Foodscapes

Toward Food System Transition

The Nature Conservancy

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Executive Summary

Foodscapes: Toward Food System Transition

This report introduces *foodscapes*. Foodscapes are the geographical components of the global food system, a combination of production system and place that represents the world food system spatially. Mapping and analyzing foodscapes reveal the transitions needed on the ground to meet this century's most pressing challenge: the threats posed by climate change, biodiversity loss, and increased demand on the integrity of the global food system.

Foodscapes help all those involved in organizing and reforming the world food system — policymakers, producers, community leaders, researchers, journalists, decision makers in the private and public sectors in general — to take the vital first step of moving from a global analysis to what needs to happen where and how it might come about. That first step revolves around nature-based solutions: ways of managing food production systems that restore and rebuild natural systems, rather than exhaust them.

The report maps the world's foodscapes and assesses their current condition. It looks at the threats they face, and the opportunities that exist through nature-based solutions to transition to a food system able to meet demand while conserving biodiversity, rebuilding ecosystem services, mitigating climate change and increasing the resilience necessary to weather climate change impacts. The report includes examination of what the transition could look like in 10 specific foodscapes (see Foodscapes in Focus).

It also locates and quantifies the global benefits, especially climate change mitigation, associated with a food system transition to nature-based solutions. Key findings:

- Global carbon benefit on croplands and grazing lands ranging from 2.2 up to 3.3 $GtCO_2\ y^{-1}$ through restoration; 4.4 up to 14.6 $GtCO_2\ y^{-1}$ through agroforestry; and 2.2 up to 5.0 $GtCO_2\ y^{-1}$ through improved soil health practices;
- Global habitat restored on up to 428 million hectares of crop and grazing lands and up to 1267 million hectares of habitat-friendly farming;
- Increase of edible food from sea of between 36-74% by 2050 through improved management of wild fisheries and restorative aquaculture;
- Reduction of 15% in water removals for agriculture; and
- Reduction of almost 50% in synthetic nitrogen fertilizer use, through nutrient management and substitution with organic sources

Diverse agricultural landscape in Myanmar.
© Heinn Htet Kyaw/TNC Photo Contest 2021

This is not a utopian manifesto. The analysis in this report takes the world as it is as a starting point. The full transformation of the global food system will involve an array of other strategies, around diets and nutrition, reducing food waste and eliminating deforestation and land conversion, which are not dealt with in this report. The analysis focuses on the value of specific transitions to the ultimate achievement of full food system transformation. The results of such transitions, as this report shows, are not modest, and achieving them will not be straightforward. This report helps us to chart a way forward.

A NECESSARY TRANSITION

The world food system employs 1 billion people and accounts for about 10% of global GDP. It also accounts for up to 35% of global emissions and is the biggest single driver of biodiversity and habitat loss. The global food system has in some ways been extraordinarily successful. The global predictions of food shortages that were common a generation ago never came to pass, although local crises of famine and food insecurity persist. Malnutrition takes new forms, with incidences of obesity and other dietary illnesses exceeding those of undernutrition.

