related to food security, greenhouse gas emissions, water use, and biodiversity (Table B).

<table>
<thead>
<tr>
<th>Table B</th>
<th>Achievement of FABLE targets under the Current Trends and Sustainable Pathways</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GLOBAL FABLE TARGET</strong></td>
<td><strong>CURRENT TRENDS</strong></td>
</tr>
<tr>
<td>Land and Biodiversity</td>
<td></td>
</tr>
<tr>
<td>Land where natural processes predominate. No net loss by 2030 (globally) ...</td>
<td>Achieved</td>
</tr>
<tr>
<td>Land where natural processes predominate. ...and an increase of at least 20% by 2050 in the area of land where natural processes predominate (globally)</td>
<td>Not achieved</td>
</tr>
<tr>
<td>Zero net deforestation globally by 2030</td>
<td>Not achieved</td>
</tr>
<tr>
<td><strong>GHG emissions from AFOLU</strong></td>
<td></td>
</tr>
<tr>
<td>Global GHG from Agriculture less than 4 GtCO₂e yr⁻¹ by 2050</td>
<td>Not achieved</td>
</tr>
<tr>
<td>Global GHG from LULUCF less than 0 GtCO₂e yr⁻¹ by 2050</td>
<td>Not achieved</td>
</tr>
<tr>
<td><strong>Food Security</strong></td>
<td></td>
</tr>
<tr>
<td>Average calorie consumption per capita greater than the average minimum daily energy requirement in all countries by 2030</td>
<td>Achieved</td>
</tr>
<tr>
<td><strong>Freshwater Use</strong></td>
<td></td>
</tr>
<tr>
<td>Global consumptive blue water use less than 2,453 km³yr⁻¹ by 2050 (global estimates in the range of 670-4,044 km³yr⁻¹)</td>
<td>Achieved (but not achieved for the lower boundary of the literature estimates)</td>
</tr>
</tbody>
</table>
Each country faces specific challenges and solutions vary. For example, FABLE country teams adopt varying assumptions on changing diets and reducing food loss and waste. These differences often reflect deep cultural and historic preferences, agroclimatic conditions, and other factors that governments and scientists should take into account when designing strategies towards sustainable land-use and food systems. This demonstrates the importance of country-driven analyses of land-use and food systems as presented in this report.

Countries need a systems approach that covers three pillars of sustainable land-use and food systems (Figure D). These pillars cover efficient and resilient agriculture systems that ensure farmers’ livelihoods, conservation and restoration of biodiversity, and food security and healthy diets – that should be embedded in integrated land-use design policies and sustainable supply chains. They contribute to many SDGs, are critical for meeting the objectives of the post-2020 Biodiversity Framework and can contribute about a third of the emission reductions to achieve the objectives of the Paris Agreement.

Countries have at least four critical levers for making land-use and food systems sustainable: (1) Dietary shifts – often towards less meat consumption and less overconsumption of food; (2) sustainable and productive agriculture; (3) improved land-use design, particularly for protecting and restoring nature; (4) rapid reductions in food loss and waste. Together, these levers can lower the demand for pasture and cropland at the global level and thereby support greater conservation and restoration of ecosystems with resultant impacts on increased carbon sequestration, biodiversity conservation and restoration. The report and the country pathways illustrate each of these levers with specific examples.

FABLE pathways provide a tool for countries to integrate biodiversity conservation and

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**Figure D**  *Three pillars for integrated land-use and food systems (Schmidt-Traub et al., 2019)*

<table>
<thead>
<tr>
<th>PILLAR 1</th>
<th>PILLAR 2</th>
<th>PILLAR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficient and resilient agriculture systems</strong></td>
<td><strong>Conservation and restoration of biodiversity</strong></td>
<td><strong>Food security and healthy diets</strong></td>
</tr>
<tr>
<td>Increase yields; reduce food loss; limit emissions from agriculture; raise water-use efficiency; reduce release of nitrogen and phosphorus.</td>
<td>Limit emissions from deforestation; protect a minimum share of terrestrial land; ensure that land supports biodiversity conservation.</td>
<td>Zero hunger, low dietary-disease risk and reduced food waste.</td>
</tr>
</tbody>
</table>
Next steps for the FABLE Consortium

In a short period of time, our global consortium of FABLE country teams has developed major analytical capacities on land-use and food systems, pioneered new tools, and strengthened the analytical capacity in 20 countries. We plan to focus upcoming work on the following priorities:

1. As part of the Food and Land Use Coalition, we will work with interested governments to support integrated strategies, including climate and biodiversity strategies under the Conventions, that address short-term pressures on land-use and food systems and are consistent with meeting long-term goals.

2. Through the new Food, Environment, Land, and Development (FELD) Action Tracker, we will advance a deeper understanding of how countries can design, implement, and monitor better policies to transform their land-use and food systems.

3. Partnering with the Food Systems Economics Commission and the Nature Map Initiative, we want to improve modeling tools to develop pathways and model policy options for land-use and food systems. This will include better integration of economic, biophysical and geospatial analyses.

4. The FABLE Consortium members want to train the next generation of analysts and policymakers in developing long-term pathways towards sustainable land-use and food systems, so that FABLE tools can be applied by any research group or government that would like to do so.

5. And finally, we will strengthen and expand the FABLE Consortium, including by welcoming new country teams.