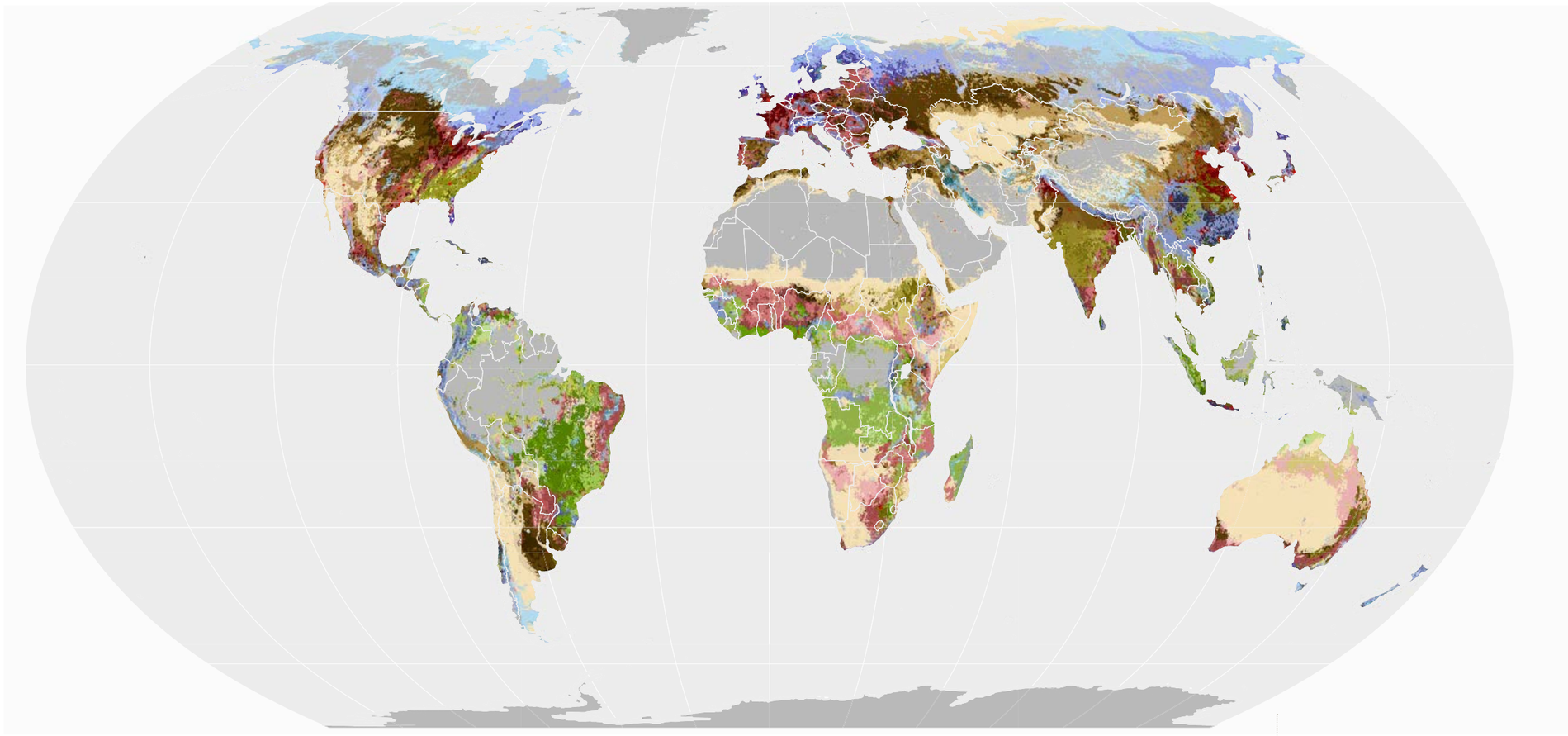
We now face a different type of threat. The climate crisis has made clear that the success of food systems in meeting this demand in the past has, ironically, created a critical new challenge for the future. Food production systems have intensified, but sustainable intensification has been the exception, not the rule. Intensification has meant greater pressure on soils, more biodiversity loss, increased agrochemical and fertilizer use and higher emissions. Climate change can lead to lower yields and threatens to destabilize production systems at exactly the moment when rapidly rising demand puts more stress on those systems.

Change is coming. It will either come as economic and social disruption, or as part of a managed transformation. At the heart of the transformation should be a focus on rethinking and regenerating the individual foodscapes that underpin the global food system.

A growing body of science, synthesized in the recent "Growing Better" report from the Food and Land Use Coalition, has laid out the necessary transitions at a global level. Research is also clear on the urgency of the food system challenge and the limited time remaining to address it. The next decade is crucial if we hope to keep Paris Agreement targets and biodiversity thresholds within reach. Many critical food production systems around the world are already facing multiple pressures; their productivity and output is eroding, through over-exploitation of the ecosystem services like water, soil organic matter and agro-biodiversity that farmers, fishers and grazers depend upon.

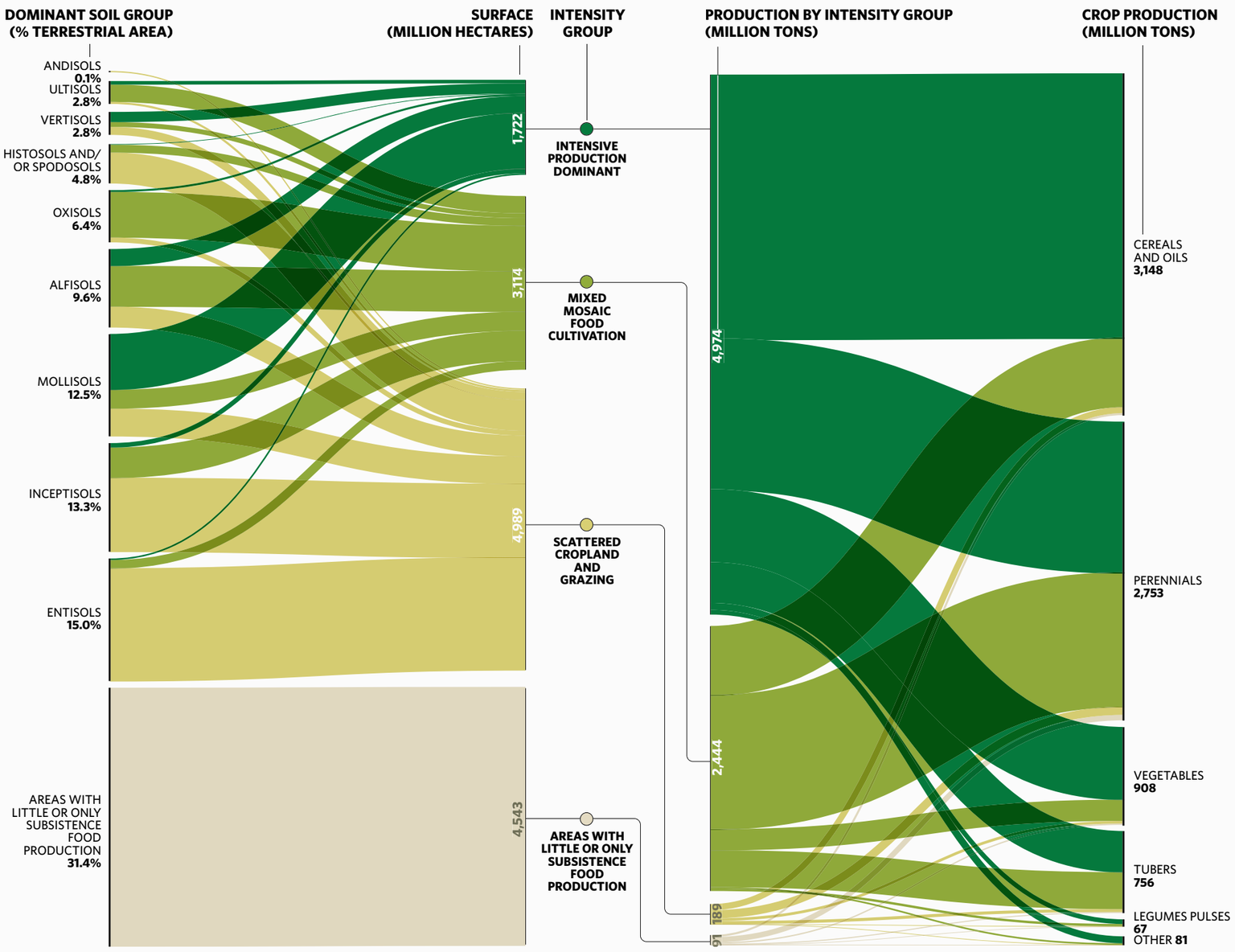
Making a food system transition work is the most urgent challenge the world faces. Done right, the transition makes economic as well as environmental sense: the hidden costs of the current world food system are estimated at $12 trillion, $2 trillion more than the system generates (FOLU, 2019). Central to that necessary transition are "Nature-Based Solutions" that have the potential to transform the world's foodscapes, helping restore ecological function and the resilience on land and at sea.

FIGURE 1. GLOBAL FOODSCAPE MAP



GLOBAL FOODSCAPE MAP visualizing 86 terrestrial foodscape classes at 5 km by 5 km resolution. Owing to the large number of classes, a legend is not shown. Map key with complete list of foodscape classes can be found in Annex 1

FIGURE 2. GLOBAL FOODSCAPE INTENSITY GROUPINGS AND CROP PRODUCTION



FOODSCAPES: A SPATIAL ANALYSIS

A foodscape is a terrestrial or aquatic food production area defined by a series of distinct biophysical attributes and management patterns, which can be mapped. They cover all parts of the globe where food is produced. When mapped, they form a mosaic at the subnational level around the world. Due to their unique combination of biophysical and management attributes, they can be considered as functional planning units to complement jurisdictional-based approaches.

This report presents the results of the first global analysis and mapping of foodscapes. Some foodscapes occur in relatively small, confined areas while others are widespread and occur on multiple continents. Examples of the latter include semi-arid grazing systems that are widespread on all continents, and "breadbasket" foodscapes with intensive grain and oil crop production in temperate plains with good soils. As is to be expected, foodscapes are very diverse, and the global mapping resulted in more than 80 foodscape classes. Defining and mapping foodscapes

FIGURE 2. Global Foodscape intensity groupings and crop production
For the purposes of this figure, the Global Foodscape classes have been consolidated into groupings of similar biophysical attributes on the left side (Dominant Soil Group), and similar management attributes in the middle of the figure (Intensity Group). The biophysical groupings are identified by the dominant soil type found in the foodscape classes. Soil type is determined by the complex interaction of parent material, climate, vegetation, terrain, time, and human activity. Foodscapes will thus contain a variety of soil types in complex associations. The management groupings are defined based on the areal extent of croplands in the foodscape overall, and the intensity of the management systems within each grouping. Areas with little or only subsistence food production may have some low intensity cropping and grazing which can be important for local communities. The crop output in fresh weight of major crop groupings from each foodscape is represented on the right.

makes it easier to envision which nature-based solutions are most relevant to the transition the foodscape will need to make to accommodate demand, conserve ecosystems and the services they provide, and mitigate greenhouse gas emissions.

Global level transitions are often hard to translate into local context: the solutions are too abstract, too removed from economic and political realities. The foodscapes concept is intended to help bridge that gap, providing a sense of the opportunity for nature-based solutions to deliver benefits globally as well as foodscape-specific understanding of potential interventions and their impact. While caution should be taken when using a global-level product such as the foodscapes analysis, it can provide useful insight that can be further developed, adapted and applied using local, place-based knowledge.

Any analysis of this type faces challenges. Marine data is not as comprehensive as terrestrial data and lacks attributes enabling detailed mapping at a sub-national or sub-regional level. The marine realm needs more work and attention from policymakers, economists and scientists to build a transition framework for marine foodscapes equivalent to the one this report presents for terrestrial foodscapes. Given the important role fish and seafood could have in supporting the transitions needed, such work should be a priority for policymakers and the research community moving forward.

A CALL TO ACTION

This report can be used as a starting point for planning transitions in global food systems. It suffers from the gaps and omissions inevitable in any effort to conduct a global-level spatial analysis. These omissions — the missing datasets, the unaddressed socioeconomic variables, the lack of comparable analysis of the marine as opposed to the terrestrial realm — show how much work still needs to be done to provide policymakers, community leaders, and market actors with the information and evidence needed to inform their decision-making. This report is also a call to action to the research community, civil society and policymakers to move further and faster on addressing these omissions.

It is also a call for a policy response proportionate to the challenge. There is growing consensus on the high-level changes necessary in the global food system. Now it is urgent that we proceed to the next step: detailed planning and implementing of food system transition at national and subnational scales. We need policy frameworks and market incentives to get behind that transition, moving beyond the inertia of business as usual and vested interests.

FOODSCAPES IN FOCUS BRIEFS

In order to show policymakers, community leaders and decision-makers how nature-based solutions can support food production in specific foodscapes, we have taken an in-depth look at specific subnational foodscapes. The case studies presented are:

Argentina Gran Chaco Foodscape
Halt biodiversity loss through mixed land use

Arkhangai Foodscape
Community-based conservation to promote rangeland health through land rights

Central New Zealand Aquaculture Foodscape
Aquaculture diversification for resilience

Chesapeake Bay Watershed Foodscape
Restore natural habitat to enhance success of nutrient reductions

East Kalimantan Foodscape
Protect and enhance habitat through adaptive land use

Granada Foodscape
Ensure climate resilience by promoting a return to traditional practices

Mopti Foodscape
Governance systems to manage land use conflicts

Punjab-Haryana Foodscape
Policy and incentives to improve crop production, water security, and human health

San Joaquin Valley Foodscape
Balancing food production and biodiversity under water scarcity

Upper Tana River Basin Foodscape
Innovate technical solutions for market-oriented smallholders